

# ElectricFlow 7.2

## User Guide

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## **ElectricFlow version 7.2**

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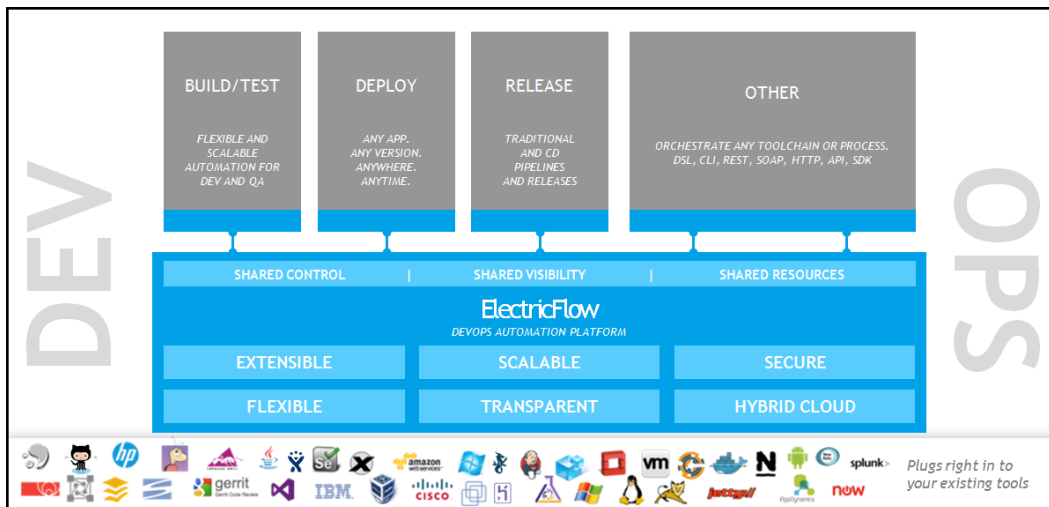
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# Chapter 1: Introduction to ElectricFlow

ElectricFlow™ is an enterprise-grade DevOps Release Automation platform that simplifies provisioning, build and release of multi-tiered applications. Our model-driven approach to managing environments and applications allows teams to coordinate multiple pipelines and releases across hybrid infrastructure in an efficient, predictable and auditable way.



## Web-Based System

At its core, ElectricFlow automation platform is a web-based system for automating and managing the build, test, deployment, and release process. It provides a scalable solution, solving some of the biggest challenges of managing these "back end" software development tasks, including these challenges:

- Time wasted on script-intensive, manual, home-grown systems that
  - Are error prone
  - Do not scale well
  - Have little or no management visibility or reporting

- Multiple, disconnected build and test systems across locations, resulting in:
  - Redundant work
  - Inability to share or reuse code files across teams
  - Hard to manage build and test data
- Slow overall build and release cycles that directly impact:
  - Release predictability
  - Time-to-market

## Automation Platform

The automation platform has a three-tier architecture, AJAX-powered web interface, and first-of-its-kind build and release analytic capabilities for reporting and compliance. With this solution, your developers, release engineers, build managers, QA teams, and managers gain:

- Shared platform for disseminating best practices and reusing common procedures
- Ability to support geographically distributed teams
- Continuous integration and greater agility
- Faster throughput and more efficient hardware utilization
- Visibility and reporting for better project predictability
- Better software quality by integrating and validating against all target platforms and configurations

For examples of ElectricFlow architecture configurations, see [ElectricFlow Architecture](#) on page 39.

## What Makes ElectricFlow Unique?

ElectricFlow provides enterprise-class speed and scalability for software build and release management. It is easy to install and use on a simple build, yet scales to support the largest and most complex build and test processes. ElectricFlow distributes jobs in parallel across multiple resources for faster overall cycle time.

ElectricFlow supports multiple teams, working in multiple locations, programming in multiple languages in an environment that can be centrally controlled and managed. Shared assets and reuse make individual teams more efficient by eliminating duplicate work, and gives organizations the power to deploy cross-company standards.

ElectricFlow's unique analytics provide visibility into one of the best indicators of project success: compiled, tested, working code. ElectricFlow's analytics database stores all build and test information for real-time and trend reporting giving your organization the power to collect pinpoint statistics and to gain visibility into important productivity metrics such as trends in error rates. Additionally, out-of-the-box reports provide information about cross-project status and build trends by project and resource utilization. ElectricFlow's integration with virtual lab automation (VLA) solutions also allows you to snapshot or reproduce a specific build for auditing or troubleshooting purposes.

ElectricFlow provides unified process automation across the entire build-test-deploy life cycle and across heterogeneous tools via integrations with leading ALM tools. Integrations with SCM tools enable continuous integration, triggering builds whenever code is checked into the specified repository/branch. When used with

VMware Lab Manager, ElectricFlow can dynamically provision either physical or virtual resources without manual intervention. This feature delivers efficient, dynamic resource provisioning and reduces development and QA dependence on IT operations.

## ElectricFlow Architecture

ElectricFlow was designed to support small, mid-range, or enterprise scale software production. Based on a three-tier architecture, ElectricFlow scales to handle complex environments. The ElectricFlow multi-threaded Java server provides efficient synchronization even under high job volume.

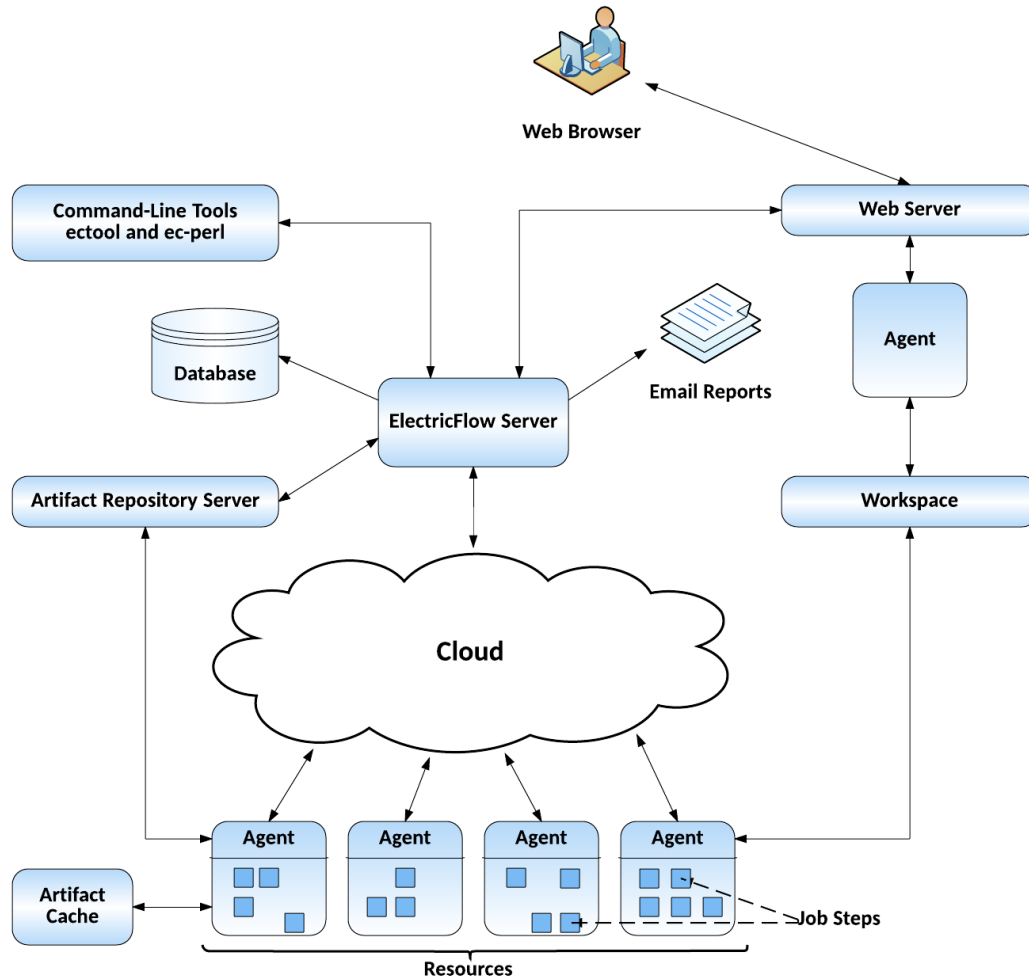
- The ElectricFlow server manages resources, issues commands, and generates reports.
- An underlying database stores commands, metadata, and log files.
- Agents execute commands, monitor status, and collect results in parallel across a cluster of servers for rapid throughput.

## Simple Architectural Overview

This local configuration applies to all the use cases. The ElectricFlow server, web server, artifact cache, Artifact Repository server, workspace, command-line tools, resources, agents, and job steps are all in the automation platform.

In this local configuration:

- The ElectricFlow server manages resources, issues commands, and generates reports.
- Resources, agents, and databases are managed in the automation platform.
- An underlying database stores commands, metadata, and log files.
- Procedures, which include job steps, are defined in the automation platform.
- Job steps are executed on resources in the defined environments.
- Applications (which include procedures), components, and environments are defined for deployment automation.
- Pipelines, stages, and tasks are defined for pipeline management.



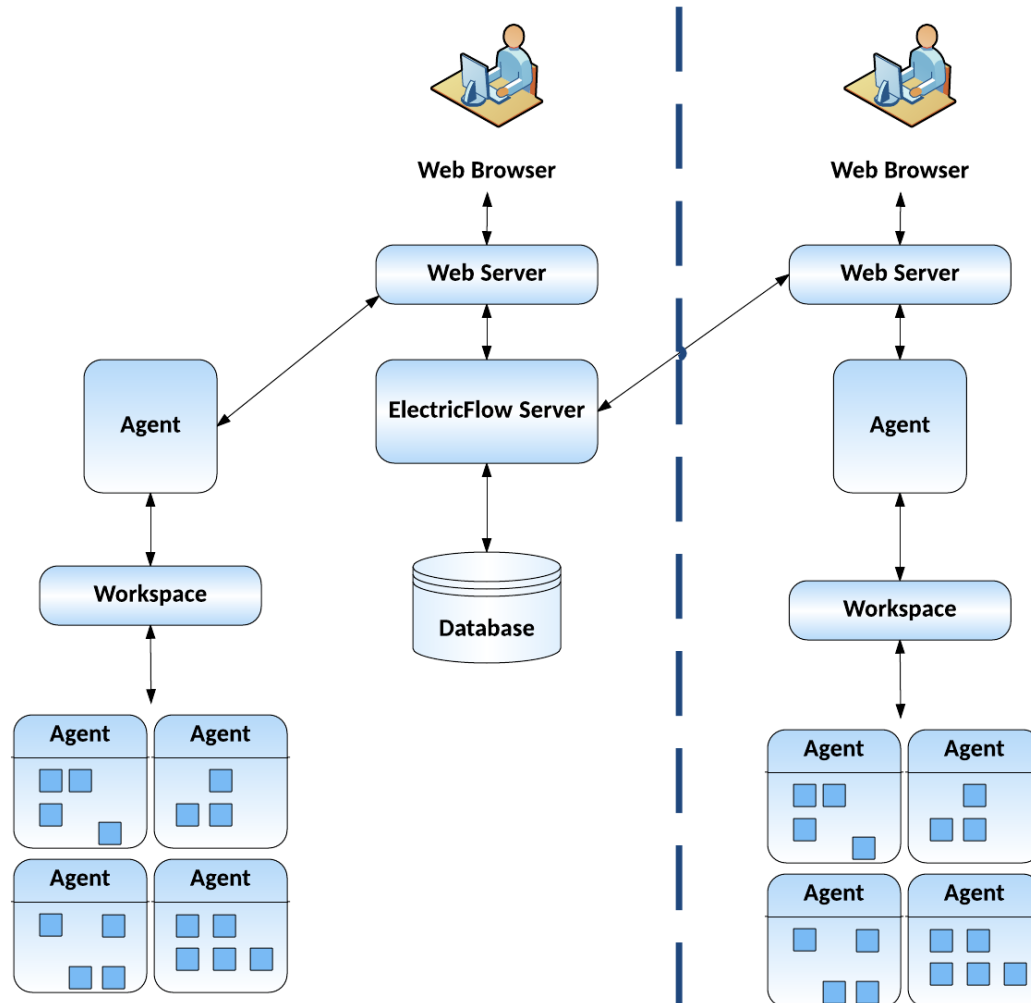
If you are only evaluating ElectricFlow, the ElectricFlow software, the database, the ElectricFlow server, the web server, and the repository server can reside on the same machine.

In a production environment, the database should reside on a separate machine from the ElectricFlow server to prevent performance issues. It is acceptable for the ElectricFlow server, web server, and repository server to reside on the same machine in a local configuration, but not required.

## Expanded Remote Configuration

ElectricFlow is not limited by only the components shown in the previous configuration. This configuration applies to all the use cases.

The following shows a remote web server configuration and is an example for how you may set up a remote web server installation.



This type of remote web server configuration helps prevent network latency. If you have multiple sites, ElectricFlow can be configured to help you work more efficiently.

## Other Configurations

Go to the ElectricFlow Installation Guide ([http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html)) for other architecture configurations:

- Proxy (universal) resources
- Remote database
- Multiple remote web servers
- Multiple remote repository servers
- Clustered configuration for horizontal scalability and high availability

## Roadmap to ElectricFlow

Depending on what you want to do, go to the appropriate section.

Use Case	Definition	Go to
Build-test automation	Executing automated build and test processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Build-test automation is a key enabler of continuous integration (CI).	<a href="#">Automation Platform</a> on page 556
Deployment automation	Executing automated application deployment processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Deployment automation is a key enabler of Application Release Automation (ARA) and continuous delivery (CD).	<a href="#">Deployment Automation</a> on page 44 <a href="#">Deployment Examples</a> on page 145
Pipelines	Executing automated end-to-end software development and delivery processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Pipeline management is a key enabler of Application Release Automation (ARA) and Continuous Delivery (CD).	<a href="#">Pipelines</a> on page 308
Release planning and management	<p>The Release feature captures, executes, visualizes, and controls the life cycle of multi-application enterprise releases, where outputs from multiple teams are coordinated to produce a final release to be pushed to production. Releases allow you to execute and manage automated software release processes (including end-to-end software development and delivery processes), enabling Application Release Automation (ARA) and Continuous Delivery (CD).</p> <p>You can use the Release feature to deliver software releases through traditional methods and/or ARA and CD methodology. ElectricFlow manages all the releases, regardless of the release methodologies used by the release team.</p>	<a href="#">Release Management</a> on page 405
Automation platform	Where you create, configure, and manage the objects that make the build-test, deployment, and pipeline management possible.	<a href="#">Automation Platform</a> on page 556

## Using Special Characters in ElectricFlow Object Names

You should avoid using the following special characters when naming objects in ElectricFlow. These characters have special purposes or meanings within ElectricFlow or in the scripting language being used.

However, if any of these characters are used in object names, then your implementation must correctly escape them at runtime (meaning in context of the scripting language, such as JavaScript, Groovy, or Perl) to avoid errors or unexpected behavior.

Character	Description
/	Used for absolute property paths in ElectricFlow. The path syntax is similar to a file system path specification.
[] or .	Used in JavaScript.
:	Might cause problems when used in job names. Some operating systems do not allow directories containing this character.
\	Used for escaping.
(space) or '	Should be enclosed in quotes when used in ectool or JavaScript. Otherwise, it should be escaped properly. Also, spaces might cause issues when used in resource pool names and should be avoided.
, or ;	Might cause issues when used in user names (such as in a list of approvers).



# Chapter 1: Deployment Automation

ElectricFlow™ DevOps automation accelerates development processes and simplifies operations. It accelerates the continuous delivery of software and makes software release processes more repeatable, visible, scalable, and efficient. It provides domain-specific capabilities to automate some or all phases of your software delivery process, including the build, test, integrate, deploy, and release processes. It gives distributed DevOps teams shared control and visibility into infrastructure, tool chains, and processes. It enables agility, availability, predictability, and security across many build-test, deployment, and release pipelines.

ElectricFlow uses a “model driven” approach to abstract the application architecture from the environment, infrastructure details so that the same application can be deployed to many environments using parameterized processes. ElectricFlow supports the creation, versioning, deployment, required middleware, and infrastructure details for a complete release package. You can model and version applications and environments to orchestrate the software release flow, and also to standardize and automate the deployment of applications between environments.

ElectricFlow Deploy makes deployments manageable, reproducible, and error-proof by modeling the application, the environments to which it will be deployed, and automating the workflow needed for the deployment. The model can be broken into these parts of your application deployment:

- What—You are deploying the application, which contains references to the files being deployed.
- Where—The application will be deployed to an ElectricFlow environment.
- How—You run processes that orchestrate deployment tasks to deploy the application to the environment.

## Deployment Fundamentals

- 1** What: Application model
- 2** Where: Environment model
- 3** How: Various Processes

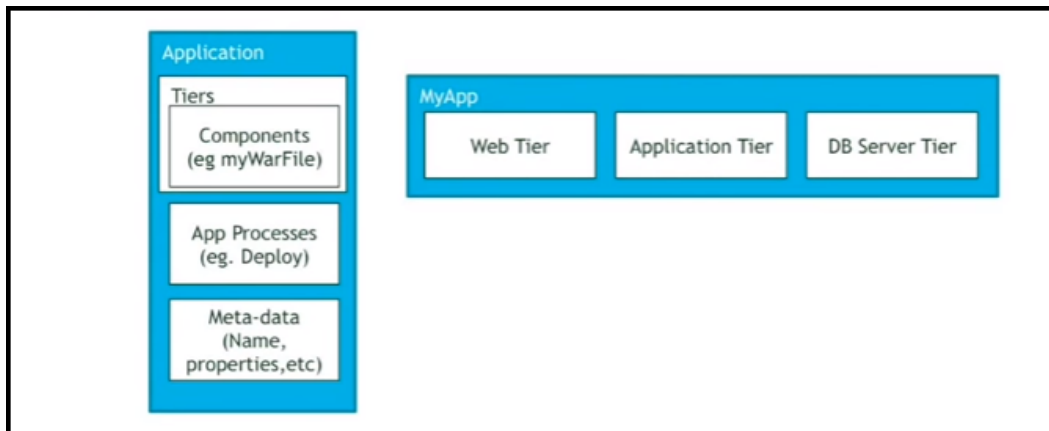
## Applications and Processes

This section describes what you model (an application) and how you deploy it to an environment.

### Deployment Fundamentals

- 1** What: Application model
- 2** Where: Environment model
- 3** How: Various Processes

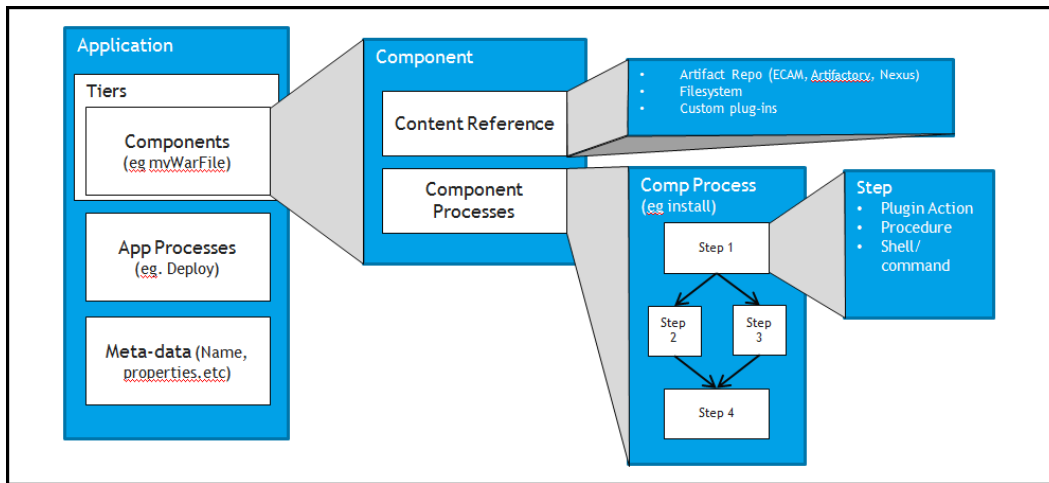
Applications are modeled by providing information about their components and defining the processes that orchestrate the deployment of those components. An application object in ElectricFlow consists of one or more application tiers. For example, MyApp is a three-tiered application with the Web, Application and database server (DB server) tiers.



An application tier is a logical grouping of components. Each tier contains components. A component is based on an artifact and contains a reference to that artifact. This can be through the file system or an artifact repository. The application tier also contains component processes. A component process is a set of actions to be taken on that specific component when the application is deployed. The set of steps in a component process can be defined as

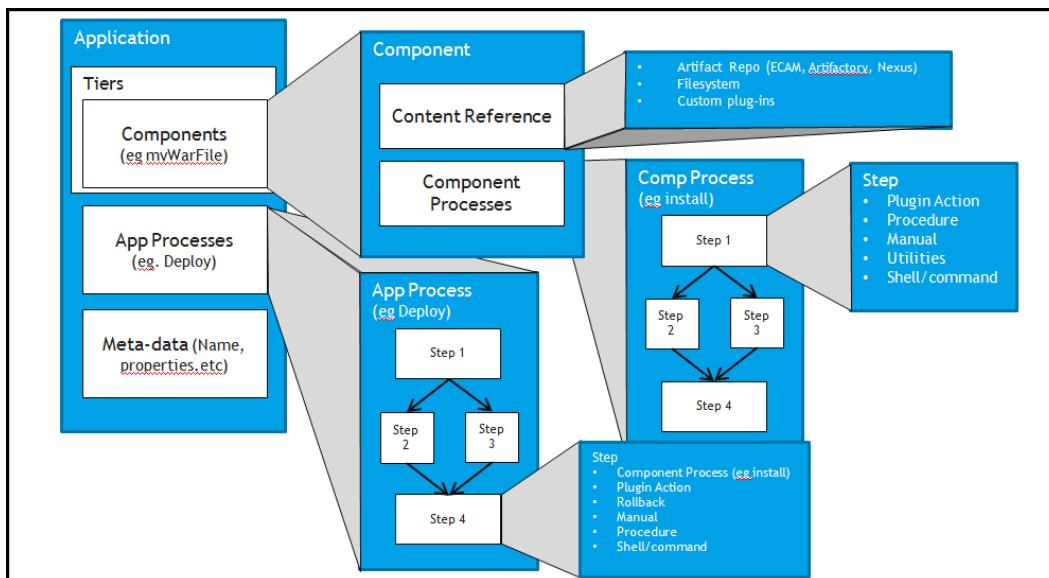
- Direct commands
- Calls to ElectricFlow plugins, procedures, or utility functions

- Component operations based on the component definition
- Manual steps



Application processes are at the application (parent) level. These processes are invoked to orchestrate operations against the application. The steps in an application process can be defined as:

- Calls to component processes
- Direct commands
- Calls to an ElectricFlow plugin, procedure, or utility function
- Manual steps
- A rollback step to roll back to a previous state or to a specific snapshot



Properties and parameters allow the same application to be deployed to many environments in a repeatable, reliable, and scalable way. They are used extensively throughout ElectricFlow and can be dynamically passed to all operations, including application deployments.

- Properties provide a flexible and powerful mechanism to manage data during all operations. They can be attached to any ElectricFlow object, such as applications, processes, tiers, components, and credentials. Go to [Properties](#) on page 1058 for more information.
- Parameters provide a way to get input from users at runtime to deploy the application to a variety of environments. Parameters can be attached to processes, process steps, components in the application. Go to [Deployment Examples](#) on page 145 and [Parameter—create new or edit existing parameter](#) on page 783 for more information.

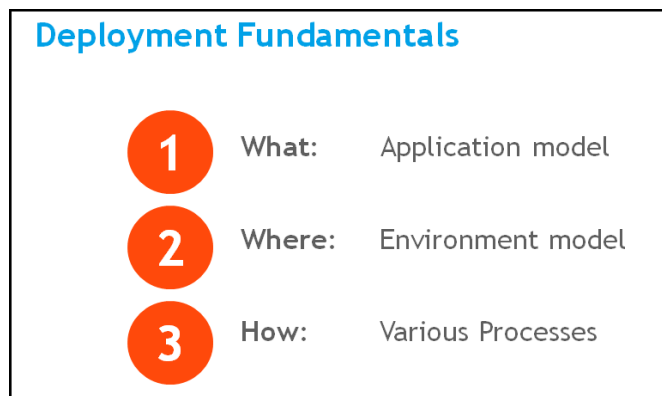
Go to [Deployment Examples](#) on page 145 for examples of how to author and deploy an application in the UI.

In an application, you can also:

- Define process steps based on commands or scripts using the ElectricFlow DSL, ElectricFlow RESTful API, ElectricFlow Perl API, Groovy, or JRuby. See the ElectricFlow API Guide on the [Electric Cloud Documentation](#) page for the commands and code samples.
- Create a library of standardized reusable components to promote best practices across the enterprise and speed up application authoring with master components. Go to [Master Components](#) on page 82 for more information.
- Save snapshots of the application throughout the software release process. A snapshot is an immutable version of an application with specific artifact versions that can be used to optimize and troubleshoot the application. Go to [Snapshots](#) on page 300 for more information.
- Track changes for non-runtime objects such as projects, applications, environments, processes, components, artifacts, resources, and properties in the Change History. Go to [Configuring Change Tracking](#) on page 980 for more information.

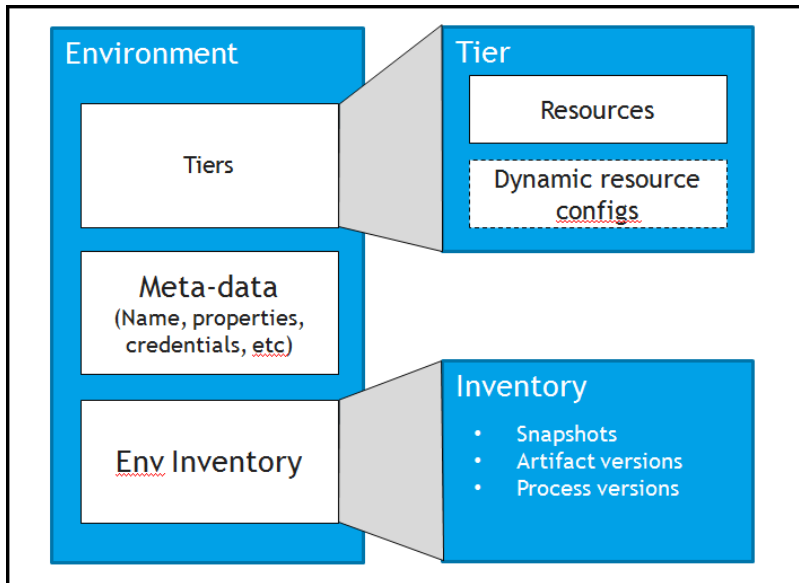
## Environments

This section describes where applications are deployed.

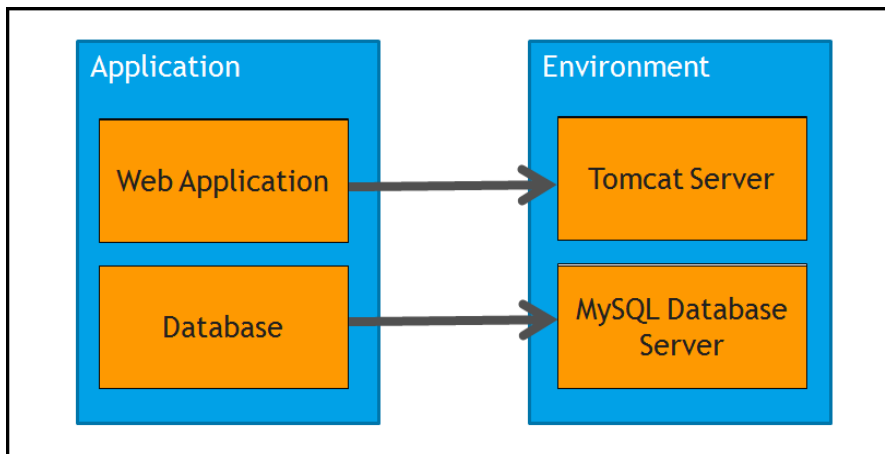


Environments are modeled using resources that are statically defined on the system, dynamically spun up at deployment time, or a combination of both. An environment object in ElectricFlow contains one or more tiers. These tiers should map with the tiers in the application and are logical groupings of resources. Each tier defines

the resources in that tier, which could be static resources in the ElectricFlow system or dynamic configurations that are spun up on deployment. An environment also contains an Environment Inventory that details the current versions of each component or snapshot deployed in that environment.



Once you have defined your application and environment, they must be connected with a tier map. This is a mapping of the application tiers to the corresponding environment tiers where the application will run. Tier maps provide a level of indirection, allowing you to freely add or remove resources from an environment without having to make any changes to the automation.



Go to [Creating Environments](#) on page 173 for more information about modeling static environments.

Go to [Deploying Applications in Dynamic Environments](#) on page 227 for more information about modeling dynamic environments.

## Property Reference Use Case

Property referencing is one of the most powerful features in the ElectricFlow product suite. Mastering property referencing will let you extend ElectricFlow to meet your organization's deployment needs.









This use case shows how to leverage properties to create a flexible deployment model. It assumes that you are developing an ElectricFlow application for a web application deployment to production. The deployment process requires that the application is properly tested in the DEV and QA environments before deploying it to the production. Each of these environments uses different database connections for certifying various aspects of the web application. The QA environment uses a database that is created specifically to test the scalability aspects of the application. The challenge is to determine how to manage the database configuration across these environments.

Start by modeling three environments under a project called Banking:

- DEV
- QA
- PROD

13 Environments <input type="text" value="Find..."/>		All projects		Select	All	Delete	+
13 Environments		1 Environment Templates		0 Resource Templates			
1	clumsy_bird-env-dsl	Default	3	3	0		
2	DEV	Banking	2	0	0		
3	hc-store dev	Default	3	3	0		
4	heatclinic-dsl	Default	2	2	0		
5	heatclinic-qe	Default	2	2	1		
6	j-env-dsl	Default	2	2	1		
7	jpetstore-qe	Default	2	2	1		
8	PROD	Banking	1	1	0		
9	QA	Default	1	1	0		
10	QA	Banking	2	0	0		

Then create the appropriate database (DB) credentials in the Banking project for each database used with these stages. Each credential is identified by a name:

1 Properties		Delete  Folder  Add 
 DEV	Select <input type="button" value="All"/>	
Name	Value	
  DEV		
 DB_credential	db-dev	

1 Properties		Delete  Folder  Add 
 QA	Select <input type="button" value="All"/>	
Name	Value	
  QA /		
 DB_credential	db-qa	

1 Properties		Delete  Folder  Add 
 PROD	Select <input type="button" value="All"/>	
Name	Value	
  PROD		
 DB_credential	db-prod	

For each environment, create a property called `DB_credential` and initialize it with its corresponding DB credentials name.

To leverage these properties in an application or component process step, use `$/myEnvironment/DB_CREDENTIAL` to identify and access the DB credential information as described in these following knowledge base articles:

<https://helpcenter.electric-cloud.com/hc/en-us/articles/202827083-KBEC-00032-Hiding-an-application-s-password-with-a-credential>

<https://helpcenter.electric-cloud.com/hc/en-us/articles/206611313-KBEC-00325-Can-t-access-attached-credential-using-ectool-getFullCredential>

Using this credential information, you can connect ElectricFlow to the appropriate database and populate the necessary test data. In this use case, `myEnvironment` refers to the currently running environment. There are similar shortcuts available for other deploy objects, such as `myApplication` or `myEnvironmentTier`. You can extend this concept to store environment- or environment-tier specific attributes such as port numbers or URLs.

## Deployment Strategies

ElectricFlow provides several ways to deploy applications, including deployment policies (such as rolling deployments, blue/green, canary, and dark launch) and deployment options (such as smart deploy, staging artifacts, and error handling). By default, applications are deployed to all resources in the environment at once, and process steps are run sequentially. You can customize how an application is deployed using the options described in [Application Deployment Options](#) on page 66. For example:

- When authoring processes, you can define the error handling method for a process step or use rollback.
- Before the running an application, you can stage artifacts to ensure that all the artifacts are available at runtime, reducing the deployment time.
- At runtime, you can deploy everything (full run), only changed objects (smart deploy), specific objects (partial run), and/or snapshots.

In some situations, instead of deploying an application to all machines in the environment at once, it is better to deploy the application in batches.

As you get closer to production environments, reducing the downtime and risk while releasing newer versions becomes business critical. This is especially critical in production environments with live end-user traffic all the time. In some cases, the applications are the backbone of a website and are critical to the business, such as a banking or investment website. Any downtime on the production website can adversely affect the business. ElectricFlow allows *modeling* the various deployment strategies described in the following sections. The end goals of all these strategies are very similar – reducing the downtime and risk. ElectricFlow also allows modeling strategies such that they can be practiced in lower environments like QA or Pre-Prod to ensure success during production rollouts.

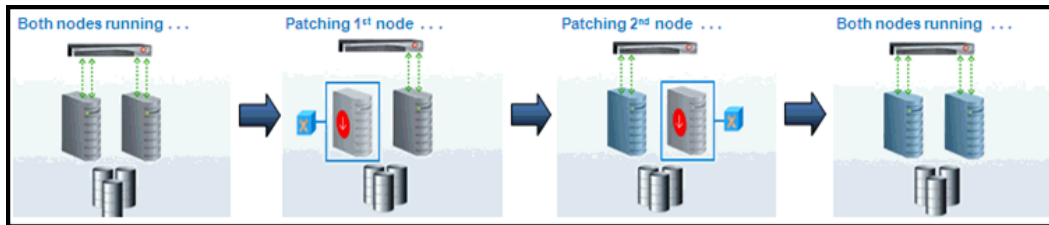
## Rolling Deployments

One way to reduce the downtime and the risk associated with application deployments is to use *rolling deployments*. The goal is to minimize downtime to zero or as low as possible without impacting the availability of business critical applications. Rolling deployments are release patterns where the application is gradually deployed to the machines one at a time or in batches. Rolling deployments can be run throughout the release, but they are especially useful near the end of the release process, close to the production environment.

The Rolling Deployment strategy is applicable when the environment caters to end-user traffic and the environments being upgraded is the same.

This is an example of a rolling deployment in a load-balanced environment. When a new version needs to be added to both nodes, it is deployed to the first node while the second node is actively handling the end-user traffic. After the new version is successfully installed on the first node, it starts to handle the end-user traffic while the new version gets applied to the second node. After the new version is successfully installed on the second node, both nodes can actively handle traffic.





Rolling deployment is an excellent strategy for reducing downtime when you have environments with large numbers of static resources. It is also a cost-effective strategy as no additional resources are required, unlike other strategies. A Rolling deployment generally requires thinking about backward compatibility across the application components.

ElectricFlow natively supports the modeling of rolling deployments for the desired environments. For an environment, you can choose if rolling deployment is enabled. For environments in which you want to run a rolling deployment, you can choose between a phased-based or batch-based deployment.

- Rolling deployment using phases: This rolling deployment strategy is useful where there is a deterministic mapping between resources and the phase to which they belong. You can either assign resources to phases manually or dynamically using expressions.
- Rolling deployment using batches: This rolling deployment strategy is useful for environments with large numbers of resources where deterministic mapping between resources and batches is not necessary.

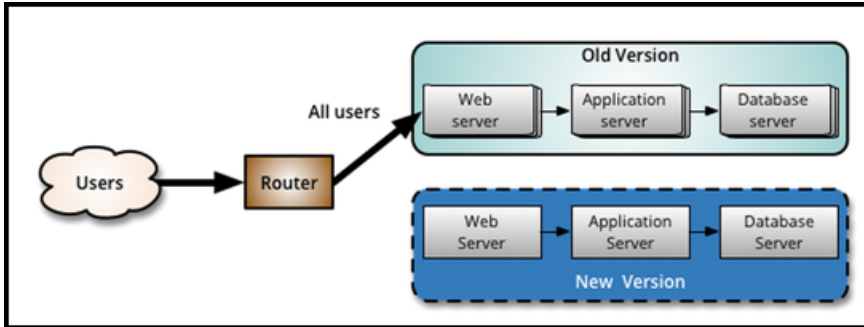
You can decide batch sizes by specifying a *number* or *percentage* per tier. Examples are deployment to two resources at a time for the Web tier or to 25% of the resources at a time in the application server tier.

You can also specify a property reference (`$( )`). This is useful when you want to apply a property reference to control the batch size based on applications, external configuration files, and so on.

Go to [Rolling Deployment Use Case](#) on page 54 for an example of modeling rolling deployment.

## Blue/Green Deployments

This technique reduces downtime and risk by running two identical production environments referred to as *blue* and *green*. The key difference between rolling deployment and blue/green deployment is that there are two physically separate environments. At any time, only one of these environments is live, serving all of the production traffic. While new versions of the applications are deployed to the second (blue) environment, the first environment (green) is serving production traffic. When the new versions are satisfactorily deployed to the second (blue) environment, all of the end-user traffic (100%) is diverted to it to make it live. After the switch, the green environment becomes inactive and next release can be applied to it and the process can be repeated.



The blue/green deployment strategy is especially useful with dynamic cloud environments. If environments are automatically spun up for every new deployment, the blue/green deployment strategy becomes compelling as the older environment can be decommissioned easily. The blue/green strategy is also useful when it is mandatory to maintain a separate mirrored environment for disaster recovery, as required by some financial companies.

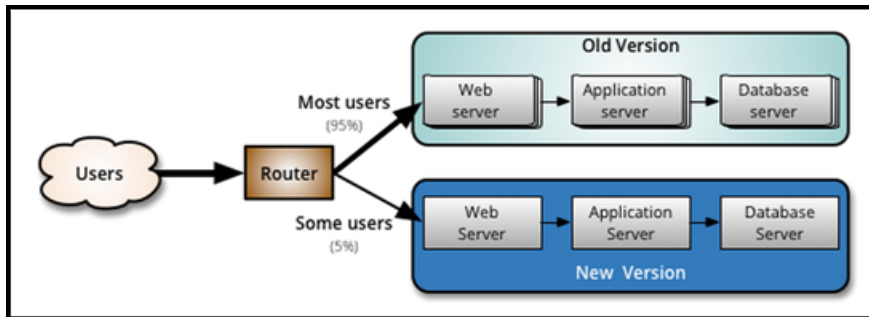
While blue/green deployment makes it much simpler to recover from unforeseen deployment errors, as there are two separate environments, it comes with a higher cost. Because the blue/green strategy requires more than one environment and resource duplication, the overall costs might be higher than rolling deployments.

ElectricFlow allows modeling blue/green deployments with multiple options, but the most logical option is to create separate blue and green environments in the product. These environments are identical for all practical purposes. They can be created before the deployment if they are using static resources, or they can be created dynamically at the deployment runtime using *environment templates*. Modeling *blue* and *green* as separate environments also allows keeping track of the component inventory independently so that users can always know what is deployed to the blue vs green environments at any time.

Go to [Blue/Green Deployment Use Case](#) on page 63 for an example of modeling a blue/green deployment.

## Canary Deployments

This technique is an advanced variation of the blue/green deployment. Similar to blue/green deployments, there are two separate environments. In steady state, only one environment is handling the production traffic. During deployment time, new versions are applied to the second inactive environment similar to a blue/green deployment. Once the second environment with the newer version is satisfactorily tested, a portion of the end-user traffic is diverted to it. The first environment runs the old production version of the applications and bears the majority of the traffic while the second environment runs the new version of the applications and caters to a small portion of the traffic. This is a great way to test the new version with live traffic, and if everything looks fine, all the traffic can be diverted to the new version, or if there are issues with the new version, the older version can be kept instead.



ElectricFlow allows modeling canary deployments similar to blue/green deployments by creating separate environment objects. They can be created before the deployment if they are using static resources, or they can be created dynamically at deployment runtime using environment templates. Modeling them as separate environments also allows keeping track of the component inventory independently so that users can always know what is deployed to which environment at any time.

The canary strategy is quite similar in purpose and implementation to strategies like **Dark Launch** where the purpose is to launch a new feature to a subset of users. These features can be either partially visible or not accessible at all, and that can be controlled using feature flags. Modeling such a deployment strategy in ElectricFlow is similar to a canary or blue-green strategy.

## Other Deployment Strategies

Deployment strategies can be named differently, but they all serve the core purpose of reducing downtime and risk. While modeling such a deployment strategy in ElectricFlow, the best practice is to ask a question—does this strategy require a single environment or multiple environments logically? Based on that answer, you can choose to model using a rolling deployment style, blue/green style, or even a combination. ElectricFlow allows the flexibility to model most of these scenarios.

## Rolling Deployment Use Case

Rolling Deployment is one of core strengths of the ElectricFlow. You can develop your application model independent of the deployment strategy and the environment model. When you model an environment, you can enable rolling deployment. You can also enable rolling deployment on an environment by selecting the rolling deployment option when you deploy an application.

In the list of application run details, ElectricFlow filters out any component process step that has no resource to execute in a particular phase of the rolling deployment. (The platform job details page continues to show all steps in the process.)

This example shows how an e-Commerce company uses the rolling deployment strategy to deploy its shopping cart application to production. The shopping cart application consists of three tiers, the Web, App and DB tiers. The company wants to deploy this application to the PROD environment in four phases:

- First phase: Deploy only to the DB tier and verify the DB upgrade.
- Second phase: Deploy to a few resources in the App and Web tiers and verify that the application was deployed successfully.

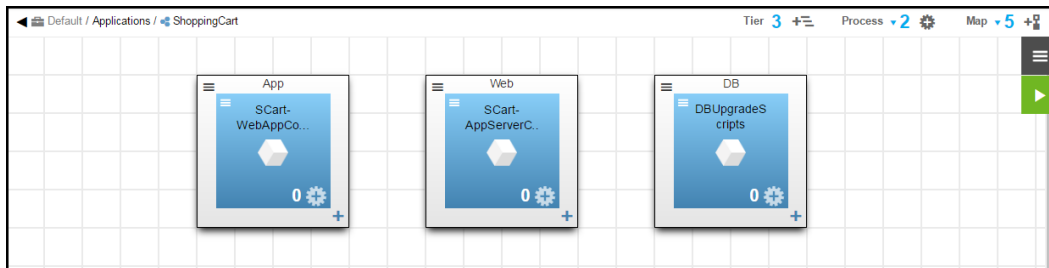
- Third phase: Deploy to a few more resources in the App tier based on some rules.
- Fourth phase: Deploy to the remaining resources.

Modeling this rolling deployment consists of the following:

1. Creating the "ShoppingCart" application with three tiers that map to the corresponding components.
2. Creating an environment named PROD with tiers matching applications tiers.
3. Configuring the PROD environment to support rolling deployment.
4. Defining the rolling deployment phases.
5. Running the application on the PROD environment using rolling deployment.
6. Viewing the application deployments details.
7. Summary

### Creating the "ShoppingCart" Application

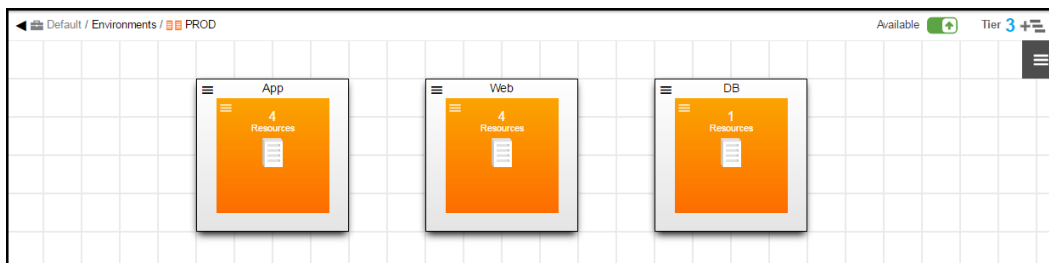
Create the "ShoppingCart" application with three tiers that map to the following components.



**Note:** In ElectricFlow, you can develop your application model based only on business requirements without having to give any special considerations to the deployment strategy.

### Creating the PROD Environment

Create an environment named PROD with tiers corresponding to the applications tiers.




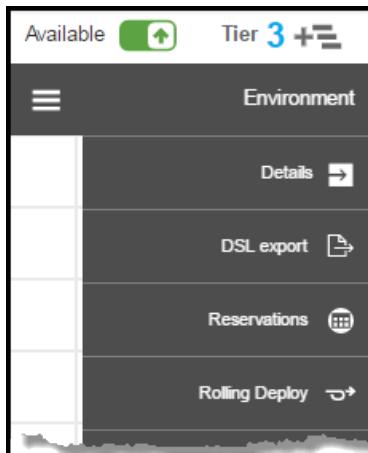
### Configuring the PROD Environment

Configure the PROD environment to support rolling deployment.

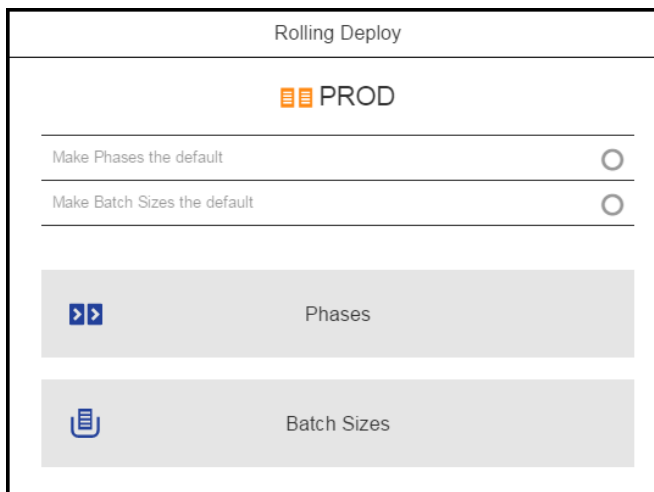
To enable rolling deployment on the environment:



Click  in the upper right corner of the Environment Visual Editor, and select **Rolling Deploy**.



The Rolling Deploy dialog box opens.



There are two rolling deployment strategies that are supported out of the box:

- Phasing: **Phases** are the preferred option when you want to control the resources and specify the order in which they are used.
- Batching: **Batch Sizes** are the preferred option when you do not need to control the resources. The resources are selected at random based on the specified batch size.

You can configure both these strategies on the environment, but only one can be active at a time

### ***Defining the Rolling Deployment Phases***

In this example, the phasing strategy will be used during the rolling deployment.

What you need to know about phases:

- Phases are ordered, and rolling deployment relies on this phase order.
- There are three types of phases:
  - Tagged: Tagged phases are useful when you want to explicitly control the resources used during a rolling deployment
  - Expression: Expression is useful when you want to pick resources for a phase dynamically at run time using conditions. This is done using JavaScript expressions. This is useful when you do not want to tag individual resources and instead want to apply an expression to pick the resources.
  - Broadcast: This type of phase can be used where you want the deployment to run on all the unused resources in environment.

While not mandatory, the broadcast phase will most likely be the last phase in the phase order. The broadcast phase combined with the expression will provide flexibility during the rolling deployment.

There can be only one broadcast phase for an environment.

In this example:

- PHASE1 is a tagged phase.
- PHASE2 is a tagged phase.
- PHASE3-EXP is an expression phase.
- PHASE3-BC is the broadcast phase.

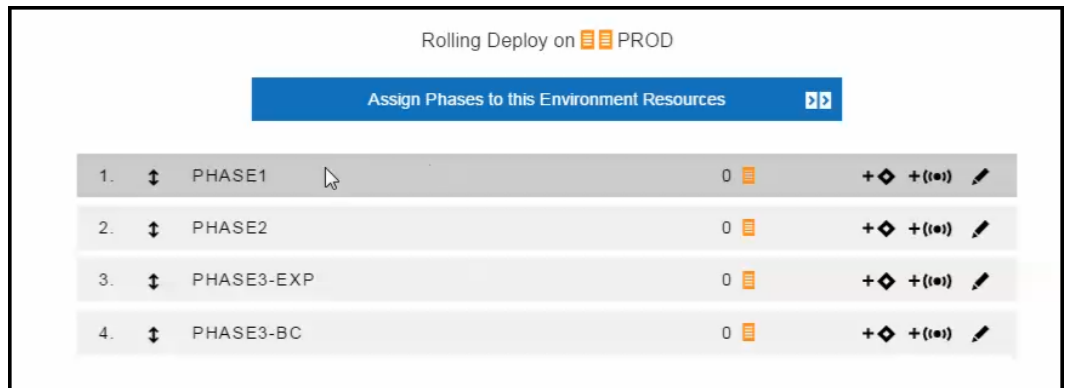
To add phases:

1. In the Rolling Deploy dialog box, click **Phases** to use phasing as the rolling deployment strategy.
2. In the Phases dialog box, click **Add+** in the upper right corner to add a phase.
3. Enter the name of the first phase (PHASE1) and click **Save**.
4. Enter the name of the second phase (PHASE2) and click **Save**.
5. Enter the name of the third phase (PHASE3-EXP) and click **Save**.
6. Enter the name of the fourth phase (PHASE-BC) and click **Save**.

To assign resources to the phases

- In PHASE1, assign the only resource in the DB tier to PHASE1.

1. Select **PHASE1**.

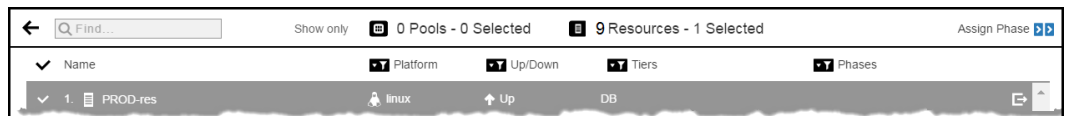


2. Click **Assign Phases to this Environment Resources**.

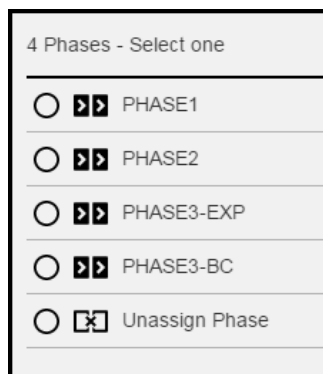
A dialog box showing all the resources across all the tier opens.

3. Select the resources that you want for this phase, and then click **Assign Phase** in the upper right corner.

For PHASE1, select the DB resource:



4. Select **PHASE1**.




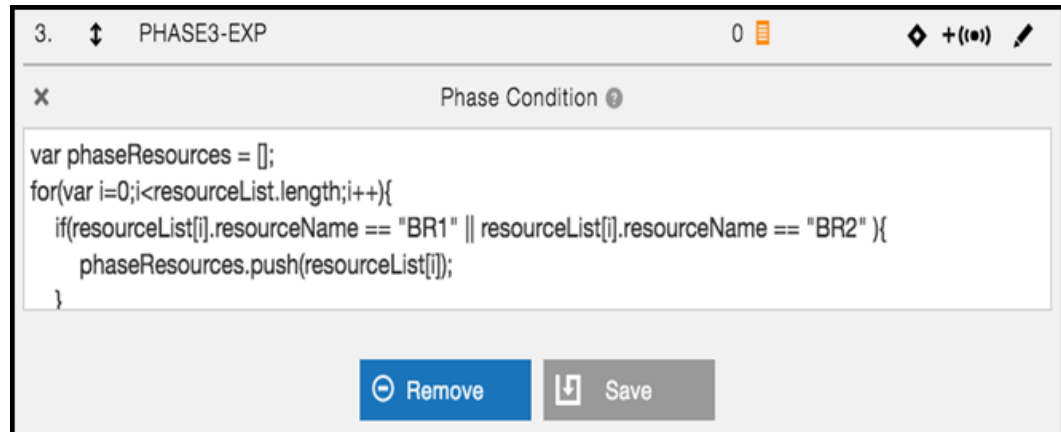
5. Click **OK**.

- In PHASE2, repeat the same steps described for PHASE1 and assign a few resources from the App and Web tiers to PHASE2.

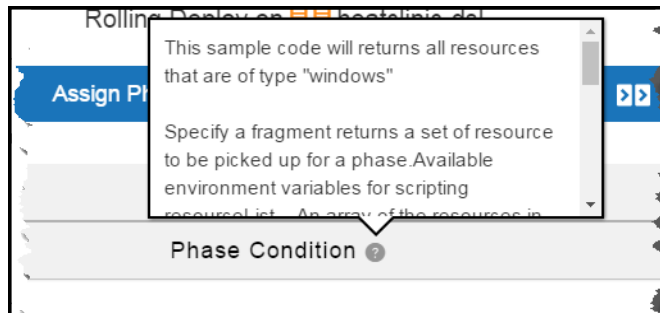
- For PHASE3-EXP, enter an expression to deploy a few more resources in the App tier based on the some rules.



1. Select **PHASE3-EXP** and click  to define the phase with an expression phrase.
2. Enter the expression phrase.




**Note:** When you click **?**, a pop-up window opens and shows sample code for phase conditions.



3. Click **Save**.





- For PHASE3-BC, click  to make this a broadcast phase to deploy to the remaining resources.

4. PHASE3-BC 0

Broadcast

Deploy to all remaining unassigned Resources in the Tier ☐

Save

- Click **Save** to save the definition.

**IMPORTANT:** You can name the phases in your rolling deployment any name you want, such as ORANGE, YELLOW, EAST, WEST, and so on. What is important when defining the phases is the order and type of the phases.

At this point, rolling deployment is enabled on the environment with phasing as the default strategy, and phases are defined as follows:

Rolling Deploy on PROD

Assign Phases to this Environment Resources

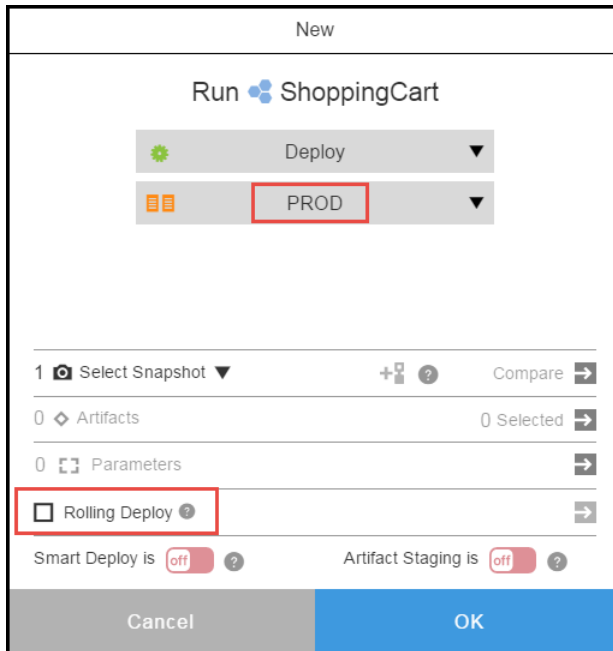
1.	↑ ↓	PHASE1	2	+ + (●)
2.	↑ ↓	PHASE2	3	+ + (●)
3.	↑ ↓	PHASE3-EXP	0	+ + (●)
4.	↑ ↓	PHASE3-BC	0	+ + (●)

**Note:** This is an example setup explaining the available options. It is not necessary to use all the different types of phases. For your deployment, choose the phase types that apply to your use case.

### Running the Application on the PROD Environment Using Rolling Deployment


When you are ready to run the application, go to the dialog box to set the runtime settings for the deployment:

When you select the PROD environment, the option to enable Rolling Deployment is available because rolling deployment was enabled on the PROD environment. If you select another environment where Rolling Deployment is not enabled, the rolling deploy option will not be available. This way, the same application process can automatically behave in different ways based on the chosen environment, giving you the benefit of the *model-driven* approach.



Rolling deployment is now enabled.



Clicking  shows the rolling deployment details.

You can enable or disable phases and to insert a manual step after each phase. When you click **Insert Manual Step after each Phase**, the options to run the manual step and the field to assign users who can perform the step are available.

### Viewing the Application Deployment Details

Once the rolling deployment starts on the PROD environment, you can view the job details to see the breakdown and progress of the deployment. You will notice the job step breakdown corresponding to PHASE1, PHASE2, PHASE3-EXP, and PHASE3-BC. You will also see the automatically inserted manual step after each phase.

Job Step	Start Time	End Time	Progress	Actions
86_Deploy_ShoppingCart_Default_20160805153204	Aug 05, 2016 - 15:32	00:01:23	99%	Stop, Refresh, Details
Phase PHASE1	Aug 05, 2016 - 15:32	00:00:04	100%	Stop, Refresh, Details
Manual Approval - Phase PHASE1 completed	Aug 05, 2016 - 15:32	00:01:18	50%	Stop, Refresh, Details
Phase PHASE2	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details
Manual Approval - Phase PHASE2 completed	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details
Phase PHASE3-EXP	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details
Manual Approval - Phase PHASE3-EXP completed	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details
Phase PHASE4-BC	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details
Manual Approval - Phase PHASE4-BC completed	Aug 05, 2016 - 15:32	00:00:00	0%	Stop, Refresh, Details

**Note:** Any phase that is skipped because there is no resource associated with it is not shown.

You can also use property references to access the current rolling deployment type or the iteration that is in progress:

- To return the rolling deployment type (phase or batch), use `$/myJob/rollingDeployType`.
- To return the rolling deployment iteration that is in progress (such as PHASE1, PHASE2, and so on for batch rolling deployment strategy or phase name for phase strategy), use `$/myJob/currentRollingDeployIteration`.

## Summary

This example shows how to deploy an application to the PROD environment using the rolling deployment strategy and meet these conditions:

- The deployment ran in four phases.
- In the first phase, deploy only to the DB tier and verify the DB upgrade.
- In the second phase, deploy to a few resources in the App and Web tiers and verify that the application was deployed successfully.
- In the third phase, deploy to a few more resources in the App tier based on some rules.
- In the fourth phase, deploy the remaining resources.

## Blue/Green Deployment Use Case

Blue/green deployments are very straightforward to implement in ElectricFlow. Because *blue* and *green* are two physically separate environments, they can be easily configured in the ElectricFlow environment model. Once these models are defined and mapped to applications, the blue/green deployment can be executed like other deployments in ElectricFlow.

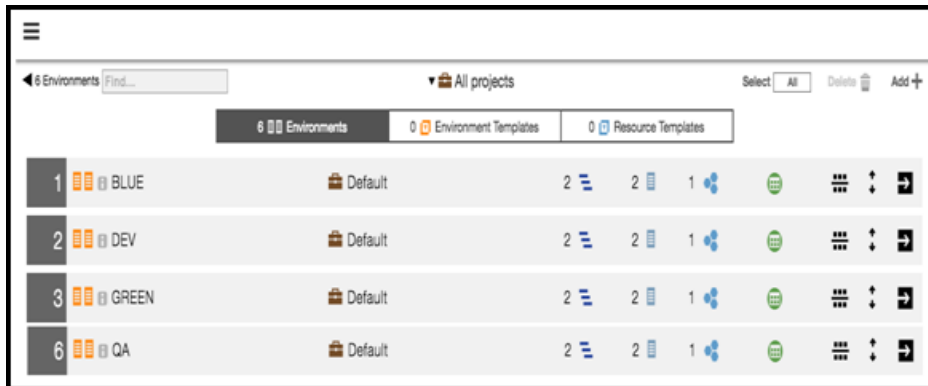
This example shows how an e-commerce company can use the blue/green deployment strategy to deploy its shopping cart application to production. The current deployment process mandates that the application be tested in development and QA environments before the application is deployed to the production environment where the blue/green strategy is used.

Modeling this blue/green deployment consists of the following:

1. [Creating four environments](#)
2. [Mapping the environments to the ShoppingCart application](#)
3. [Creating a pipeline with three stages](#)
4. [Creating three tasks for the PROD stage](#)
5. [Running the pipeline](#)
6. [Summary](#)

### ***Creating Four Environments (DEV, QA, BLUE, and GREEN)***

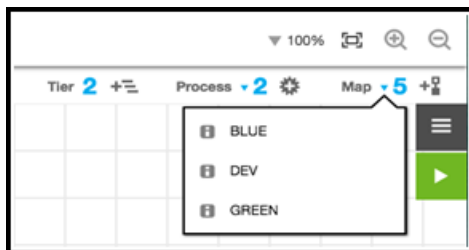
Create four environments called DEV, QA, BLUE, and GREEN.



**Note:** *BLUE* and *GREEN* are names for the environments in this use case. You can use any names you want for them as long as it is clear how they map to BLUE and GREEN.

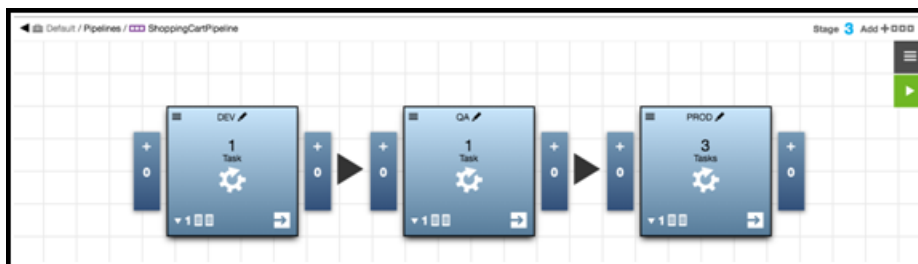
### Mapping the Environments to the ShoppingCart Application

Select the ShoppingCart application, and map the application tiers to the corresponding environment tiers in DEV, QA, BLUE, and GREEN.



### Creating a Pipeline with Three Stages

Create a pipeline with three stages called DEV, QA and PROD.



### Creating Three Tasks for the PROD stage.

In PROD stage, create three tasks:



These are the task details:

Number	Task Name	Description
1	DeployShoppingCart	This is another process task similar to what is in the DEV and QA stages that the environment name is parameterized. The system will automatically switch deployments between the BLUE and GREEN environments.
2	CertifyDeployment	This is a manual step to review and certify the deployment.
3	completePostCertificationTasks	<p>This is an automation task to run any post certification tasks such as updating the load balancer and switching the environment in preparation for the next pipeline run (for example, update the <i>TargetEnv</i> parameter)</p> <div> </div>

## Running the Pipeline

In a blue/green deployment, before you run the pipeline, the GREEN environment is serving all of the production traffic, and the BLUE environment is ready to be upgraded to the new software version.

Before starting the deployment, set the `RollingDeploy/TargetEnv` property on the project to the first environment to which you want to deploy. `RollingDeploy/TargetEnv` will be set to `BLUE` because the GREEN environment is currently catering to end-user traffic.

When the pipeline starts:

1. The pipeline will start at the DEV stage and continue to the PROD stage.
2. Once the deployment reaches the PROD stage, the application process task will deploy to the BLUE environment based on the property value `[/myProject/RollingDeploy/TargetEnv]`, which was set to `BLUE` at the beginning of the run.
3. Once the deployment task has completed, there is a manual step to functionally verify the deployment.  
  
If there was a need for some automated testing, those tasks can easily be added to the pipeline stage.
4. Once the deployment completes successfully, switch the user traffic to the BLUE servers, and update the `RollingDeploy/TargetEnv` property to `GREEN`.

Setting the property value to `GREEN` will ensure that the next deployment will happen to the GREEN environment while the BLUE environment serves all of the production traffic.

## Summary

This example shows that blue/green deployments is very straight forward and easy to implement in ElectricFlow.

## Canary Deployment Use Case

The purpose of a canary deployment is to deploy an application to a small set of servers for validation by a subset of users. Once user validation is complete, the application is rolled out to a larger set of servers. This is very similar to blue/green deployments where you can model separate environments and use pipelines to control deployments to higher-order environments. To implement this use case, see the [Blue/Green Deployment Use Case](#) on page 63 first. The key difference with canary deployments is that part of the traffic is routed to the environment with the latest version. You can achieve this by interacting with load balancers using plugins such as F5's [BigIP](#) at the right time in a pipeline task or process step.

## Application Deployment Options

ElectricFlow supports the following out-of-the-box options to deploy applications:

- When authoring processes or procedures:
  - When defining a step for an application or component process, you must select the actions if a step fails:  
  
**On Error:** Select **Stop running** to stop the process or **Continue running** to go to the next step in the process. The default is **Continue running**.

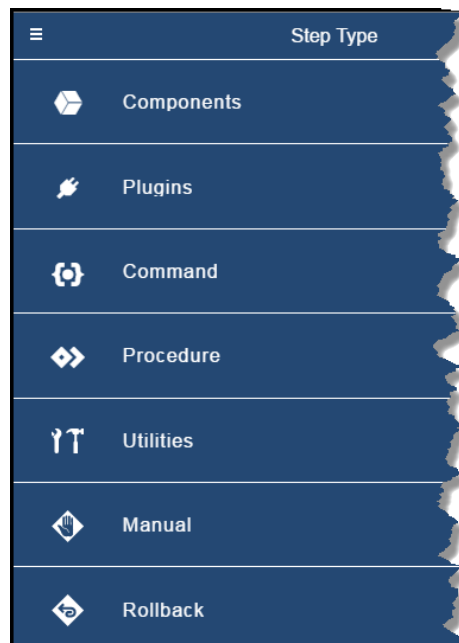
**Run if:** When there are conditions to be met before going to the next step, select one of the following options. The default is **all**.

- **all:** All conditions must be met before the step proceeds.
- **any:** At least one condition must be met for the step to proceed.

You can also attach parameters that affect how the step is executed at runtime. Depending on the type of step that you selected, different sets of parameters or fields are displayed.

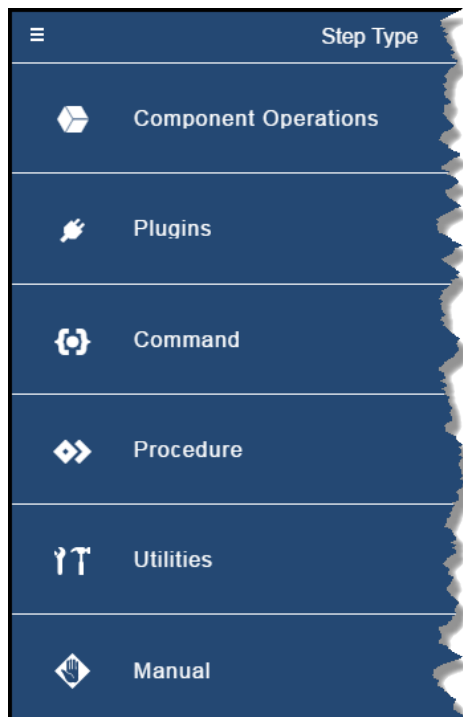
Go to [Examples: Modeling and Deploying Applications](#) on page 148 for examples of how to do define component and application process steps.

- When defining a step for an application process, you can select one of these options:
  - **Components**—Use this to run a component process when the step is executed.
  - **Plugins**—Use this to run a third-party plugin.
  - **Command**—Use this to run one or more commands or a script.
  - **Procedure**—Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level.
  - **Utilities**—Use this to run a higher-order operation than a third-party plugin for application modeling.
  - **Manual**—Use this when a manual step is to be performed by a designated assignee.
  - **Rollback**—Use this to restore the deployment model to a previous state before a deployment failed.





- When defining a step for a component process, you can select one of these options:
  - **Component Operations**—Use this to run a component operation.
  - **Plugins**—Use this to run a third-party plugin.
  - **Command**—Use this to run one or more commands or a script.
  - **Procedure**—Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level.
  - **Utilities**—Use this to run a higher-order operation than a third-party plugin for application modeling.
  - **Manual**—Use this when a manual step is to be performed by a designated assignee.



- You can use *process branching* to specify the path through an application or component process based on transition conditions other than out-of-the-box options. Decisions about the next step in the flow are made while the process runs. This is similar to the transition conditions for workflows in the automation platform (see [Workflow Overview](#) on page 1213 and [Workflow Details](#) on page 896).

Go to [Process Branching](#) on page 125 for more information about process branching states and conditions and how to set them in a process.

- When defining a step for a procedure, you must select the **Error handling** action if the step fails.

You can set the parameters for subprocedure steps.

You can also set run conditions and preconditions for command and subprocedure steps.

Go to [Step—create new or edit existing step](#) on page 772 on how to set these options.

- When modeling environments:

*Environment tiers* in the environment model represent groups of targets defined by their purpose, such as web servers, databases, and artifact repositories. For example, an environment may have environment tiers for the different types of web servers called "Apache," "Tomcat," and "MS SQL", which contain all the files for your company's website in one or more locations. The resources in the Apache environment tier are the Apache servers in each location.

*Environment Reservation and Calendaring* allows you to manage and reduce deployment conflicts and risk when deploying applications, pipelines, or releases. You can schedule blackout periods for planned maintenance work and reserve environments to ensure that resources are available when you need them. The Calendar view makes it easy to visualize planned deployments and conflicts.

- When staging artifacts before the runtime:

*Artifact staging* retrieves artifacts that will be deployed before the deployment run starts. This ensures that all the artifacts are downloaded and available during runtime. It also reduces the application runtime. Artifact staging is enabled by default. Go to [Artifact Staging](#) on page 120 for more information.

- At runtime, select one of the following ways to deploy the application. Go to [Examples: Modeling and Deploying Applications](#) on page 148 for deployment examples.

- Smart deploy

This deployment method reduces risk and time by only deploying changed objects. ElectricFlow automatically detects the differences between what is about to be deployed and what has already deployed to an environment. It deploys only those objects not yet deployed to a specific resource or to resources where the object version is different. You can use this method throughout the software release life cycle.

- Full run

The system deploys the application with all the application processes, components, and artifacts.

- Partial run

The system deploys the application with only the selected application processes, components, and artifacts.

- Selecting artifacts with specific versions to deploy

The system runs the application with only the selected versions of the artifacts.

- Snapshot

The system deploys a snapshot of the application. Also go to [Example: Creating, Deploying, and Comparing Snapshots](#) on page 302 for an example using snapshots.

- A combination of these ways:

	Smart deploy	Full run	Partial run	Artifacts with specific versions	Snapshot
Smart deploy		No	Yes	Yes	Yes
Full run	No		No	Yes	Yes
Partial run	Yes	No		Yes	Yes
Artifacts with specific versions	Yes	Yes	Yes		Yes
Snapshot	Yes	Yes	Yes	Yes	

- **Artifact Staging**

ElectricFlow retrieves the artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target. It also minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment. Go to [Artifact Staging](#) on page 120 for more information.

- **When an action fails in the process**

When an application deployment fails, you can use *rollback* to restore the deployment to a previous state before the failure occurred. This operation is supported only in application processes in the deployment model. Go to [Rollback](#) on page 122 for more information.

## Automated Environment Discovery

*Automated Environment Discovery*, also referred to as *auto-discovery*, makes it easier to create models using your existing resources and environments for deployment automation. You need to set up the resources and environments before creating the deployment model and authoring processes in ElectricFlow. When deployments have large numbers of resources and environments, automated environment discovery speeds up application authoring by:

- Providing resource discovery using middleware plugins, such as EC-WebSphere, on existing resources and environments.
- Allowing the use of discovered resource configurations to accelerate process authoring and deployment automation.

You can initiate the discovery operation on resources from the following pages in the UI:

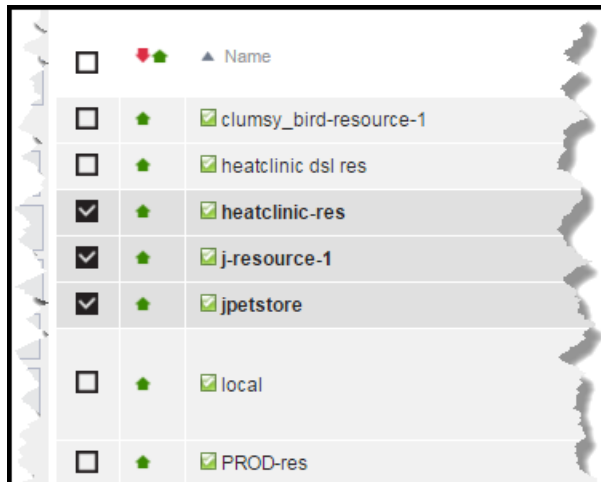
- At the platform level, go to the **Cloud > Resources** page.
- From the Environments Visual Editor for a specific environment.
- From an environment tier in the Environments Visual Editor.


## Resources Page

Starting from the **Cloud > Resources** page:

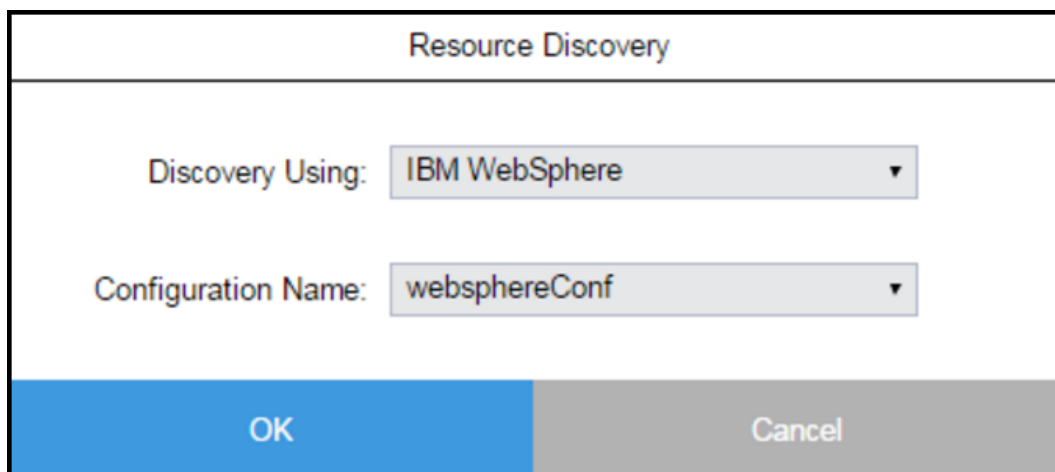
1. Select one or more resources.

### Example:



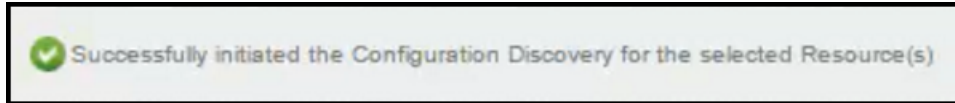
- Click the **Resource Discovery** button (  ) in the upper right corner.  
The Resource Discovery dialog box opens.
- In the **Discover Using** field, select the plugin to use to run the Discover procedure for the selected resources.
- (Optional) If the plugin requires a configuration for the Discover procedure, select the configuration from the drop-down list in the **Configuration Name** field.

### Example:



- Click **OK**.

If the discovery request was successfully submitted, a message appears in the dialog box:



If the discovery could not be run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.

## Environment Visual Editor

Starting from the Environments List:

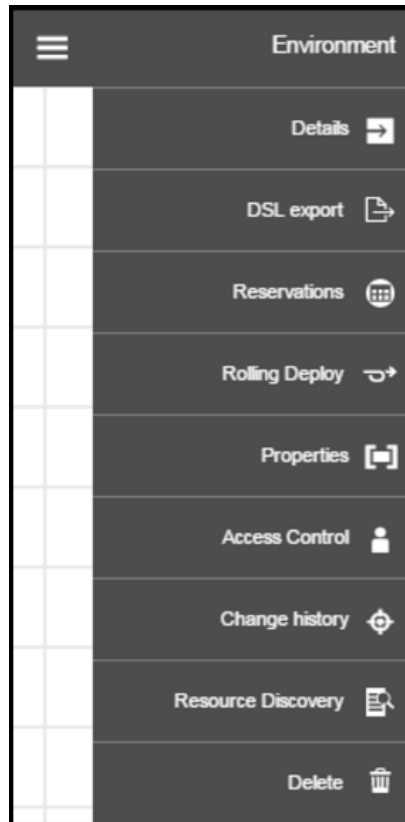
1. Click on an environment name to select it.

The Environments Visual Editor opens.



2. Click the button and select **Resources Discovery**.

### Example:



The Resource Discovery dialog box opens.

### Example:



3. In the **Discover Using** field, select the plugin to use to run the Discovery procedure for the selected resources.
4. (Optional) If the plugin requires a configuration for the Discovery procedure, select the configuration from the drop-down list in the **Configuration Name** field.

### Example:



5. Click **OK**.

If the discovery request was successfully submitted, a message appears in the dialog box:

Successfully initiated the Configuration Discovery for the Environment Resources

If the discovery could not be run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.


## Environment Tier

Starting from an Environment Tier:

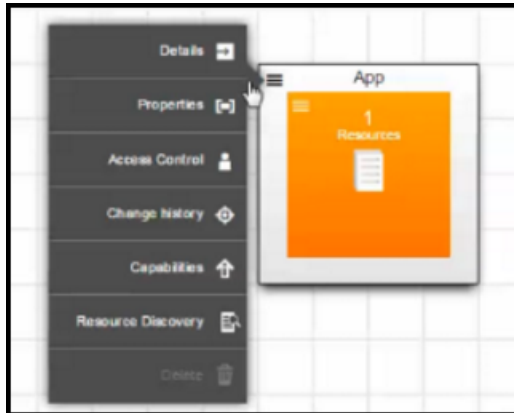


1. Select an environment tier in the Environments Visual Editor.



2. Click the  button for the tier, and select **Resource Discovery**.

### Example:



The Resource Discovery dialog box opens.

3. In the **Discover Using** field, select the plugin to use to run the Discovery procedure for the selected resources
4. (Optional) If the plugin requires a configuration for the Discovery procedure, select the configuration from the drop-down list in the **Configuration Name** field.

### Example:



5. Click **OK**.

If the discovery request was successfully submitted, a message appears in the dialog box:

Successfully initiated the Configuration Discovery for the Tier Resources

If the discovery could not run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.

## Microservice Application Deployment Using Containers

ElectricFlow brings the application release automation practices of modeling, automation, and coordination to containers and microservices. This model-based solution avoids cloud provider or container lock-in by separating application models from environment models that are platform specific.

### Container and Microservice Concepts

ElectricFlow lets enterprises safely deploy microservices and containers at scale in large, enterprise environments. DevOps teams can streamline and simplify processes to get containerized applications up and running, easily promote applications across different container environments, and gain visibility into application pipelines—both traditional and microservice/container-based—through a single pane of governance. Microservices architecture and container utilization provide the speed, flexibility, predictability to let teams build functionality quickly and deliver it instantly across multiple clouds and environments.

Containers and microservices in complex, large-scale, hybrid environments present operations, governance, and orchestration challenges. ElectricFlow lets teams coordinate software releases when deploying containerized workloads or microservices throughout the software delivery lifecycle. ElectricFlow lets teams coordinate and manage three types of releases:

- Large, monolithic application releases
- Microservices application releases that are backed by containers
- Hybrid monolithic and container-backed microservice application releases

ElectricFlow supports legacy or traditional monolithic applications, hybrid data centers and clouds, and large-scale infrastructure.

ElectricFlow lets developer, QA, and operations teams deploy microservices to their preferred container infrastructure or cluster manager solution such as Google Container Engine (GCE), Amazon EC2 Container Service (ECS), or Kubernetes without knowledge of the underlying integrations. This lets them coordinate and manage a mix of monolithic application and microservice releases across legacy or continuous delivery pipelines in both on-premises and cloud environments. Also, the model-based approach is agnostic of container environments or cluster orchestration solutions and enables easy portability among providers.

### *Implementing Containers and Microservices for Use with Your Runtime Environment*

ElectricFlow containers and microservices are “container runtime-agnostic.” This means that you use ElectricFlow to set them up independent of any runtime environment details and then deploy them to the runtime environment of your choice. ElectricFlow supports the GCE and ECS runtime environments.

ElectricFlow supports three types of applications: monolithic applications, microservices applications backed by containers, and hybrid applications, which are a combination of the first two. You can create all three types independent of where they will be deployed.

- Monolithic applications—These are typically a set of applications that point to traditional build artifacts such as .war files, .jar files, database scripts, and database components, none of which are not backed

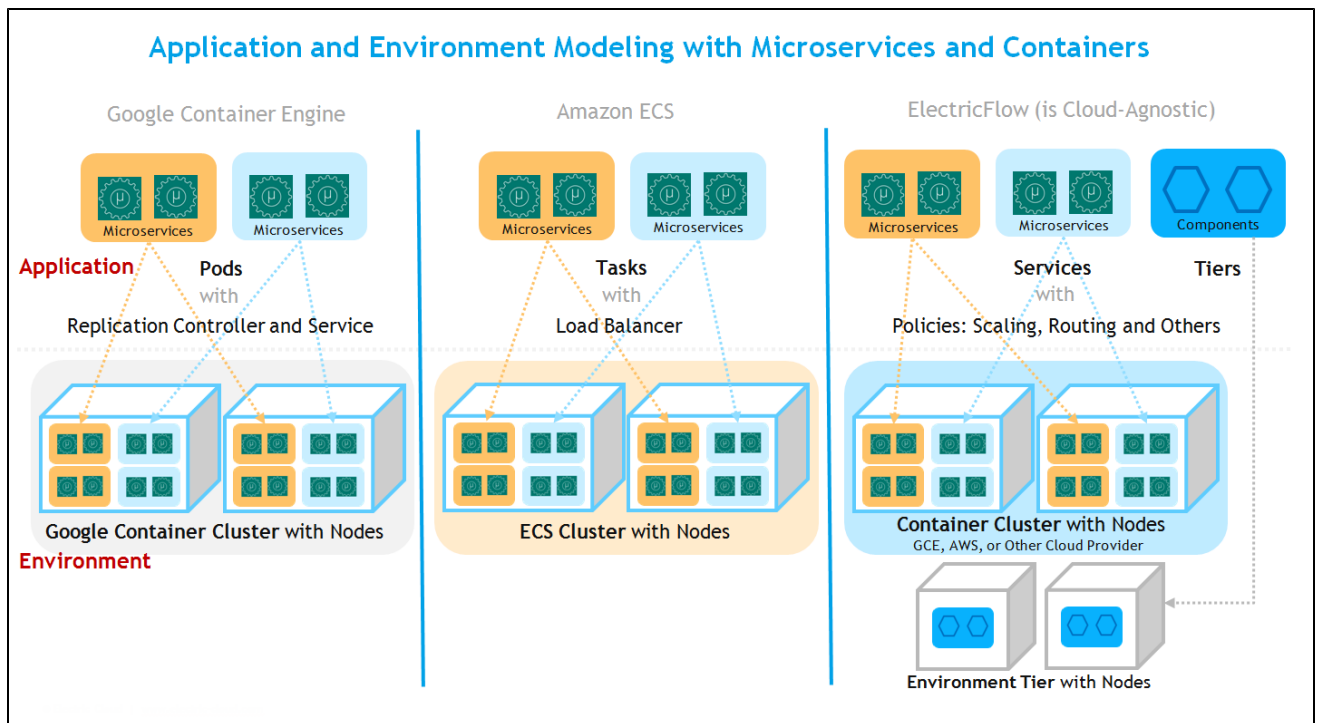
by containers.

- **Microservices applications backed by containers**—A microservices-based containerized application is one that is composed of smaller, focused services, each of which is in a container. Microservices let you scale your development teams and enable higher deployment frequency. Although you can take advantage of the benefits of a microservices architecture without containers, using containers lets you remove configuration challenges across environments by creating lightweight, standalone, deployable packages that contain everything that your software requires.
- **Hybrid applications**—A hybrid application is a combination of monolithic, traditional components such as .war files, .jar files, and databases and other components that are backed by containers. Using hybrid applications lets you re-architect monolithic applications into microservice applications backed by containers in phases rather than all at once.

### Comparison of Modeling Among GCE, ECS, and ElectricFlow

The following figure compares how containers are modeled and deployed in ECS, GCE, and ElectricFlow. In ECS, tasks are used to represent a microservice that is made up of one or more containers. The same microservice in GCE is modeled as pods. These tasks and pods can then be deployed to appropriate cluster nodes that were created in their respective platforms.

With ElectricFlow, each microservice is modeled as an application service that maps to one or more containers that make up the microservice. In addition, you can use application tiers that represent monolithic application components to support a hybrid model. This makes the application model agnostic to the deployment platform. Then you create environments using the clusters and optionally the tiers that correspond to each platform that you want to support. And through the application tier mapping, you associate the application model with the environment model for deployment. You can create multiple tier mappings that correspond to each of the platforms to which you want to deploy.



**Note:** The ElectricFlow user interface abbreviates “microservice” as “service.”

The following table shows a comparison of the key terms used by the container management service supported by ElectricFlow and the equivalent terms used in the ElectricFlow user interface.

Amazon EC2 Container Service (ECS)	Google Container Engine (GCE)	ElectricFlow
Application	Application	Application
Cluster	Cluster	Cluster
Task definition	Pod	Service/container
Load balancer	Service/replication controller	Container ports and service port

## Workflow for Implementing Containers and Microservices in ElectricFlow

Following is the high-level process for setting up containers and microservices using ElectricFlow and then integrating them with the runtime environment of your choice:

### 1. Create an application model that is composed of services.

You complete this step independent of the environment(s) that you will use. Each service can have one or more containers.

In this step, you group the containers into a cluster. Also, in this step, you enter the metadata for each container to specify the location of the container image, the CPU requirement, the scaling criteria, the memory requirement, and so on.

At the time of deployment, ElectricFlow ensures that the application does the right things and calls the correct APIs.

You can create an application in a hybrid manner in which some pieces point to traditional build artifacts such as .war files, .jar files, database scripts, and database components and others are containerized microservices.

### 2. Create one or more environment models.

You complete this step independent of the application that you will deploy. In each environment, you create a cluster of nodes, each of which has a set of containers that hold microservices. You enter the metadata to point each environment to a specific provider (a runtime engine such as GCE or ECS). You can create an environment in a hybrid manner in which some pieces are clustered and others are traditional physical resources or static VMs.

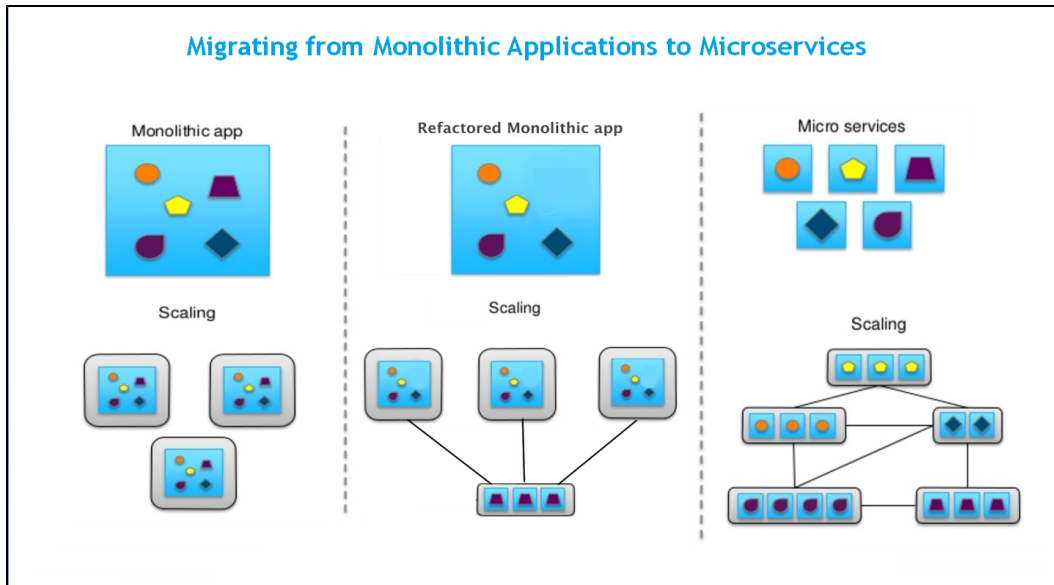
### 3. Map the application model to one or more environment models.

This lets you deploy the same application to any container runtime platform of your choice.

## Migrating from Monolithic Applications to Microservices

The following figure shows how ElectricFlow supports a hybrid model, which means that you do not need to convert an entire monolithic application to containers all at once. That is, you can continue to deploy part of the application, and you can convert other parts to containers and deploy them alongside the remaining monolithic

functionality using the same process. This lets you adopt containers over time without converting the entire application at once (without losing the overall visibility of the entire application definition/model). This also lets you test parts of the application to lower risk.



## Volume Support

To be able to save (persist) data and share data between containers, Docker uses volumes. Volumes are directories (or files) that are outside of the default Union File System and exist as normal directories and files on the host file system. ElectricFlow lets you specify the volume pointing to a storage device or a partition that can be mounted by a container.

## Private and Public Registries and the Use of Credentials

Container infra-structure	Docker public registry	Docker or Docker certified private registry	Google Container Registry (GCR)	Amazon EC2 Container Registry (ECR)
Amazon ECS	Supported natively	Requires preconfiguration of images (VMs)	Requires preconfiguration of images (VMs)	Requires preconfiguration of images (VMs)
Google Container Engine	Supported natively	Supported via secrets. (Uses registry URL/credential)	Supported via secrets. (Uses registry URL/credential)	Supported via secrets. (Uses registry URL/credential)

## Object Naming Guidelines

Following are the restrictions in ElectricFlow for naming services, containers, clusters, service ports, and environment variables. (These restrictions also apply to values that you use with the `newName` argument.)

### *Restrictions*

ElectricFlow has restrictions for naming the following objects: services, containers, service ports, and environment variables. This means that these restrictions apply to the `serviceName`, `containerName`, `clusterName`, `environmentVariableName`, and `environmentVariableName` respectively.

Object names must contain:

- Between 1 and 253 characters
- Only alphanumeric, commas, underscores, and hyphens. Spaces are not allowed.

Kubernetes has length restrictions for fields. ElectricFlow does not limit or truncate the lengths in the ElectricFlow plugins for GCE and ECS, and the API reports an error if the length restrictions are violated.

Because ECS and GCE have their own naming restrictions for services and containers, these restrictions let you use your model across those platforms.

The ElectricFlow plugins for ECS and GCE do not use the ElectricFlow cluster name. The platform cluster name is passed in as a procedure-specific parameter and is separate from the Deploy cluster name, so these naming restrictions do not apply.

### *Conversion of Characters in Object Names by ECS and GCE*

- The ElectricFlow plugin for GCE converts spaces and underscores to dashes and converts uppercase characters to lowercase.
- The ElectricFlow plugin for ECS converts spaces to dashes.
- The ElectricFlow plugins for GCE and ECS remove leading and trailing dashes.

## Guidelines for Using Clusters

Creating clusters in GCE requires more time than creating clusters in ECS. The Provision Cluster procedure in the GCE and ECS container plugins creates the cluster on the container platform if it does not already exist. Google Container clusters take time to spin up, so the Provision Cluster procedure waits (five minutes by default) for the cluster creation to finish before continuing.

## Limitations

- Amazon ECS does not support providing the private registry credentials at the service deployment time. The registry credentials must be available on the EC2 container instances when the ECS agent starts. You must ensure that the registry credentials are available on the instance by following the guidelines in the *Private Registry Authentication* page at <http://docs.aws.amazon.com/AmazonECS/latest/developerguide/private-auth.html>. Deploy users can provide the required information (using these guidelines) through the User Data parameter value provided with the Provision Cluster procedure.
- Rollback of containers is not supported.

## Configuring a Database for Containers and Services

Following are the recommended sources of information that describe how to connect to a database for containers and services.

### Connecting to Kubernetes

See *Connecting from Google Container Engine* at <https://cloud.google.com/sql/docs/container-engine-connect> or *Connecting MySQL Client Using IP Addresses* at <https://cloud.google.com/sql/docs/mysql-client>.

### Connecting to Amazon

See *Connecting to an Amazon RDS DB Instance* at [http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP\\_CommonTasks.Connect.html](http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_CommonTasks.Connect.html).

### Configuring the CIDR Range of Containers Allowed to Connect

Another option is configure the CIDR range of containers that are allowed to connect to a database. See *Creating a DB Cluster and Connecting to a Database on an Amazon Aurora DB Instance* at [http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP\\_GettingStarted.CreatingConnecting.Aurora.html](http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_GettingStarted.CreatingConnecting.Aurora.html).

## Master Components

Master components promote component reuse. They provide an easy way to create new components by reusing existing component definitions and the underlying process definitions. Master components are components that can be created and managed independent of any application. A master component consists of a component definition and one or more component processes. Master components are then leveraged to create application components either by referencing or copying them.

You can use master components to create a library of standardized reusable components which can help to promote best practices across the enterprise (such as a standard WebSphere component, standard IIS component, and so on). When deployments have large numbers of similar components, this can be used to speed up application authoring by leveraging prebuilt component and component-process logic.

A component has two parts:

- The component details describe the artifact on which the component is based. It can include where the artifacts are stored (the source or repository server), artifact name, artifact version, the directory where the artifact can be retrieved, and so on. You can parameterize part of the artifact definition to account for variations in the artifact details every time you deploy the application. This allows you to reuse the master component in multiple deployment scenarios. For example, you can create a master component that has a standard process to deploy and undeploy, and the only thing that changes is which specific artifact to use based on parameters.

- *Component processes* are used to define the automation steps to perform on the artifact defined in the component details. These processes can be used to deploy, undeploy, or do any other action. Each master component can have one or more component processes, and each process can have specific automation steps. These steps can describe how to perform specific tasks such as publish or retrieve an artifact, stop a server process, copy files, restart the server, and so on. A master component must have at least one component processes. You can parameterize the master component processes so that certain behaviors can be achieved when master components are used in an application definition. For example, you can have *port number* as a component process parameter for a master component, and have different values for the port number in different application models where this master component is used.

After creating the master component, you can reference or copy it to create a new component in an application.

- You can reference a master component when authoring an application. The new application component will have the same properties as the master component. Any changes made to the master component will affect all the application components that reference it.

Use the *reference* method when you want to maintain lineage with the master component so that the application component continues to inherit definitions from the master component. Before making a change to a master component, check how many applications reference it and determine the impact of changing it.

- You can also copy a master component when authoring an application. The new application component will have the same properties as the master or existing application component when it is created.

Use the *copy* method when you want to use a master component just as a baseline for your application component. After an application component is created from a master component, any subsequent changes to the master component will not affect the application component. To get the latest changes in the application component, you delete and recreate the application component, and copy the latest master component to create a new application component.

You can also take an existing component that was originally copied from a master component, modify it, and then save it as a new master component that can be reused and shared by other users.

## Master Component Examples

This example shows how to create a master component, create parameters for the artifact definition, define the component processes, create parameters for the component processes, and use the master component in an application, promoting the component reuse throughout your organization. It does not include how to author applications and environments or how to deploy the application. For information about these tasks, see the example in [Examples: Modeling and Deploying Applications](#) on page 148.

In the following steps, you will learn how to:

1. [Create a master component and parameters for the artifact definition.](#)
2. [Author component processes and parameters.](#)
3. [Use the master component in an application.](#)

### *Creating a Master Component and Parameters for the Artifact Definition*

This section shows how to create a new master component and create parameters for the artifact definition.

#### **Example:**



Master Components		▼ All projects		Select	Delete	Add +
8 Applications   4 Master Components						
1	datalead_mc	Default	Jul 13, 2015 02:46	admin	0 Used	▼ 1 ⭐
2	HC Cleanup DB	Default	Jan 23, 2016 21:16	admin	0 Used	▼ 2 ⭐
3	HC Config	Default	Jan 23, 2016 21:16	admin	0 Used	▼ 2 ⭐
4	HC HeatClinic	Default	Jan 23, 2016 21:16	admin	0 Used	▼ 2 ⭐

By default, the master components for all projects are displayed.

To see only the objects for a specific project, click the down arrow in the **All projects** field and then select one or more projects in one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

Starting from the Master Components List:

1. Click the **Add +** button.  
The **New** dialog box opens.
2. Click **Master Component > Create New** to create a new master component.
3. Enter the name of the new master component and select a project to which the master component belongs.

**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

### Example:

New

New Component

Electric Cloud ▼

jboss-mc-prod

Description

4. Click **Next**.  
The **Component Details** page dialog box opens.
5. Click the down arrow in the **Content Location** field.

6. Select an artifact repository where artifacts are stored, which is represented as a plugin.

### Example:

Select **EC-Maven**.

The screenshot shows a web interface titled "Component Details" for a component named "iboss-mc-prod". The interface includes a "Description" link. Below this, a dropdown menu is set to "EC-Maven" with a "Browse" link next to it. The form contains several input fields and labels:

- Configuration Name:
- Public Server URL:
- Repository:  Required
- Artifact:  Required
- Version: ☒ Latest
- ☐ Exact
- Classifier:
- Artifact Extension:  Required

7. Enter the information about the artifact.

The information that you enter depends on the artifact repository (plugin) that you selected.

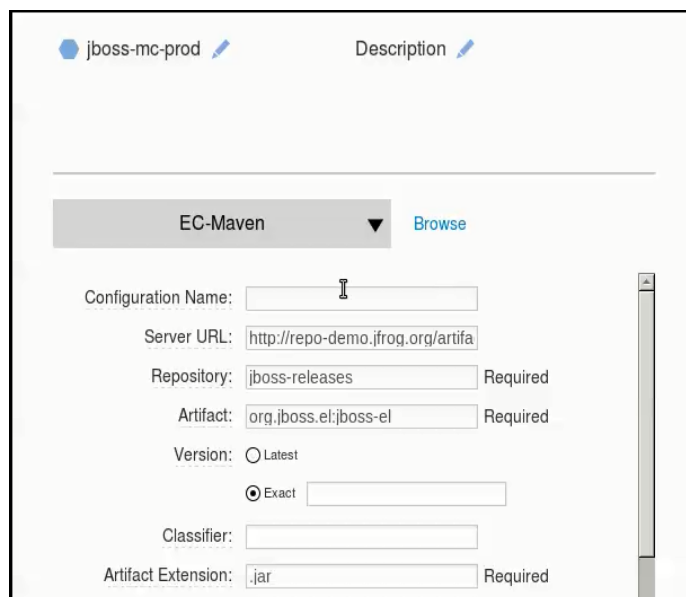
### Example:

For **EC-Maven**, enter the following information.

- Server URL: `http://repo-demo.jfrog.org/artifactory/`
- Repository: `jboss-releases`
- Artifact: `org.jboss.el:jboss-el`
- Version: `Exact`
- Artifact extension: `jar`

We will be parameterizing the artifact name and replacing **jboss-el** with a variable. For now, enter the information in the **Artifact** field above because it is required and the component cannot be created without this required information.


If you had selected another plugin, you may not have to do this.



The screenshot shows the configuration form for the 'EC-Maven' plugin. At the top, there is a header with 'jboss-mc-prod' and a 'Description' field. Below this, a dropdown menu is set to 'EC-Maven' with a 'Browse' button next to it. The form contains several input fields: 'Configuration Name' (empty), 'Server URL' (filled with 'http://repo-demo.jfrog.org/artifa'), 'Repository' (filled with 'jboss-releases' and marked 'Required'), 'Artifact' (filled with 'org.jboss.el:jboss-el' and marked 'Required'), 'Version' (radio buttons for 'Latest' and 'Exact', with 'Exact' selected and an empty text box next to it), 'Classifier' (empty), and 'Artifact Extension' (filled with '.jar' and marked 'Required').

8. Click **OK**.

The component that you created now appears in the list.

9. Go to the row for the master component that you just created, and click the  button.
10. Select **Parameters**.

11. In the Parameters dialog box, click **There are no Parameters yet. Add one +**, or click **Add +**.

### Example:

The screenshot shows a dialog box titled "Parameters" with a header bar containing "0 Parameters", a "Delete" button with a trash icon, and an "Add +" button. Below the header is a table with one row: "jboss-mc-prod" in the "Name" column, "Select" in the "Type" column, and "None" in the "Required" column. Below the table is a large light gray box with the text "There are no Parameters yet. Add one +" in blue.

12. In the New Parameter dialog box, enter the parameter settings.

### Example:

In the **Name** field, enter **artifactName**.

In the **Label** field, enter **Artifact Name**.

Keep the rest of the fields as is.





The screenshot shows a "Parameters" dialog box with a "New Parameter" section. It contains the following fields: "Name" with the value "artifactName", "Description" (empty), "Label" with the value "Artifact Name", "Type" with a dropdown menu showing "Text Entry", and "Default Value" (empty). There are "Cancel" and "OK" buttons. At the bottom, there are two checkboxes: "Required" (checked) and "Defer Expansion" (unchecked).

This parameter has default value and is required. The user must enter a value for this parameter when this master component is used in an application.


13. Click **OK**.

### Example:

The Parameters dialog box now shows that there is one required parameter for the master component called Artifact Name and that the user has to enter the text (the artifact name) for it.

1 Parameters			Delete 	Add 
jboss-mc-prod			Select	All
Name	Type	Required		
1.  Artifact Name	Text Entry		>	



14. Go to the row for the master component that you created, and click the  button.
15. Select **Details** to modify the artifact definition with the artifact-name parameter.
16. In the Component Details dialog box, go to the **Artifact** field and replace **jboss-el** with **\${artifactName}**.

### Example:

Component Details

jboss-mc-prod

Description

EC-Maven

Browse

Configuration Name:

Public Server URL:

http://repo-demo.jfrog.org/artifactory/

Repository:

jboss-releases

Required

Artifact:

org.jboss.el:\${artifactName}

Required

Version:

Latest

Exact

Classifier:

Artifact Extension:

jar

Required

17. Click **OK**.

You have now created a master component with one parameter for the artifact definition.


**Note:** The other ways to create a master component are:—Create it from an existing master component by selecting an existing component from the "Create from existing component" list in the dialog box. —Create from an existing application component by selecting an application and an application tier associated with that application and then an existing component in that application and application tier.

The next step is to add processes to the master components and create parameters for the processes.

## Authoring Component Processes and Creating Parameters

This section shows how to author component processes for the master component created in the previous section and create parameters for those processes.

Starting in the Master Component list:

1. Go to the row for the master component that you created, and click the  button.
2. Select **Add process**.

The **Component Process** dialog box opens.

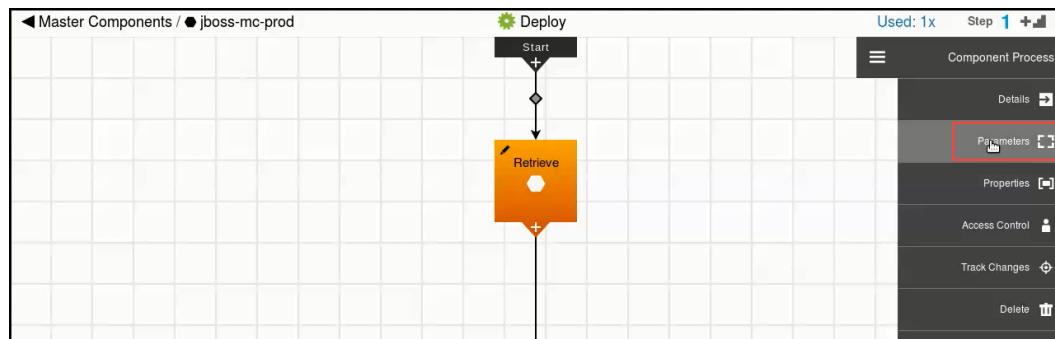
3. Enter the component process details, and click **OK**.
4. Define the component process in the Component Process Visual Editor.


For detailed instructions and examples, go to [Examples: Modeling and Deploying Applications](#) on page 148.

5. Select the **Deploy** process.

The Component Process Visual Editor for it opens.

### Example:



6. Click the  button on the right side, and select **Parameters**.
7. In the Parameters dialog box for the Deploy process, click **There are no Parameters yet. Add one +**, or click **Add +**.

8. In the New Parameter dialog box, enter the parameter settings, and click **OK**.

### Example:

In the **Name** field, enter **portNumber**.

In the **Label** field, enter **Port Number**.

Keep the rest of the fields as is.

Parameters

New Parameter

portNumber

Description

Port number

Text Entry

Default Value

☒ Required

☐ Defer Expansion

This parameter has no default value and is required. The user must enter a port number when this master component is used in an application.

9. Click **OK**.

### Example:

The port number parameter is created for the Deploy process.

The Parameters dialog box shows that the port number parameter is required for the Deploy process.

1 Parameters			Delete	Add
Deploy			Select	All
Name	Type	Required		
1. Port number	Text Entry		>	

10. Close the Parameters dialog box.

11. Reference the master component in an application, or copy it to an application.

- To reference the master component in an application, go to [Referencing a Master Component in an Application](#) on page 92.
- To copy the master component to an application, go to [Copying a Master Component to an Application](#) on page 97.

After you add the component to an application tier, a dialog box appears prompting you to enter values for the parameters for the master component process, starting with [this step](#).

You have now authored component processes for the master component and have created a parameter for it.

### Viewing the Master Component Details

You can ensure that the artifact definition and component process step defined by the master component are correct by viewing the master component details in the following places.

They first appear in the artifact definition:

The screenshot shows the 'Component Details' dialog box for a component named 'jboss-mc-prod'. The dialog has a header bar with the component name and a 'Description' link. Below the header, there is a section for 'EC-Maven' with a 'Browse' button. The main area contains several input fields and radio buttons for configuring the component. The 'Artifact' field is highlighted with a red box and contains the text 'org.jboss.e:jboss-ejb3'. The 'Repository' field contains 'jboss-releases'. The 'Public Server URL' field contains 'http://repo-demo.jfrog.org/artifactory/'. The 'Version' field has radio buttons for 'Latest' and 'Exact', with 'Exact' selected. The 'Classifier' field is empty. The 'Artifact Extension' field contains 'jar'. The 'Configuration Name' field is empty. The 'Required' label is present next to the 'Repository', 'Artifact', and 'Artifact Extension' fields.

Component Details	
jboss-mc-prod	Description
EC-Maven <a href="#">Browse</a>	
Configuration Name:	
Public Server URL:	<a href="http://repo-demo.jfrog.org/artifactory/">http://repo-demo.jfrog.org/artifactory/</a>
Repository:	jboss-releases Required
Artifact:	org.jboss.e:jboss-ejb3 Required
Version:	<input type="radio"/> Latest <input checked="" type="radio"/> Exact
Classifier:	
Artifact Extension:	jar Required

They also appear in the component process step details. When you view the component process details for the Deploy process in the Component Process Editor, you can see that the Deploy process consists of one step called Retrieve, which is defined by the jboss-mc-prod master component.



**Define Step**

On Error: ☐ Stop running ☒ Continue running

---

**Parameters inherited from component**

Configuration Name:

Server URL:

Repository:  Required

Artifact:  Required

Version: ☐ Latest ☒ Exact

Classifier:

Artifact Extension:  Required

Retrieve to Directory:

Overwrite: ☐

### *Using a Master Component in an Application*

After master components have been defined, they can be used in application models. There are two ways to leverage master components in an application:

- [Reference the master component in an application.](#)
- [Copy the master component to an application.](#)

To review the implications of these methods, go to [Master Components](#).

### *Referencing a Master Component in an Application*

When you reference a master component in an application, it is added to the application as an application component with the same definition, processes, parameters, and properties as the referenced master component. Any changes made to the master component will affect all the application components that reference it. Use the reference method when the component is used in multiple applications and you want to ensure that these application components continue to inherit all changes made to the master component.

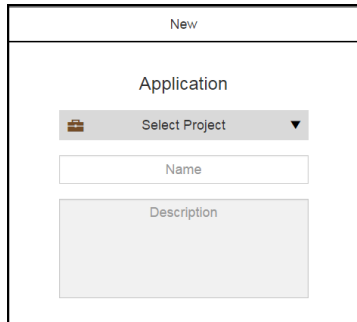
This section shows how to author a new application that references the master component created in the previous sections.

Starting in the Applications List:

1. Click the **Add +** button.  
The New dialog box opens.
2. Click **Application > Create New** to create an application.

3. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description of it.

### Example:



4. Click **OK**.

The Applications Visual Editor for your application opens. This is where you will author the application.

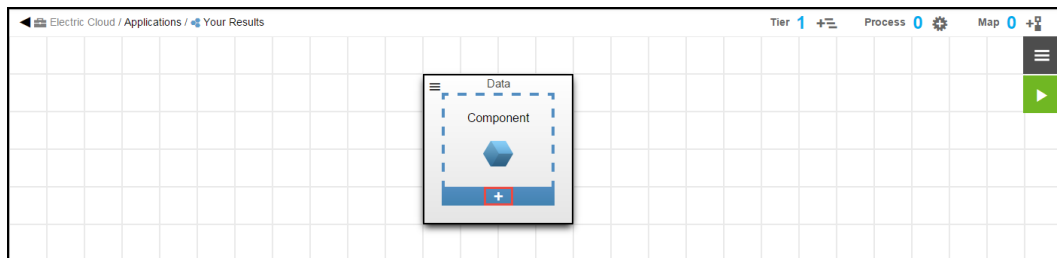
Notice that there is an undefined application tier (Tier 1) with an undefined component in it.



5. Click the button in the application tier and select **Details** to open the Applications Tier Details dialog box.
6. Change the tier name to **Data** in the Name field, and click **OK** to rename the application tier.

The Applications Visual Editor now shows one environment tier called Data.

### Example:



7. Click the + button in the component to add a component to the application tier.

8. Select **Create from existing master component**.

A list showing all available the master components opens.

You can also create a new application component using one of these options:

- **Create a new application component**—Clicking this creates a new component as described in [Examples: Modeling and Deploying Applications](#) on page 148.
- **Create from existing application component**—Clicking this opens the **Create from existing component** dialog box. Click in the **Select Application** field and select an application. Then click in the **Select Tier** field and select an application tier. A list of components in the selected application and application tier appears. Select a component from this list.

9. In the **Create a reference to a master** list, select a master component.

In this example, select the master component called **jboss-mc-prod**.

10. Click **Next**.

The **Create from existing component** dialog box opens.

11. In the **New** dialog box, change the name to **jboss-mc-results**, and click **Next**.

12. Click **Next**.

If the master component has parameter for its artifact definition, you are prompted to enter values for those parameters in the next step.

### Example:



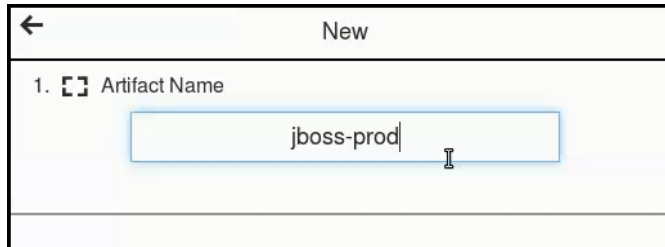
If the component does not have parameters for its artifact definition, click **OK**. Then go to the Component Process Visual Editor and add a parameter to the component, starting at Step 9 in [Creating a Master Component and Parameters for the Artifact Definition](#) on page 83 [Authoring Component Processes and Creating Parameters](#) on page 89

13. Enter the values for the parameters, and click **OK**.

### Example:

The jboss-mc-results component has one parameter called Artifact Name.

Enter **jboss-prod** in the Artifact Name field.



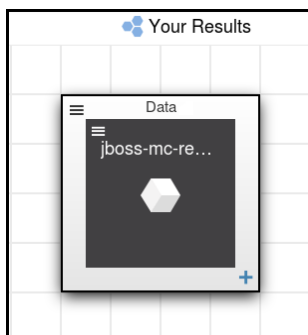
14. Click **OK**.

The Applications Visual Editor now shows that the application has an application tier with a referenced master component.

**IMPORTANT:** If you want to edit the master component, you need to do this in from the Master Component list. (There is no button in the lower right corner where you can access the component processes.) The UI also lets you know that this is a master component because the icon is different than that for a normal component.

### Example:

The Applications Visual Editor now shows that the application has an application tier called Data with a referenced master component called jboss-mc-results.

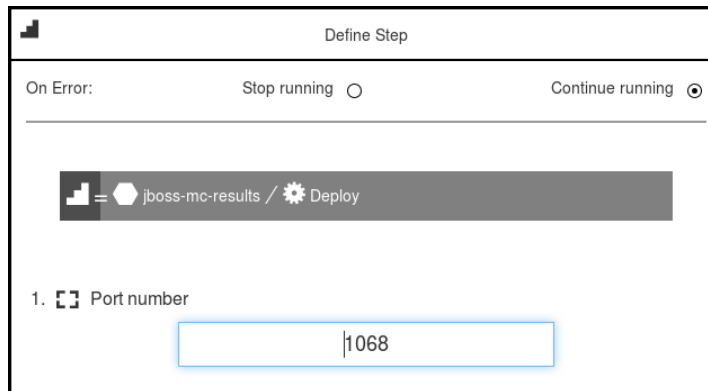


15. Define the application process to include a step that references the master component.
  - a. The first step is defined by the jboss-mc-results component and its Deploy process.

After you select the Deploy process, you are prompted enter to a value for the port number. Then click **OK**.

### Example:

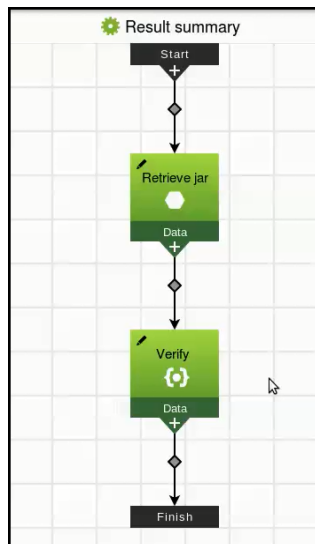
This is the parameter that is created for the master component process.



- b. The second step prints the port number that you entered in the previous step.

### Example:

This is the application process:



Now you can deploy your application as described in [Deploying and Troubleshooting Applications](#) on page 186.

## Copying a Master Component to an Application

When you copy a master component to an application, it becomes an application component with the same definition, processes, parameters, and properties as the master component on which it is based. After an application component is created from a master component this way, any subsequent changes to the master component will not affect the application component. Use this method when you want to use a master component just as a baseline for your application component.

For details about how to create master components and parameters for them, see [Creating a Master Component and Parameters for the Artifact Definition](#) on page 83 and [Authoring Component Processes and Creating Parameters](#) on page 89.

This example describes how to copy a master component in an application.

Starting in the Applications list:

1. Click the **Add +** button.

The **New** dialog box opens.

2. Click **Application > Create New**.

3. Enter the name of the new master component and select a project to which the master component belongs.


In this example, we will create a new application called "Your Group Summary" that will include the master component called jboss-mcjc.

4. Click **OK**.

The Applications Visual Editor for your application opens. This is where you will author the application.

Notice that there is an undefined application tier (Tier 1) with an undefined component in it.



5. Click the  button in the application tier and select **Details** to open the Applications Tier Details dialog box.

6. Change the tier name to **Data** in the Name field, and click **OK** to rename the application tier.

7. Click the **+** button in the application tier to add a component to it.

8. Select **Create from existing master component**.

A list showing all available the master components opens.

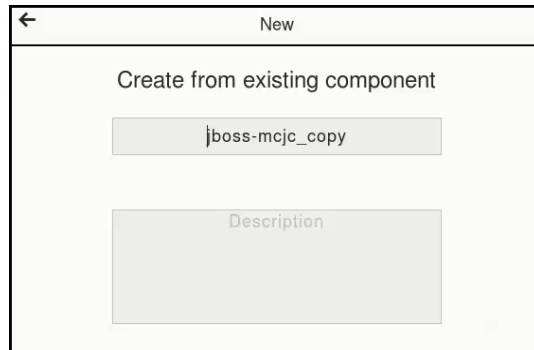
9. In the "Create a reference to a master" list, select a master component.

Select the master component called **jboss-mcjc**, select **Use a copy**, and select a project to which the master component belongs.

10. Click **Next**.

The **Create from existing component** dialog box opens.

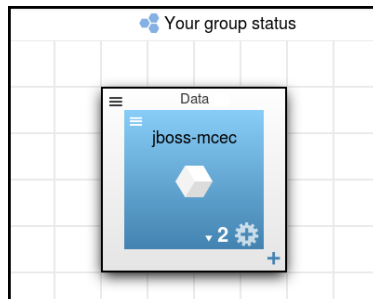
### Example:



11. Change the name of the component to something that gives it more context.

### Example:

After changing the component name to **jboss-mcec** and clicking **OK**, the Data tier now has a new application component called jboss-mcec, where "ec" refers to a software version:



12. If the master component has parameters for the artifact details, modify the artifact details of the new application component and remove the parameter reference.
  - a. Go to the Component Details dialog box.
  - b. Replace the parameter (`${artifactName}`) in the artifact details section with a specific value.

In the example, replace `${artifactName}` with **jboss-5-maintenance**, where software versions starting with lower case letters are maintenance releases
  - c. Click **OK**.

13. Define the application process to include a step that references the new application component.

- a. The first step is defined by the jboss-mcec component and its Deploy process.

After you select the Deploy process, you are prompted enter to a value for the port number.  
Then click **OK**.

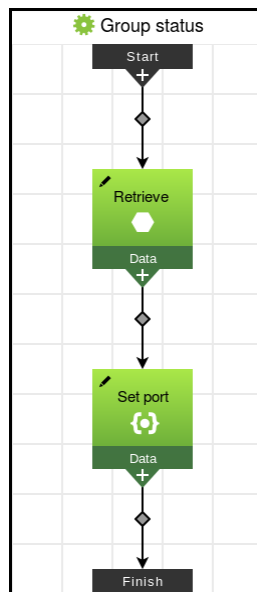
### Example:

This is the parameter that is created for the component process.

- b. The second step prints the port number that you entered in the previous step.

### Example:

This is the application process:



14. Make other modifications to the application component and its component processes within application.



Now you can deploy your application as described in the [Guidelines for Modeling and Deploying Applications in ElectricFlow](#) on page 145.

### ***Creating Master Components Based on Existing Application Components***

Starting from the Master Components List:

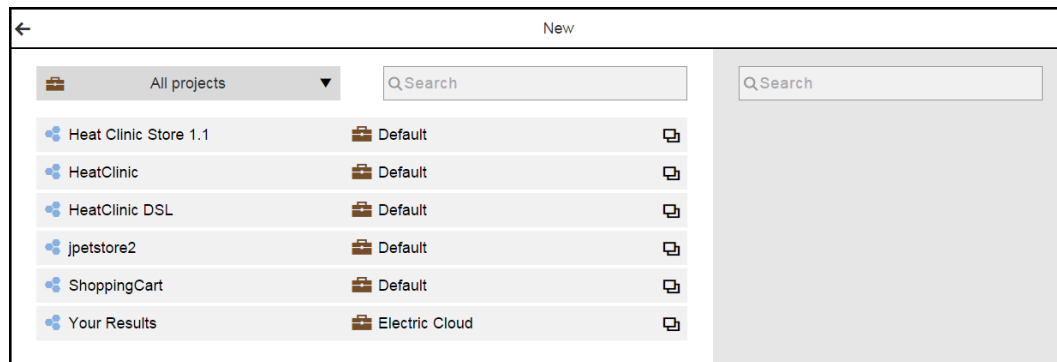
1. Click **Add +**.

The **New** dialog box opens.

2. Click **Master component > Copy Application Component**.

A list of existing applications opens. It shows the list of available applications. The default is to show the applications for all projects. If you want to see only the applications for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more applications by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no applications in the selected projects.

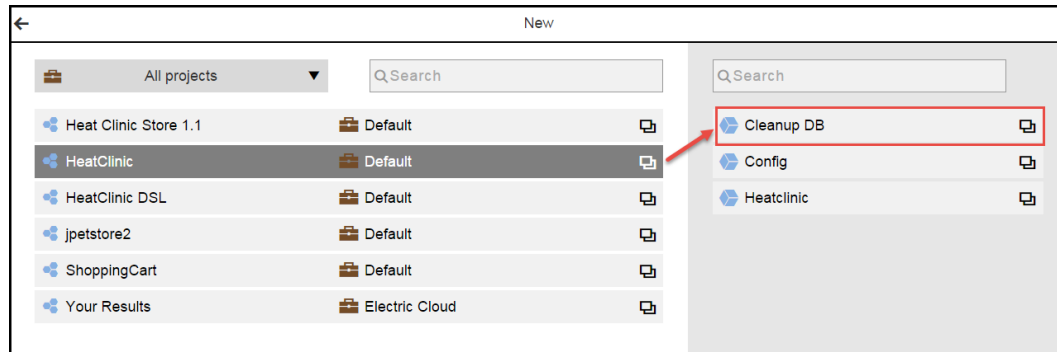
#### **Example:**



3. On the left side of the dialog box, select an existing application.

A list of existing components in that application appears on the right side.

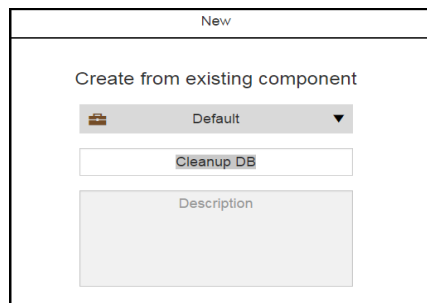
### Example:



4. Select an existing application component.

The **Create from existing component** dialog box opens with the name of the selected component highlighted.

### Example:



5. Change the name of the component, and enter an optional description.

You can also change the project to which the master component belongs.

## 6. Example:

New

Create from existing component

Electric Cloud ▼

Archived DB

Save on the App Server.

## 7. Click **OK**.

The Master Component List now includes master component you just created. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

## Example:

5 Master Components						
		▼ All projects		Select All Delete Add +		
6 Applications		5 Master Components				
1	Archived DB	Electric Cloud	Jan 28, 2016 15:22	admin	0 Used	▼ 2 ⚙️
2	dataload_mc	Default	Jul 13, 2015 02:46	admin	0 Used	▼ 1 ⚙️
3	HC Cleanup DB	Default	Jan 27, 2016 21:23	admin	0 Used	▼ 2 ⚙️
4	HC Config	Default	Jan 27, 2016 21:23	admin	0 Used	▼ 2 ⚙️
5	HC HeatClinic	Default	Jan 27, 2016 21:23	admin	0 Used	▼ 2 ⚙️

## Creating Master Components Based on Existing Master Components

Starting from the Master Components List:

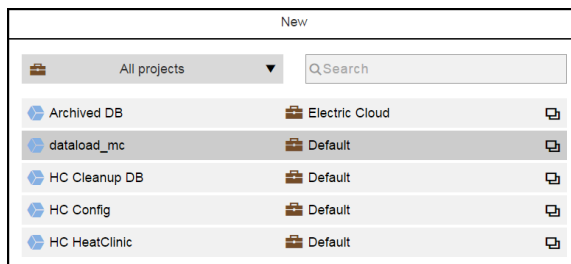
### 1. Click **Add +**.

The **New** dialog box opens.

2. Click **Master component > Copy Master Component**.

A list of existing master components opens. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

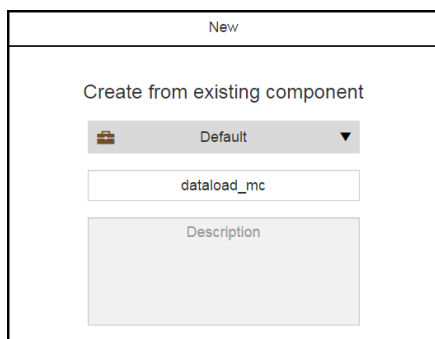
**Example:**



3. Select an existing application component.

The **Create from existing component** dialog box opens with the name of the selected component highlighted.

**Example:**



4. Change the name of the component, and enter an optional description.

You can also change the project to which the master component belongs.

## 5. Example:

New

Create from existing component

Electric Cloud ▼

Clinic DB

Production DB

## 6. Click **OK**.

The Master Component List now includes master component you just created. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

## Example:

6 Master Components		▼ All projects		Select	Delete	Add
1	Archived DB	Electric Cloud	Jan 28, 2016 15:22	admin	0 Used	▼ 2
2	Clinic DB	Electric Cloud	Jan 28, 2016 15:38	admin	0 Used	▼ 1
3	dataload_mc	Default	Jul 13, 2015 02:46	admin	0 Used	▼ 1

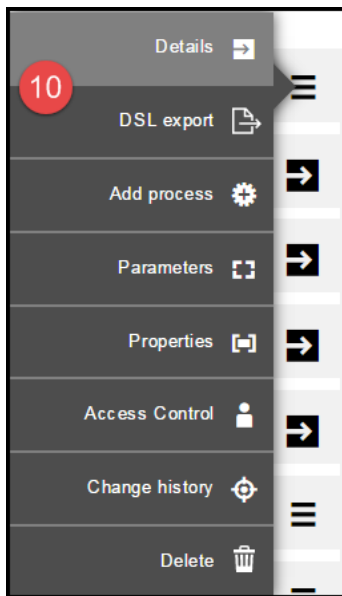
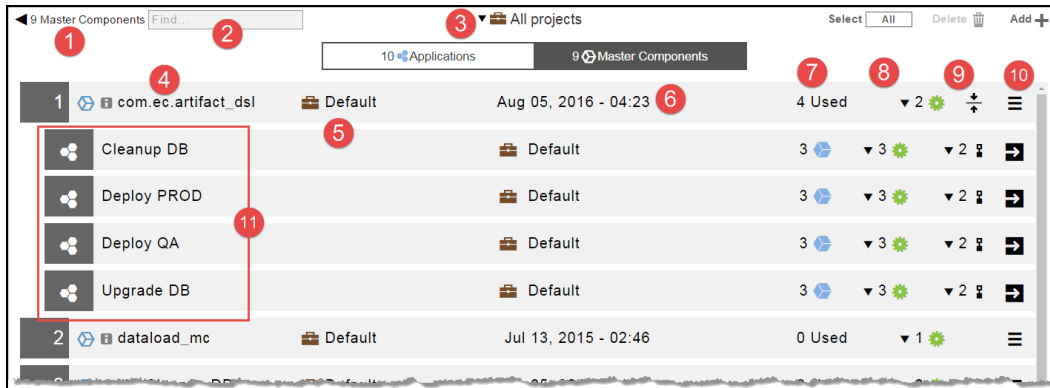
## Master Components List UI

### How to get here:

One of these ways:

- From the Home page:
  1. Click the **Applications** launch pad to open the Applications List.
  2. Click the **Master components** tab.
- Click the **Main menu** button, and then click **Applications > Master Components**.

This is a Master Components List:





1	Breadcrumb identifying the object you are viewing and the total number of master components.
2	Breadcrumb
3	<p>It shows the list of available master components. The default is to show the master components for all projects.</p> <p>If you want to see only the master components for a specific project , click the down arrow in the <b>All projects</b> field to select one or more projects one of these ways:</p> <ul style="list-style-type: none"> <li>• Click on the name of one or more projects.</li> <li>• Enter the search criteria in the Search field. The projects that match the criteria appear in the list.</li> </ul> <p>You can also search for one or more master components by entering the search criteria in the <b>Search</b> field next to the <b>All projects</b> field. If there are no matches, a message appears stating that there are no master components in the selected projects.</p>
4	Name of the master component.
5	Name of the project to which the master component belongs.
6	Date and time when the master component was created.
7	Number of applications dependent on this master component reference.
8	Number of component processes for the master component.
9	Hide or show the applications that reference the master component.

10	<p>Click the <b>Menu</b> button to open the context menu. You can get more details about the master component:</p> <ul style="list-style-type: none"> <li>• <b>Details</b>—The name and description of the object.</li> <li>• <b>DSL Export</b>—Click this to quickly and easily generate and export a DSL script from the ElectricFlow UI.</li> <li>• <b>Add Process</b>—Add a component process. The <b>Component Process</b> dialog box opens.</li> </ul> <p>A master component can have one or more component processes.</p> <ul style="list-style-type: none"> <li>• <b>Parameters</b>—The parameters defined for the master component.</li> <li>• <b>Properties</b>—The properties in the object.</li> <li>• <b>Access Control</b>—The access control configuration in the automation platform for the object.</li> <li>• <b>Track Changes</b>—The change history of the object.</li> <li>• <b>Delete</b>—Delete this object.</li> </ul>
11	Applications that reference the master component. This allows you to perform quick impact analysis to understand which applications would be impacted if a referenced master component is changed.
12	<p>Clicking the <b>i</b> button shows information about the element.</p> <p>This shows the description of the master component.</p>
13	Clicking on the down arrow next to number of component processes (number 9 above) shows the list of processes for this master component.

## Environment Reservations

Environment Reservation equips the operations team with capabilities that allow it to impart control on environments or environment tiers, making application deployments more reliable and predictable.

Every environment has an *enable* or *disable* flag that you can leverage to control the deployment, acting as an ON/OFF switch for the environment. Once enabled, an environment is open for deployments 24 hours a day. An additional option called **Reservation Required** can be used to restrict deployments on enabled environments. Deployment to environments that require reservation are permitted only if the application, pipeline, or release has a valid reservation. This is a good way to control deployments to controlled environments, such as production environments.

There are two main types of environment reservations:

- Blackouts

These are times during which all deployments are prohibited to the environment. They are useful when an environment needs to be brought down for system upgrades or maintenance tasks or to reflect restricted time periods based on business needs such as *trading windows* for financial institutions.

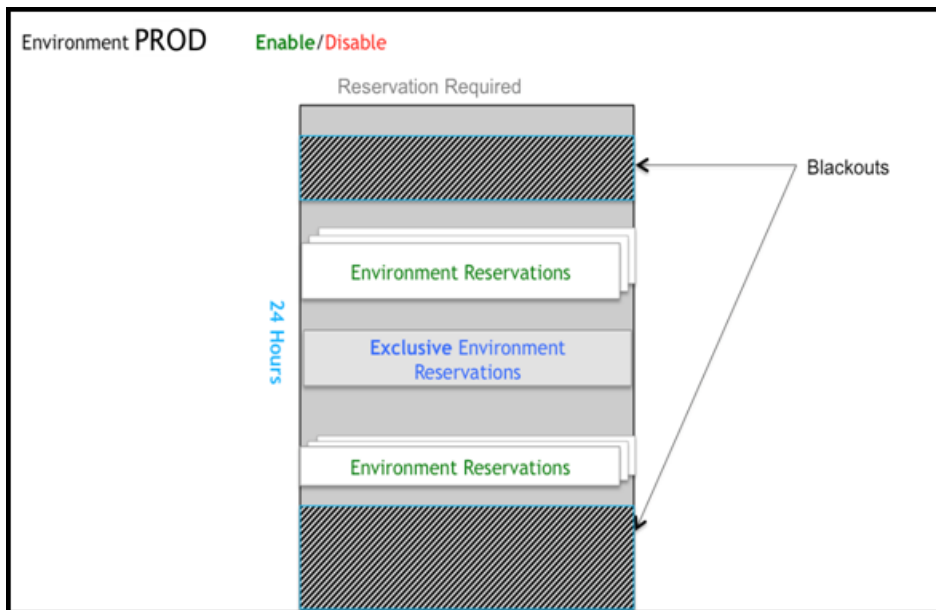


- Environment reservations for applications, pipelines, and releases

Environment reservations can be exclusive or nonexclusive.

Exclusive reservations are useful when you want to control deployment conflicts. Only one application, pipeline, or release can have an exclusive reservation on an environment at any time. This helps to avoid conflicts due to double booking. Exclusive reservations can be set by not allowing overlap.

Nonexclusive reservations are useful when it is acceptable for reservations to overlap at the same time.



**IMPORTANT:** Environment reservation rules are only validated and enforced at the beginning of application deployments. If you try to run an application when the reservation exists in the future, the job will wait for the reservation window to open before it is executed. This will relieve you of having to wait for the reservation period to open before the application is deployed.

This is a summary of the business rules for environment reservations that are validated when you try to run an application.

- Check whether the environment is `ENABLED`.  
If `TRUE`, continue.
- Check whether the deployment falls within a `BLACKOUT` period.  
If `TRUE`, the job will wait until the blackout period is over (given that the maximum job wait time is not exceeded).

- An environment reservation is not required.

Look for `EXCLUSIVE` reservations.

- Check whether a `RESERVATION` exists for a different application.
  - If `TRUE`, the job will not run.
- Check whether a future `RESERVATION` exists for the application.
  - If `TRUE`, the job will wait till the reservation time.
- Check whether an `ACTIVE RESERVATION` exists for the application or if no other application has an `EXCLUSIVE` reservation.
  - If `TRUE`, start the deployment.
- An environment reservation is required.
  - Check for an application reservation.
    - If `TRUE`:
      - If the reservation is currently active, the deployment starts.
      - If the reservation is in the future, ElectricFlow *waits* for the reservation period to open.
    - If `FALSE`:
      - The job will not run.

In a pipeline, execution starts immediately. However, when an application deployment task begins, ElectricFlow looks for the pipeline reservation on the environment. A release follows the same pattern as the pipeline. The release will start immediately. However, when the Deployer task begins deploying the application, the system will validate the reservation to make sure the appropriate environment reservation exists for that release. In both of these scenarios, the rules previously mentioned for application deployments apply to each of the applications that are deployed by the pipeline task and the Deployer task.

## Environment Reservation Use Case

*ABC Bank* is one of the leading banks that pride themselves for their cutting edge transaction processing system, which is leveraged by major businesses. Keeping systems up and running at all times is paramount to their business. This describes how environment reservations can be leveraged to streamline deployments by reducing deployments conflicts and improving system uptimes.

These are the main business rules for the production environment:

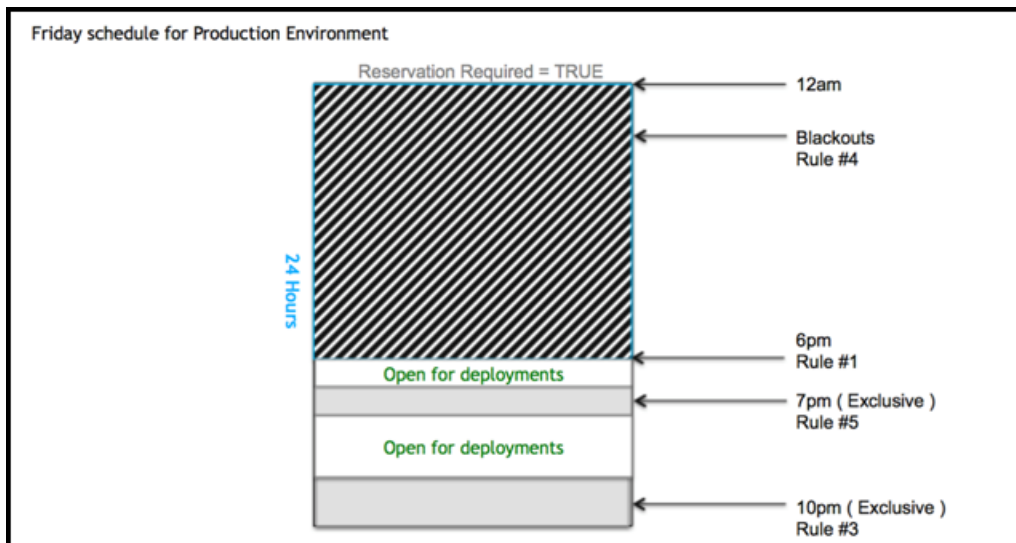
1. No deployments can happen to production environments without proper approval. Approval is required primarily to make sure the deployment window is properly planned to reduce deployment conflicts and downtime.
2. No deployments can happen on Sunday between noon and midnight. This is when all the transaction settlements (batch processing) happen, and the bank does not want any interruption or degradation of system performance during these critical times.

3. Maintenance windows are on Friday nights from 10:00 P.M. to midnight. The bank has an application process for patching production machines.
4. No deployments can happen between midnight and 6:00 P.M. on Monday through Friday because these times are considered critical business hours.
5. At 7:00 P.M. on Friday, the "Online Banking" application needs an exclusive reservation to upgrade to newer version. No other deployments are allowed during this time because avoiding conflicts for this critical rollout is important.

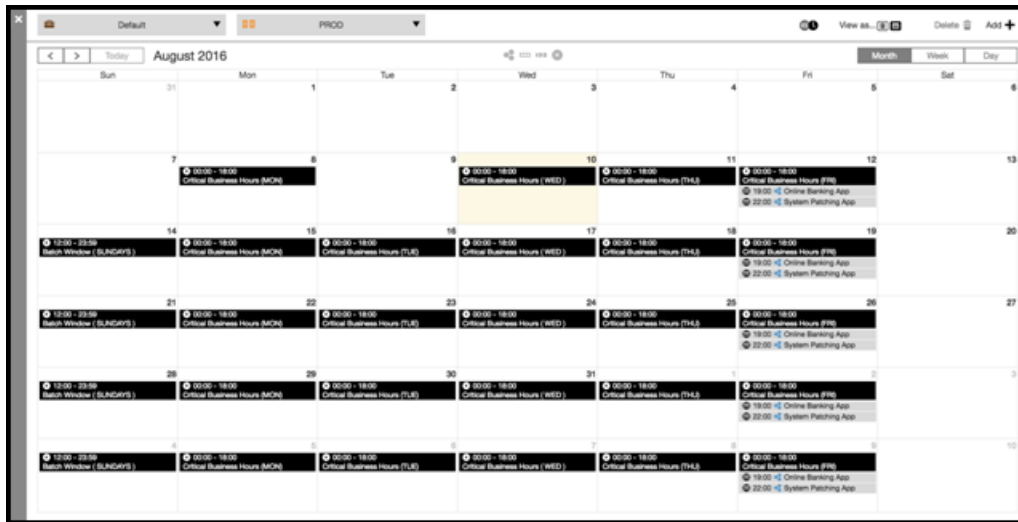
To implement these rules, starting with the most restrictive clause:

1. First implement the fourth rule by creating a recurring blackout from Monday through Friday between midnight and 6:00 P.M. This will ensure that no one will be able to deploy during this time period.
2. Implement the second rule next by creating a recurring blackout on Sundays from noon to midnight. This will prevent anyone from deploying during the transaction settlement window.
3. For the third rule, create a recurring exclusive reservation starting on Friday from 10:00 P.M. to midnight to deploy the application process used for system patching.
4. For the fifth rule, create a recurring exclusive reservation for the "Online Banking" application starting on Friday at 7:00 P.M.
5. For the first rule, start by setting the **Reservation Required** attribute on the production environment. This will prevent any unscheduled deployments to production. Then enhance the approval process to create an environment reservation during the available open deployment time periods for the application you want to deploy. It also makes sense to create an application run schedule to match the reservation.

The following are visual representations of the schedule for the production environment on Friday.



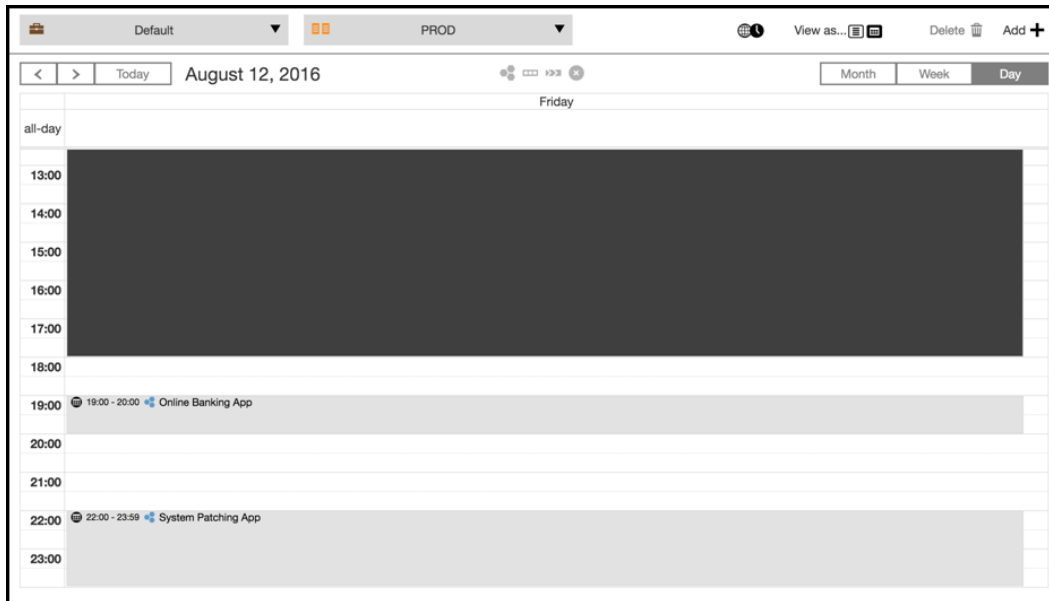
This is the monthly view of the environment reservations for the production environment:



This shows the details for August 11 and 12 and also for August 18 and 19.



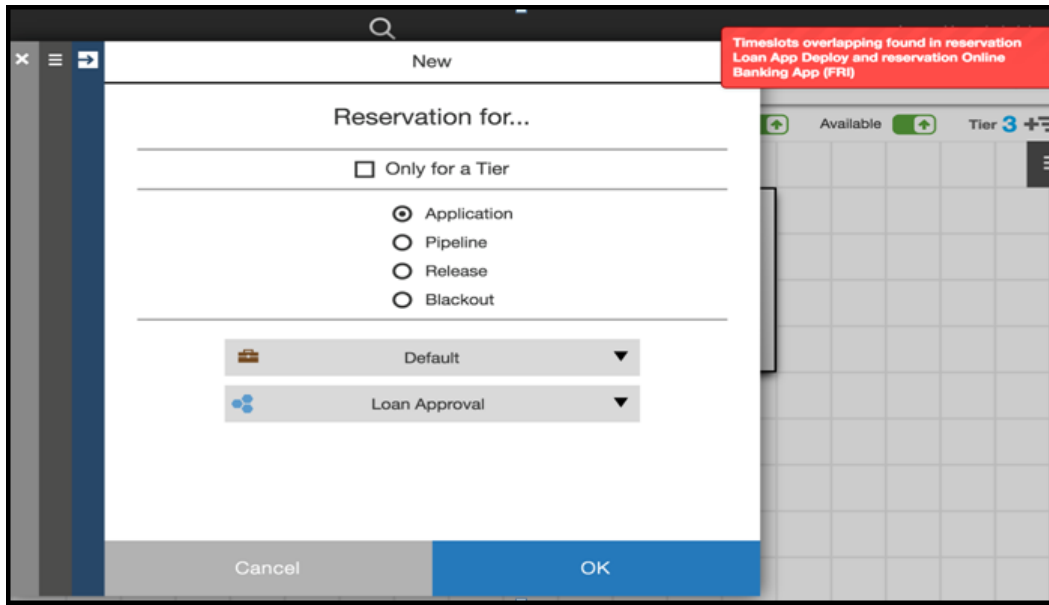
This is the daily view of the environment reservations for the production environment.



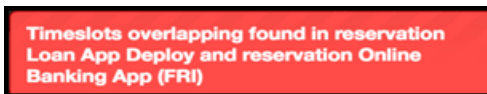
## Conflict Resolution

If you try to deploy during the blackout or exclusive reservation windows in the previous section, the job will wait until the blackout period is over (given that the maximum job wait time is not exceeded).

When you try to create a reservation that conflicts with existing exclusive reservation, the job will also fail with an error.



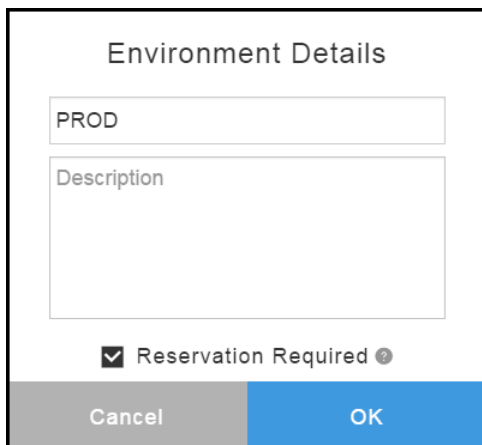
This is the error message:



## Environment Reservation UI

### *Restricting Deployments to Enabled Environments*

You can restrict deployments to environments by selecting the **Reservation Required** option for an environment. In the Environment Details dialog, select **Reservation Required** and click **OK**. Deployment to this environment permitted only if an application, pipeline, or release has a valid reservation.




## Adding Environment Reservations

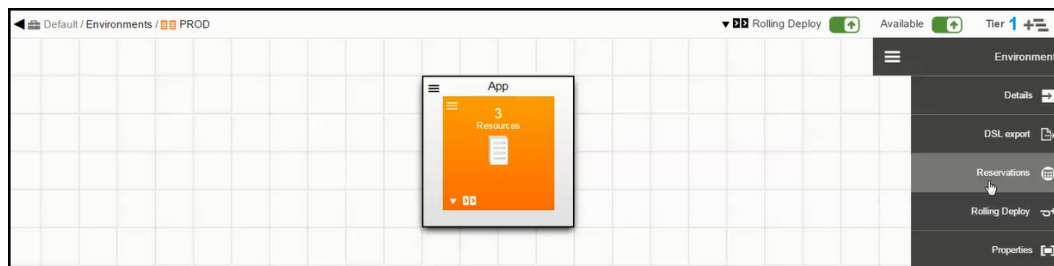
This example shows how to add environment reservations to the PROD environment.

Starting from the Environments list:

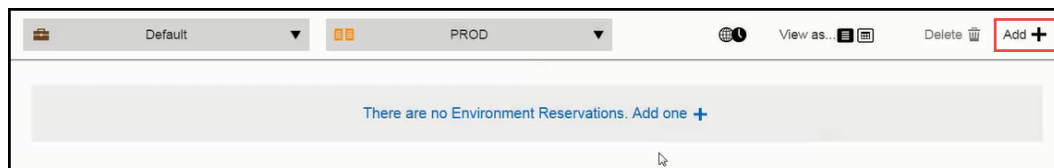
1. Select the environment to which you want to add reservations.



2. In the Environments Visual Editor, click  in the upper right corner, and select **Reservations**.



The dialog box showing the list of environment reservations opens.



3. Click **Add+** to add an environment reservation.

The **Environment Reservation Details** dialog box opens.

New

Environment Reservation Details

Reservation name

Start: Aug 11, 2016

10:00

End: Aug 11, 2016

Duration: 1 hrs

11:00

Once

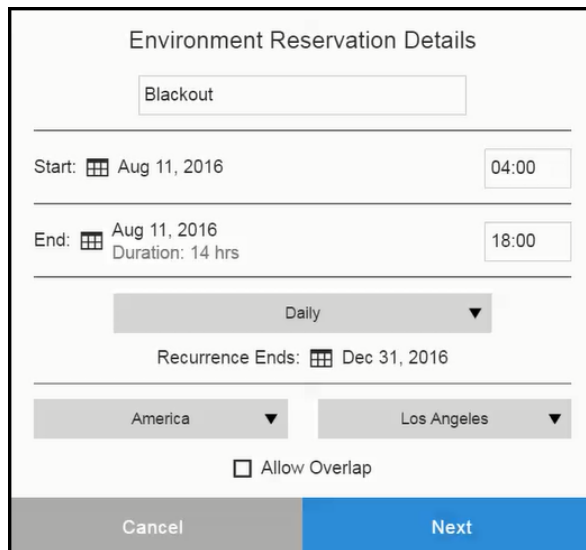
America

Los Angeles

☐ Allow Overlap

## 4. To create a blackout:

- a. In the **Reservation name** field, enter the name of the reservation.
- b. In the **Start** field, select the start date and enter the start time.
- c. In the **End** field, select the end date and enter the end time.
- d. In the **Once** field, select the frequency: **Once**, **Daily**, **Weekly**, or **Monthly**.
- e. (Optional) If you select **Daily**, **Weekly**, or **Monthly**, select the date when the reservation ends in the **Recurrence Ends** field.
- f. (Optional) Change the time zone.
- g. (Optional) Select **Allow Overlap** to make the reservation nonexclusive.



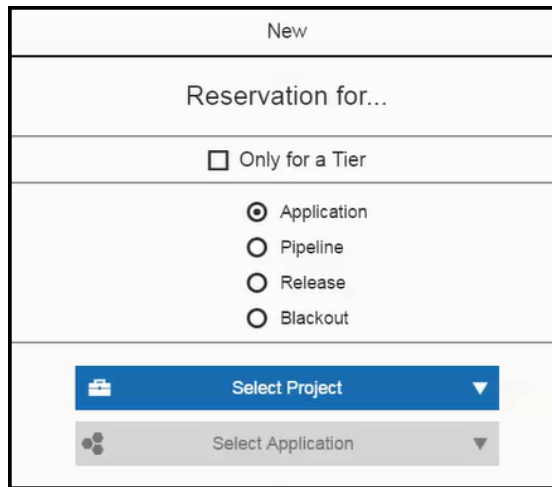
The form is titled "Environment Reservation Details". It contains the following fields and controls:

- Reservation name:** A text input field containing the word "Blackout".
- Start:** A date and time selector showing "Aug 11, 2016" and "04:00".
- End:** A date and time selector showing "Aug 11, 2016" and "18:00". Below the date, it says "Duration: 14 hrs".
- Frequency:** A dropdown menu currently set to "Daily".
- Recurrence Ends:** A date selector showing "Dec 31, 2016".
- Time Zone:** Two dropdown menus, the first set to "America" and the second set to "Los Angeles".
- Allow Overlap:** A checkbox that is currently unchecked.
- Buttons:** "Cancel" and "Next" buttons at the bottom.

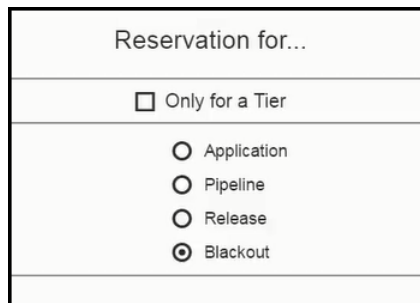


- h. Click **Next**.

The **Reservation for** dialog box opens.



- i. (Optional) Select **Only for a Tier** if the reservation only applies to an environment tier.  
j. Select **Blackout**.



- k. Click **OK**.

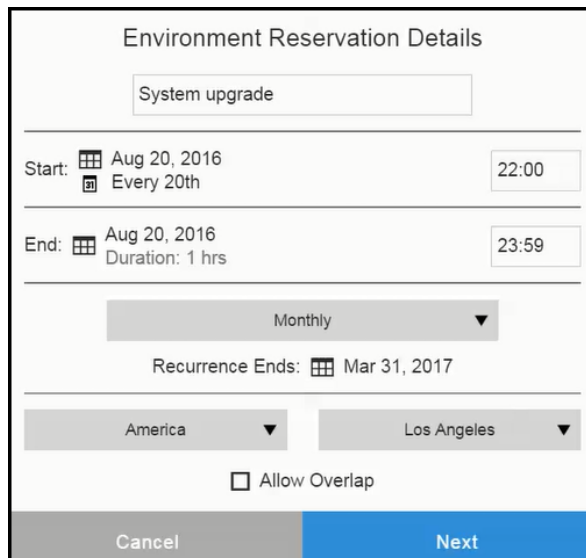
The Environment Reservations list returns and has been updated with the reservation you just created.

Default		PROD		View as...		Delete	Add
✓	Name	Object	Tier Only	Frequency	Start	End	No Overlap
✓	1. Blackout	Blackout		Daily	Aug 11, 2016 - 04:00	Aug 11, 2016 - 18:00	

- l. (Optional) Click **Add +** to add another reservation.

## 5. To create an exclusive invitation:

- a. In the **Reservation name** field, enter the name of the reservation.
- b. In the **Start** field, select the start date and enter the start time.
- c. In the **End** field, select the end date and enter the end time.
- d. In the **Once** field, select the frequency: **Once, Daily, Weekly, Monthly**.
- e. (Optional) If you select **Daily, Weekly, or Monthly**, select the date when the reservation ends in the **Recurrence Ends** field.
- f. (Optional) Change the time zone.
- g. (Optional) Select **Allow Overlap** to make the reservation nonexclusive.



The dialog box titled "Environment Reservation Details" contains the following fields and controls:

- Reservation name:** A text input field containing "System upgrade".
- Start:** A date and time selector. The date is "Aug 20, 2016" and the time is "22:00". A frequency dropdown is set to "Every 20th".
- End:** A date and time selector. The date is "Aug 20, 2016" and the time is "23:59". The duration is "Duration: 1 hrs".
- Frequency:** A dropdown menu currently set to "Monthly".
- Recurrence Ends:** A date selector set to "Mar 31, 2017".
- Time Zone:** Two dropdown menus, the first set to "America" and the second set to "Los Angeles".
- Allow Overlap:** An unchecked checkbox.
- Buttons:** "Cancel" and "Next" buttons at the bottom.

h. Click **Next**.

The **Reservation for** dialog box opens.

- i. (Optional) Select **Only for a Tier** if the reservation only applies to an environment tier.

- j. Select the object that will have the reservation (**Application**, **Pipeline**, or **Release**) and the object's project and object name.

Reservation for...


☐ Only for a Tier


☒ Application

☐ Pipeline

☐ Release

☐ Blackout

 Default ▼

 ShoppingCart ▼

Cancel

OK

- k. Click **OK**.

The Environment Reservations list returns and has been updated with the reservation you just created.

Default		PROD		View as...		Delete	Add
✓	Name	Object	Tier Only	Frequency	Start	End	No Overlap
✓	1. Blackout	Blackout		Daily	Aug 11, 2016 - 04:00	Aug 11, 2016 - 18:00	
✓	2. System upgrade	ShoppingCart		Monthly	Aug 20, 2016 - 22:00	Aug 20, 2016 - 23:59	

## Viewing Environment Reservation Calendars

There are two ways to access the environment reservation calendars:




- From the Environment Reservations list, click [here](#) for the calendar view.

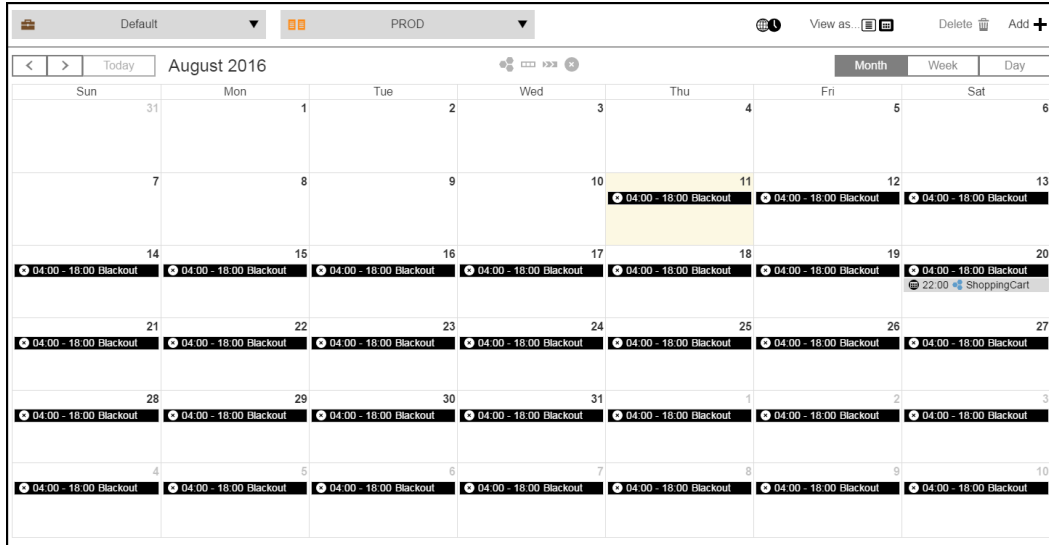


- From the Environments List, select an environment and click  to view the Environment

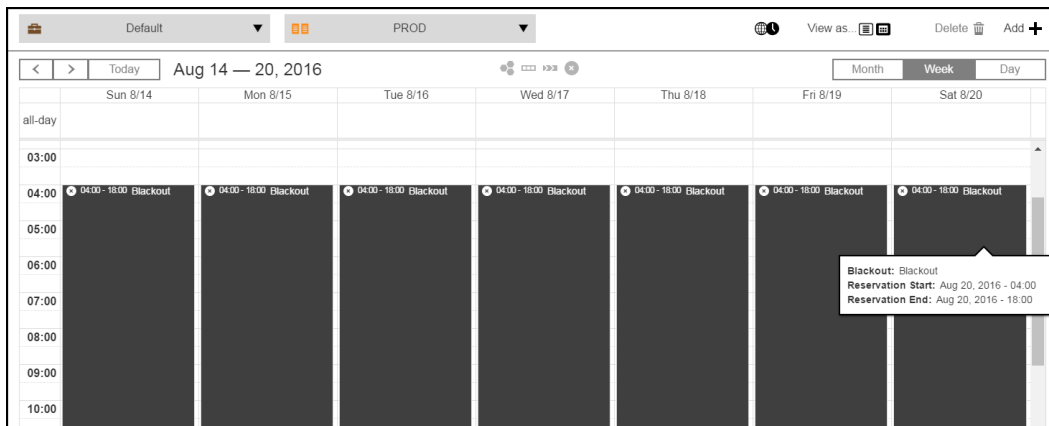


Reservations list. Then click  at the upper right of the dialog box.

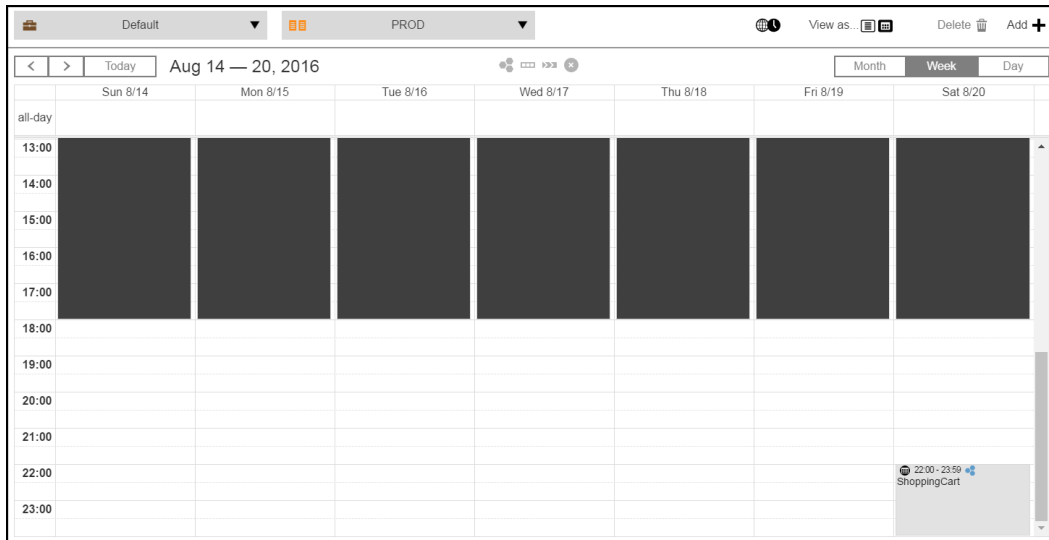
This is the **Month** view:



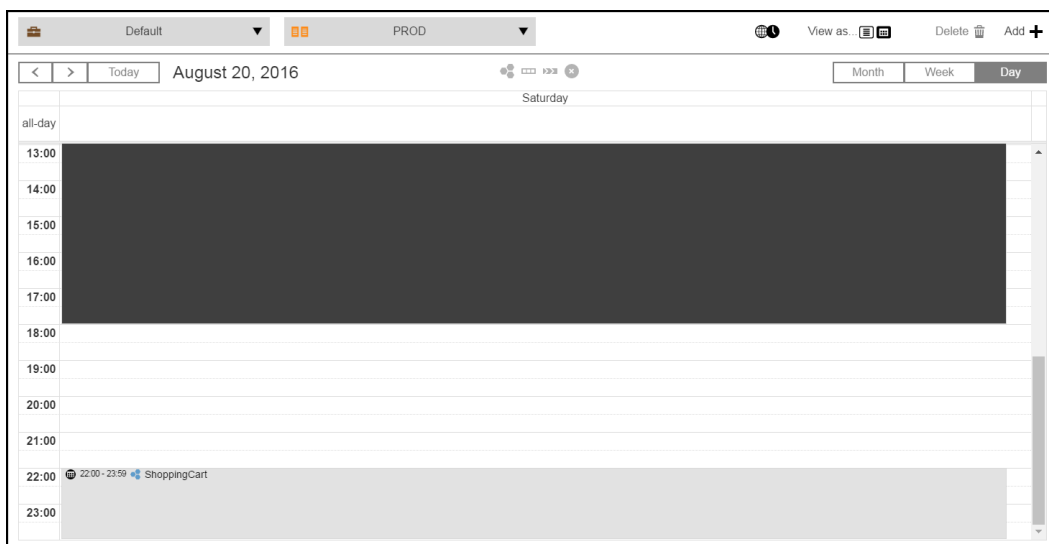
Click **Week** to see the **Week** view:



Scroll down to see more:



Click **Day** to see the **Day** view:



For examples of conflict resolution, go to [Conflict Resolution](#) on page 112

## Artifact Staging

You can use artifact staging to retrieve artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target, either the artifact cache (the default) or a directory specified in the component definition. Staging artifacts minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment.

Artifact staging is enabled by default in the UI. However, when you use the API commands in the command line interface or in a script, make sure to enable artifact staging when modeling the application.

Go to [Deploying and Troubleshooting Applications](#) on page 186 for how to use artifact staging when deploying an application.

## At the Application Level

When artifact staging is enabled in a deployment model, ElectricFlow dynamically creates and executes a job step to stage the artifacts. If the application process being deployed includes process branching, the staging job step retrieves all artifacts in the application process in parallel to reduce the staging time. In addition, the deployment processes, including the staging job step, are skipped on disabled resources.

You can deploy applications with the artifact staging enabled and following options:

- With smart deploy enabled, the staging job step retrieves artifacts only for those objects that have not been deployed to specific resources.
- With full deploy enabled, the staging job step retrieves artifacts only for all artifacts in the application.
- With partial deploy enabled, the staging job step retrieves artifacts only for artifacts in the application.
- With a selected snapshot, the staging job step retrieves artifacts only for artifacts in the selected snapshot.

### Note:

For a component process, the process step to retrieve an artifact is optional because the component process is referenced in the application process. If you author a component process, the process type should be "Deploy" to ensure that the artifacts defining the component can be staged.

If an artifact staging for a component fails, it will then be retried when the process execution continues and when the actual component process execution happens.

You can view the progress of the staging job step in the Application View Run page.

- When the staging job step is successful, the artifact is retrieved and staged before the deployment run starts.
- When the staging job step fails, the application process automatically retrieves the artifact during the component retrieval step in the application run.

The environment inventory is updated as the job step runs. In addition to viewing the status of the resources in the environment, you can also view the state of other objects including the application processes, components and component processes, and artifacts being deployed.

## At the Pipeline and Release Levels

Artifact staging is supported in pipelines and Releases.

- When you define the tasks in a pipeline stage, you can select application processes with artifact staging. The staging job step is executed as part of the application in the pipeline run as described in the previous section. Go to [Pipeline Tasks](#) on page 311 for more information about stage tasks in a pipeline.
- The Release definition includes the pipeline and applications that you want to run in the Release. Go to [Release Definition](#) on page 417 for more information about the release definition.

## Rollback

When an application process has a predefined rollback step and the application deployment fails, you can restore the deployment model to a previous state before the failure occurred. ElectricFlow provides these ways to do this:

- Automatic rollback—ElectricFlow automatically reverses what was deployed up to the point of failure in the process flow. See [Rollback](#) on page 122 for more information.
- Snapshots—You manually create and save snapshots of previous successful deployments and run a snapshot the next time the application is deployed. See [Snapshots](#) on page 300 for more information.
- A component process defined as an undeploy process—When defining a component process, select **Undeploy** as the process type.

Application rollback occurs only for components that were not skipped (because of branching) in the application process.

### Guidelines for Using Rollback

- You must enable change history.
- Rollback will not work after a full import until you redeploy an application successfully after the import.
- You should use environment snapshots for rollback (not application snapshots).
- If you rename the application process after a successful deployment, and if rollback to the previous state is configured, ElectricFlow cannot determine the last successful deployment. In this case, rollback will fail. (The undeploy process will still occur.)
- You can define multiple rollback steps in an application process.
- Use smart deployments instead of partial deployments.
  - If the last successful deployment was a partial deployment, the rollback job will only revert components included in the partial deployment.
  - If you are using partial deployments, we recommend taking a manual snapshot (using EF-Utilities) and use it with rollback step.
  - Use the `$( )` property reference to reference the snapshot so that it can be dynamically set.
- Do not rename the application process.
- Use environment snapshots instead of application snapshots for reliable software deployments.

- When a rollback step is executed due to a deployment failure, one of these options is invoked based on the rollback step configuration:

- Roll back to a previous state

ElectricFlow looks for a previous successful deployment with the same process name to start the rollback.

Once a successful deployment is found, ElectricFlow starts the rollback using the same process and parameters from that deployment with component versions determined by the inventory state before the failed deployment. If a successful deployment is not found, the rollback will fail. This means the rollback step expects a successful deployment to exist to determine where to rollback to, even when you are deploying with a snapshot.

**Note:** The last successful deployment could be part of a snapshot deployment or a regular application deployment.

- Roll back to a snapshot

ElectricFlow uses a user-specified snapshot for the rollback. The last successful deployment process and parameters that are stored as part of the environment snapshot are used to initiate the rollback. Component versions are defined as part of the snapshot. If the user-specified snapshot is an application snapshot, ElectricFlow looks for a successful deployment of the process with the same name, which is the same as the first option.

For both options, a combination of component definitions and deployment runtime parameters determine the version of the components that will be deployed.

## Triggering Rollback Even if Undeploy Fails

You can trigger rollback even if undeploy fails. To do so, use the **Continue running** option in the **Application Process Step** dialog box when configuring a rollback step.

## Enabling Rollback Only on Components that Successfully Undeployed

You can limit rollback to those components that undeployed successfully. To do so, use the **Rollback only successfully undeployed components** option in the **Define Step** dialog box when defining a rollback step.

## Enabling Rollback Only on Failed Components

You can activate rollback only on those components that failed. To do so, use the **Component Level Rollback** option in the **Define Step** dialog box for defining a rollback step.

ElectricFlow automatically tracks all components that failed during application deployment and will roll back only those components. This option is useful when the components do not have version dependencies. You can use **Component Level Rollback** with automatic rollback and with snapshots.

## Automatic Rollback

ElectricFlow supports a rollback step in application processes. This allows an automatic rollback to the environment before an erroneous deployment or to any previous environment snapshot. This reduces the time to author the rollback logic.

During an application deployment, the predefined rollback operation is invoked when the rollback step is executed. ElectricFlow reverses what it executed in the process flow up to the application process step where



the failure occurred. This operation is supported only in application processes. It puts the deployment in the same state as the last successful deployment, which is usually the same as the previous deployment state.

If the **Roll back to previous state** option is enabled and no last good deployment exists (for the restore point), the rollback step is skipped. The undeploy step (if configured) will still run.

When defining an application process step as a rollback step, the application can roll back to the previous state up to where the deployment failed (the default) or to a specific snapshot. Also, you can specify how the application will be rolled back.

- By default, the **Smart Deploy** option is enabled. If you want ElectricFlow to execute a full or partial run the next time the application is deployed, disable this option.
- When the **Undeploy Application before Rollback** option and the application process that you want to undeploy (in the **Select Process** field) are selected, the environment inventory record is removed before the rollback operation is executed. This allows dirty files in the erroneous deployment to be automatically removed from the system. When you use the **Undeploy Application before Rollback** option with the **Component Level Rollback** option, failed components are undeployed and then rolled back.

When a specific snapshot is selected for rollback, ElectricFlow tries to determine the last successfully-deployed process and then tries to execute it from the snapshot.

While a native rollback step is available, ElectricFlow also gives you complete control over creating a custom rollback handling operation and using that as part of the error handling logic.

**Note:** If the last successful deployment was a partial deployment and the rollback job is reverted, ElectricFlow reverts only the components included in the partial deployment.

## Manual Tasks and Steps

You can define manual steps and tasks in application or component processes and in release delivery pipelines. They describe the actions that must be taken by a human to complete the process step and/or pipeline task. In application and component processes, these actions are referred to as *manual steps*. In pipelines, they are referred to as *manual tasks*. Any time a manual task or step is reached in the process flow, an email notification is sent to all users in the assignee list.

Manual steps and tasks consist of user-specified instructions and assignees.

**Note:** Email notifications for manual process steps are sent to assignees whether or not notifications are enabled at the application or process level. If a user does not want to receive an email notification, their name should be removed from the assignee list.

- To set up a manual task or step:
  - Enter instructional text to help the approvers. This text can include URLs.
  - You can also define optional parameters to collect information during the approval step.
  - Specify who can approve. You can define the step or task to accept either user or group IDs or variables using the `${ [ ] }` notation to represent assignees as property references, but *not both*.

- To attach a parameter to a manual task or step:
  - Use the `${[ ]}` notation as a property reference to access other user-specified parameters at runtime, such as evidence and status.
  - For a pipeline manual task, use `$/javascript myFlowRuntime.flowRuntimeStates[0].evidence` to collect the user's response in subsequent tasks. This command using (0) assumes that the manual task is the first task in the stage.
  - For an application process, use `$/myJobStep/comment` or `$/myJob/jobSteps/stepName/comment` to access the instructional text, which is usually in the notification emails sent to the users who perform the actions or who approve the completion of the manual step.
  - Put hyperlinks in the instructions and comments fields in the GUI. You can create a file on a server or other storage device and add the URL to that file in the GUI.
- To specify a default email template:
  - For a manual task in a pipeline, use `/ec_deploy/ec_pipelineNotifierTemplates/ec_default_pipeline_manual_task_notification_template`.
  - For a manual process step in an application, use `/ec_deploy/ec_notifierTemplates/ec_default_manual_process_step_notification_template`.
- Go to [Example: Authoring a Pipeline with Manual and Utility Tasks](#) on page 338 for how to define a manual task in a pipeline stage.

## Process Branching

You can use process branching to specify the path through an application or component process based on transition conditions other than out-of-the-box options. Decisions about the next step in the process are made while the process runs. This is similar to the transition conditions for workflows in the automation platform. If the application or component process applies to multiple use cases, you can design one process with two or more branches instead of designing multiple processes for each use case. You can also define steps that run in parallel.

For example, to install or upgrade software, you can define one process for multiple use cases and use the same steps except for the following:

- The source files can be in .zip or .tar format. The steps to extract the files depend on the format.
- The operating system can be Linux or Windows. The steps to download the files, install them on the server, and enter commands depend on the operating system.

ElectricFlow supports the following branching conditions. The default is **Always**.

- Completion status of the previous process step
- A property set in another part of the system, not the in the previous step
- Custom validation rules

## Using Process Branching

You define process branching when authoring an application or component process.

## Process Branching Example

This example shows an application process with process branching that deploys a .war file.

Clicking a connector in a link opens the branching conditions menu. Depending on the location of the connector, some or all of these options may be available (enabled):

- **Always**—Always go to the next step, referred to as the target.
- **Successful**—Go to the next step if the previous step, referred to as the source, is successful.
- **Failure**—Go to the next step if the previous step fails.
- **Add Condition**—Add a custom condition that must be met before going to the next step.
- **Add Connector**—Add a connector from the source of the link to a new target by selecting one of the highlighted eligible steps. You can only select an eligible step.
- **Change Source**—Change the source by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Change Target**—Change the target by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Delete**—Delete the selected connector and link.

When you select the connector between the Start step and first step after it, only some of conditions appear and only some are available. The condition between the Start and the next step is **Always**, the default branching condition.

When you select the connector between subsequent steps, all of the conditions are available.

## Usage Guidelines

Follow these guidelines when the process includes process branching:

- When you add a step, you must define it before adding another step.
- You can only configure branching conditions on a connector between two process steps.
- You cannot configure branching conditions between these objects:
  - The start of the process and the steps immediately after it.
  - The end of the process and the steps immediately before it.
- When defining a step in an application or component process, you configure what ElectricFlow does when an error occurs. *This setting overrides any job-step-level branching condition.*

You can select **Stop running** or **Continue running** in the **On Error** field in the Define Step dialog box.

If an error occurs in a job step and **Stop running** is selected, ElectricFlow aborts the process even if the branching condition is set to **Failure**.

## Process Branching States and Conditions

### State of the Branching Condition Connectors in the UI

In the ElectricFlow UI, the status of the link is based on the shape and color of the connector.

Shape	Color	Link Status
Diamond	Light gray	Always
Diamond	Dark gray	Disabled
Square	Green	Successful
Circle	Red	Failure

### Examples of Branching Conditions

These are examples of branching conditions that you can apply in your processes.

- Based on the status of the previous step

Follow the branch based on the result of the previous step: Successful, Failure, or both (Always).

Example:

- **Successful**—If the file is downloaded successfully, the next step is to extract the files.
- **Failure**— If the file was not downloaded properly, the next step is to abort the process.
- **Always**—The next step is to always extract the files.

- Based on a value of an operation during the step

Follow the branch that matches the result of an operation such as calculating a value or processing data during the step.

Example: The result of an operation is a file type.

- If the result is an XML zip file, the next step is open an XML text editor.
- If the result is a .htm file, open a web browser.
- If the result is a .mov, open an application to play the movie.

- Based on a property in another part of the system

Follow the branch based on a property set in another part of the system, not in the previous process step.

Example:

- If the property `os_type = linux` is set on a resource, always follow the branch for Linux steps.
- If the property `release_type` is set to minor in the application, always follow the branch for minor releases when running the process.

### Custom Conditions in Process Branching

In a component or application process with branching, when you click the connector on a link between two steps, the Condition dialog box opens.

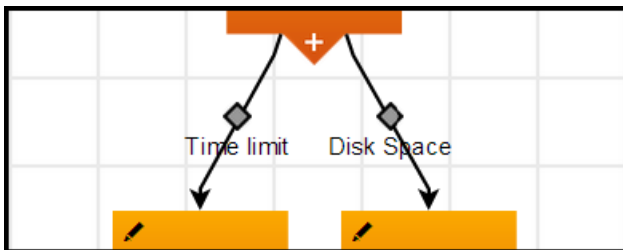
When you click the connector between the "Deploy War" and "Start Server" steps, these conditions appear:

- **Always**—Always go to the next step, referred to as the target.
- **Successful**—Go to the next step if the previous step, referred to as the source, is successful.
- **Failure**—Go to the next step if the previous step fails.
- **Add Condition**—Add a custom condition that must be met before going to the next step.
- **Add Connector**—Add a connector from the source of the link to a new target by selecting one of the highlighted eligible steps. You can only select an eligible step.
- **Change Source**—Change the source by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Change Target**—Change the target by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Delete**—Delete the selected connector and link.

When you configure a **Property based** condition, the fields in the Condition dialog box remain the same.

When you configure a **Custom** condition, the fields change.

After you configure your conditions, they appear near the affected connectors in the process.



## Full-Stack Dependency View

The full-stack dependency view helps you to visualize and manage dependencies in application models. In distributed environments, different teams can author applications and manage the infrastructure, which means that managing dependencies across the stack is crucial. This view shows the mapping between application tiers and environment tiers so that you can verify that the infrastructure capabilities can support the minimum application requirements.


[Viewing Dependencies and the Stack Comparison](#)

[Stack Definition](#)

[Stack Templates](#)

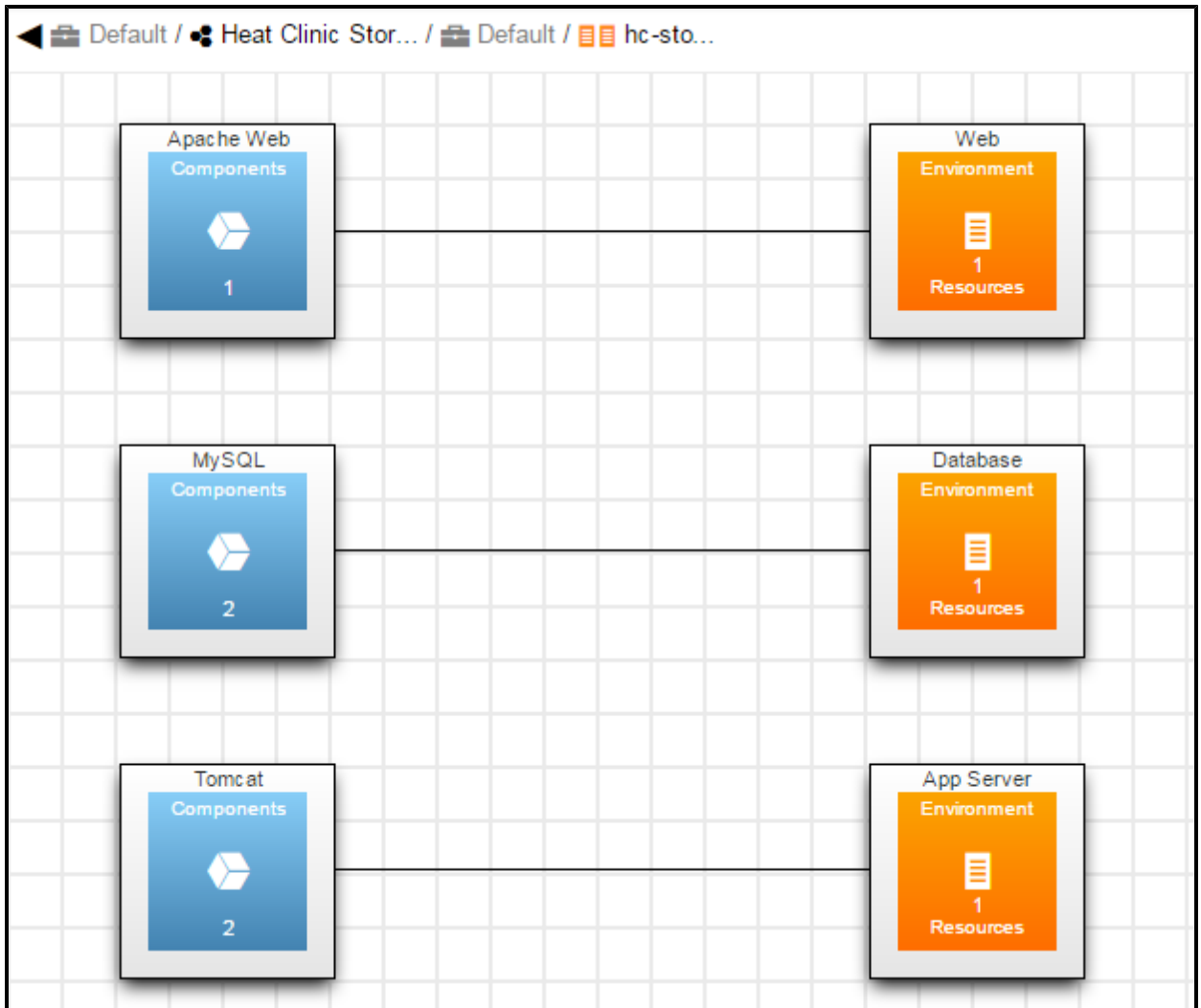
## Viewing Dependencies and the Stack Comparison

The full-stack dependency view shows the mapping of application tiers to environment tiers in an application model. This lets you compare application tier requirements to environment tier capabilities for a tier mapping. There are two ways to access this view:

1. From the Applications list, click the  (tier maps) button for an application and then select a tier map:



The tier map appears:

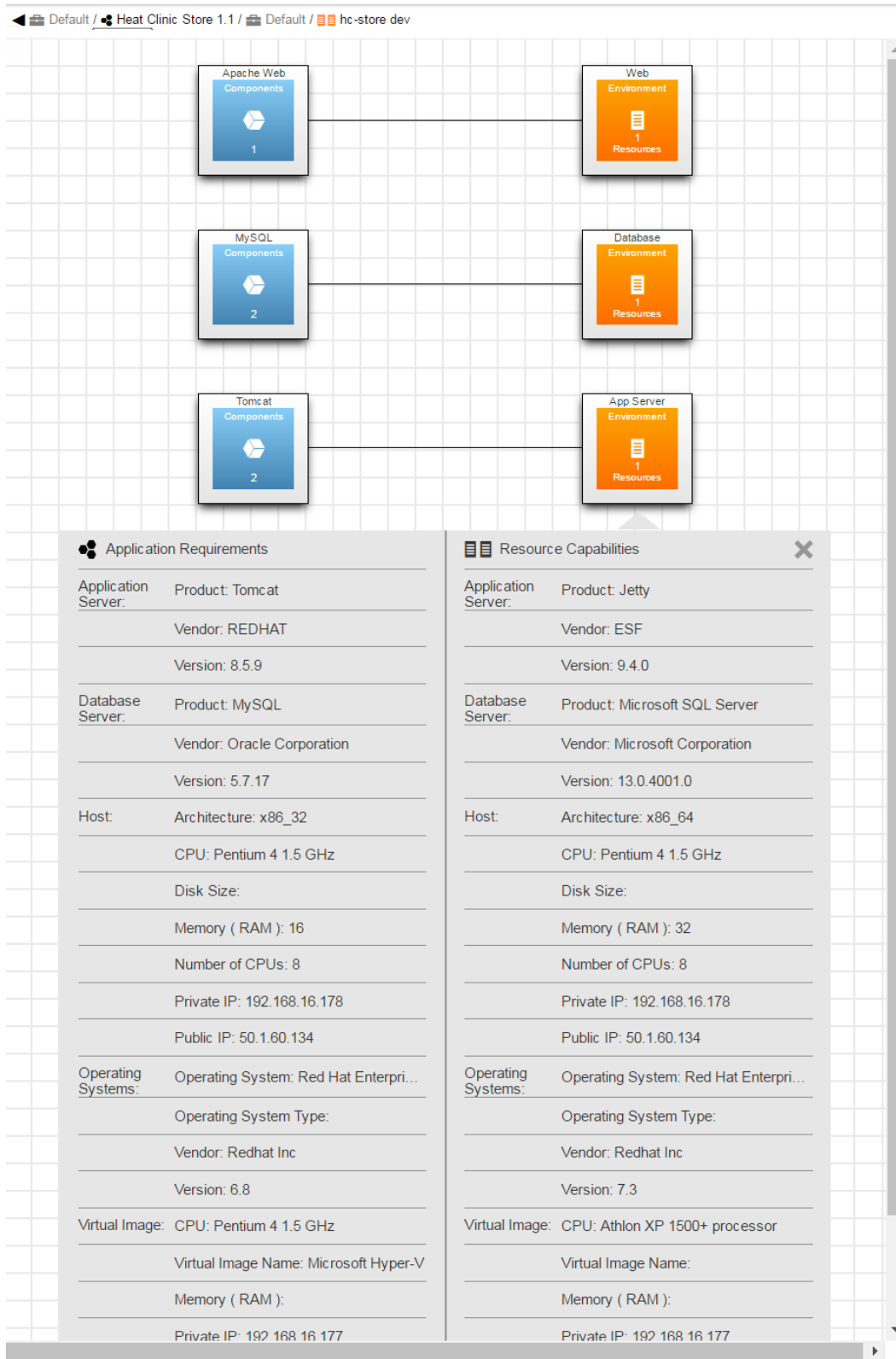


2. Click either an application tier or an environment tier for each mapping pair.

The stack comparison view appears. See [Stack Definition](#) on page 133 for more information.

You can click on either tier in a tier mapping to see the currently set values for application requirements and environment capabilities. This lets you do a side-by-side comparison to see if any application requirements are out of compliance. For example:





## Stack Definition

When you are modeling an application, you have a target environment in mind. You might be modeling an application that is compute-intensive or data-intensive. For optimal performance, the application should run in an environment with 4 cores and 32 GB of RAM. If the application is deployed to an environment with one core and 8 GB of RAM, the application deployment might take a long time to run or might fail due to timeout errors.


You can define application requirements and environment capabilities such as:

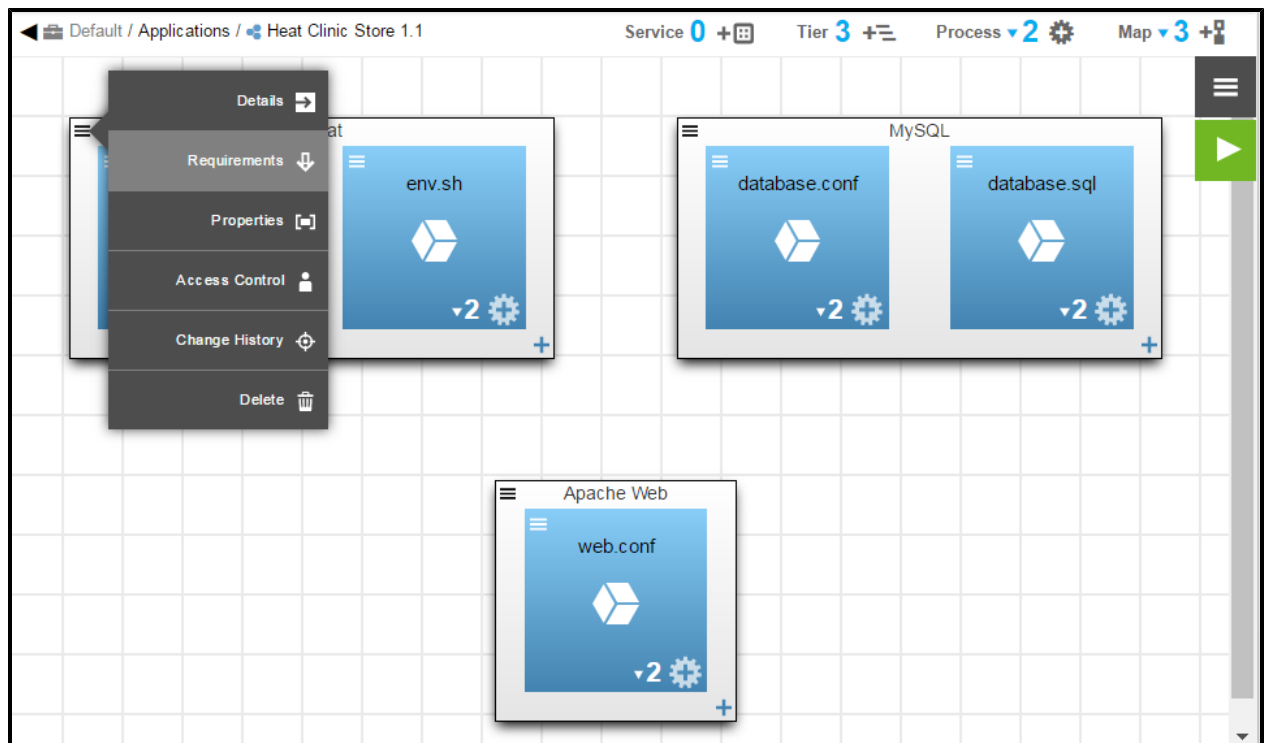
- Supported platforms
- Hardware requirements
- Database requirements
- Disk usage
- Memory usage

### Modeling Application Requirements

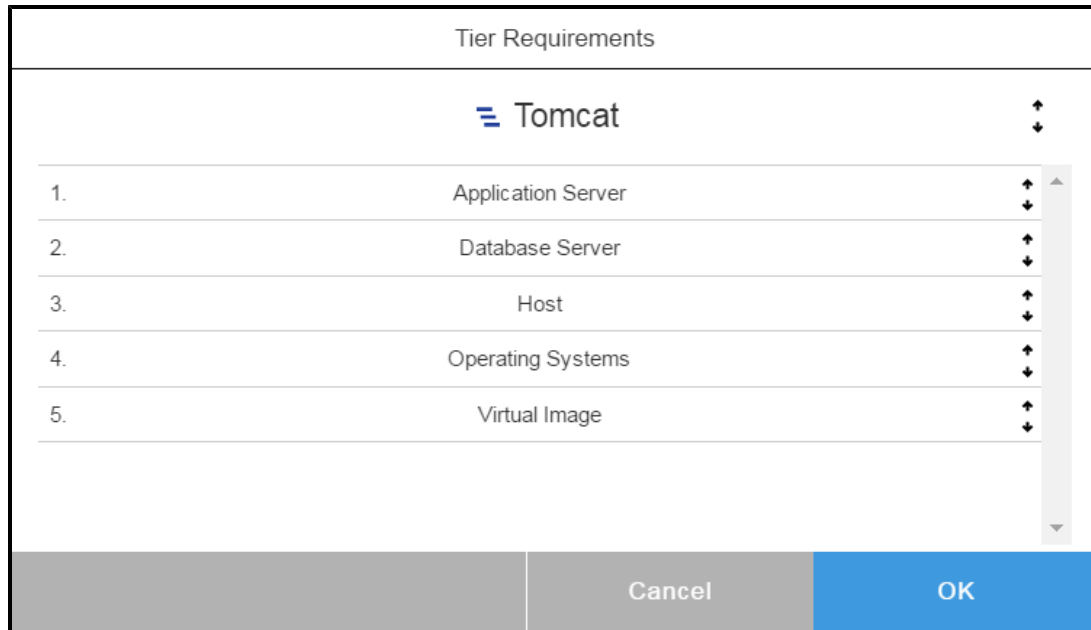
You can define requirements per application tier.

Starting in the Applications Visual Editor:

1. Click  (the tier menu) in an application tier, and then click **Requirements**:



The **Tier Requirements** dialog box opens:

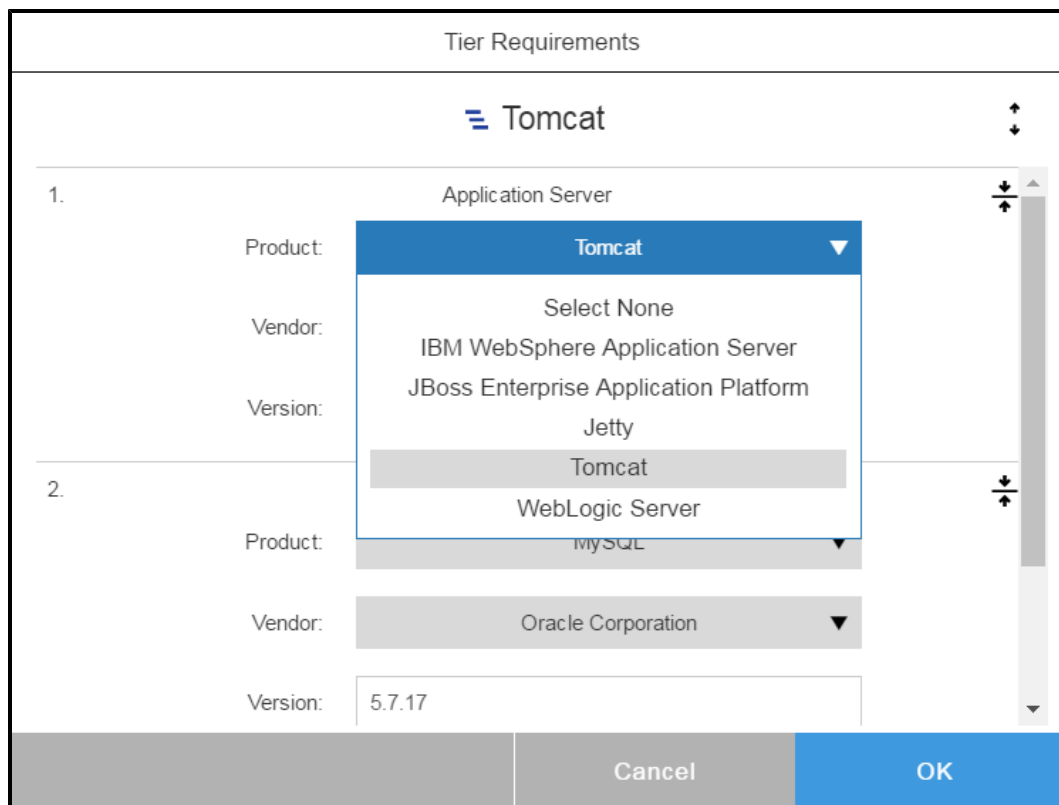


The image shows a dialog box titled "Tier Requirements". At the top, there is a header bar with the title. Below the header, the text "Tomcat" is displayed with a blue icon to its left. A list of requirements is shown below, each with a number, a description, and a vertical double-headed arrow icon to its right. The requirements are:

Number	Description	Icon
1.	Application Server	Vertical double-headed arrow
2.	Database Server	Vertical double-headed arrow
3.	Host	Vertical double-headed arrow
4.	Operating Systems	Vertical double-headed arrow
5.	Virtual Image	Vertical double-headed arrow

At the bottom of the dialog box, there are two buttons: "Cancel" and "OK".

2. In the **Tier Requirements** dialog box, enter the requirements for the tier. For example:



The image shows the same "Tier Requirements" dialog box, but with the first requirement, "Application Server", selected. A dropdown menu is open, showing a list of options. The options are:

- Select None
- IBM WebSphere Application Server
- JBoss Enterprise Application Platform
- Jetty
- Tomcat
- WebLogic Server

The "Tomcat" option is currently selected. Below the dropdown menu, the "Product" field is set to "MySQL", the "Vendor" field is set to "Oracle Corporation", and the "Version" field is set to "5.7.17".


3. Click **OK**.

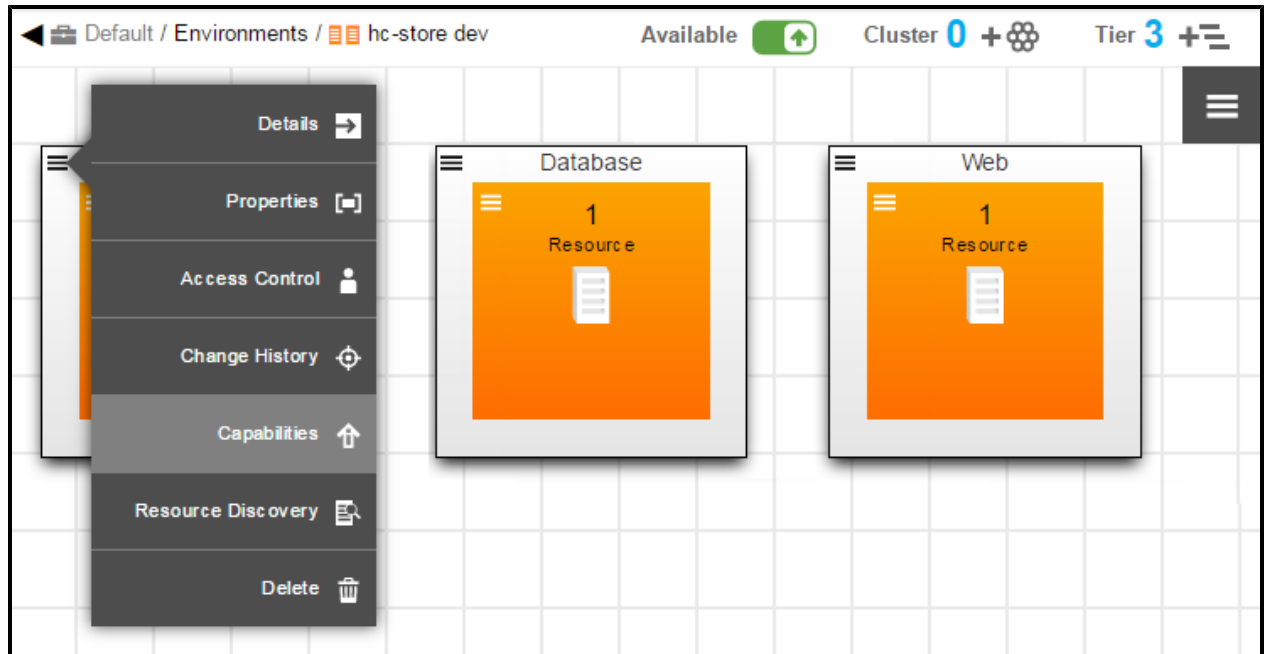
4. Repeat these steps to define the requirements for the other application tiers.

### ***Modeling Environment Capabilities***

You define capabilities per environment tier.

1. Open the Environments Visual Editor for the environment that you want to model.

2. Click  (the tier menu) in an environment tier, and then select **Capabilities**:



The **Tier Capabilities** dialog box opens:

Tier Capabilities

≡ App Server

1.

Application Server

Product: 

Select

Vendor: 

Select

Version:

2.

Database Server

Product: 

Select

Vendor: 

Select

Version:

Cancel

OK

3. In the **Tier Capabilities** dialog box, enter the capabilities for the tier. For example:

The screenshot shows the 'Tier Capabilities' dialog box with the title 'App Server'. It contains a list of tiers, with the first tier '1. Application Server' selected. The 'Product' dropdown is open, showing options: 'Select None', 'IBM WebSphere Application Server', 'JBoss Enterprise Application Platform', 'Jetty', 'Tomcat' (highlighted), and 'WebLogic Server'. The 'Vendor' dropdown is set to 'Oracle Corporation' and the 'Version' text box contains '5.7.17'. The 'OK' button is highlighted in blue.


4. Click **OK**.
5. Repeat these steps to define the capabilities for the other environment tiers.

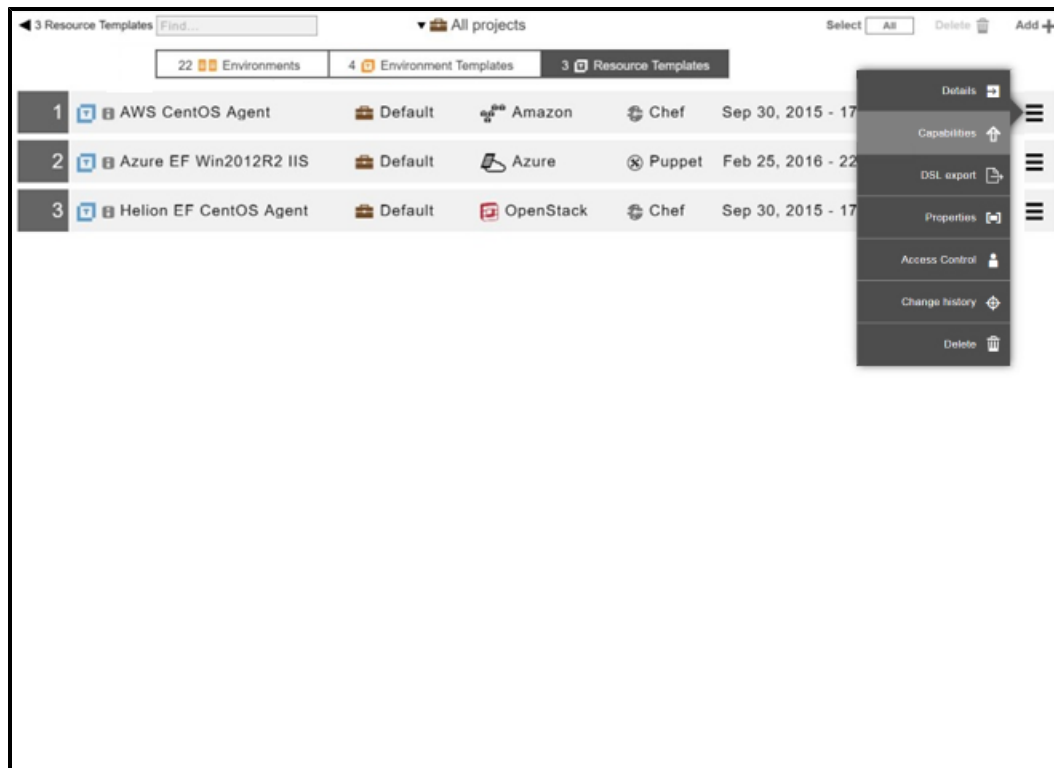
### ***Modeling Infrastructure and Middleware Capabilities***

ElectricFlow also allows the modeling of infrastructure and middleware capabilities for resource templates as well as environment tiers.

1. Go to the Resource Templates list and then select any resource template. If no resource template exists, create one.



2. Click  for a resource template, and then select **Capabilities**:



The **Resource Template Capabilities** dialog box opens. This dialog box lets you capture the infrastructure and middleware details:

Resource Template Capabilities

AWS CentOS Agent

1.

Application Server

Product:

JBoss Enterprise Application Platform

Vendor:

Redhat Inc

Version:

7.1

2.

Database Server

3.

Host

Architecture:

CPU:

Athlon XP 1500+ processor

Cancel

OK

3. You can model many attributes for the resource template. Some examples of these attributes are:

- Application Server:
  - Product
  - Vendor
  - Version
- Database Server:
  - Product
  - Vendor
  - Version
- Host:
  - Architecture
  - CPU
  - Disk size
  - Memory (RAM)
  - Number of CPUs
  - Public IP
  - Private IP
- Operating System:
  - Operating System
  - Operating System Type
  - Vendor
  - Version
- Virtual Image:
  - CPU
  - Virtual Image Name
  - Memory (RAM)
  - Public IP
  - Private Subnet Mask
  - Private IP

This list is extensible and more modeling attributes can be added. These attributes let you model infrastructure and Middleware as well as hardware capabilities. These can then be used to compare with the requirements defined on the application tier level.

## Stack Templates

A stack template defines the categories of resources (such as Application Server) that are available when you specify the requirements for an application tier. Within each category, the stack template specifies the available properties (such as Jetty).

### *The Default Stack Template*

A property named `ec-deploy` under **Administrator > Server > Properties** contains a property sheet named `ec_stack_templates`, which contains several default categories: Application Server, Database Server, Host, Operating Systems, and Virtual Image, each of which contains several properties that you want to capture. For example, the Host category has properties such as `memory` and `num_cpus` for capturing a system's memory and number of CPUs.

### *Modifying the Default Stack Template*

You can add more properties. You can also create new categories. For example, you could create a category named Operating System and then beneath it, you could create a type that says whether it is a Linux or a Windows system.

A stack template does not contain values. It just determines the values that you want to capture from an application standpoint and from an environment standpoint. The values are stored as attributes.

You can specify two types of values: string or text values and a list of values. For example, to capture the operating system type, you could define a list of the following values: Linux, Windows, AIX, and Lattice.

**IMPORTANT:** To prevent an ElectricFlow upgrade from overwriting customizations of the existing `ec_defaultStackTemplate`, you must copy that template into a new one. Then, you must set the `ec_deploy/ec_defaultStackTemplate` server property with your new template name

**Edit Property** / ec\_defaultStackTemplate Help

Name:

ec\_defaultStackTemplate

Value:

default

Description:

Expandable:

☒

OK

Cancel

## Configuration Drift

Throughout the software release process, ElectricFlow tracks changes in the release to ensure that the applications are repeatedly and reliably deployed and that the release is successfully completed. ElectricFlow uses snapshots and change tracking to track the changes and identify differences, and then can notify users about them.

Snapshots are a version of the application at a point in time, encapsulating the specific state of the application, its environment states, its components, and the artifacts and artifact versions that define the components. You can manually take snapshots and compare two to determine the differences between them. You can also automate a procedure that takes snapshots on a schedule, create custom reports, and send them to users, making it easier to identify differences between deployments and resolve issues in the release. Go to [Snapshots](#) on page 300 for more information about snapshots.

Change tracking is another way to track differences between deployments. Change tracking can track the changes between every state of non-runtime objects and allows you to revert to any previous state of the objects, such as applications, application processes, components, artifacts, procedures, workflows, resources, and workspaces. In the Change History, you can find what changed for a specific object, such as an artifact, and when the change occurred. Go to [Change Tracking](#) on page 980 for more information about this feature and how to use it.

# Chapter 1: Deployment Examples

This section has examples of application deployments and includes:

- How to identify ElectricFlow objects—These are easily identified by icons and colors in the Visual Editors (such as the Applications Visual Editor, Environments Visual Editor, and Application Process Visual Editor) and lists (such as the Applications List and the Environment List).

- How to view details about the objects

In the Applications Visual Editor and Environments Visual Editor, you can view details and other information of the application tiers, components, environment tiers, and resources.

In the Application Process Visual Editor and Component Process Visual Editor, you can view details about the process steps.

- How a process can take different paths in the deployment based on parameter inputs.
- What to expect with different deployment options.
- How to model dynamic environments that provision (commission) environments and spin them up at runtime.
- How to use master components.
- How to use snapshots.

## Guidelines for Modeling and Deploying Applications in ElectricFlow

### When Modeling Applications

Keep the following in mind:

- By default, change tracking is enabled for all ElectricFlow Deploy projects.
- When authoring a component process, you specify the process type. The default is **Deploy**.

In the **Component Process** dialog box, select one of these values in the **Type** field:

- **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks the artifacts deployed to environments.
- **Undeploy**—The next time that the process is run, the ElectricFlow server removes information about the artifacts deployed to environments.
- **Other**—Disables Inventory Tracking.

- You can also create a library of standardized reusable components to promote best practices across the enterprise and speed up application authoring with *master components*. This is an easy way to reuse existing definitions and their underlying process definitions. Go [Master Components](#) on page 82 for more information.

- After creating an application, you can version the entire application model by taking a snapshot of it. A snapshot is an immutable version of an application with specific artifact versions.

You can save more than one snapshot of an application during the software release life cycle. You can compare snapshots to optimize and troubleshoot the application. You can also deploy a snapshot even if the latest version of the application has been modified.

Go to [Snapshots](#) on page 300 for more information.

- You can include hyperlinks as part of an object description for any ElectricFlow object.
- Known issues:
  - If an application tier has two components that cannot be deployed to the same host, the components need to be in different application tiers.
  - If a formal parameter in a manual process step is renamed, the formal parameter properties are not updated.
- Go to [Inventory Tracking](#) on page 296 for more information.
- Go to [Environment Inventory](#) for more information.
- Go to [Examples: Modeling and Deploying Applications](#) on page 148 for an example of the Application Inventory in the Application View Run page.

## When Modeling Environments

You can optimize how resources are used in application deployments. You can model dynamic environments that are automatically spun up when an application is deployed. These environments can have cloud and static resources. Cloud resources are provisioned using resource templates, which are specified in environment templates.

Using dynamic environments allows you to:

- Provide ways to optimize how cloud resources are used.
- Reuse provisioned resource pools.
- Track how provisioned cloud resources are used.
- Provide the status of the provisioning process.
- Verify the credentials of cloud resources before provisioning them.
- Configure the middleware of cloud resources on an on-demand basis.

## When Deploying Applications

How an application is deployed depends on what you want to deploy. You can select the following deployment options.

- **New run**—Specify the runtime parameters and settings in the dialog box.
- **Last run**—Use the parameters from a previous run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.

**Note:** The option does not appear the first time an application is deployed.

- **Schedule**—Set the application to run on a schedule as described in [Running Applications with Schedules](#).

You can also deploy the application with these options and methods:

- **Full deploy**—ElectricFlow deploys all the objects (including application processes, components, and artifacts) in the application. When you deploy an application for the first time, you must do a full deploy. Later, you can use this method to verify that the software is ready to be released.
- **Smart deploy**—This deployment method reduces risk and time by only deploying changed objects. ElectricFlow automatically detects the differences between what is about to be deployed and what has already deployed to an environment. It deploys only those objects not yet deployed to a specific resource or to resources where the object version is different. You can use this method throughout the software release life cycle.
- **Partial deploy**—The system deploys only objects that you select. You can use this method to verify incremental changes.
- **Partial deploy with specific artifact versions**—The system deploys only the artifacts with selected versions. You can use this method to verify incremental changes.
- **Schedule**—You can create schedules to deploy applications on a one-time, daily, weekly, or monthly basis. You can schedule nightly builds so that the developers and quality always have a new version to work on every day.
- **Snapshot**—You select a snapshot to deploy. A snapshot is an immutable version of the application with specific artifact versions. You can save and compare snapshots throughout a Release life cycle.

**Note:** If you select a snapshot and modify it, it is no longer a snapshot and becomes a different version of the application, which you can save as a new snapshot.

- **Based on custom parameters defined in application processes**—Set these parameters when you deploy the application or when you define an application process step. They determine how the application should be deployed.
- **Artifact staging**—ElectricFlow retrieves the artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target. It also minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment. Go to [Artifact Staging](#) on page 120 for more information.
- **Rollback**—When an application deployment fails, you can use the rollback functionality to restore the deployment model to a previous state before the failure occurred. This operation is supported only in application processes. Go to [Rollback](#) on page 122 for more information.

You can deploy applications by combining methods, such as:

- Smart deploy and partial deploy
- Smart deploy, artifact staging, and a partial deploy with specific artifact versions
- Full deploy and artifact staging with a snapshot



- Smart deploy and artifact staging
- Artifact staging and partial deploy

For example, this sequence is an example of how you may deploy your software over time:

- When you create an application in ElectricFlow and deploy it for the first time, you must do a full deploy. By default, smart deploy is disabled the first time that you run an application.
- Throughout these deployments, you can schedule the deployments to occur on a daily or weekly basis to provide builds that can be tested and installed on a regular basis.
- You can also save snapshots of the software at regular intervals or milestones. When you need to troubleshoot the software or want to do performance testing, you can use one of these snapshots for comparison.
- If the application does not deploy successfully, you can redeploy parts of it to troubleshoot the application or component processes that failed.

You can do a partial deploy and redeploy the application with only the objects that failed.

You can also do a partial deploy only with specific versions of artifacts to determine if one or more specific versions of artifacts are causing problems.

- Later, after successfully deploying the application, you can redeploy parts of the application when new versions of artifacts or new resources are available.
- When a new version of an artifact is released, you can deploy only the artifact by selecting the new version and doing a partial deploy.
- When you add artifacts and resources to the application, you deploy the new artifacts to resources and specific versions of selected artifacts to the new resources, a combination of smart deploy and partial deploy with specific artifact versions.

## Getting the Real-Time Status of Application Runs and Troubleshooting

Use the Environment Inventory and Application Inventory to view the progress of the application as it runs and the results of previous runs. They show detailed results that can be used to troubleshoot the application. Go to [Inventory Tracking](#) on page 296 for more information.

- In the Application Inventory (on the Applications Run View page), you can get information about the application, its application processes, components, and job steps and about the status of these objects.
- In the Environment Inventory, you can get more details about the environment, the applications mapped to it, number of deployed artifacts in the applications, where the artifacts are deployed, and the status of these objects.

Use Change Tracking to troubleshoot a failed job, look for more information about non-run object, and/or look for differences between objects. Go to [Change Tracking](#) on page 980 for more information.

Compare snapshots to refine and troubleshoot an application. Go to [Snapshots](#) on page 300 for more information.

## Examples: Modeling and Deploying Applications

You can model applications using one of the following:

- Tiers and Components
- Services and Containers

You can use Change Tracking to track all the changes for non-runtime objects such as the application model, components, artifacts, resources, the environment model, and projects. Go to [Configuring Change Tracking](#) on page 980 for more information.

When defining a component or container, you specify the artifact repository (plugin) and the artifact version that you want to use. ElectricFlow supports artifacts from a variety of Artifact Repositories, such as the EC-Artifact repository, Maven based repositories such as Nexus or Artifactory (using EC-Maven), or artifacts on any file system (using EC-FileSysRepo). These artifacts could point to any build outputs, configuration scripts, database, scripts, and so on. The information that you enter in the component or container definition depends on the artifact repository that you select. For more information about artifacts, go to [Artifact Management](#) on page 928 and [Artifacts](#) on page 686.

Applications consist of services and the processes that orchestrate the deployment of these services. Each application object has one or more application services, where a service is a logical group of containers. A container is based on an artifact, and the container definition contains a reference to this artifact.

When using containers and services, you can:

- Create services and containers under applications
- Create clusters in environments (ElectricFlow supports GCE and ECS)
- Map services to clusters and set provider-specific values

These examples show how to model and deploy an application in ElectricFlow.

- [Creating a New Application](#) on page 149
- [Authoring Application Processes](#) on page 167
- [Creating Environments](#) on page 173
- [Defining Tier Maps and Cluster Maps](#) on page 181
- [Deploying and Troubleshooting Applications](#) on page 186
- [Viewing the Real-Time Progress of Deployments](#) on page 193
- [Troubleshooting Deployments](#) on page 195

## Creating a New Application

Applications consist of components and the processes that orchestrate the deployment of these components. Each application object has one or more application tiers, where a tier is a logical group of components, and one or more services, where a service is a logical grouping of containers.

A component is based on an artifact, and the component definition contains a reference to this artifact.

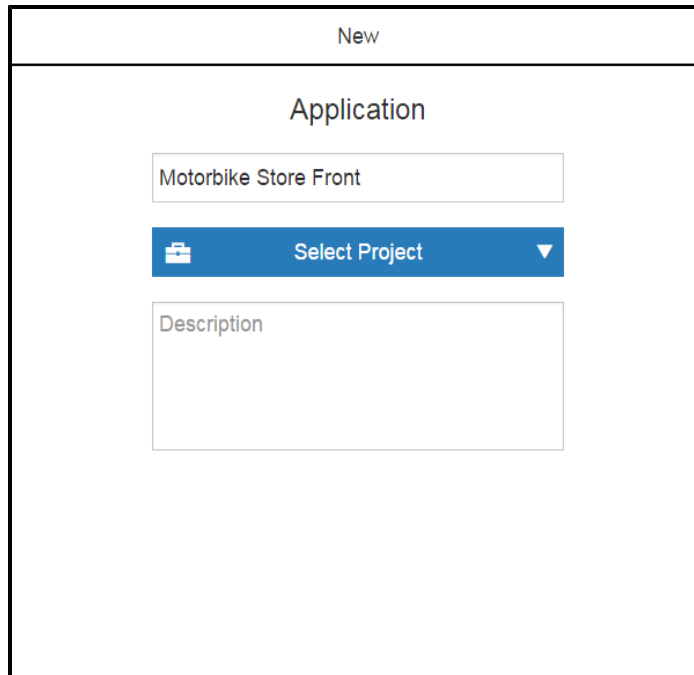
This example shows how to create a “hybrid” application consisting of an application tier with a component and two services with a container in each service.

1. In the Applications List, click **Add +** to add an application.
2. In the **New** dialog box, click **Application > Create New**.

3. Enter "Motorbike Store Front" as the application name, select a project to which the new application will belong in the **Select Project** field, enter a description of the application, and click **OK**.

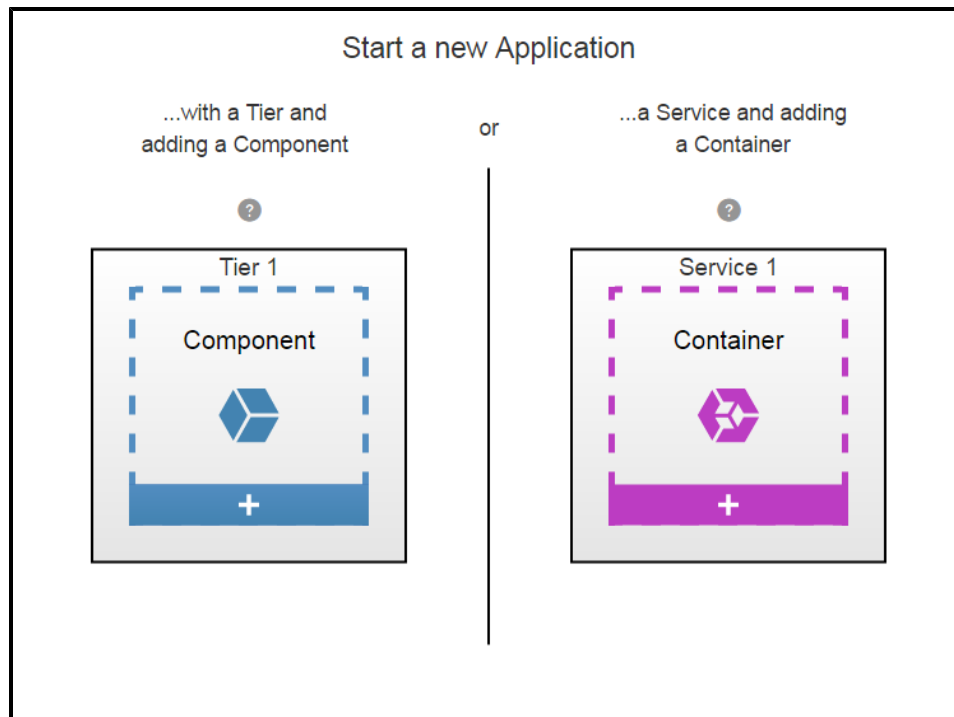
**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

Example:



The image shows a 'New' dialog box with a title bar. Inside, the word 'Application' is centered. Below it, there is a text input field containing 'Motorbike Store Front'. Underneath that is a blue button with a folder icon, the text 'Select Project', and a downward arrow. At the bottom is a larger text area with the placeholder text 'Description'.

The Application Visual Editor opens:




This dialog box lets you quickly define an application tier and the components in it or a service and the containers in it. This example uses an application tier and components. For more information about services and containers, see [Microservice Application Deployment Using Containers](#) on page 77

4. Click **Tier 1**.

5. Define an application tier and the components in it.



In Tier 1, click  and select **Details** to edit the details in the **Application Tier** dialog box.

- a. Rename the application tier to "dbTier" and click **OK**.
- b. To define the component:
  - i. Click **+** under the **Component**.
  - ii. Click **Create new application component**.
  - iii. Enter "update.sql" as the component name, and click **Next**.

The **Component Definition** dialog box appears.

- iv. In the **Content Location** field, select **EC-Artifact**.

Depending on the value that you select in the **Content Location** field, different fields appear.

- v. Enter the artifact Version. In this example, select **Exact**, and enter **1**.
- vi. Enter the information to define the component.

Example:


- c. Click **OK**.

## Authoring Component Processes

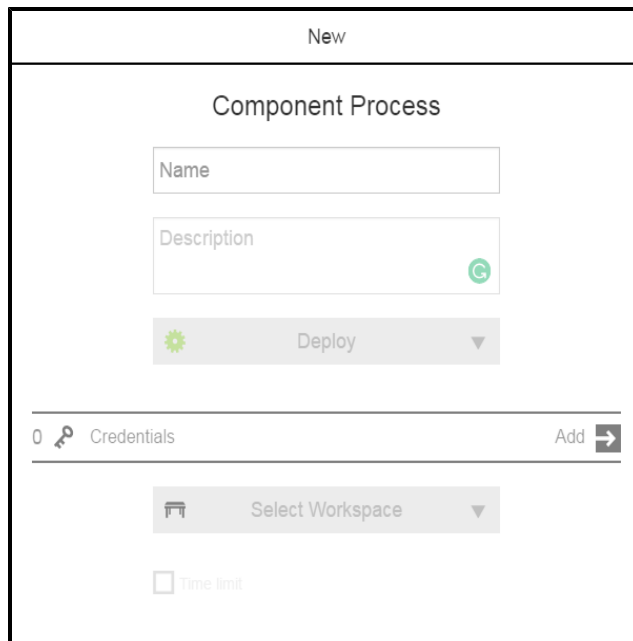
In a component process, you define a set of actions that will be executed on a specific component during the deployment. A component process step can be defined as a call to an ElectricFlow plugin or procedure, a direct command or script in any scripting language, a manual task, or a utility function (a higher-order operation than a plugin).

In the Cleanup DB component of the "DB" tier:



1. Click  to start authoring a component process.

The **Component Process** dialog box appears:



2. In the **Component Process** dialog box, enter the following details:
  - Enter "updateDB" in the **Name** field.
  - Enter an optional description in the **Description** field.
  - Keep the selection as **Deploy** in the **Type** field. This value determines track what is built, tested, and deployed during the application deployment. The default is **Deploy**.

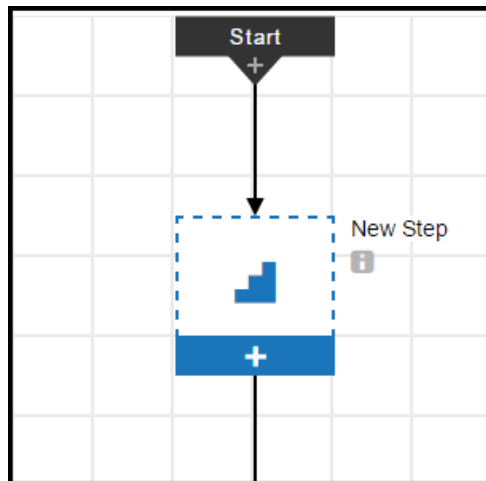
3. Click **OK**.

The Component Process Visual Editor opens.

The process model shows a process with **Start** and **Finish** steps with a **New Step** in between them.

**Note:** Clicking **i** under the step name displays the details about the process step.

Example:



4. Click + in the first step.

5. Define the first step in the Component Process Step dialog box:
  - a. Enter "getScript" in the **Name** field.
  - b. Enter "Retrieve the new sql file" in the **Description** field.
  - c. Use the **Continue Running** setting in the **On Error** field. Go [here](#) for more information.
  - d. Use the **all** setting in the **Run if** field. Go [here](#) for more information.
  - e. Click **Next**.

Example:

Edit

### Component Process Step

getScript

Retrieve the sql file

On Error: ☒ Continue running ☐ Stop running

Run if... ☒ all ☐ any in-coming condition is met

0 Credentials Add

Select Workspace ▼

☐ Time limit

Cancel Next



6. Define the first step in the Component Process Step dialog box based on a component operation, select **Component Operations** as the **Step Type**. The parameters for this process step are automatically inherited from the "update.sql" component.

Example:

**EC-Artifact / Retrieve**

Parameters inherited from component

Artifact:  Required

Version: ☐ Latest

☒ Exact:

☐ Range:

Minimum:  ☐ Inclusive?:

Maximum:  ☐ Inclusive?:

Retrieve to directory: ☒  Overwrite:

Retrieved Artifact Location Property:

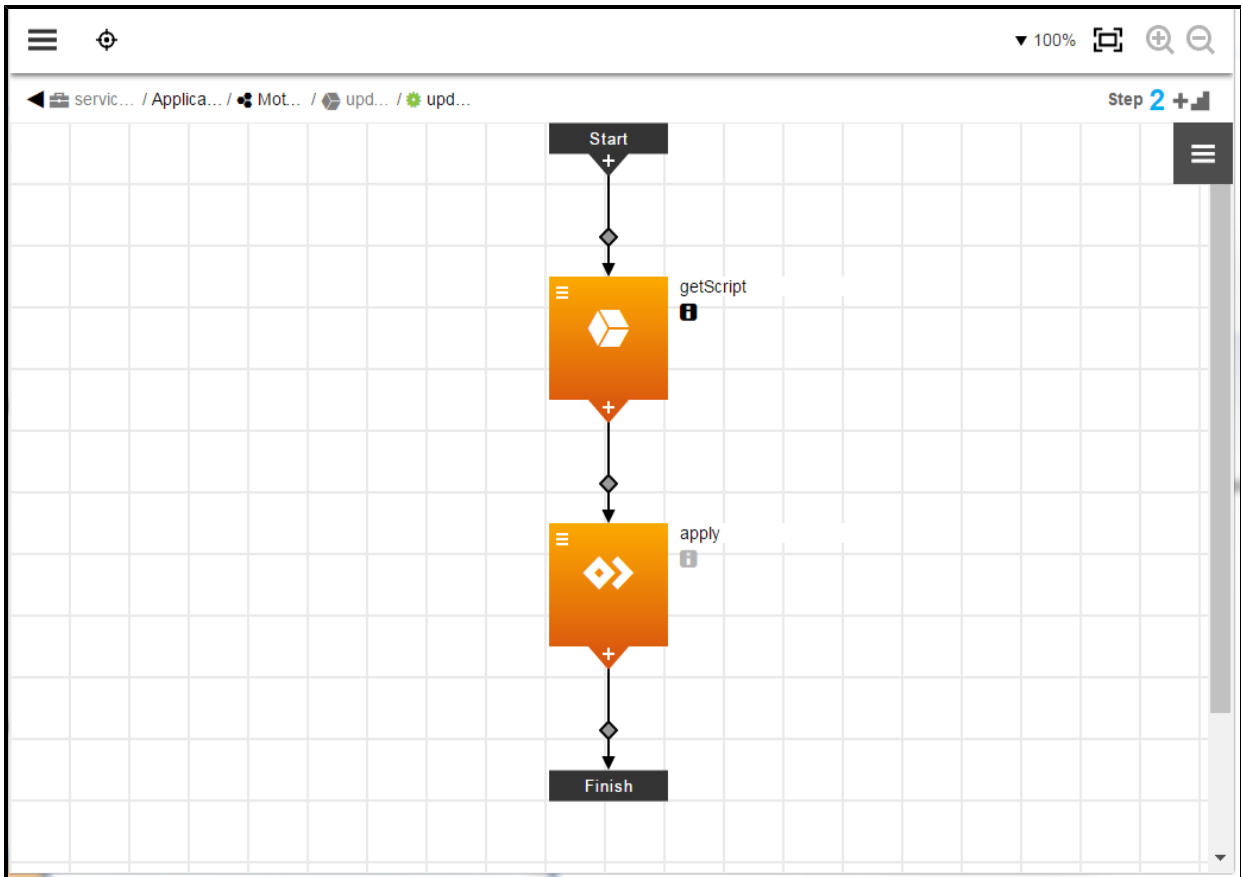
Filter(s):  equals  [Remove](#)

[+Add Filter](#)

7. Click **OK**.
8. Click **+** on the bottom of the first step to add a new step below it.
9. Click **+** in the second step.
10. Define the second step in the Component Process Step dialog box:
  - a. Enter "apply" in the **Name** field.
  - b. Use the **Stop Running** setting in the **On Error** field. Go [here](#) for more information.
  - c. Use the **all** setting in the **Run if** field. Go [here](#) for more information.
  - d. Click **Next**.


11. Define the second step in the Component Process Step dialog box based on a component operation by selecting **Procedure** as the **Step Type**. The parameters for this process step are automatically inherited from the "update.sql" component.
12. Click **OK**.

This is the component process:



- You can get details about each step by clicking **i** under the step name.
- The first step is a component operation.  
The second step is a procedure.
- These steps are deployed in series.  
The second step can only start after the first step is completed.



- Clicking  displays menu where you can select options:
  - **Details**—View step details
  - **Properties**—View step properties.
  - **Access Control**—View access control settings.
  - **Add Connector**—Add another connector to the step.
  - **Track Changes**—View the Change History.

This example shows how to create an application consisting of multiple application services with multiple containers.



1. Click the button to add a service.

2. Define an application service and the containers in it.

A new service named Service1 appears.



In Service 1, click and select **Details** to edit the details in the **Container Definition** dialog box.

- a. Rename the application service to "store-front-end" and click **OK**.

- b. To define the container:
- Click **+** under the **Container**.
  - Click **Create new container**.
  - Enter `Config` as the container name, and click **Next**. The **Container Definition** dialog box appears:

New	
Container Definition	
1.	Details
2.	Environment
3.	Ports

Cancel OK

- Click the "down" arrows to fully expand the dialog box.

- v. Enter the container attributes as needed. The following table describes the available attributes.

Label	Description	Default	
<b>Container Definition</b>			
Registry Type	Public: Specifies that your container images are stored in a public Docker registry.  Private: Specifies that your container images are stored in registries other than a public Docker registry.	Public	
Registry URL	(Optional) Private container registry URL. This is the registry where your image is stored. For example, <code>http://gcr.io</code> .	—	
Registry Credential	(Optional) Credentials (username and password) required to access the private registry. You must create a credential under a project and attach to it ( by providing the absolute path when using <code>gcloud</code> or by browsing and selecting it in the UI).	—	
Image	Relative or absolute path to the container image. For example, <code>username/image</code> .	—	
Version	(Optional) Version of the image. For example, <code>v1.0</code> . This will be used as a tag when you publish an image to Docker Hub. If a tag is not provided, Docker tags it as <code>latest</code> .	latest	



Label	Description	Default	
Volume Mounts	<p>(Optional) Volume mounts required by the container. Use JSON format. For example:</p> <pre>[{   "name": "scratch-space", // required attribute. To be used to reference volume definition at service level.    "mountPath":     "/tmp/cache" // required attribute.   Mount location for volume in container. }]</pre>	—	
Minimum CPU Requested	<p>(Optional) Amount of CPU (in number of cores) requested by the container. Specifying the amount of CPU needed allows the underlying container service to make better placement decisions when deploying the services on the nodes in the cluster based on the available capacity.</p> <p>If no value is specified, the underlying container service determines the default.</p>	—	


Label	Description	Default
Maximum CPU Allowed	(Optional) Maximum amount of CPU (in number of cores) that the container may use. If the limit is exceeded, the behavior depends on the container service.	If this is left empty, the platform-specific default is used.
Minimum Memory Requested	(Optional) Amount of memory (in MB) requested by the container. Specifying the amount of memory needed by the container allows the underlying container service to make better decisions when deploying the services on the nodes in the cluster based on the nodes' available capacity. If no value is specified, the underlying container service determines the default.	None. However, on ECS, the plugin will use a default soft memory limit (memory request) of 128 MB.
Maximum Memory Allowed	(Optional) Maximum amount of memory (in MB) that the container may use. If the limit is exceeded, the behavior depends on the container service.	If this is left empty, the platform-specific default is used.

Label	Description	Default
Entry Point	<p>(Optional) Comma-separated list of one or more values to override the <code>ENTRYPOINT</code> instruction in the Docker image at runtime.</p> <p><code>ENTRYPOINT</code> specifies a command that will always be executed when the container starts. For example, <code>/bin/ping</code>.</p> <p>For details about how <code>CMD</code> and <code>ENTRYPOINT</code> interact, see <a href="https://docs.docker.com/engine/reference/builder/#/understand-how-cmd-and-entrypoint-interact">https://docs.docker.com/engine/reference/builder/#/understand-how-cmd-and-entrypoint-interact</a>.</p>	—
Command	<p>(Optional) Comma-separated command arguments to use with the container's entry point. If specified, they override the <code>CMD</code> instruction defined in the container image. <code>CMD</code> specifies arguments that will be passed to the <code>ENTRYPOINT</code> (for example, <code>localhost</code>).</p>	—
<b>Environment</b>		
Variable	<p>(Optional) Environment variable name used in the container. For example, <code>TEMP_FOLDER</code> or <code>DB_PORT</code>.</p>	—
Value	<p>(Optional) Default value for the environment variable. You can override these values during the service-to-cluster mapping phase.</p>	—
<b>Ports</b>		

Label	Description	Default	
Name	(Optional) Logical name for the container port. For example, <code>http</code> or <code>https</code> .	–	
Container Port	(Optional) Port that the container is listening on.	–	

vi. Click **OK**.




3. Click the  button to add a service named `store-backend` as described above and enter the container attributes as needed.

## Authoring Application Processes

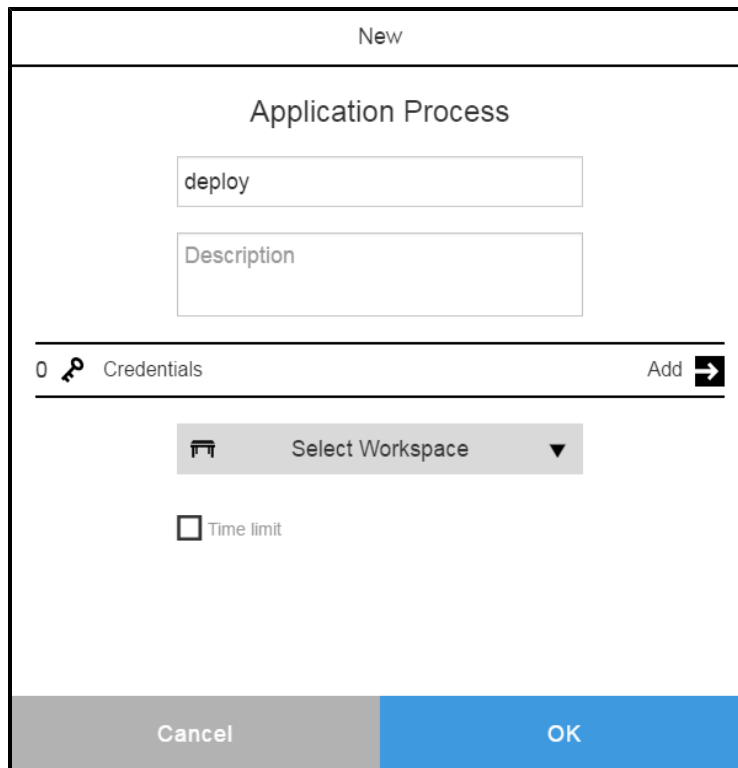
At the application (parent) level, you author application processes. When deploying an application, the application process that you select is executed to orchestrate operations against the application. An application process step can be defined as a call to an ElectricFlow plugin, procedure, or component process as well as a direct command, script, a manual task, or a utility function (a higher-order operation than a plugin).

In the Applications Visual Editor for the Upgrade application:



1. Click  to start authoring an application component process.
2. In the Application Process Details dialog box, enter the following details:
  - Enter "deploy" in the **Name** field.
  - Enter an optional description in the **Description** field.
  - Keep the selection as **Deploy** in the **Type** field. This value determines track what is built, tested, and deployed during the application deployment. The default is **Deploy**.
    - **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks artifacts deployed to environments.
    - **Undeploy**—After the first successful job step in a component process with this setting, the automation platform removes the environment inventory record.
    - **Other**—Disables Inventory Tracking.

Example:






New

Application Process

deploy

Description

0  Credentials Add 

 Select Workspace ▼

☐ Time limit

Cancel OK

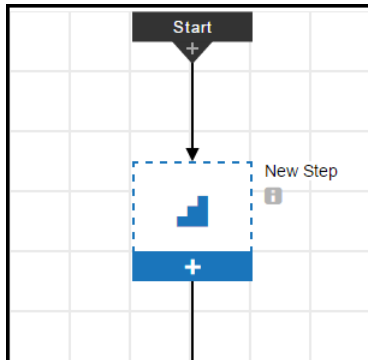
3. Click **OK**.

The Application Process Visual Editor opens.

The process model shows a process with **Start** and **Finish** steps with a **New Step** in between them.

**Note:** Clicking **i** under the step name displays the details about the process step.

Example:

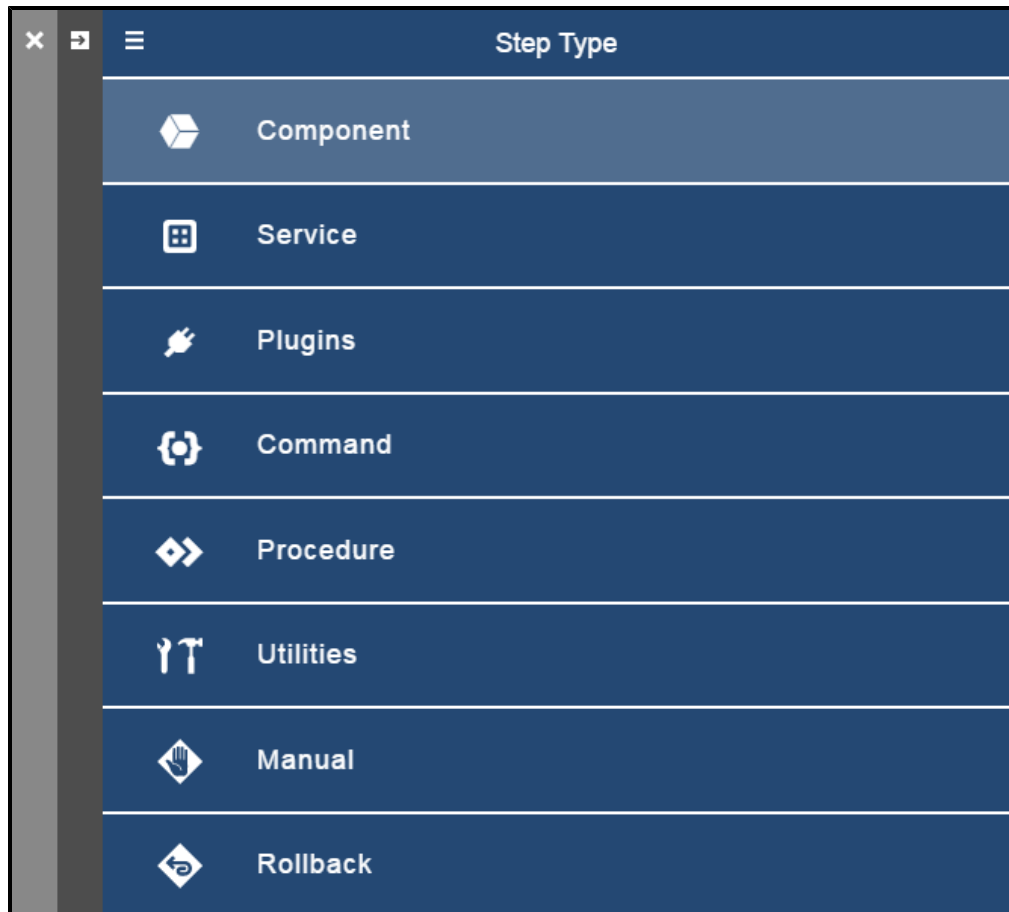


4. Click **+** in the first step.

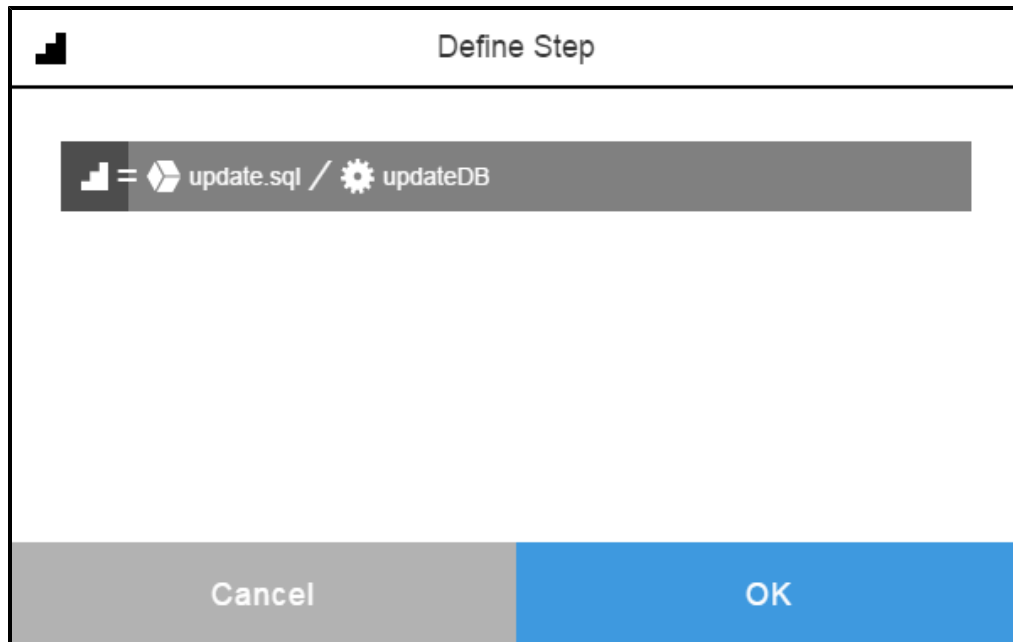
5. Define the first step in the Application Process Step dialog box :

- a. Enter "applyDBChange" in the **Name** field.
- b. Use the **Stop running** setting in the **On Error** field. Go [here](#) for more information.
- c. Use the **all** setting in the **Run if** field. Go [here](#) for more information.
- d. Click **Next**.

The **Step Type** dialog box appears:



6. Define the second step in the Application Process Step dialog box based on a service by clicking **Component > update.sql> updateDB**. The step is defined by the component Deploy process for the update.sql component:



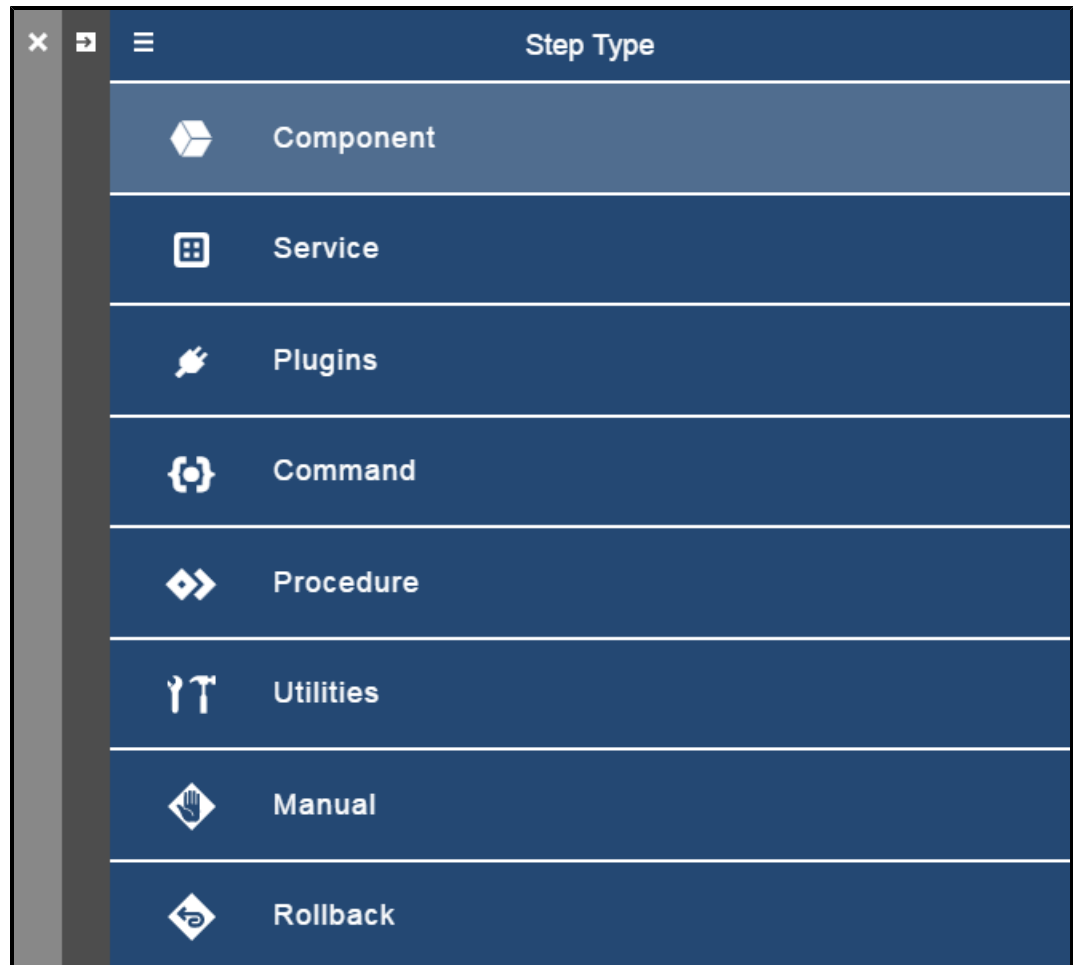
7. Click **OK**.
8. Click + on the bottom of the first step to add a new step below it.
9. Click + in the second step.



10. Define the second step in the Application Process Step dialog box as follows:

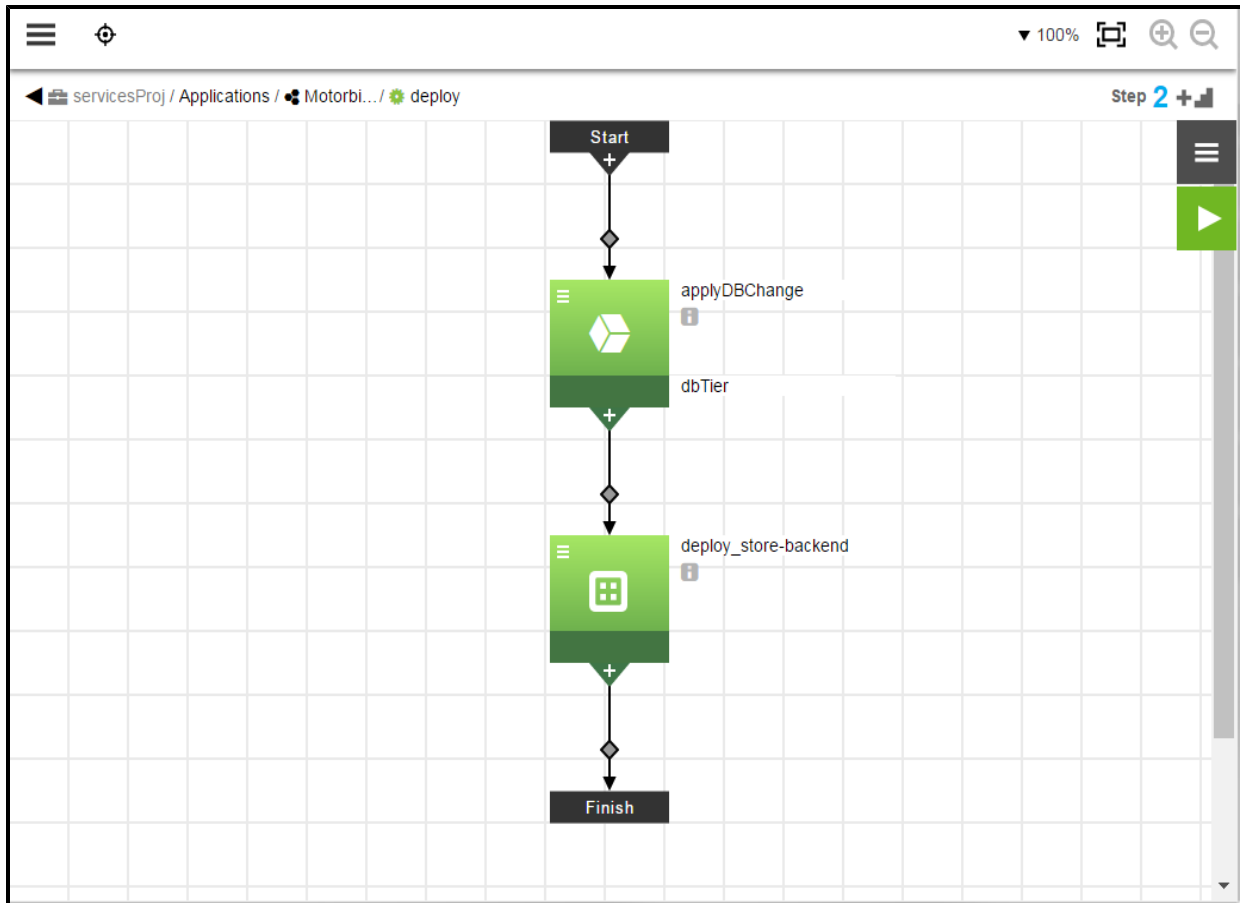
- a. Enter "deploy\_store-backend" in the **Name** field.
- b. Use the **Stop running** setting in the **On Error** field. Go [here](#) for more information.
- c. Use the **all** setting in the **Run if** field. Go [here](#) for more information.
- d. Click **Next**.

The **Step Type** dialog box appears:




1. Define the second step in the Application Process Step dialog box based on a service by selecting **Service > store-backend**. The step is defined by the component Deploy process for the motorbikeMS service.
2. Click **OK**.

This is the application process called "deploy.":



- You can get details about each step by clicking **i** under the step name.



- Clicking  displays a menu where you can select the following options:
  - **Details**—View step details
  - **Properties**—View step properties.
  - **Access Control**—View access control settings.
  - **Add Connector**—Add another connector to the step.
  - **Track Changes**—View the Change History.

## Creating Environments

Environments are logical grouping of machines to which various applications can be mapped and deployed. Using environments and templates, you can model the infrastructure and the middleware available for various applications. Environments consist of logical groups of resources with a similar function or role called environment tiers. An environment tier can be a group of machines with a similar function or role, such as all the web servers or application servers or database servers for an environment. Resources are actual target end point machines (such as physical servers), virtual machines, or mobile devices.

Environments can be static, dynamic, or hybrid. A *static environment* has resources that are already provisioned and managed at the platform level. Each resource has its own logical name to identify it from the other resources in the system. It also can be assigned to one or more resource pools or to a zone (a collection of agents). Several resources can correspond to the same physical host or agent machine. Resources can also be configured as *standard* or *proxy*. Standard resources are machines running the ElectricFlow agent on a supported agent platform while proxy resources (agents and targets) are on remote platforms or hosts that exist in your environment and requires SSH keys for authentication. The ElectricFlow agent does not need to run on the remote platform or host. Go to [Resources](#) on page 809 for more information about to create, configure, and manage resources.

This example shows to how model a static environment to which the application will be deployed. For information about dynamic environments and how to model them, go to [Deploying Applications in Dynamic Environments](#) on page 227.

### ***Creating Environment Tiers***

In the Environments List:

1. Click **Add +** (in the upper right corner) to add an environment.
2. In the **New** dialog box, select **Environment > Create New**.  
The **Environment** dialog box appears.
3. Enter 'A—Amazon ECS Production' into the **Name** field.

4. Select a project to which the new environment will belong in the **Select Project** field and enter a description of the environment.

**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

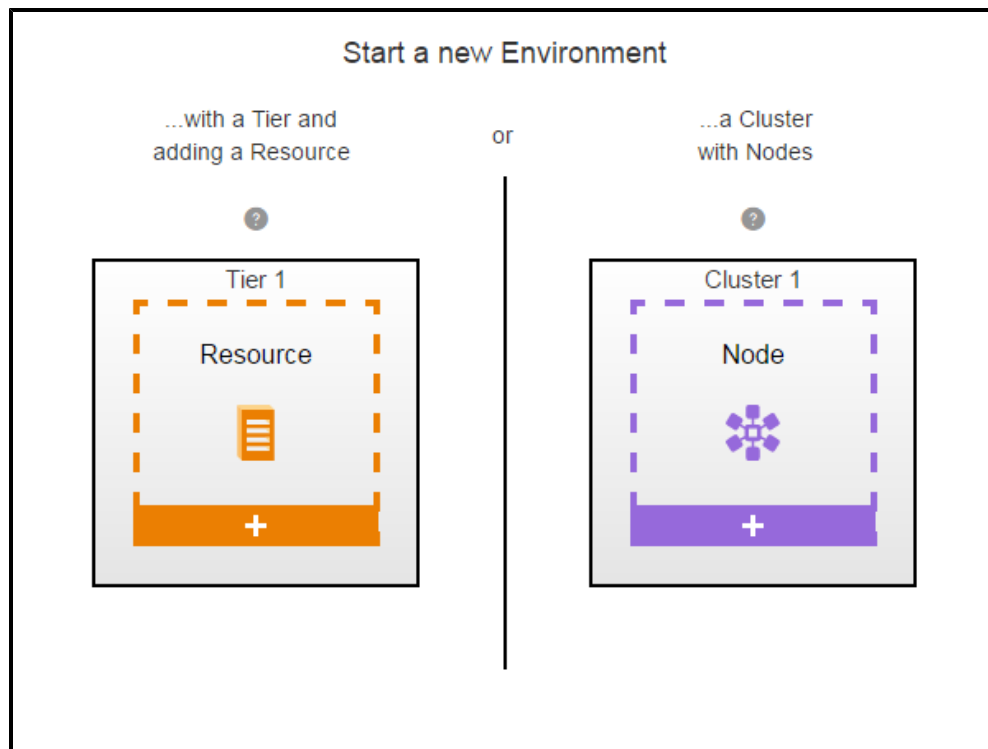
Example:

The image shows a 'New Environment' dialog box. At the top, there is a title bar with the word 'New'. Below it, the main title 'Environment' is centered. The first input field contains the text 'A - Amazon ECS Production'. Below this is a dropdown menu with a briefcase icon on the left, the text 'servicesProj', and a downward arrow on the right. Underneath the dropdown is a larger text area labeled 'Description'. At the bottom of the main content area, there is a checkbox labeled 'Reservation Required' followed by a small circular help icon. The dialog box has a footer with two buttons: 'Cancel' on the left and 'OK' on the right.

This dialog box lets you quickly define an environment tier and the resources in it or a service and the nodes in it.

5. Click **OK**.


The Environments Visual Editor opens.



6. Click **Tier 1**.

7. Define an environment tier and assign resources it.
- a. In the New dialog box, click **Add resources**.



- b. Click , then click **Details**, then rename the environment tier to "mysql," and then click **OK**.
- c. To define the resource:

Click **+** under the **Resource**.

Click **Add resources**.

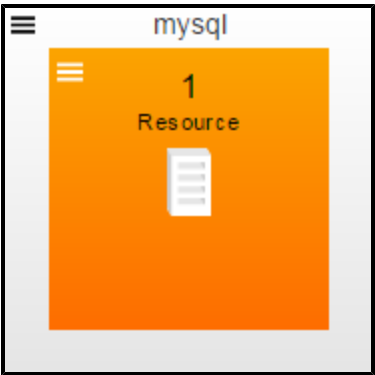
Select the resource that you want to assign to the environment tier, and click **OK**. A resource is available if it is enabled.

Example:

7 Resources				1 Selected	
✓ Name ▲▼	Platform ▲▼	Up/Down ▲▼	Used in...		
✓ 1. QA-res	linux	+	QA		✕
✓ 2. PROD-res	linux	+	PROD		✕



The Environments Visual Editor now has an environment tier called "mysql" with one resource.

Example:




## Creating Environment Clusters



1. Click  (in the upper right corner) to add an environment cluster.
2. Click  at the bottom of Cluster 1. The **Cluster Definition** dialog box appears:

New

Cluster Definition

 Select platform ▼

3. In the **Cluster Definition** dialog box, select a platform. For example, Amazon EC2 Container Service.



4. Enter the cluster attributes as needed. The following table describes the available attributes.

Label	Description	Default
Configuration	Name of an existing configuration which holds the connection information for Amazon ECS.	
Container Cluster Name	Name of the cluster to be provisioned for in Amazon ECS.	
Description	(Optional) Description of the cluster that needs to be provisioned.	–
Desired Capacity	Number of EC2 instances that should be running in the group.	
Maximum Size	(Optional) Maximum size of the group.	
Minimum Size	(Optional) Minimum size of the group.	
VPC Subnet Ids	(Optional) Comma-separated list of subnet identifiers for your virtual private cloud (VPC) in which to launch the EC2 instances.	
Availability Zones	Availability zones in which to launch your EC2 instances.	
Image	ID of the Amazon Machine Image (AMI) to use to launch your EC2 instances.	
Instance Type	Instance type of the EC2 instance.	
Security Groups	One or more security groups with which to associate the instances.	
Key Name	(Optional) Name of the key pair.	
Associate Public IP	(Optional) Checkbox that specifies whether to associate a public IP address.	
Container Instance IAM Role	ECS container instance IAM role for the launched container instances to use.	

Label	Description	Default
Results Property Sheet	Name of the property sheet to hold results.	

5. Click **OK**.



6. In the cluster that you just created, click **> Details**.

The **Environment Cluster** dialog box appears:

Edit

Environment Cluster

Name

Description

Cancel
OK

7. In the **Environment Cluster** dialog box, enter a cluster name into the **Name** field. For example, `ecs-cluster1`.
8. Click **OK**.


## Defining Tier Maps and Cluster Maps

Before deploying application that use an application tier or an application cluster, you must define a tier map to associate the application with an environment.

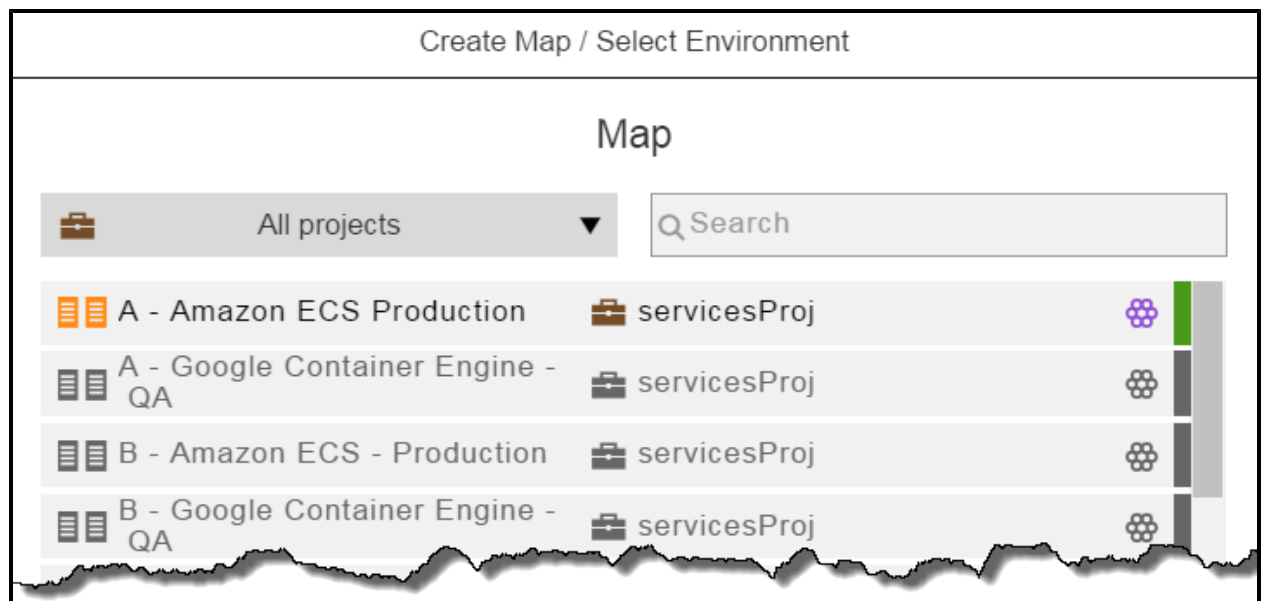
### Defining an Application Tier Map

In the Applications Visual Editor for the application that you want to deploy:




1. Click .  
The Map dialog box opens.
2. Click **Environment**.
3. From the list of environments that you have permission to view, select an environment. You can search for environments by project name or enter the search criteria in the **Search** field.

Example: Select Amazon ECS Production.

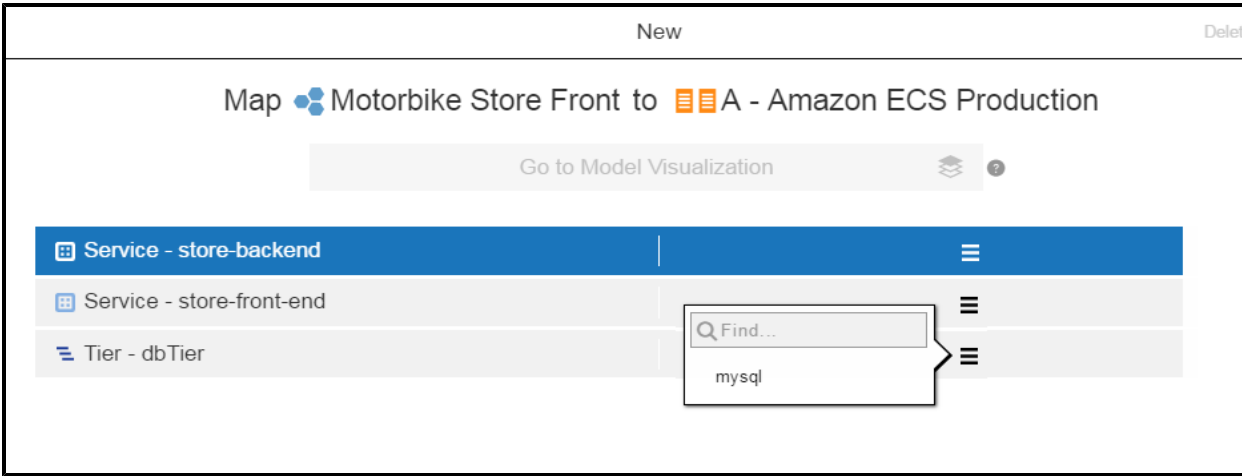


4. Map the application tier to the environment tier:



- a. In the application tier, click  in the corresponding environment tiers column and select an environment tier. Select one from the list or enter the search criteria in the **Search** field.

Example:



- b. Click **OK** when the application tier is mapped to an environment tier.


**Defining an Application Cluster Map**

For details about the cluster attributes for Amazon ECS and Google Container Engine, see the plugin documentation for the EC-AmazonECS and EC-GoogleContainerEngine plugins.

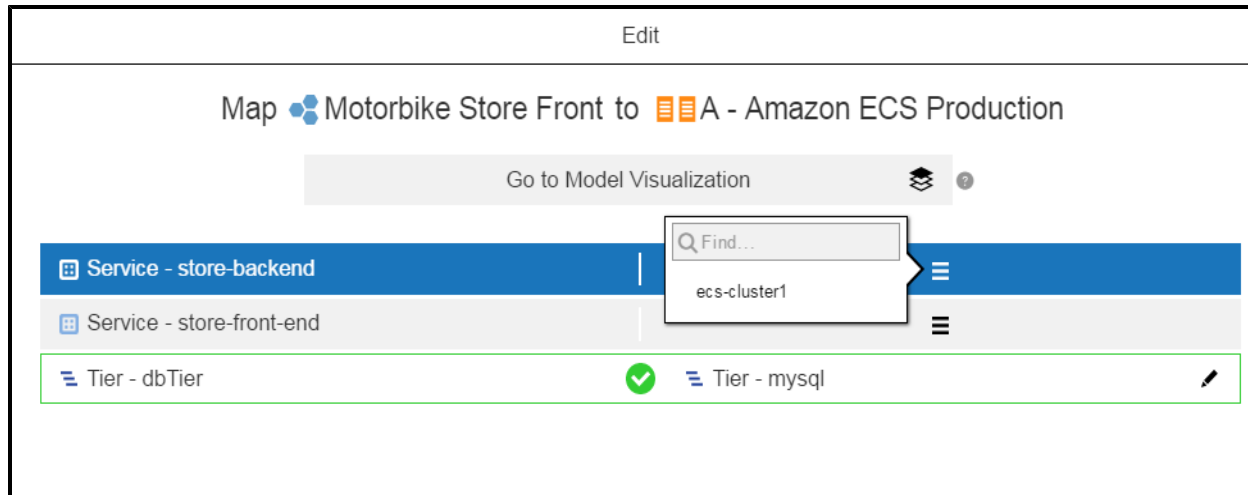
You can override the service and container attributes and add platform-specific service and container attributes.

1. Map the store-backend to an environment tier:



- a. In the service, click  in the corresponding environment tiers column and select an environment tier. Select one from the list or enter the search criteria in the **Search** field.

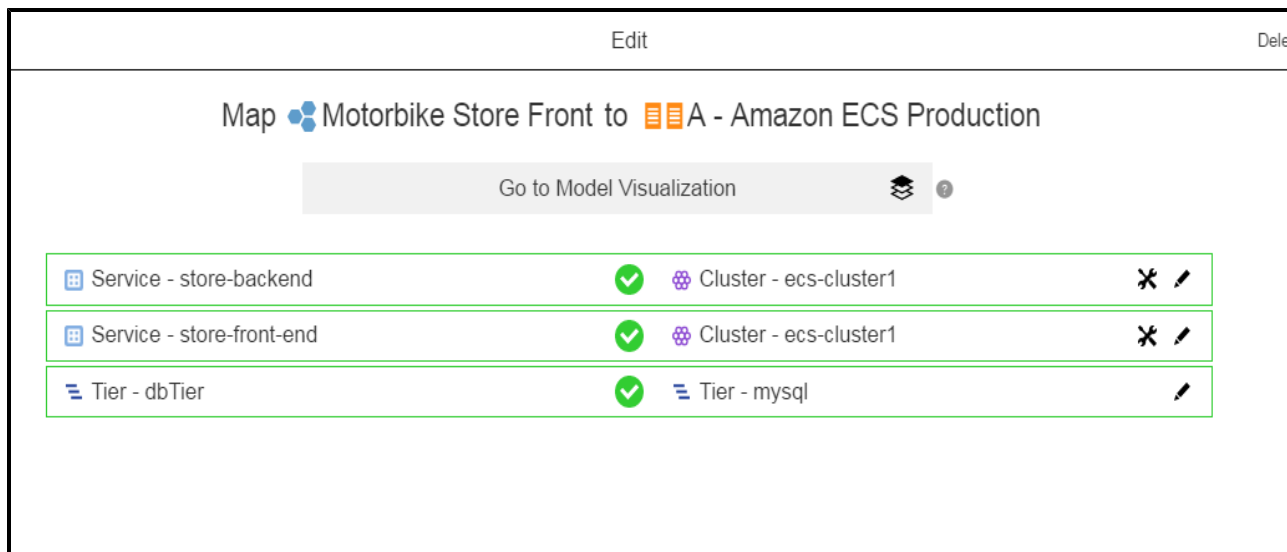
Example:



- b. Click **OK** when the application tier is mapped to an environment tier.
2. Map the store-front-end service to an environment tier as described above.

The application now has one tier map and two cluster maps.

Example:




3. Click  to configure the cluster map for the store-backend service.

4. Enter the cluster map attributes as needed. The following table describes the available attributes.

	Label	Description	Default
<b>Service Configuration Details</b> You can use these fields to override the service and container attributes and add platform-specific service and container attributes.			
	Volume	(Optional) Volume pointing to a storage device or a partition that can be mounted by a container. Use JSON format. For example: <pre>[{   "name": "web-content",   "hostPath": "/var/html" }]</pre> Location on host/container instance where volume is expected to be already attached.	–
	Number of Service instances	(Optional) Number of service instances to use.	1
	Rolling Deployment—Min Service Instances	(Optional) Minimum number of services that can be brought down during a rolling deployment.	If this is left empty, the platform-specific default is used.
	Rolling Deployment—Max Service Instances	(Optional) Maximum number of services that can be created during a rolling deployment.	If this is left empty, the platform-specific default is used.
<b>Port Mapping</b>			
	Name	Reference to the container port name.	–
	Container Port	Reference to the container port.	–
	Listener Port	External or listener port mapping for the container port. A listener port setup is required for pods to communicate with each other.	–
<b>Amazon EC2 Container Service Specifications</b>			

	Label	Description	Default
	LoadBalancer Name	Name of the load balancer on Amazon EC2. Required if the service contains port mappings.	—
	IAM role for Service and Loadbalancer	Name or full Amazon Resource Name (ARN) of the AWS Identity and Access Management (IAM) role that allows ECS to make calls to your load balancer on your behalf.	—




5. Click  to configure the cluster map for the store-front-end service as described above.


## Deploying and Troubleshooting Applications


This example shows how to deploy the application multiple times with different runtime conditions.


### First Run







In the Applications List, clicking  and selecting **New Run** opens the dialog box where you can set the runtime settings.


Run  Upgrade


 Select Process ▼


 Select Environment ▼

0  Select a Snapshot ▼   Compare →

0  Artifacts 0 Selected →

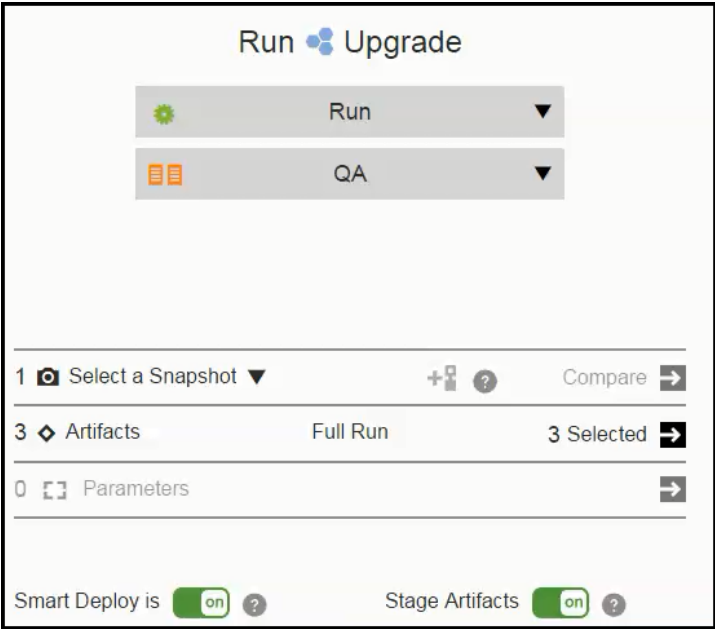
0  Parameters →

Smart Deploy is off 

Stage Artifacts off 

- In the Select Process field, select **Run**.
- In the Select Environment field, select **QA**.
- You can select a snapshot in the **Select a Snapshot** field if you have one or more.

- For the first run, all artifacts will be deployed.
- **Smart Deploy** and **Stage Artifacts** are enabled.



Click **OK** to start the application run.

The Applications View Run page shows the progress of the application run:

- The blue steps are running (in progress).
- The green steps were completed successfully.
- The red steps failed.



Clicking opens the Job Details page where you can begin the troubleshoot the step.

- The gray steps were skipped.



Applications / View Run / Upgrade / Run / QA				Errors 2
1_Run_Upgrade_Default_20160418142339	Apr 18, 2016 - 14:23	00:00:17	66%	
Stage Artifacts	Apr 18, 2016 - 14:23	00:00:01	100%	
Staging Heatclinic	Apr 18, 2016 - 14:23	00:00:01	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:01	100%	
Staging Cleanup DB	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	
Staging Config	Apr 18, 2016 - 14:23	00:00:01	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:01	100%	
Check	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	
deploy war	Apr 18, 2016 - 14:23	00:00:00	100%	
Retrieve	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	

cleanup db	Apr 18, 2016 - 14:23	00:00:01	100%	
Retrieve	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	
drop and create	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	
start server	Apr 18, 2016 - 14:23	00:00:34	75%	
Retrieve	Apr 18, 2016 - 14:23	00:00:00	100%	
QA-res	Apr 18, 2016 - 14:23	00:00:00	100%	
start server	Apr 18, 2016 - 14:23	00:00:34	50%	
QA-res	Apr 18, 2016 - 14:23	00:00:34	50%	

## Subsequent Runs

After the first application run, you can deploy the **Run** process to the **QA** environment with other deployment options.


### Based on the Last Run

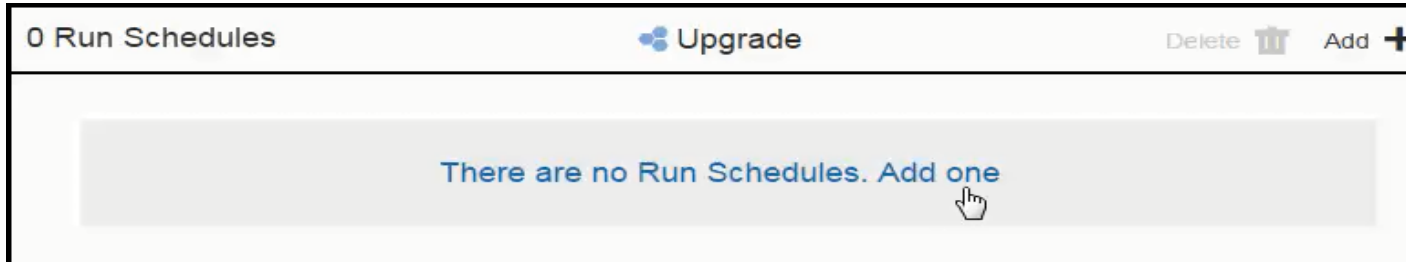


Clicking **Last Run** opens the dialog box where you can set the runtime settings. It displays the runtime settings from the previous. You can deploy the application using the same settings as the previous run or you can modify one or more them for the current run.

### Based on Schedules










Clicking  and selecting **Schedule** opens the list of schedules for the application. If there are no schedules, the list looks like this:



Clicking **There are no Run Schedules. Add one** (or **Add +**) opens the Run Schedule dialog box.

- Select **Create new** to create a new schedule, and then [enter the schedule details](#).
- Select **from Previous Runs** to create a schedule based on a previous application run.

A list of the last five application runs appears:


Last 5 Runs			
Smart - Partial	 Run	on  heatclinic-qe	at  Apr 20, 2016 - 13:25:51
Smart - Full	 Run	on  heatclinic-qe	at  Apr 20, 2016 - 13:24:26
Smart - Full	 Run	on  heatclinic-qe	at  Apr 20, 2016 - 11:46:43

Select an application run, and then [enter the schedule details](#).


In the **Run Schedule Details** dialog box, enter the schedule details:

- In the **Schedule name** field, enter the schedule name.
- In the **Frequency field** field, click the down arrow and select **Once**, **Daily**, **Weekly**, or **Monthly**.
- In the **Country** field, click the down arrow and select a value in the drop-down list.
- In the **City** field, click the down arrow and select a value in the drop-down list.



- In the **Start** field, click  if you want to change the start date, and click in the **hh:mm** box to set the start time using the 24-hour clock.



- In the **End** field, click  and select the end date from the pop-up calendar. The end time is the same as the start time.

### Run Schedule Details

Schedule A


Daily ▼

---

America ▼


Los Angeles ▼

---

Start:  Apr 20, 2016

23:00

---

End:  May 31, 2016

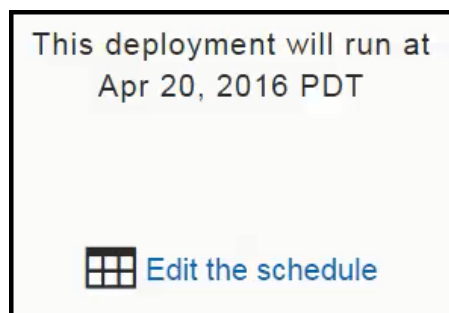
23:00

- Click **Next**.

The dialog box where you can set the runtime settings appears. You can also modify the runtime settings at this time.

- Click **OK**.

This message appears:



Click OK to close it.

When you view the list of schedules for the application again, the schedule that you created appears in the list.

1 Run Schedules		Upgrade					Delete
✓	Name	Process	Environment	Frequency	Start	End	Enabled
✓	1.  Schedule A	Run	heatclinic-qe	Daily	Apr 20, 2016 - 23:00	➔ May 31, 2016 - 23:00	

Runtime Settings

In the dialog box where you can set the runtime settings, the **Artifacts** field looks like this for a full run:

3 Artifacts

Full Run

3 Selected

- Partial deploy with smart deploy and artifact staging are enabled:



Clicking opens the list of artifacts and containers that can be deployed in the application process. Artifacts are grouped by application tier. You can enable or disable an artifact within a tier or the entire tier itself as part of a deployment.

← Run		Full	
✓ 2  Tiers	3  Artifacts	Versions	
✓ 1 App Server	2		
✓ 1  Config	env.sh	\$/projects/Default/applications/Upg... ▼	
✓ 2  Heatclinic	mycompany.war	\$/projects/Default/applications/Upg... ▼	
✓ 2 DB	1		
✓ 3  Cleanup DB	cleanup.sql	\$/projects/Default/applications/Upg... ▼	

If you want to only deploy the DB artifact (cleanup.sql), click in the "1 App Server" column to deselect (disable the selection of) the Config and Heatclinic components (based on the env.sh and mycompany.war artifacts), and click **OK**.

← Run		Partial	
✓ 2  Tiers	3  Artifacts	Versions	
✓ 1 App Server	2		
✓ 1  Config	env.sh	\$/projects/Default/applications/Upg... ▼	
✓ 2  Heatclinic	mycompany.war	\$/projects/Default/applications/Upg... ▼	
✓ 2 DB	1		
✓ 3  Cleanup DB	cleanup.sql	\$/projects/Default/applications/Upg... ▼	

The **Artifacts** field now looks like this for a partial run:

3 ♦ Artifacts

Partial Run

1 Selected ➔

With microservices and containers, you can enable or disable a service:

✓	3.  store-backend	1	⬆
✓	4.  store-frontend	1	⬆
	5.  nodejsapp		

(You cannot disable an individual container within a service.)

- Partial deploy with specific artifact versions and with smart deploy and artifact staging are enabled:

In the list of artifacts to be deployed in the application process, click in the "2 DB" row to deselect the "Cleanup DB" component (based on the `cleanup.sql` artifact), select the **Latest** version of the `mycompany.war` artifact, and click **OK**.

← Run		Partial	
✓ 2  Tiers	3 ♦ Artifacts	Versions ⬆	
✓ 1 App Server	2	⬆	
✓ 1  Config	♦ env.sh	\$[/projects/Default/applications/Upg... ▼	
✓ 2  Heatclinic	♦ mycompany.war	Latest ▼	
✓ 2 DB	1	⬆	
✓ 3  Cleanup DB	♦ cleanup.sql	\$[/projects/Default/applications/Upg... ▼	

The **Artifacts** field now looks like this for the partial run:

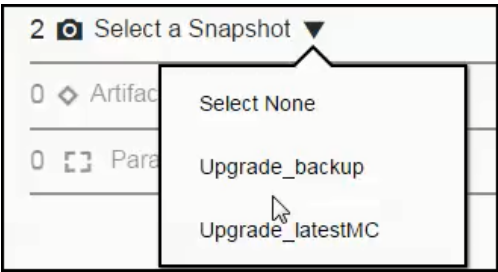
3 ♦ Artifacts

Partial Run

2 Selected ➔

- Snapshot with partial deploy and with smart deploy and artifact staging are enabled:

In the **Select a Snapshot** field, click the down arrow and select the **Upgrade\_latestMC** snapshot.



In the list of artifacts to be deployed in the application process, click in the "1 Config" row to deselect (disable the selection of) the Config component (based on the `env.sh` artifact) and click **OK**.

← Run			Partial	
✓ 2 Tiers	3 Artifacts	Versions		
✓ 1 App Server	2			
✓ 1 Config	env.sh	1		
✓ 2 Heatclinic	mycompany.war	1		
✓ 2 DB	1			
✓ 3 Cleanup DB	cleanup.sql	1		

The **Select a Snapshot** and **Artifacts** fields now look like this for the partial run:



## Viewing the Real-Time Progress of Deployments



This example shows the job details for a specific step. Clicking in the "cleanup db" step opens the Job Details page:

	✓ heatclinic-res	Apr 18, 2016 - 14:30	⌚ 00:00:02	100%	⊕ ⊖ ▶
	✓ Put to webapps	Apr 18, 2016 - 14:30	⌚ 00:00:02	100%	⊕ ⊖ ▶
	✓ heatclinic-res	Apr 18, 2016 - 14:30	⌚ 00:00:02	100%	⊕ ⊖ ▶
	✓ cleanup db	Apr 18, 2016 - 14:30	⌚ 00:00:00	100%	⊕ ⊖ ▶
	⌛ Retrieve	Apr 18, 2016 - 14:30	⌚ 00:00:00	100%	⊕ ⊖ ▶
	⌛ heatclinic-res	Apr 18, 2016 - 14:30	⌚ 00:00:00	100%	⊕ ⊖ ▶
	✓ drop and create	Apr 18, 2016 - 14:30	⌚ 00:00:00	100%	⊕ ⊖ ▶
	✓ heatclinic-res	Apr 18, 2016 - 14:30	⌚ 00:00:00	100%	⊕ ⊖ ▶

Job: 4\_Run\_Upgrade\_Default\_20160418143047

Job Step Details / cleanup db

**Completed with Success**  
 Start Time: 2016-04-18 14:30:53 PDT  
 Elapsed Time: 00:00:00.631

Job: 4\_Run\_Upgrade\_Default\_20160418143047  
 Procedure: External

General | Diagnostics | Properties | Notifiers

**General**

```

Step Id: d109e8f5-05ac-11e6-94c9-0050568f747c
Step Name: cleanup db
Subproject: Default
Create Time: 2016-04-18 14:30:48 PDT
Elapsed Time: 00:00:00.631
End Time: 2016-04-18 14:30:53 PDT
Last Modified: 2016-04-18 14:30:53 PDT
Last Modified By: project: Default
Precondition:
  $([javascript myParent.jobSteps['Check'].status == 'completed']
  )
Run Condition: true
Exclusive Mode: none
Release Mode: none
  
```


**Diagnostics**

```

Exit Code: 0
Error Handling: Fail Procedure
  
```

This example shows that the rollback step has not run yet:




Clicking  in the rollback step opens the Job Details page, showing that the status is *Waiting for Precondition*. This step will not run until the precondition is met.

```
Precondition: $[javascript  
              $[javascript myParent.jobSteps['start server'].status == 'completed']  
              ]
```

Job: 4\_Run\_Upgrade\_Default\_20160418143047

Job Step Details / Rollback

 **Waiting for Precondition**  
Start Time:  
Elapsed Time: 00:00:00.000

Job: 4\_Run\_Upgrade\_Default\_20160418143047  
Procedure: External

General

Diagnostics

Properties

Notifiers

**General**

Step Id: d10a1009-05ac-11e6-94c9-0050568f747c

Step Name: Rollback

Create Time: 2016-04-18 14:30:48 PDT

Last Modified: 2016-04-18 14:30:49 PDT

Last Modified By: project: Default

Precondition: \$[javascript  
 \$[javascript myParent.jobSteps['start server'].status == 'completed']  
 ]

Run Condition: \$[javascript  
 \$[javascript myParent.jobSteps['start server'].outcome != 'skipped'] &&  
 \$[javascript myParent.jobSteps['start server'].outcome == 'error']  
 ]

Exclusive Mode: none

Release Mode: none

Troubleshooting Deployments

This example shows that the "start server" step was *Completed with Errors*.

  start server	Apr 18, 2016 - 14:30	00:03:02	100%				
  heatclinic-res	Apr 18, 2016 - 14:30	00:03:02	100%				

Clicking  in the "start server" step opens the Job Details page.



Job: 4\_Run\_Upgrade\_Default\_20160418143047

Job Step Details / start server

Completed with Errors

Start Time: 2016-04-18 14:30:58 PDT  
Elapsed Time: 00:03:02.762

Job: 4\_Run\_Upgrade\_Default\_20160418143047  
Procedure: External

GeneralDiagnosticsPropertiesNotifiers

General

```

Step Id: d109e8f7-05ac-11e6-94c9-0050568f747c
Step Name: start server
Subproject: Default
Create Time: 2016-04-18 14:30:48 PDT
Elapsed Time: 00:03:02.762
End Time: 2016-04-18 14:34:01 PDT
Last Modified: 2016-04-18 14:34:01 PDT
Last Modified By: project: Default
Precondition:
  $([javascript myParent.jobSteps[\"cleanup db\"] status == \"completed\"] &&
  $([javascript myParent.jobSteps[\"deploy war\"] status == \"completed\"]
  ]
Run Condition: true
Exclusive Mode: none
Release Mode: none

```

Clicking in the Diagnostics tab can provide more information about the errors.

## Example: Manual Steps with Runtime Parameters

This topic describes manual steps with parameter inputs and how the parameter inputs influence the process flow to take different paths. You can define manual steps in an application process or component process.

In the following example, an application process called Deploy has the following steps. When deployed, this process updates the website for an online store.

- The first step is a command step to retrieve a .war file that will be deployed to the website.
- The second step is a manual step to log into a terminal where you can enter CLI commands to update the website.

If you have *admin* privileges, you can update the home (parent) page.

If you do not have privileges to update the home page, you can update only the product (child) pages.

Depending on your privileges, the parameter input to the manual step is either *pass* (you have the privileges to update the home page) or *fail* (you can only update the product pages).

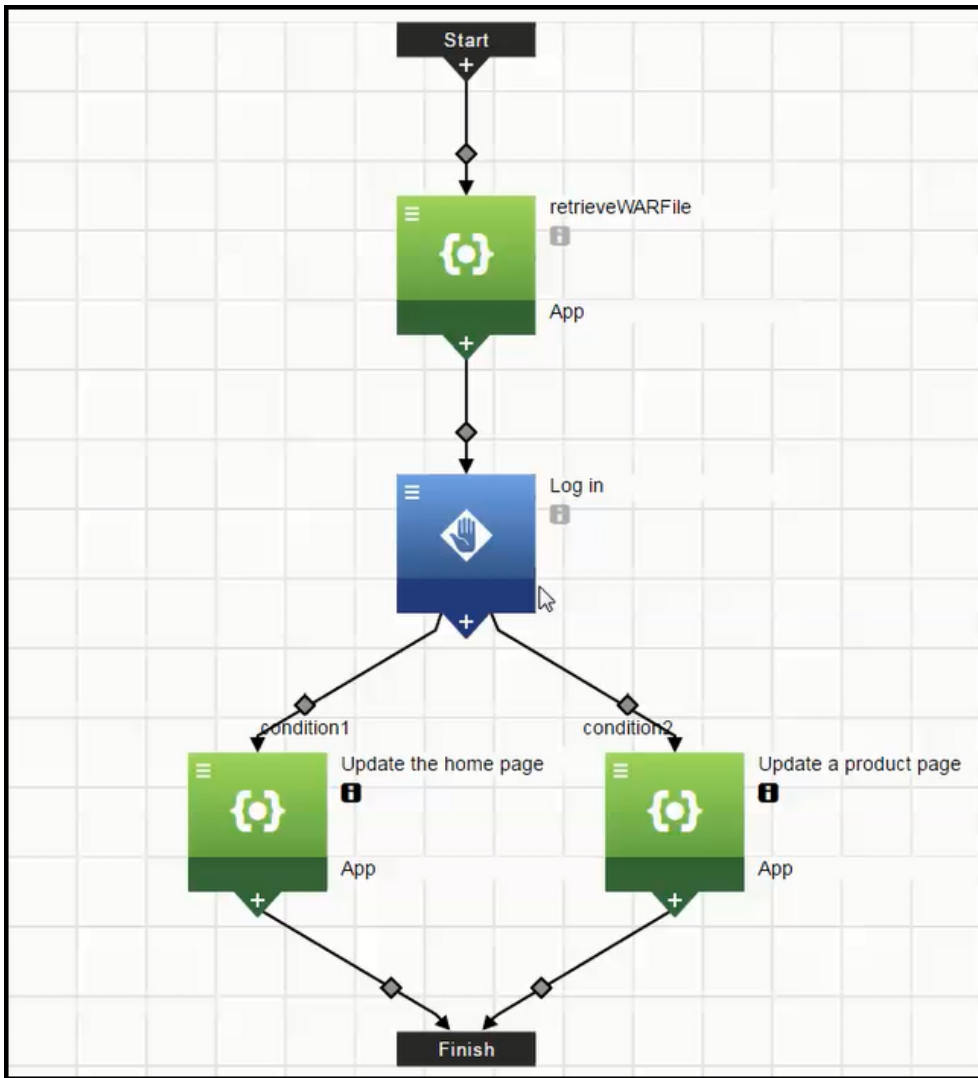
- The parameter inputs to the manual step are the preconditions to the third and fourth steps.
  - *condition 1* is fulfilled if the input to the manual step is *pass*.
  - *condition 2* is fulfilled if the input to the manual step is *fail*.

These preconditions determine the step that is executed after the manual step.

- The next step is either the third or fourth step.

If the parameter input for the manual step is *pass*, the process continues to the “Update the home page” step.

If the input is *fail*, the process continues to the “Update a product page” step.



## Process Flow Details

After starting the deployment, the .war file is automatically retrieved in the first step.

In the second step, email notifications are sent to one or more assignees. One of the required assignees performs the manual task, which is to log into a terminal and enter the appropriate CLI commands to set up the website update. After clicking on the link in the email, the assignee goes to the ElectricFlow UI and provides input to the manual process step using the `pass_fail_value` parameter.

- If the assignee has admin privileges, the value of the `pass_fail_value` parameter is *pass*. The process continues to the “Update the home page” step.
- If the assignee does not have admin privileges, the value is *fail*. The process continues to the “Update a product page” step.

In the third and fourth steps:

- The **On Error** setting is **Continue running**.

If the process encounters an error while the web page is being updated, it completes the step with errors and then continues to next step.

The default is **Stop running**, where the process will abort if the process encounters an error.

- The **Run if** setting is **all** (the default). All the preconditions to the step have to be met before the process goes to the next step.

If **any** is selected, only one of the conditions has to be met before the process continues running.

## Deployment Scenarios

These are possible deployment scenarios.


### Assignee has admin privileges and the deployment is completed successfully

The home page is updated in this scenario.

When the Deploy application process is deployed to the QA environment, you can view the progress of the deployment in the "Applications / View Run" page.

Step Name	Status	Timestamp	Duration	Progress	Actions
16_Deploy_onlineStore_Default_20160523175930	In Progress	May 23, 2016 - 17:59	00:00:04	37%	Stop, Refresh, Play, Add
retrieveWARFile	Completed	May 23, 2016 - 17:59	00:00:00	100%	Stop, Refresh, Play, Add
QA-res	Completed	May 23, 2016 - 17:59	00:00:00	100%	Stop, Refresh, Play, Add
Log in	In Progress	May 23, 2016 - 17:59	00:00:02	50%	Stop, Refresh, Play, Add
Update the home page	Not Started	May 23, 2016 - 17:59	00:00:00	0%	Stop, Refresh, Play, Add
Update a product page	Not Started	May 23, 2016 - 17:59	00:00:00	0%	Stop, Refresh, Play, Add



Clicking  opens the Manual dialog box. Clicking



in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter *pass* in the **pass\_fail\_value** field, select **Completed** as the **Outcome**, and click **OK**, the process continues to the "Update the home page" step.

Manual

Instruction

Do you have admin privileges?  
If yes, pass\_fail\_value = pass.  
If no, pass\_fail\_value = fail.

1 Parameters

Outcome: ☐ Failed ☒ Completed

Comment

1. pass\_fail\_value

pass

The parameter value (*pass*) is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

The step to update the home page is successfully completed. Notice that the "Update a product page" step is skipped.

Applications / View Run / onlineStore / Deploy / QA				Errors 0	
	16_Deploy_onlineStore_Default_20160523175930	May 23, 2016 - 17:59	00:00:14	100%	
	retrieveWARFile	May 23, 2016 - 17:59	00:00:00	100%	
	QA-res	May 23, 2016 - 17:59	00:00:00	100%	
	Log in	May 23, 2016 - 17:59	00:00:10	100%	
	Update the home page	May 23, 2016 - 17:59	00:00:00	100%	
	QA-res	May 23, 2016 - 17:59	00:00:00	100%	
	Update a product page	May 23, 2016 - 17:59	00:00:00	100%	



In the top row, clicking takes you to the Job Details page.

Job Details

Job Details / 16\_Deploy\_onlineStore\_Default\_20160523175930

Completed with Success

Start Time: 2016-05-23 17:59:30 PDT

Elapsed Time: 00:00:14.715

Project: Default

Procedure: External

Launched by: admin

Priority: normal

Steps

Diagnostics

Parameters

Properties

Notifiers

Published Artifact Versions

Retrieved Artifact Versions

View: All


Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
retrieveWARFile		Completed with Success	00:00:00.459		
QA-res		Completed with Success	00:00:00.459		
runCommand		Completed with Success	00:00:00.266	QA-res	
Log in		Completed with Success	00:00:10.289		
Update the home page		Completed with Success	00:00:00.388		
QA-res		Completed with Success	00:00:00.388		
runCommand		Completed with Success	00:00:00.132	QA-res	
Update a product page		Skipped	00:00:00.000		

Records per page: 100

1 thru 8 of 8

retrieveWARFile		Completed with Success
QA-res		Completed with Success
runCommand		Completed with Success
Log in		Completed with Success
Update the home page		Completed with Success
QA-res		Completed with Success
runCommand		Completed with Success
Update a product page		Skipped

Clicking  in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.

Job: 16\_Deploy\_onlineStore\_Default\_20160523175930

Workspace File / runCommand.cd53b36e-214a-11e6-b9d7-0050568f7ab6.log

pass

Assignee does not have admin privileges and the deployment is completed successfully

A product page is updated in this scenario.

When the Deploy application process is deployed to the QA environment again, you can view the progress of the deployment in the "Applications / View Run" page.



When the process reaches the second step, clicking opens the Manual dialog box.



Clicking in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter *fail* in the **pass\_fail\_value** field, select **Completed** as the **Outcome**, and click **OK**, the process continues to the "Update a product page" step.

1 Parameters1 Required

Outcome: ☐ Failed ☒ Completed

1. pass\_fail\_value

fail

The parameter value (*fail*) is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

In this deployment, both the Deploy process and the step to update product page are completed successfully.

Applications / View Run / onlineStore / Deploy / QA					Errors 0	
18_Deploy_onlineStore_Default_20160523180043	May 23, 2016 - 18:00	00:00:15	100%			
retrieveWARFile	May 23, 2016 - 18:00	00:00:00	100%			
QA-res	May 23, 2016 - 18:00	00:00:00	100%			
Log in	May 23, 2016 - 18:00	00:00:08	100%			
Update the home page	May 23, 2016 - 18:00	00:00:00	100%			
Update a product page	May 23, 2016 - 18:00	00:00:00	100%			
QA-res	May 23, 2016 - 18:00	00:00:00	100%			



In the top row, clicking takes you to the Job Details page.

Job Details / 18\_Deploy\_onlineStore\_Default\_20160523175930

Completed with Success

Start Time: 2016-05-23 18:02:40 PDT

Elapsed Time: 00:00:13.553

Project: Default

Procedure: External

Launched by: admin

Priority: normal

Steps

Diagnostics

Parameters

Properties

Notifiers

Published Artifact Versions


Retrieved Artifact Versions

View: All

Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
<div>retrieveWARFile</div>		<div>Completed with Success</div>	00:00:00.369		<div></div>
<div>QA-res</div>		<div>Completed with Success</div>	00:00:00.369		<div></div>
<div>runCommand</div>	<div></div>	<div>Completed with Success</div>	00:00:00.202	QA-res	<div><div></div><div></div></div>
<div>Log in</div>		<div>Completed with Success</div>	00:00:07.588		<div></div>
<div>Update the home page</div>		<div>Skipped</div>	00:00:00.000		<div></div>
<div>Update a product page</div>		<div>Completed with Success</div>	00:00:00.252		<div></div>
<div>QA-res</div>		<div>Completed with Success</div>	00:00:00.252		<div></div>
<div>runCommand</div>	<div></div>	<div>Completed with Success</div>	00:00:00.151	QA-res	<div><div></div><div></div></div>



Clicking  in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.

```

Job: 18_Deploy_onlineStore_Default_20160523175930
Workspace File / runCommand.3e8ef99f-214b-11e6-a00e-0050568f7ab6.log

fail


```

### Assignee does not have admin privileges and the deployment is completed with errors


A product page is updated in this scenario.

When the Deploy application process is deployed to the QA environment again, you can view the progress of the deployment in the "Applications / View Run" page.




When the process reaches the second step, clicking  opens the Manual dialog box.



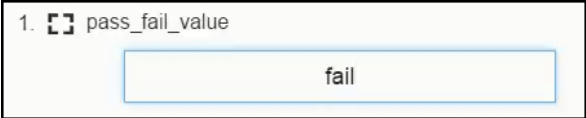
Clicking  in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter **fail** in the **pass\_fail\_value** field, select **Failed** as the **Outcome**, and click **OK**, the process continues to the "Update a product page" step.

1  Parameters 1 Required 

---

Outcome: ☒ Failed ☐ Completed



The parameter value (*fail*) is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

In this deployment, the step to update the product page is completed successfully even though the Deploy application was completed with errors. The error is in the second step where the outcome is **Failed**.

A screenshot of a deployment run summary table. The table has columns for step name, time, duration, and status. The first row, "17\_Deploy\_onlineStore\_Default\_2016052317", is highlighted in orange and shows a status of "100%". Below it, several steps are listed: "retrieveWARFile", "QA-res", "Log in", "Update the home page", "Update a product page", and another "QA-res". The "Log in" step is highlighted in orange and shows a status of "100%". The "Update the home page" step is highlighted in grey and shows a status of "100%". The "Update a product page" step is highlighted in green and shows a status of "100%". The final "QA-res" step is highlighted in green and shows a status of "100%".

Step Name	Time	Duration	Status
17_Deploy_onlineStore_Default_2016052317	May 23, 2016 - 17:59	00:00:23	100%
retrieveWARFile	May 23, 2016 - 17:59	00:00:00	100%
QA-res	May 23, 2016 - 17:59	00:00:00	100%
Log in	May 23, 2016 - 17:59	00:00:17	100%
Update the home page	May 23, 2016 - 17:59	00:00:00	100%
Update a product page	May 23, 2016 - 17:59	00:00:00	100%
QA-res	May 23, 2016 - 18:00	00:00:00	100%



In the top row, clicking takes you to the Job Details page.



Clicking in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.



## Setting Up Custom Parameters for Application and Component Processes

Parameters are used throughout the release planning and management process. They provide an easy way to model releases, pipelines, and applications. They can be inputs to procedures, workflows, applications, pipelines, and releases. You can use parameters in place of predefined credentials, property paths, user or group names for notifications, runtime conditions. Parameters are created and managed independent of any object at the platform level.



These examples show how to add custom parameters and setting the parameter labels in the GUI.

### ***Adding Custom Parameters***

In the Application Process or Component Process Visual Editor:



1. Click on the upper right corner of the Visual Editor.
2. Click **Parameters**.

The **Parameters** dialog box opens.

Example:

The Parameters dialog box shows a title bar with "0 Parameters", "Delete" (trash icon), and "Add +" (plus icon). Below the title bar is a "Deploy" button with a green play icon and a "Select" dropdown menu currently set to "None". A table with headers "Name", "Type", and "Required" is shown below. The table is empty, and a message at the bottom states "There are no Parameters. Add one +" with a blue plus icon.

3. Click **Add +** or if no parameters have not yet defined for the object, click **There are no Parameters yet. Add one +** to add a parameter.

The **New Parameter** dialog box opens.

Example:

The "New Parameter" dialog box has a title bar "Parameters" and a subtitle "New Parameter". It contains several input fields: "Name", "Description" (a larger text area), "Label", "Text Entry" (a dropdown menu with a downward arrow), and "Default Value". At the bottom, there are two checkboxes: "Required" (checked) and "Defer Expansion" (unchecked), each with a help icon (question mark).

4. Enter the following information:

- **Parameter Name**—Name of the parameter.
- **Description**—This is optional.  
**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.
- **Label**—Label that appears on the GUI. This is optional.
- **Text Entry**—How the user selects the value for this parameter. Valid options are **Text Entry**, **Text Area**, **Dropdown Menu**, **Radio Selector**, **Checkbox**, or **Credential**.
- **Default Value**—Default value for the parameter. This is optional.
- **Required**—If the parameter is required, select the **Required** check box.
- **Defer Expansion**—Determines whether to expand the parameter value. A parameter value expansion occurs in one of two places:
  - When the procedure request is made (the default) (the check box is unchecked)
  - When the step executes (the check box is checked)

The check box is unchecked by default (meaning that expansion is not deferred).

- Depending on the parameter type that you select, other fields appear in the dialog box. Go to the following appropriate step to complete setting up the parameter.
5. If you select **Text Entry** as the parameter type, the **Default Value** field appears. You can enter a default value but is not required, and then click **OK**.
  6. If you select **Text Area** as the parameter type, the **Default Value** field appears. You can enter a default value but is not required, and then click **OK**.

Example:

7. If you select **Dropdown Menu** as the parameter type, the **Default Value** field and ways to add the menu options appear. You can enter a default value but is not required.
- On the right side of the dialog box, enter the menu options.
  - Click **OK**.

Example:

The screenshot shows the 'Parameters' dialog box with the 'New Parameter' section. The parameter type is set to 'Dropdown Menu'. The left sidebar shows the configuration fields: 'Stage' (with a value of 'Stage of the deployment process'), 'Label', 'Dropdown Menu' (selected), and 'Default Value'. The right sidebar shows the 'Enter options' section with three radio buttons: 'Enter options' (selected), 'Load options from list', and 'Load options from property sheet'. Below these are three rows of options: 1. 'Development' / 'Dev', 2. 'Quality' / 'QA', and 3. 'Release' / 'Prod'. Each row has a delete icon (X). At the bottom are 'Cancel' and 'OK' buttons.

8. If you select **Radio Selector** as the parameter type, the **Default Value** field and ways to add the menu options appear. You can enter a default value but is not required.
- On the right side of the dialog box, enter the menu options.
  - Click **OK**.

Example:

The screenshot shows the 'Parameters' dialog box with the 'New Parameter' section. The parameter type is set to 'Radio Selector'. The left sidebar shows the configuration fields: 'Ranking' (with a value of 'Ranking in the queue'), 'Priority', 'Radio Selector' (selected), and 'Normal'. The right sidebar shows the 'Enter options' section with three radio buttons: 'Enter options' (selected), 'Load options from list', and 'Load options from property sheet'. Below these are three rows of options: 1. 'High' / 'High', 2. 'Normal' / 'Normal', and 3. 'Low' / 'Low'. Each row has a delete icon (X). At the bottom are 'Cancel' and 'OK' buttons.

9. If you select **Checkbox** as the parameter type, the **Default Value** field and values for the check box appear. You can enter a default value but is not required.
- On the right side of the dialog box, enter the values.
  - Click **OK**.

Example:

The screenshot shows a 'Parameters' dialog box with a 'New Parameter' section. On the left, there are four parameter types: 'Ranking', 'Ranking in the queue', 'Priority', and 'Radio Selector'. The 'Radio Selector' is selected, and its default value is 'Normal'. Below these, there are two checkboxes: 'Required' (checked) and 'Defer Expansion' (unchecked). On the right, there are three radio buttons for 'Enter options', 'Load options from list', and 'Load options from property sheet'. The 'Enter options' radio button is selected. Below the radio buttons, there is a list of three options: 1. 'High', 2. 'Normal', and 3. 'Low'. The 'Low' option is selected. At the bottom, there are 'Cancel' and 'OK' buttons.

10. If you select **Credentials** as the parameter type, the **Default Value** field appears. You can enter a default value but is not required, and then click **OK**.

Example:

The screenshot shows a 'Parameters' window with a 'New Parameter' sub-dialog. The 'Identity' field is filled with 'User Name and Password'. The 'Description' field is empty. The 'Credentials' dropdown is selected, and the 'Default Value' field is visible. The 'Required' checkbox is checked, and the 'Defer Expansion' checkbox is unchecked. The 'Cancel' and 'OK' buttons are at the bottom.

After completing these steps, the **Parameters** dialog box opens and shows the new parameter in the list.

Example:

The screenshot shows the 'Parameters' dialog box with a list of parameters. The list has columns for Name, Type, and Required. The first parameter is 'User Name' with type 'Text Entry' and is required (indicated by a green checkmark).

Name	Type	Required
1. User Name	Text Entry	✓

## Setting and Modifying the Parameter Label

In the **New Parameter** dialog box:

Example:

1. Add a label in the **Label**. This is optional.

Example:

If you enter a label, it appears in the UI form when you deploy the application. If you do not enter a label, the parameter name appears in the UI form when you deploy the application.

2. Click **OK**.

3. To modify the label:
  - a. Open the **New Parameter** dialog box.
  - b. Clear the **Label** field.
  - c. Enter a new label.

Example:

The screenshot shows the 'New Parameter' dialog box. On the left side, there are several input fields: 'QA Verification Required', 'Description', 'Verify by QA' (highlighted with a red box), 'Checkbox' (with a dropdown arrow), and 'Default Value'. Below these fields are two checkboxes: 'Required' and 'Defer Expansion'. On the right side, there are two input fields: 'Value when unchecked' (containing 'No') and 'Value when checked' (containing 'Yes'). Below these fields is a checkbox labeled 'Initially checked' which is unchecked.

- d. Click **OK** to save the change.

- 4. To delete the label:
  - a. Click **Delete** next to the **Label** field.

Example:

The screenshot shows a 'Parameters' dialog box with a 'New Parameter' section. On the left, there are input fields for 'QA Verification Required', 'Description', 'Verify by QA', 'Checkbox', and 'Default Value'. Below these are checkboxes for 'Required' and 'Defer Expansion'. On the right, there are input fields for 'Value when unchecked' (containing 'No') and 'Value when checked' (containing 'Yes'), along with an 'Initially checked' checkbox. A blue 'Delete' button is located between the left and right sections, highlighted with a red box. At the bottom are 'Cancel' and 'OK' buttons.

Notice that the text in the **Label** field changes.

Example:

This screenshot shows the same 'Parameters' dialog box, but after a confirmation step. A new blue button labeled 'Yes, delete this Label' has appeared in the left section, highlighted with a red box. A small 'Cancel' link is next to it. The other elements of the form remain the same as in the previous screenshot.



- b. Click in the **Label** field.

The label disappears.

Example:

The screenshot shows a dialog box titled 'Parameters' with a back arrow on the left. Inside, there's a section titled 'New Parameter'. On the left side of this section, there are several input fields: 'QA Verification Required', 'Description', 'Label' (which is highlighted with a red rectangle), 'Checkbox' (with a dropdown arrow), and 'Default Value'. Below these fields are two checkboxes: 'Required' and 'Defer Expansion', both with question mark icons. On the right side of the 'New Parameter' section, there are two text input fields: 'Value when unchecked' (containing 'No') and 'Value when checked' (containing 'Yes'). Below these is a checkbox labeled 'Initially checked'. At the bottom of the dialog box, there are two buttons: 'Cancel' and 'OK'.

- c. Click **OK**.

The **Parameters** dialog box opens. The parameter name now appears in the name column.

## Looking Up Parameters in Application and Component Processes

To apply parameters to an application or component process step, starting in the Application Process or a Component Process Visual Editor:

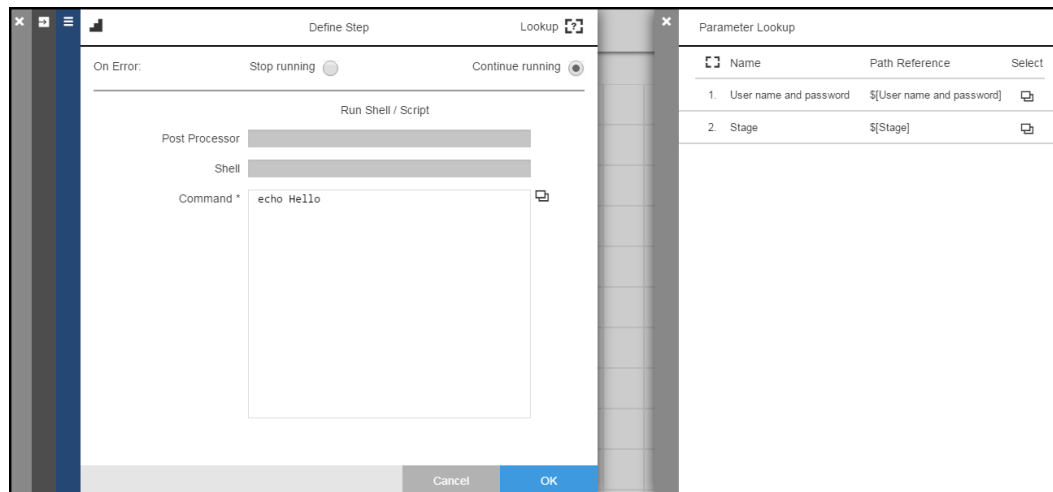
1. Add a new step to the process.
2. Define the process step in the **Define Step** dialog box.

- When you define the process step with a plugin (**Plugins**), command or script (**Command**), or project (**Procedure**), click the **Lookup** button to open the **Parameter Lookup** dialog box.

Example:



The **Parameter Lookup** dialog box opens.



- Choose a parameter and click the **Copy** button to copy the path reference.

A message appears in the row : *<Parameter Name>* has been copied.

The **Define Step** dialog box now has a **Parameter** field.


- Click in the **Parameter** field and paste the path reference that you copied in it.
- Repeat the previous two steps to apply another parameter to the process step.
- Click **OK**.

## Attaching Credentials to Application and Component Processes

This topic describes how to add credentials and parameters to a component processes and apply custom parameters to them. These parameters are required at runtime when the application is deployed.

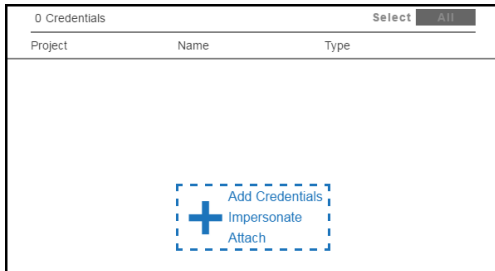
When defining an application or component process step:



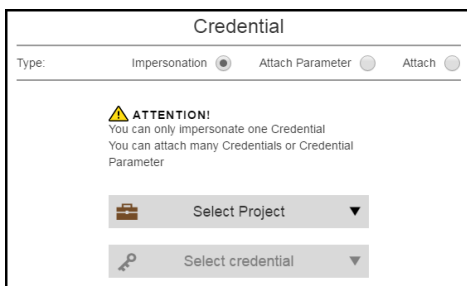
1. Click  in the Credentials row in the dialog box where you can set the runtime settings.



The Credentials dialog box opens and shows the list of credentials for this process step. If there are no credentials, the dialog box looks like this:



2. Click **+ Add Credentials Impersonate Attach** to add a credential.



3. Select **Attach** to attach a credential to the process step. This credential is created and managed at the platform level.

The other ways to add credentials to a process step are:

- If you want to impersonate one credential, select **Impersonation**, select the project to which the credential belongs, and the credential that you want to use for impersonation.
- If you want to attach a credential parameter to the process step, select **Attach Parameter**. Click in the **Select credential parameter** field to set the parameter.

4. Select the project to which the credential belongs in the **Select Project** field, the credential in the **Select Credential** field, and click **Next**.

The list of credentials now shows the credential you added:

1 Credentials			Select	All
Project	Name	Type		
Default	aws	impersonation		

5. Click **Next**.

The dialog box where you can set the runtime settings now shows that one credential is attached to the process step.

6. Repeat the previous steps to attach another credential or use impersonation.

#### IMPORTANT:

When you impersonate a credential, make sure that the impersonated user has the absolute path to the bin directories in the `$PATH` environment.

If you define a process step with a command, you must enter the absolute path in the **Post Processor** and **Shell** fields in the "Define Step" dialog box.

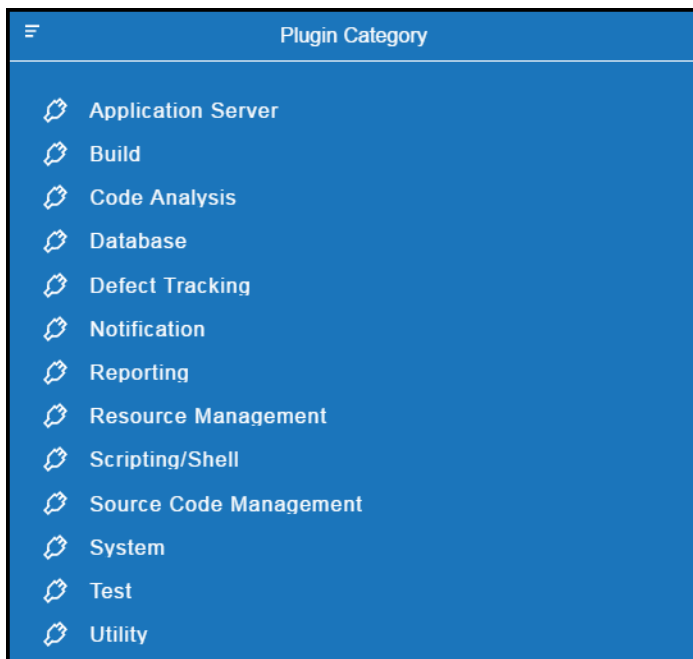
## Plugin Process Steps

Plugin steps allow you to orchestrate third-party tools at the appropriate time in your component or application process. The following third-party tools can be used with ElectricFlow:

- Application Servers—Examples are IIS, JBoss, and Tomcat.
- Builds—Examples are EMake, Maven, or Visual Studio.
- Code Analysis—Examples are Clover CMD, Coverity, or Klocwork..
- Databases—Examples are DBI, Oracle, or SQLServer.

- Defect Tracking—Examples are Bugzilla, JIRA, or Rally.
- Notification—An example is Twitter.
- Reporting—An example is Reports.
- Resource Management—Examples are Chef, EC2, or OpenStack.
- Scripting/Shell operations—Examples are Groovy, Python, or Ruby.
- Source Code Analysis—Examples are ECSCM-ClearCase, ECSCM-Git, or ECSCM-Perforce.
- System —Examples are Artifact or FileSysRepo.
- Test —Examples are HPQualityCenter, Jasmine, or Selenium.
- Utility—Examples are FileOps or SendEmail.

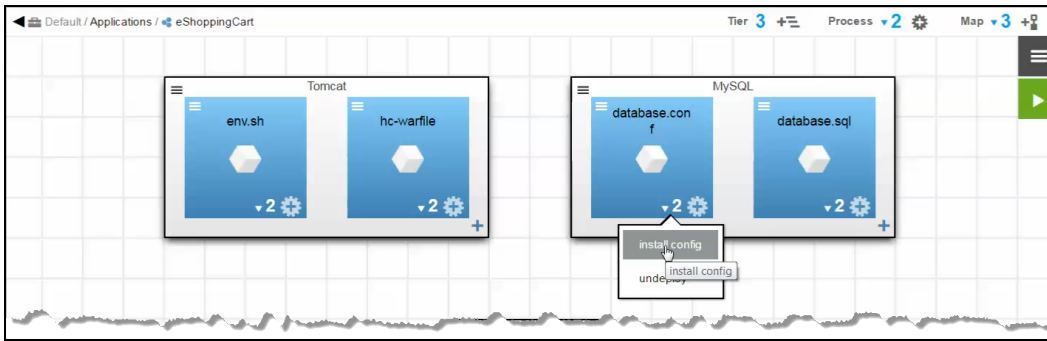
You can access these options from the Plugin Category dialog box:



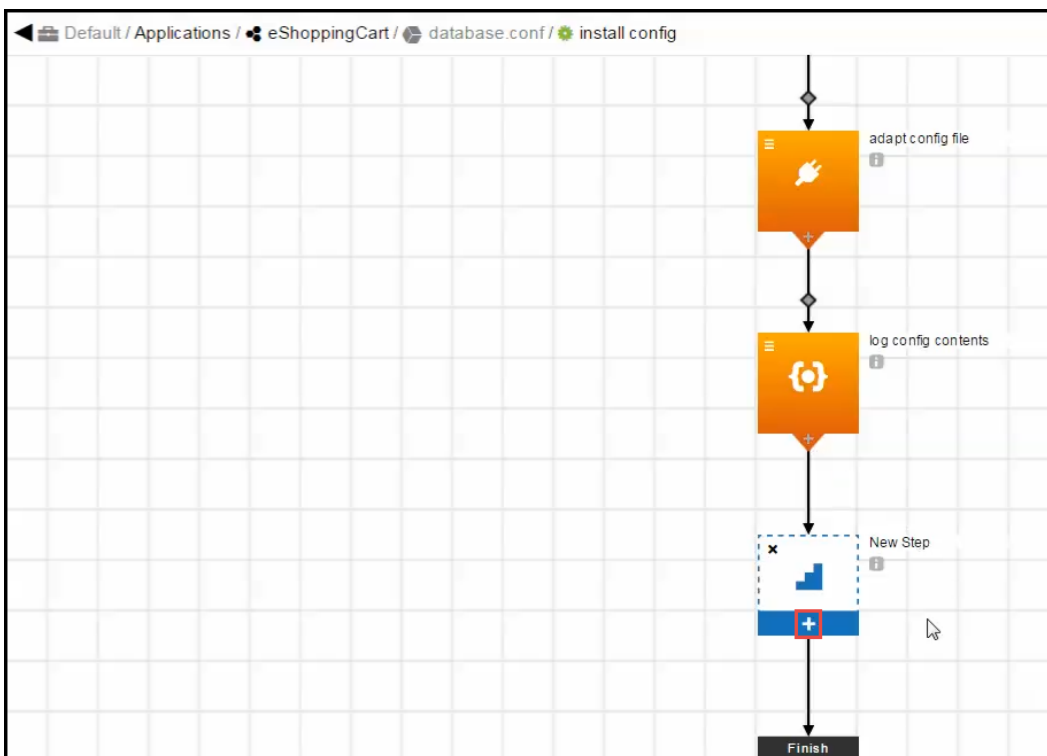
## Plugin Steps in a Component Process

This example shows how to define a test plugin step in a component process.

In the Applications Visual Editor for the eShoppingCart application, select the "install config" process for the database.conf component in the MySQL application tier.

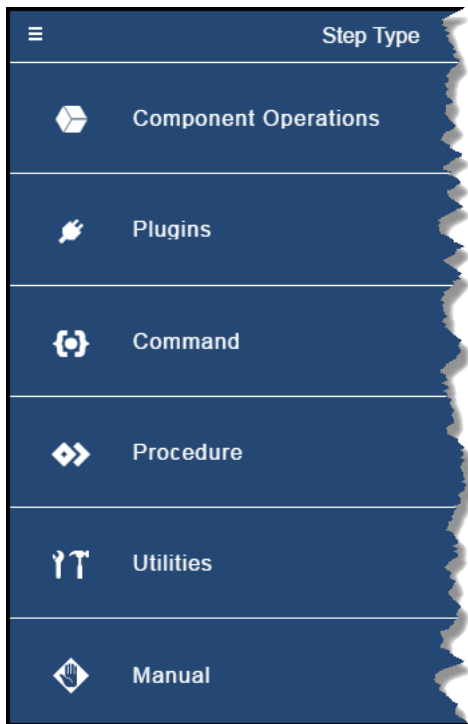


In the Component Process Visual Editor, add a step after the "log config contents" step. The "New Step" appears after this step.

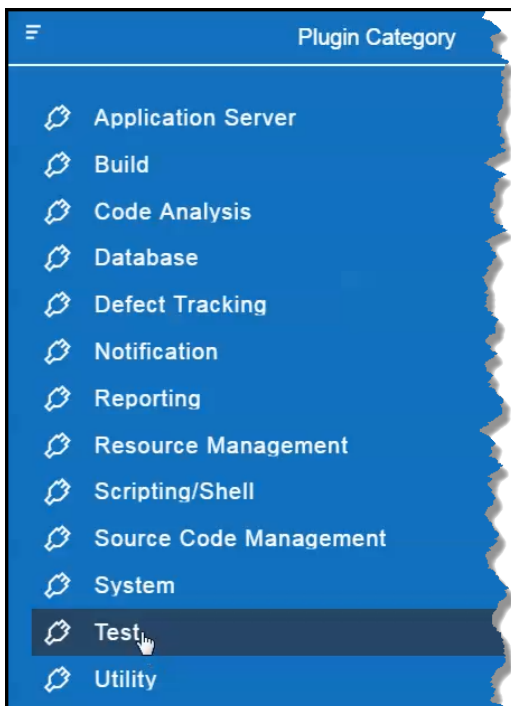


Click **+** in the "New Step" to define it. Name the step "Verify configuration", use the default values, and click **Next**.

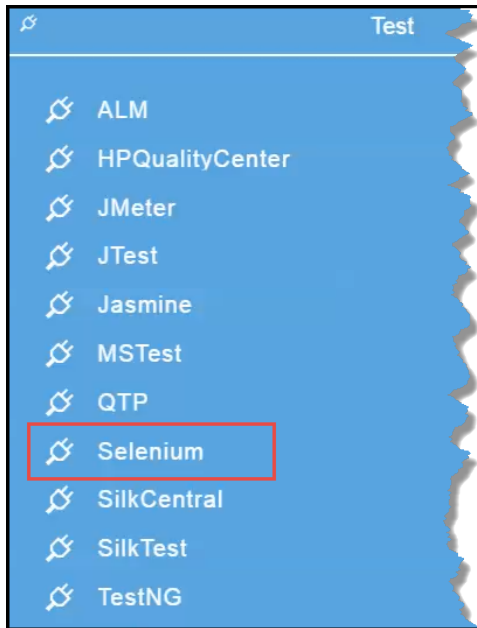
In the Step Type dialog box, select **Plugins**.



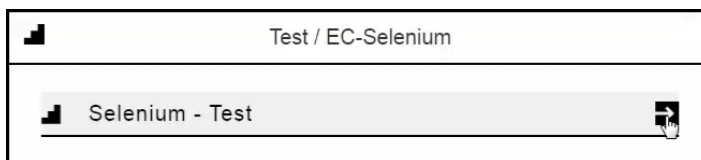
In the Plugins Category dialog box, select **Test**.



In the Test dialog box, select **Selenium**.



Select the **Selenium—Test** procedure.

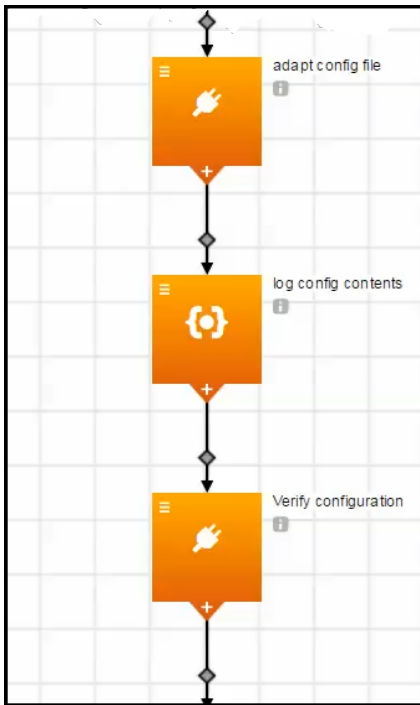


Enter the required parameters for the procedure, and click **OK**.

A screenshot of a configuration dialog titled 'Selenium - Test'. It contains several input fields with 'Required' labels to their right. The fields are: 'Java installation path:' with 'java', 'Selenium installation path:' with 'selenium-server.jar', 'Browser:' with 'firefox', 'Start URL:' with 'www.myapp.com', 'Suite file:' with 'config-test.jar', and 'Result file:' with 'results-test.jar'. These last three fields are grouped within a red rectangular box. Below these are 'Log file:' and 'Port:' fields, both currently empty. A 'Lookup' button with a magnifying glass icon is in the top right corner.

The Component Process Visual Editor now shows this step:

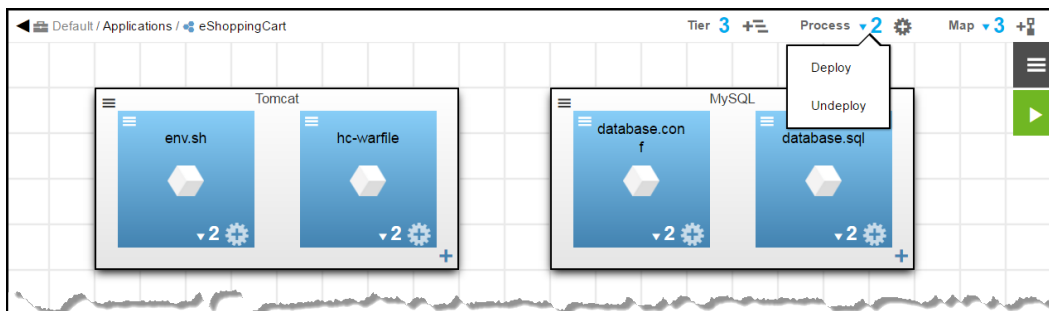




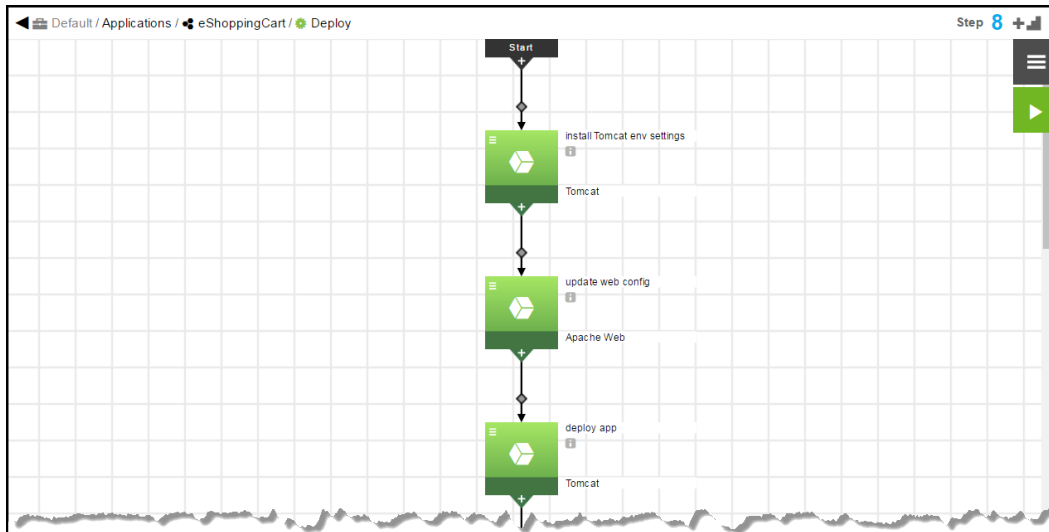
## Plugin Steps in an Application Process

This example shows how to add a test plugin step in an application process.

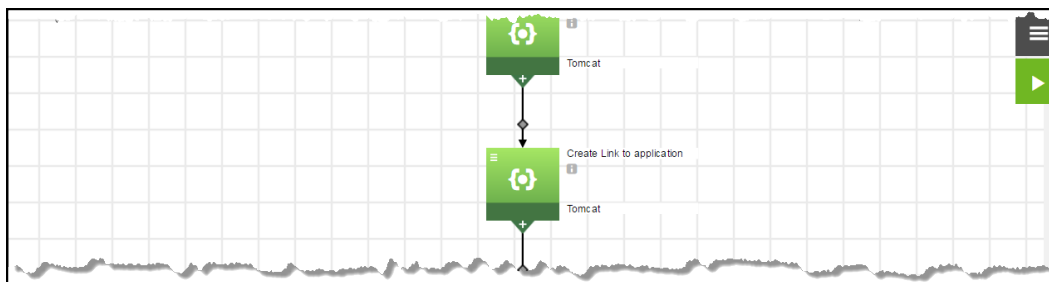
In the Applications Visual Editor for the eShoppingCart application, select the "Deploy" application process.



The Application Process Visual Editor opens.

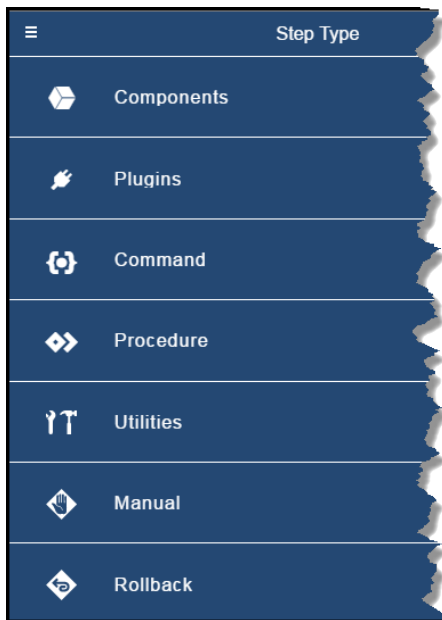


Add a step after the "Create Link to application" step.

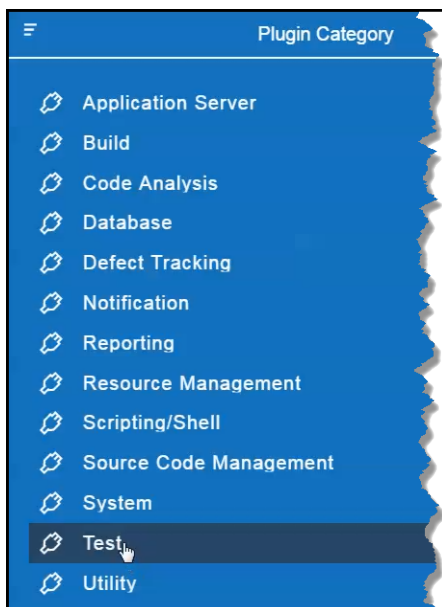


Click **+** in the "New Step" to define it. Name the step "Verify setup", use the default values, and click **Next**.

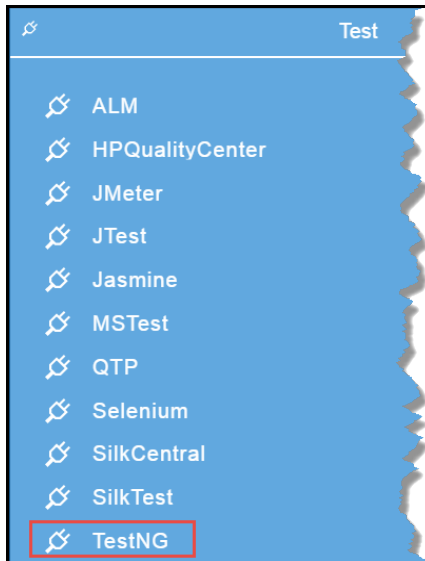
In the Step Type dialog box, select **Plugins**.



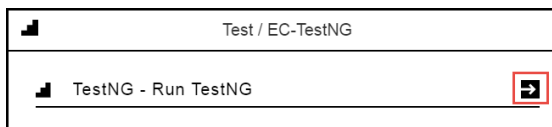
In the Plugins Category dialog box, select **Test**.



In the Test dialog box, select **TestNG**.



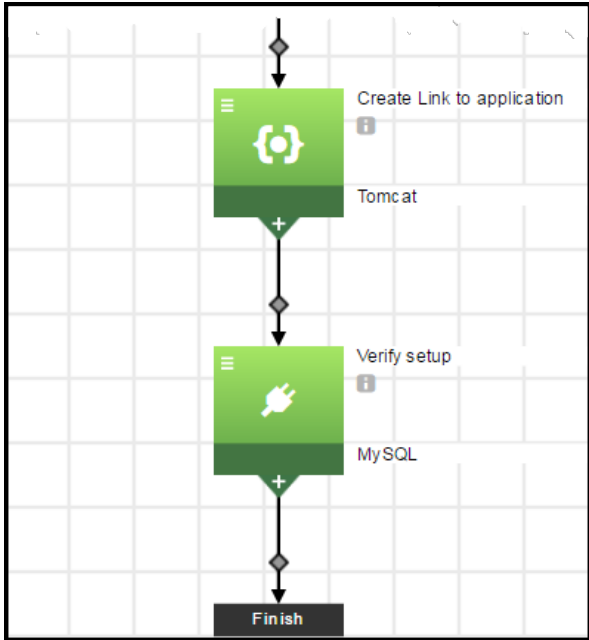
Select the **TestNG—Run TestNG** procedure.



Enter the required parameters for the procedure, and click **OK**.

A screenshot of a dialog box titled 'TestNG - runTestNG'. The dialog has a 'Lookup' button with a magnifying glass icon in the top right corner. Below the title bar is a dropdown menu currently set to 'MySQL'. The main area of the dialog contains five input fields, each with a 'Required' label to its right. The fields are: 'Directory' with the value '/test/tmp', 'TestNG.xml File(s)' with the value 'test1.xml', 'Class Path' with the value '/test/myResults', 'Option(s)' which is empty, and 'Report directory' which is empty. There are also small help and save icons to the right of the input fields.

The Application Process Visual Editor now shows this step:



## Adding Process Steps

### How to get to the Application Process Visual Editor:

- In an existing application process:

From the Applications Visual Editor, click the down arrow next to the number-of-application-processes button and select an application.

The Application Process Visual Editor for that application process appears.

- In a new application process:

From the Applications Visual Editor, click the **Add process** button, set the details in the **Application Process Details** dialog box, and click **OK**.

The Application Process Visual Editor for the application appears.

### How to get to the Component Process Visual Editor:

- In an existing component process:

From the Applications Visual Editor, click the down arrow next to the number-of-component-processes button in a component, and select a component process in the drop-down list.

The Component Process Visual Editor for that component process appears.

- In a new component process:

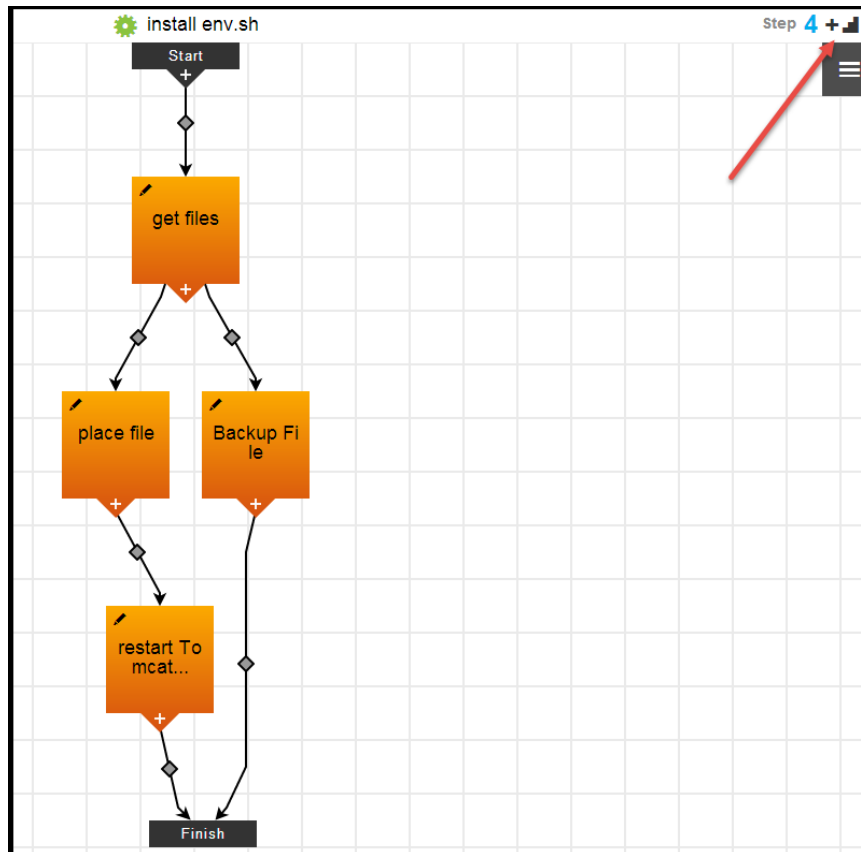
From the Applications Visual Editor, click the **Add process** button in a component, set the details in the **Component Process** dialog box, and click **OK**.

The Component Process Visual Editor for the component process appears.

To drag and drop a new step in a component or application process:

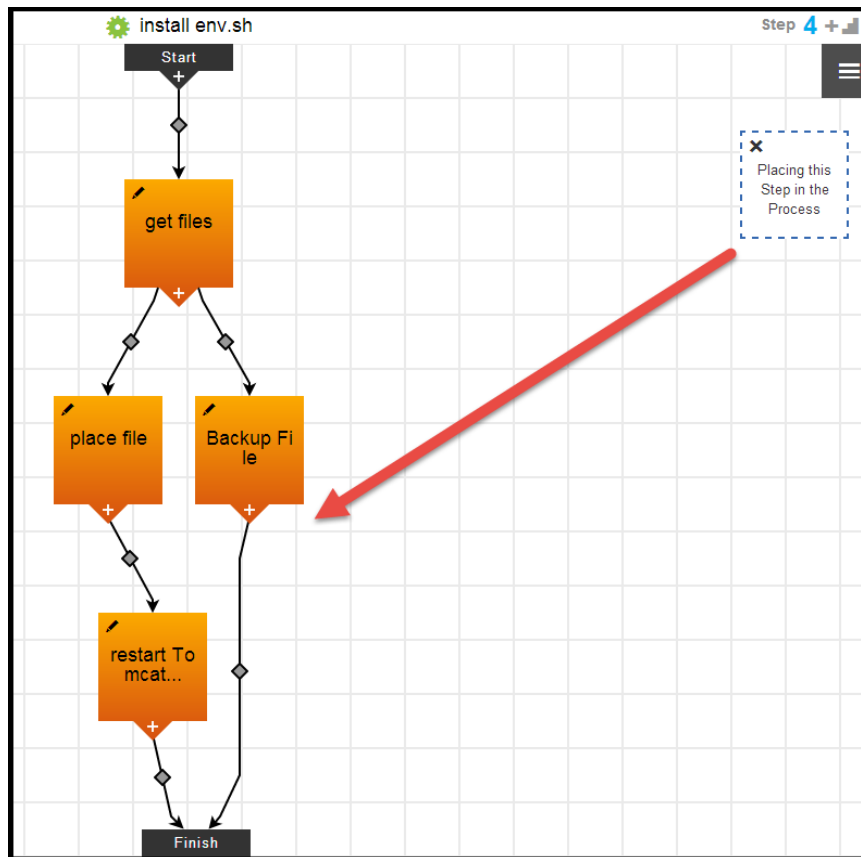
1. Click the **Add step** button in the upper right corner of the Component Process Visual Editor or Application Process Visual Editor.

.A new undefined step appears.



2. Select the new step.

3. Drag the step to where you want to add it in the process.



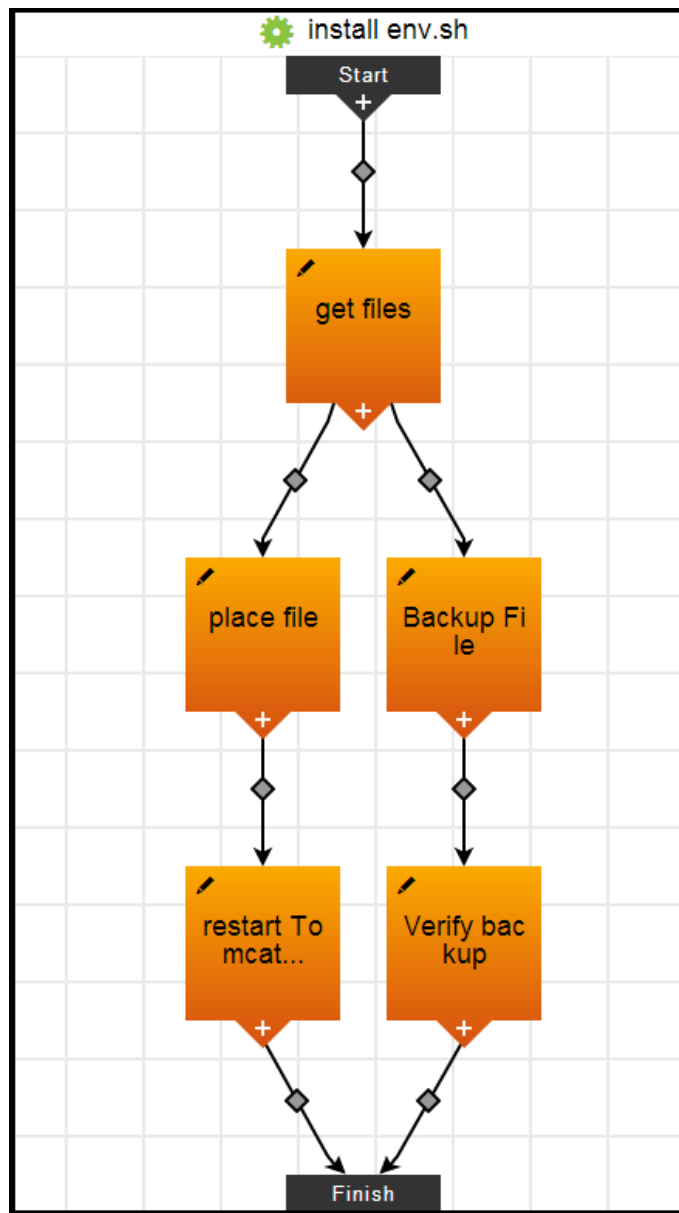
When you are near where you want to add the step in the process, notice that the icon changes shape and the text in it changes to "Dropping this Step in the Process."

4. Drop the step in the process.

The **Component Process Step** dialog box appears.

5. Enter information about the step.

The new step is in the process.



## Deploying Applications in Dynamic Environments

This section describes dynamic environments and how to model them.

Environments can be static, dynamic, or hybrid. Any *dynamic environment* is automatically spun up when the application is deployed. Environments can have a combination of static and cloud resources that will be provisioned and configured dynamically. Go [here](#) for more information about static environments and how to model them.



Using dynamic environments allows you to:

- Provide ways to optimize how cloud resources are used.
- Reuse provisioned resource pools on an on-demand basis.
- Track how provisioned cloud resources are used.
- Provide the status of the provisioning process.
- Verify the credentials of cloud resources before provisioning them.

You provision cloud resources by creating a resource template and adding it to an environment template. When the application deployment that includes a dynamic environment begins, the environment is spun up at runtime with the required cloud resources, and the application is deployed there.

Resource templates allow you to

- Define the cloud provider details to provision of machines at the appropriate time and the configuration management tools to install the appropriate middleware.
- Configure the resources for optimal performance.

## About Resources

Each resource in an environment has its own logical name to identify it from the other resources in the system. It also can be assigned to one or more resource pools or to a zone (a collection of agents). Several resources can correspond to the same physical host or agent machine. Resources can also be configured as standard or proxy. Standard resources are machines running the ElectricFlow agent on a supported agent platform while proxy resources (agents and targets) are on remote platforms or hosts that exist in your environment and requires SSH keys for authentication. The ElectricFlow agent does not need to run on the remote platform or host. Go to [Resources](#) on page 809 for more information about to create, configure, and manage resources.

## Examples

Infrastructure in ElectricFlow is modeled by configuring the cloud provider for dynamic environments. This configuration is versioned when you name and save the resource template. For an example of an Amazon EC2 infrastructure configuration, go to . For an example of an OpenStack infrastructure configuration, go [here](#).

[Example: Resource Template for Infrastructure using Amazon EC2](#) on page 237 and [Example: Resource Template for Infrastructure using OpenStack](#) on page 244. For examples of infrastructure configurations, go to [Example: Resource Template for Infrastructure using Amazon EC2](#) on page 237 and [Example: Resource Template for Infrastructure using OpenStack](#) on page 244.

Middleware is modeled by configuring the configuration management tool for dynamic environments. This configuration is versioned when you name and saved the resource template. For an example of a middleware configuration, go to [Example: Resource Template for Middleware Using Chef](#) on page 249.

## Modeling Dynamic Environments

This is the high-level process to provision cloud resources that can be dynamically spun up during the application deployment.

1. Create and define one or more resource templates.

The resource template has the information required to spin up the resources on an on-demand basis and to provision dynamic resource pools. It has the following information:

- Cloud provider and cloud instance details
- Configuration management settings
- Both cloud provider and configuration management settings
- Environment capabilities (see [Full-Stack Dependency View](#) on page 129 for more information)

2. Create and define one or more environment templates.

When modeling an environment template, you define the environment tiers and then add resources to the tiers. You can either add static resources or a resource template to an environment tier.

When adding static resources, you can select one or more resources to add to the tier.

When adding resource templates, you can select only one to add to the tier and then enter the number of resources to provision.

Environment templates have this information:

- Name and description
- Environment tier details and properties
- Resources assigned to the environment tiers
- Cloud resource details from the resource templates

## Usage Guidelines and Best Practices

Review the following information before creating and using dynamic environments.

- This matrix shows the resource types that are allowed in environments and environment templates.

Resource Type	Origin	Environment Tier	Environment Template Tier	Use Rules
Static resources	–	Yes	Yes	<p>You may only add them to one environment. You cannot reuse them in more than one environment.</p> <p>You can add one or more static resources to an environment tier or an environment tier template.</p>
Static resource pool	–	Yes	No	<p>You may only add it to one environment. You cannot reuse it in more than one environment.</p> <p>You can add only one resource pool to an environment tier.</p>
Resource pool provisioned in the resource template	Platform	Yes	No	<p>You may only add it to one environment. You cannot reuse it in more than one environment.</p> <p>You can add only one resource pool to an environment tier.</p>
Resource pool provisioned in an environment template	ElectricFlow	No	No	<p>You cannot reuse the resource pools provisioned in an environment template.</p> <p>You can only use it in the dynamic environment created by the environment template.</p>
Resource template	–	No	Yes	<p>You may only add one resource template to an environment template tier.</p>

In environments and environment templates, you can create a tier with static resources, a static resource pool, or a static resource template. When you are editing the tier, ElectricFlow maintains the initial resource-type association.

For example, if you initially add static resources to an environment tier, you can add only static resources to it. You are not allowed to add a resource this environment tier.

- ElectricFlow validates the information you provide for configuring and provisioning the cloud provider.

For instance, when you configure Amazon EC2 as the cloud provider, ElectricFlow validates the Service URL using the Access ID and Access Key. The configuration information that you provide is also used to retrieve and display the available options from the cloud provider service for the provisioning parameters such as the Image or the Security group to use.

However, if your ElectricFlow server is unable to access external services such as the Amazon EC2 service, you may disable this validation and the dynamic options retrieval capability for the cloud provider plugin by setting the plugin property `ec_disable_dynamic_operations` to 1.

## Creating AMIs

Before creating a resource template, you must create an Amazon Machine Image (AMI) with a pre-installed agent for the cloud provider. In ElectricFlow 5.4, Amazon EC2 and OpenStack are the supported cloud providers.

### AMIs with ElectricFlow Agents

1. Install agents on ElectricFlow server node machines.

See the following sections in the [ElectricFlow Installation Guide](#) for detailed instructions:

- System Requirements and Supported Platforms > Agent Platforms
- System Requirements and Supported Platforms > Server and Agent Compatibility
- Installing ElectricFlow > Interactive Command-line Installation Method > Express Agent Command-Line
- Installing ElectricFlow > Non-Server Platform Agent Installation Method
- Configuration > Environment Proxy Server Configuration > Configuring Proxy Agents

2. Create the AMI on the Amazon EC2 or OpenStack platform.

Go to <http://aws.amazon.com/amazon-linux-ami/> for Amazon EC2.

Go to <http://docs.openstack.org/image-guide/content/index.html> for OpenStack.

3. Create a resource template in ElectricFlow.

When you set the cloud provider, you can select **Amazon** or **OpenStack** and enter information in the fields in the dialog boxes. The fields that you see depend on the cloud provider that you select.

For detailed Amazon EC2 instructions, go to [Configuring Amazon EC2 as the Cloud Provider](#).

For detailed OpenStack instructions, go to [Configuring OpenStack as the Cloud Provider](#).

## AMIs with ElectricFlow Agents and Chef Configuration Management

1. Install agents on ElectricFlow server node machines.

See the following sections in the [ElectricFlow Installation Guide](#) for detailed instructions:

- System Requirements and Supported Platforms > Agent Platforms
- System Requirements and Supported Platforms > Server and Agent Compatibility
- Installing ElectricFlow > Interactive Command-line Installation Method > Express Agent Command-Line
- Installing ElectricFlow > Non-Server Platform Agent Installation Method
- Configuration > Environment Proxy Server Configuration > Configuring Proxy Agents

2. Configure a Chef server with run-lists that will be applied to your cloud resources.

Go to <http://docs.chef.io/>.

3. Create the AMI on the Amazon EC2 or OpenStack platform.

Go to <http://aws.amazon.com/amazon-linux-ami/> for Amazon EC2.

Go to <http://docs.openstack.org/image-guide/content/index.html> for OpenStack.

4. Create a resource template in ElectricFlow.

- a. When you set the cloud provider, you can select **Amazon** or **OpenStack** and enter information in the fields in the dialog boxes. The fields that you see depend on the cloud provider that you select.

For detailed Amazon EC2 instructions, go to [Configuring Amazon EC2 as the Cloud Provider](#).

For detailed OpenStack instructions, go to [Configuring OpenStack as the Cloud Provider](#).

- b. When you set the configuration management tool, select **Chef**.

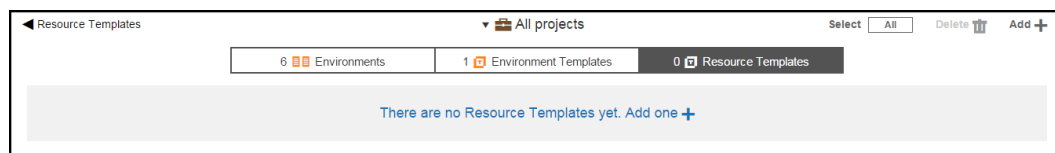
For detailed instructions, go to [Configuring Chef as the Configuration Management Tool](#).

## Creating Resource Templates

1. Go to the Resource Templates List.

If there are no defined resource templates, the Resource Templates List is empty.

### Example:

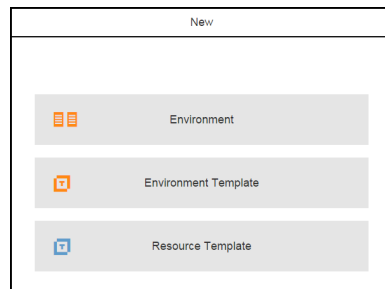


2. Add a resource template.

- a. If the Resource Templates List is empty, click **There are no Resource Templates yet. Add one +** or click the **Add +** button.

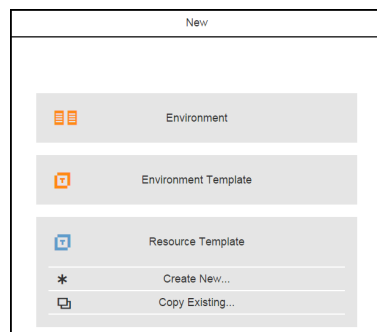
In the New dialog box, click **Resource Template**.

**Example:**



The **New** dialog box opens.

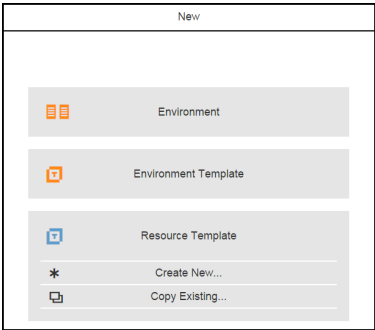
**Example:**



- b. If the Resource Templates List is not empty, click the **Add +** button.

The **New** dialog box opens.

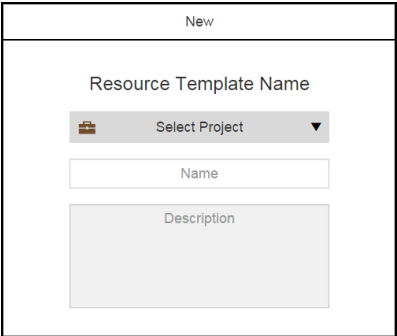
**Example:**



- 3. Click **Create New** to create a new resource template.

The **New** dialog box opens.

**Example:**





- Enter a name for the environment template, select a project to which it belongs, and enter an optional description.

### Example:

The screenshot shows a 'New' dialog box with the following fields:

- Resource Template Name:** AWS 1
- Project:** Electric Cloud (selected from a dropdown menu)
- Uses EC2:** Checked (indicated by a red checkmark)

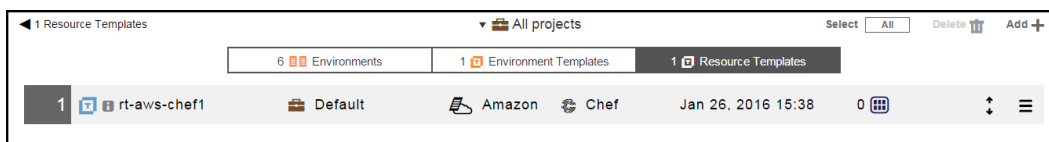
- Click **Next**.
- Enter the cloud provider settings in the **New Cloud Provider** dialog box.
  - To use Amazon EC2 as the cloud provider, go to [Example: Resource Template for Infrastructure using Amazon EC2](#) on page 237 for detailed instructions.

**IMPORTANT:** Before configuring the cloud provider, you must have an Amazon Machine Image (AMI) with a pre-installed agent available.

- To use OpenStack as the cloud provider, go to [Example: Resource Template for Infrastructure using OpenStack](#) on page 244 for detailed instructions.
- (Optional) Enter the configuration management settings in the **New Configuration Management** dialog box..
 

To use Chef as the configuration management tool, go to [Example: Resource Template for Middleware Using Chef](#) on page 249 for detailed instructions.

After completing these steps, the Resource Template List now shows the template that you created. The breadcrumb in the upper left corner shows the object hierarchy.



By default, the resource templates for all projects are displayed.

To see only the objects for a specific project, click the down arrow in the **All projects** field and then select one or more projects in one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

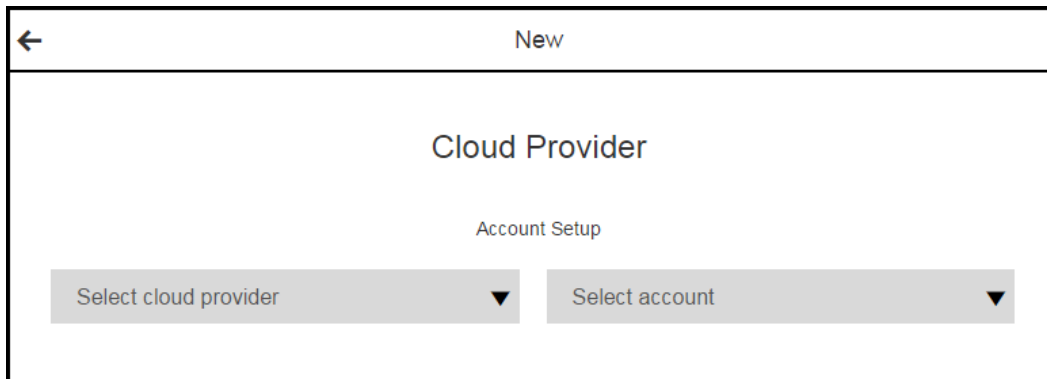
## Example: Resource Template for Infrastructure using Amazon EC2

This section describes how to configure Amazon EC2 as the cloud provider for a resource template.

**IMPORTANT:** Before configuring the cloud provider, you must have an Amazon Machine Image (AMI) with a pre-installed agent available.

In the **New Cloud Provider** dialog box, "*account*" refers to the cloud provider setup. Select one of these options to enter the setup information:

- Click **Select cloud provider** to enter the cloud provider settings. Go to [Select Cloud Provider](#) on page 237 for the detailed instructions.
- Click **Select account** if you want to use an existing plugin configuration. Go to [Select account](#) on page 243 for the detailed instructions.



The screenshot shows a dialog box titled "New" with a back arrow icon. The main heading inside is "Cloud Provider". Below this heading is the subtitle "Account Setup". At the bottom of the dialog, there are two buttons: "Select cloud provider" and "Select account", each followed by a downward-pointing triangle icon.

### Select Cloud Provider

To enter the cloud provider settings:

1. Click **Select cloud provider > Amazon**.

2. Enter the following values:

- **Configuration Name**—A unique name for the EC2 connection. (Required)
- **Description**—A description for this configuration. The default is *EC2 integration*.
- **Access Key ID**—The Access Key ID that is required for communicating with Amazon EC2. The configuration stores this Access Key ID in the **User Name** field of the credential.

The screenshot shows a configuration form with the following fields and values:

- Configuration Name:** EC2config
- Description:** EC2 integration
- Access Key:** (empty field)
- Access Key ID:** <your Access Key ID>

- **Secret Access Key**—The Secret Access Key that is required for communicating with Amazon EC2. The configuration stores this value in the **Password** field of the credential.
- **Retype Secret Access Key**—The Secret Access Key in the **Retype Password** field of the credential.
- **Service URL**—The service URL for the EC2 service. The default is *https://ec2.amazonaws.com*. (Required)

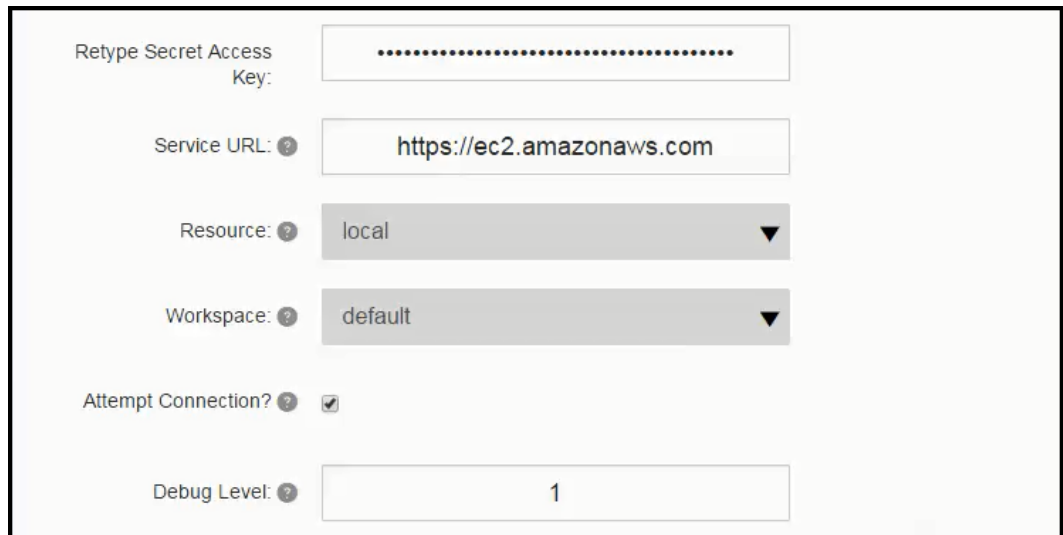
When you provide the Access Key values and the Service URL, the system will validate that the provided values are valid for connecting to Amazon EC2.

- **Resource**—The resource or pool on which the integration steps can run. The default is *local*.
- **Workspace**—The workspace to use for resources dynamically created by this configuration. The default is *default*.
- **Attempt Connection?**—If the check box is selected, the system tries to connect to Amazon EC2 using the provided Access Key values and the Service URL to check credentials before creating the configuration.

- **Debug Level**—The debug level for the output. The default is 1.

The possible values are

- **0** – Errors only.
- **1** – Normal headers and responses.
- **2+** – Debugging information included.



A screenshot of a configuration form with the following fields:

- Retype Secret Access Key:** A text input field containing a series of dots (.....).
- Service URL:** A text input field containing the URL `https://ec2.amazonaws.com`.
- Resource:** A dropdown menu with the selected value `local`.
- Workspace:** A dropdown menu with the selected value `default`.
- Attempt Connection?** A checkbox that is checked.
- Debug Level:** A text input field containing the value `1`.

3. Click **Next**.

The **Provision Parameters** fields appear.

The Configuration field is prepopulated with the name you entered in the previous dialog box.

ElectricFlow tries to retrieve the provision parameters for this configuration:

This screenshot shows a form titled "Provision Parameters" with the following fields and values:

- Configuration: ?
- Number of Instances: ?
- Security Group: ?  \* (Required)
- Image: ?  \* (Required)
- Instance Type: ?  \*
- Key name: ?  \* (Required)
- Results Location: ?

This screenshot shows the same "Provision Parameters" form, but with the following changes:

- Configuration: ?
- Number of Instances: ?
- Security Group: ?  ▼
- Image: ?  ▼ (Required)
- Instance Type: ?  ▼
- Key name: ?  ▼ (Required)
- Results Location: ?

4. Enter the **Provision Parameters** settings:

- **Number of Instances**—The number of instances to start. The default is 1.
- **Security Group**—The default is *default*.
- **Image**—Select the EC2 image to deploy. The drop-down menu displays the images that you own in your current region. (Required)

Image: ?	ami-c270e7aa (centos65) ▼
----------	---------------------------

- **Instance Type**—You get the list of instance types at runtime. The default is **Small(m1.small)**.
- **Key name**—Select the name of the key pair to use. (Required)

Key name: ?	alex ▼
-------------	--------

- **Results Location**—Location where the output properties will be saved. If not specified, it defaults to `/myParent/parent`.
- **User Data**—Extra user data to pass to the `API_runInstances` procedure.
- **Availability Zone**—The zone where the instance will be created. (Required)  
Selecting a zone causes ElectricFlow to find a subnet in the selected zone.

Availability Zone: ?	us-east-1a ▼
Subnet Id: ?	▼ ✱

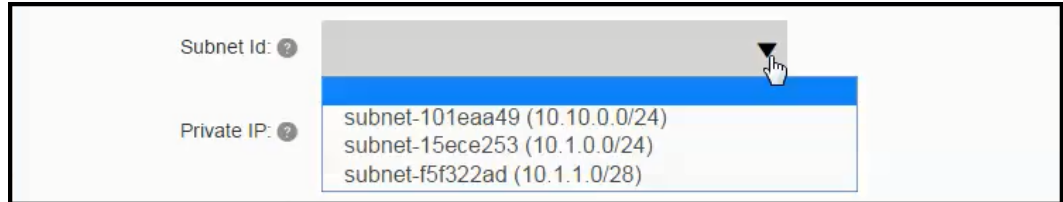
- **Resource Pool**—The name of the resource pool. If you enter a name, a new resource pool is created, and new resources are added to the pool for the instances created in Amazon EC2.

Resource Pool: ?	WebServers
------------------	------------

- **Commander Workspace**—If you specify a resource pool name in **Resource Pool** field, this is the workspace that will be used when creating the resource.

- **Subnet Id**—The ID of the subnet in which the instances are launched. This parameter is used with VPCs.

After selecting the zone where the instance will be created, you can select a subnet in that zone.



- **Private IP**—The private IP address to assign. If you specify a value, it must be from the IP address range of the subnet. If no value is specified, an available IP address from the IP address range of the subnet is selected. This parameter is used with VPCs
- **Use Private IP for subnet?**—If this check box is selected, the private IP address assigned to the instance will be used for the newly created resource. This is enabled by default.
- **Resource Port**—If you specify a resource pool name in 'Resource Pool' field, this is the port that will be used when creating the resource. If no value is specified, port 7800 will be used by default when creating the resource.
- **Resource Zone Name**—The zone to which the newly created resources will belong. The default zone is *default*.

5. Click **Next** to enter the configuration management settings.
6. Go to [this step](#) in [Creating Resource Templates](#) on page 233 to continue creating the resource template.
7. If you do not want to enter the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.

### Select account

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the cloud provider settings and puts them in the appropriate fields.

1. Click **Select account**
2. Select an existing plugin.
3. Click **Next**.

The dialog box shows for the settings for the selected the plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.
5. Click **Next** to enter the configuration management settings.
6. Go to [this step](#) in [Creating Resource Templates](#) on page 233 to continue creating the resource template.
7. If you do not want to set the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.



## Example: Resource Template for Infrastructure using OpenStack

This section describes how to configure OpenStack as the cloud provider for a resource template.

### Prerequisites and Configuration Guidelines

Review the following information before creating a resource template using OpenStack as the cloud provider:

- Prerequisite:

**IMPORTANT:** Before configuring the cloud provider, you must have an image with a pre-installed agent on OpenStack.

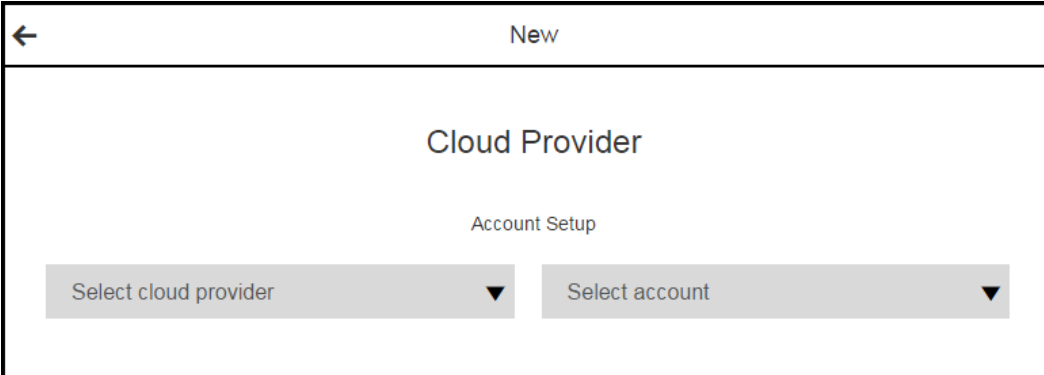
- When creating a resource template using OpenStack as the cloud provider, only one security group can be selected.

To select more than one security group, the workaround is to disable the `serverOptions` flag for the `security_groups` parameter in the EC-OpenStack plugin. In the plugin procedure called `_DeployDE`, edit the XML form as follows:

1. Go to the Custom Procedure Properties section.
2. Click `ec_parameterForm`.
3. In the **Edit Property / ec\_parameterForm** dialog box, set the `security_groups` `formElement` called `serverOptions` to 0.

In the **New Cloud Provider** dialog box, "*account*" refers to the cloud provider setup. Select one of these options to enter the setup information:

- Click **Select cloud provider** to enter the cloud provider settings. Go [here](#) for the detailed instructions.
- Click **Select account** if you want to use an existing plugin configuration. Go [here](#) for the detailed instructions.



The screenshot shows a dialog box titled "New" with a back arrow icon. The main heading inside is "Cloud Provider". Below this, the text "Account Setup" is centered. At the bottom, there are two buttons: "Select cloud provider" and "Select account", each with a downward-pointing triangle indicating a dropdown menu.

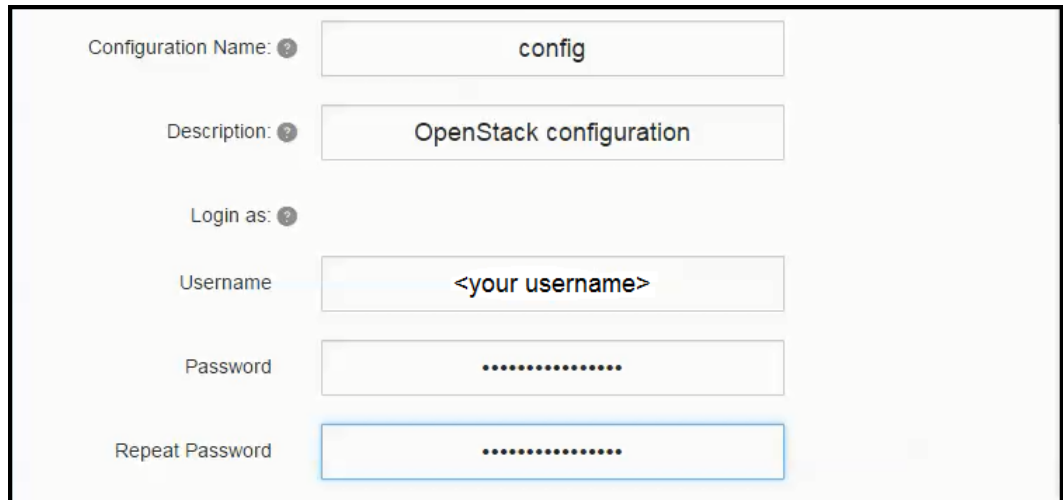
### Select cloud provider

To enter the cloud provider settings:

1. Click **Select cloud provider > OpenStack**.

2. Enter the following values. As you enter them and click in an empty field, ElectricFlow tries to retrieve the cloud provider settings.

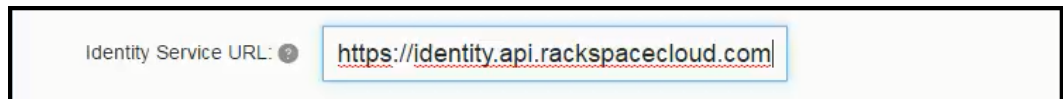
- **Configuration Name**—A unique name for the OpenStack configuration. (Required)
- **Description**—A description for this configuration. The default is *OpenStack configuration*.
- **Login as**—The OpenStack account username and password. It must have enough privileges to perform API functions. (Required)



The screenshot shows a configuration form with the following fields and values:

- Configuration Name:** config
- Description:** OpenStack configuration
- Login as:** (empty)
- Username:** <your username>
- Password:** .....
- Repeat Password:** .....

- **Identity Service URL**—The service end-point URL for the Identity Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)



The screenshot shows the Identity Service URL field with the value: <https://identity.api.rackspacecloud.com>

- **Keystone API version**—The version of the Keystone Service API. The default is 3. (Required)

- **Tenant ID**—The ID of the OpenStack tenant to use. (Required)

The screenshot shows a configuration form with the following fields:

- Identity Service URL:** A text input field containing the URL `https://identity.api.rackspacecloud.com`. To the right of the field is a gear icon.
- Keystone API version:** A dropdown menu showing the value `3`. To the right of the dropdown is a downward arrow icon.
- Tenant ID:** A text input field containing the value `981279`. To the right of the field is a gear icon.
- Compute Service URL:** An empty text input field. To the right of the field is a gear icon and the word **Required** in red text.

When you click in the next empty field, ElectricFlow tries to retrieve the rest of the cloud provider settings for the selected configuration.

- **Compute Service URL**—The service end-point URL for the Compute Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Compute API version**—The version of the Compute Service API. The default is 2.0. (Required)
- **Block Storage URL**—The service end-point URL for the Block Storage Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Block Storage API version**—The version of the OpenStack block storage API. The default is 1. (Required)
- **Image Service URL**—The service end-point URL for the Image Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Image API version**—The version of the Image Service API. (Required)
- **Orchestration Service URL**—The service end-point URL for the Orchestration Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Resource**—The name of the resource or pool on which the integration steps can run. The default is *local*. (Required)
- **Debug Level**—The debug level for the output. The default is 1.

The possible values are

- **0** – Errors only.
- **1** – Normal headers and responses.
- **2+** – Debugging information included.

### 3. Click **Next**.

The **Provision Parameters** fields appear.

The Configuration field is prepopulated with the name you entered in the previous dialog box.

ElectricFlow tries to retrieve the provision parameters for this configuration.

4. Enter the **Provision Parameters** values.

- **Number of Instances**—The number of servers to deploy. If there is more than one, a suffix (\_#) is added to the server names. The default is 1. (Required)
- **Image**—Select the image to use in OpenStack. (Required)
- **Flavor**—Select the flavor to use in OpenStack. (Required)
- **Key Pair Name**—Select the key pair to use in OpenStack. (Required)
- **Security Group(s)**—Select the security group to use in OpenStack.
- **Availability Zone**—Select the availability zone in OpenStack in which to launch the server.
- **Customization script**—Configuration information or scripts to execute when the server starts.
- **Results Location**—Location where the output properties will be saved. If not specified, this defaults to `/myJob/OpenStack/deployed`.
- **Resource Pool**—Name of the resource pool. If you enter a name, a new resource pool is created, and new resources are added to the pool for the servers created in OpenStack.
- **Resource workspace**—If you specify a resource pool name, this is the workspace that will be assigned to the created resources.
- **Resource Zone Name**—The zone to which the newly created resources will belong. The default zone is *default*.

5. Click **Next** to set the configuration management settings.

6. Go to [this step](#) in [Creating Resource Templates](#) on page 233 to continue creating the resource template.

7. If you do not want to set the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.

### Select account

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the cloud provider settings and puts them in the appropriate fields.

1. Click **Select account**
2. Select an existing plugin.
3. Click **Next**.

The dialog box shows for the settings for the selected the plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.
5. Click **Next** to enter the configuration management settings.
6. Go to [this step](#) in [Creating Resource Templates](#) on page 233 to continue creating the resource template.
7. If you do not want to set the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.

## Example: Resource Template for Middleware Using Chef

This section shows how to configure Chef as the configuration management tool for a resource template after you have entered the cloud provider settings.

In the **New Configuration Management** dialog box, "account" refers to the configuration management setup.

Select one of these options to enter the setup information:

- Click **Select configuration management** to enter the configuration management tool settings. Go [here](#) for the detailed instructions.
- Click **Select account** if you want to use an existing plugin configuration. Go [here](#) for the detailed instructions.

### Select configuration management

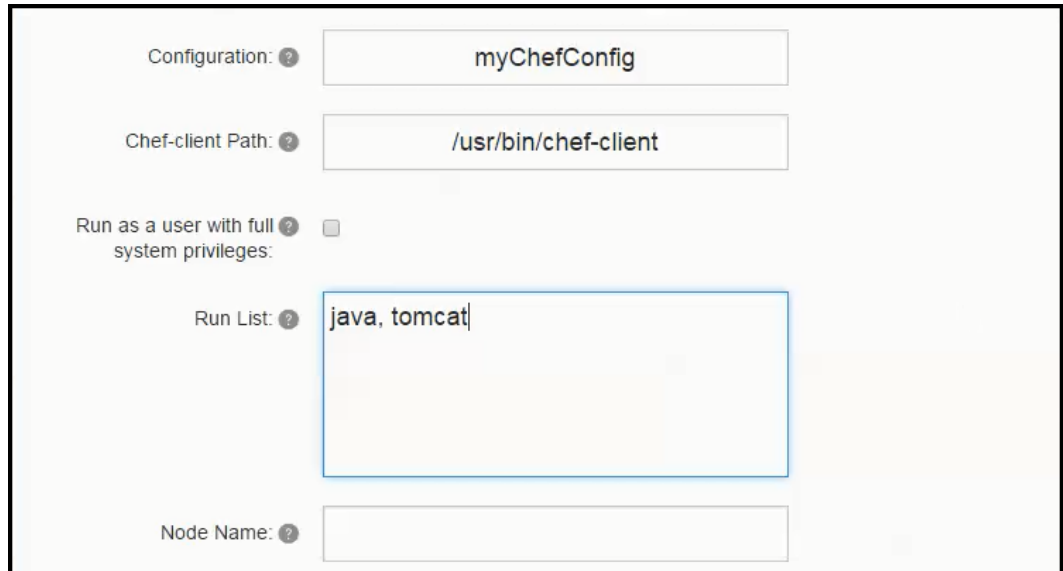
To enter the configuration management settings:

1. Click **Select configuration management** > **Chef**, and select **Next**.

The **Converge Parameters** fields appear.

2. Enter these settings:

- **Configuration**—Name of the Chef configuration. This is required.
- **Chef-client Path**—The path to the chef-client executable. The default value is `/usr/bin/chef-client`. (Required)
- **Run as user with full system privileges**—If this check box is selected, chef-client is run as a user with elevated privileges on Unix systems (using sudo).
- **Run List**—The ordered list of Chef recipes to run. This is required.



The screenshot shows a configuration form with the following fields and values:

- Configuration:** `myChefConfig`
- Chef-client Path:** `/usr/bin/chef-client`
- Run as a user with full system privileges:** ☐ (unchecked)
- Run List:** `java, tomcat`
- Node Name:** (empty field)

- **Node Name**—Unique name for the node that will be maintained by the chef-client. If not specified, Chef will use the Fully Qualified Domain Name of the node as the node name. (Required)

- **Additional Arguments**—Any additional arguments that need to be passed to the chef-client.

Run List: ? java, tomcat

Node Name: ?

Additional Arguments: ?

3. Click **OK**.

The Resource Templates List now shows the resource template that you created.

### Select account

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the configuration management settings and puts them in the appropriate fields.

1. Click **Select account**
2. Select an existing plugin.
3. Click **Next**.

The dialog box shows for the settings for the selected the plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.
5. Click **Next**.

The Resource Templates List now shows the resource template that you created.

### Viewing and Editing Resource Templates

You can view and edit this information about resource templates:

- [Resource Template Details](#) on page 252
- [Resource Template Properties](#) on page 253
- [Access Control Settings](#) on page 255
- [Change Tracking](#) on page 256



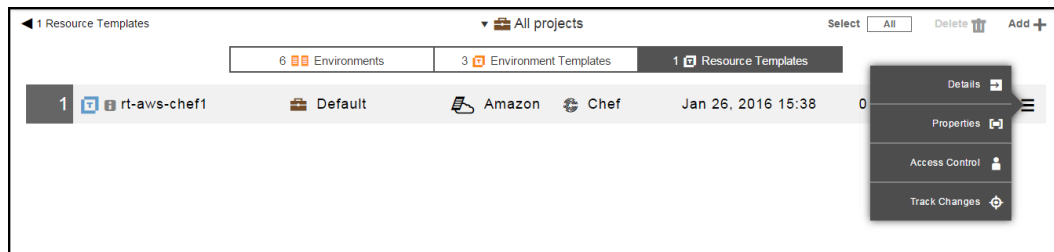
## Resource Template Details

Starting in the Resource Template List, follow these steps to view and edit the resource template details:

1. Choose a resource template and click the **Menu** button.

A list of menu options appears.

### Example:



To see only the objects for a specific project, click the down arrow in the **All projects** field and then select one or more projects in one of these ways:

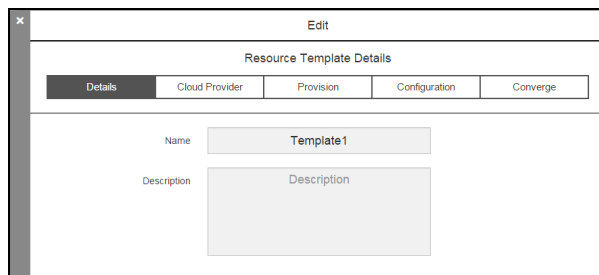
- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

2. Select **Details**.

The **Edit Resource Template Details** dialog box opens.

### Example:



3. In the **Details** tab, edit the name and description of the resource template.
4. In the **Cloud Provider** tab, edit the cloud provider account information.
5. In the **Provision** tab, edit the information about the provision settings for the cloud provider.
6. In the **Configuration** tab, view and edit the configuration management details.

- 7. In the **Converge** tab, view and edit the details about how the virtual instances are converged in the defined configuration.
- 8. Click **Next** to go to the next tab.
- 9. Click **OK** to save your changes.

Resource Template Properties

Starting in the Resource Template List, follow these steps to view and edit the resource template properties:

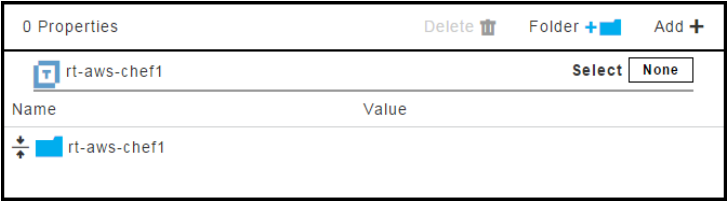
- 1. Choose a resource template and click the **Menu** button.

A list of menu options appears.

- 2. Select **Properties**.

The **Properties** dialog box opens.

Example:



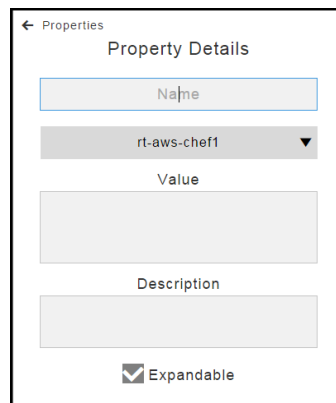
3. To add a property:

- a. Click the **Add +** button.

The **Property Details** dialog box opens.

If **Expandable** is selected, the property value can contain property references using the "\$[]" notation.

### Example:



The screenshot shows a dialog box titled "Property Details" with a back arrow and the word "Properties" in the top left corner. The dialog contains the following fields and controls:

- A text input field labeled "Name" with the value "rt-aws-chef1".
- A dropdown menu labeled "Value" with the selected option "rt-aws-chef1".
- A text input field labeled "Description".
- A checkbox labeled "Expandable" which is checked.

b. Enter the details and click **OK** to save them.

Example:

← Properties

Property Details

Release version

rt-aws-chef1

Value

Description

Software release version

☒ Expandable

The **Property Details** dialog box now shows the new property that you added.

Example:

1 Properties

Delete Folder Add

rt-aws-chef1 Select All

Name	Value
rt-aws-chef1	
Release version	

Access Control Settings

Clicking **Access Control** opens the Access Control page in the automation platform.

Example:

Project: Default

Access Control / Resource Template: rt-aws-chef1

Privileges for Resource Template: rt-aws-chef1

Add User | Add Group | Add Project | Break Inheritance

Currently, there are no records to display in this list.

Privileges inherited from Project : Default

Type	Name	Location	Read	Modify	Execute	Change Permissions
group	Everyone		allow	allow	allow	allow
project	Default		allow	allow	allow	allow

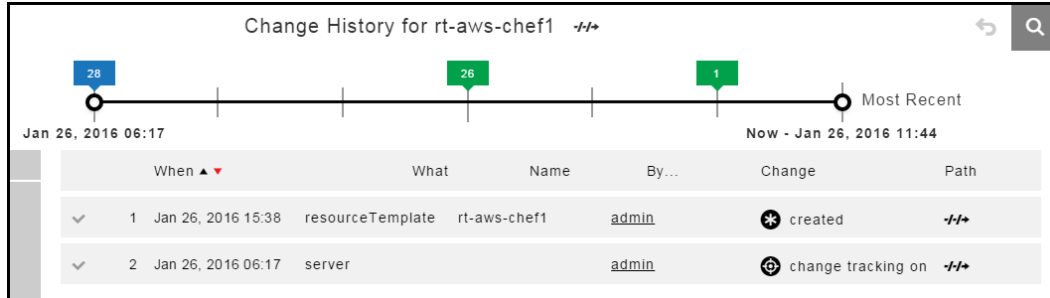
Privileges inherited from Projects

Type	Name	Location	Read	Modify	Execute	Change Permissions
project	EC-EC2-2.3.4.54		allow	allow	allow	allow

## Change Tracking

Clicking **Track Changes** opens the Change History for the resource template.

### Example:



## Accessing the Resource Templates in the Automation Platform

You can generate new resource pools in ElectricFlow by accessing the resource templates from the automation platform UI.

1. Go to **Cloud > Pools**.

### Example:

Home	Flow Tools	Projects	Jobs	Workflows	Cloud	Artifacts	Search	Administration	Change History
Resources	Pools	Workspaces	Zones	Gateways					
Resource Pools									
									Resource Templates ★
Create Resource Pool   New Search									
Pool Name	Enabled	Type	# Resources	Resource Template Name	Auto Delete	Description	Actions		
default	<input checked="" type="checkbox"/>	Static	1			Default resource pool containing local agent created during installation.			


2. Click **Resource Templates**.

The **Resource Templates** list opens.

### Example:

Resource Templates									
▼ All projects									
							Select	Delete	Add
1	rt-aws-chef1	Default	Amazon	Chef	Jan 26, 2016 15:38	0			



3. (Optional) To view details about a resource template, choose a template and click the **Menu** button (  ) for it.

The Context menu opens.


4. Click one of these options:

- **Details**—The **Edit Resource Template Details** dialog box opens.

The tabs that appear in the dialog box depend on the cloud provider specified in the resource template.

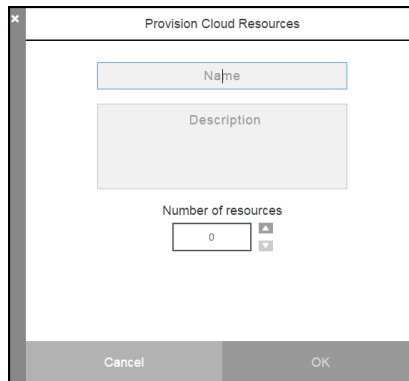
- **Properties**—The **Properties** dialog box opens.  
You can view and edit the properties that apply to the resource template.
- **Access Control**—The Access Control page opens.
- **Track Changes**—The Change History for the resource template opens.



5. To provision the resource template, choose a resource template, click the **Menu** button (  ), and select **Details > Provision**.

The **Provision Cloud Resources** dialog box opens.

### Example:



Provision Cloud Resources

Name

Description

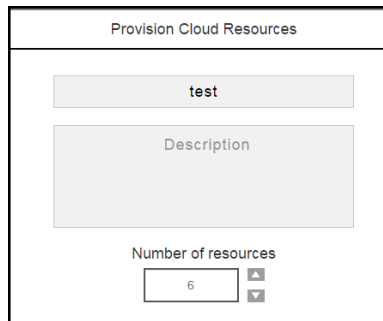
Number of resources

0

Cancel OK

6. Enter the resource pool name, an optional description, and the number of resources in the pool, and then click **OK**.

### Example:



Provision Cloud Resources

test

Description

Number of resources

6

You go to the Job Details page in the automation platform.

## Creating Environment Templates

You can create a new environment template from scratch or create one based on an existing template.

- [Creating a New Environment Template](#) on page 258
- [Creating an Environment Template Based on an Existing Template](#) on page 266

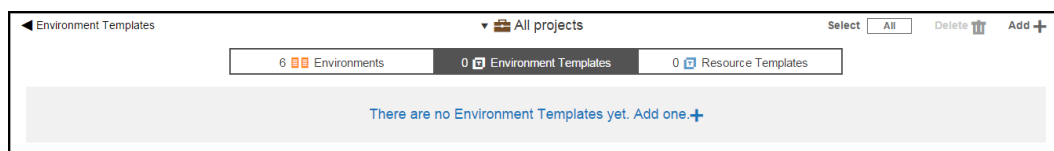
### Creating a New Environment Template

Starting from the Environment Templates List, follow these steps to create an environment template from scratch:

1. Go to the Environment Templates List.

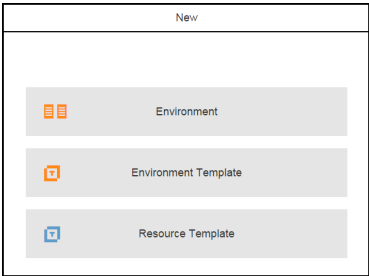
If there are no defined environment templates, the Environment Templates List is empty.

### Example:



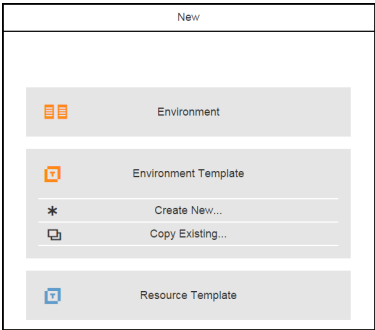
- 2. Add an environment template.
    - a. If the Environment Templates List is empty, click **There are no Environment Templates yet. Add one +** or click the **Add +** button.
- In the **New** dialog box, click **Environment Template**.

Example:



The **New** dialog box opens.

Example:

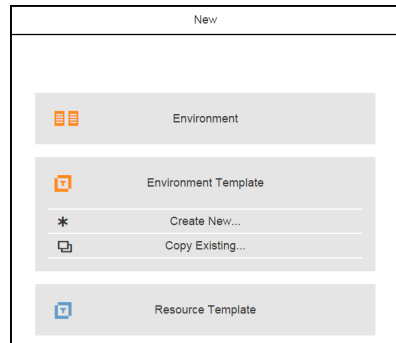




- b. If the Environment Templates List is not empty, click the **Add +** button.

The **New** dialog box opens.

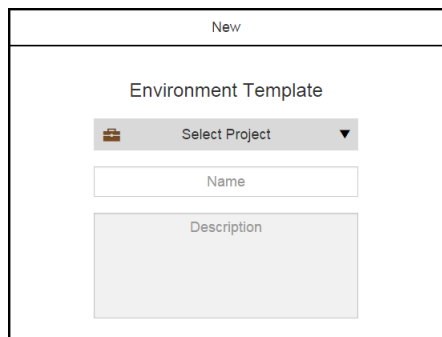
### Example:



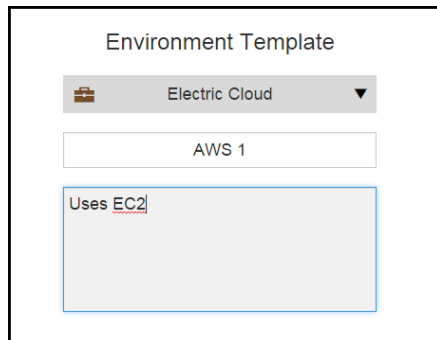
3. Click **Create new** to create a new environment template.

The **New** dialog box opens.

### Example:

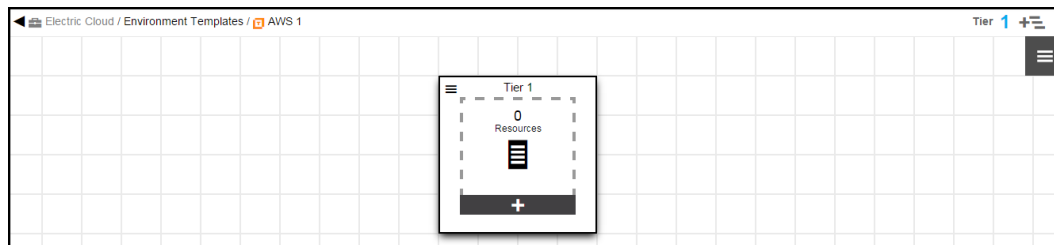



4. Enter a name for the environment template, select a project to which it belongs, and enter an optional description.

**Example:**

5. Click **OK**.

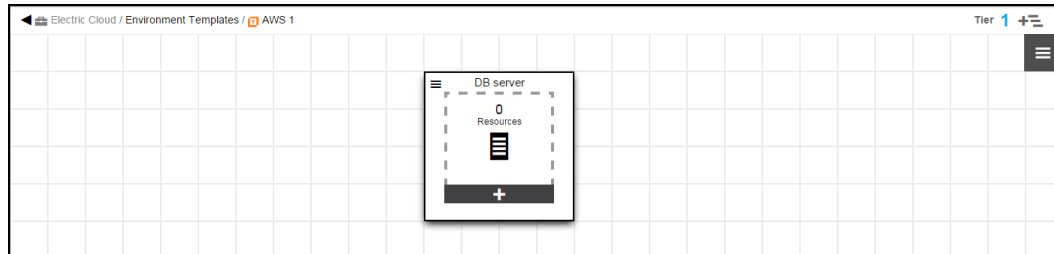
The Environment Templates Visual Editor opens. The environment template has one tier with no assigned resources. The breadcrumb in the upper left corner shows the object hierarchy.

**Example:**

6. In Tier 1, click the  button and select **Details**.

7. In the **Environment Tier Details** dialog box, enter a new name for the environment tier and an optional description, and then click **OK** to save the settings.

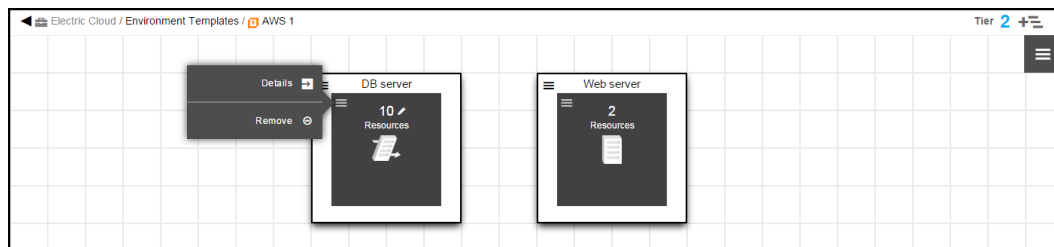
### Example:



8. In the tier, click the **+** button to add a resource to it.

The **New** dialog box to add resources opens.

### Example:



9. Click **Add resource template** to select a resource template.

The Resource Templates List opens.

10. Select a resource template, and click **OK**.

The dialog box to select a resource template opens.

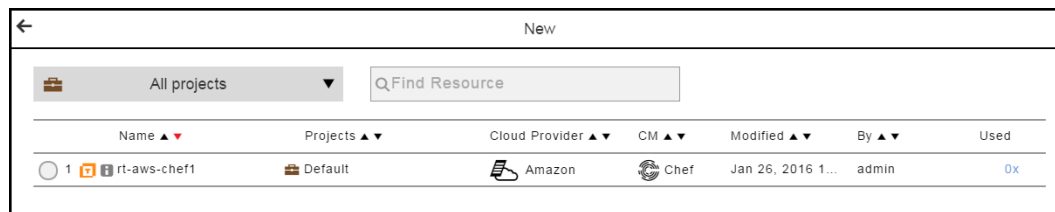
It shows the list of available environment templates. The default is to show the environment templates for all projects.

If you want to see only the environment templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

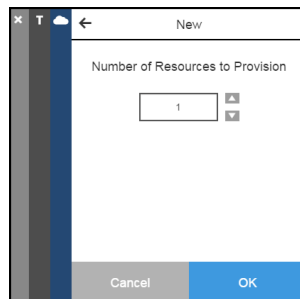
You can also search for one or more environment templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environment templates in the selected projects.

### Example:



The **New** dialog box to select the number of resources to provision opens.

### Example:

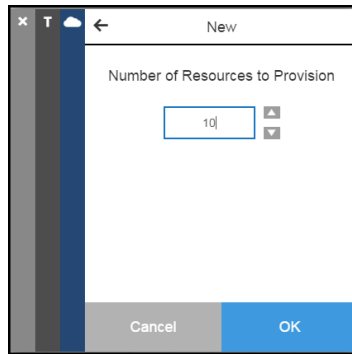


11. Enter the number of resources to provision, and click **OK**.

You must provision at least one resource (1).

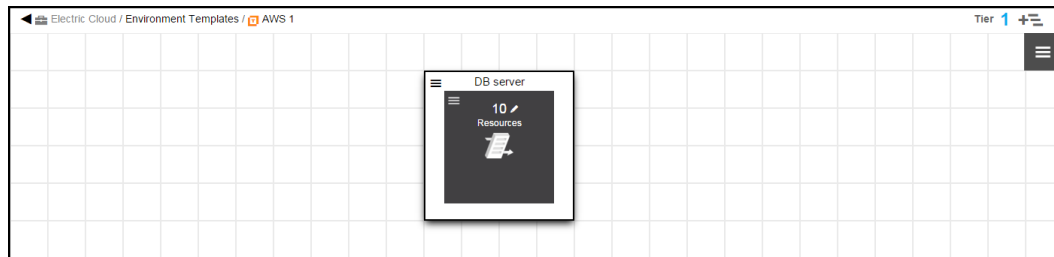
**Note:** You cannot override the number of resources when deploying an application with an environment template.

### Example:



The Environment Templates Visual Editor now shows that the tier (Tier 1) has 10 dynamic cloud resources set to be provisioned when the application is deployed.

### Example:



12. To add static resources to an environment template:

- a. Click the **Add tier** button to create a new tier.

A new environment tier appears in the Environment Templates Visual Editor.

- b. Rename the new environment tier.

- c. Click the **+** button in the new tier to add resources to it.

The **New** dialog box opens.

- d. Click **Add resources** to add static resources to the environment tier.

A list of static resources opens.

**Note:** You cannot override the setting for the number of static resources when deploying the application with an environment template

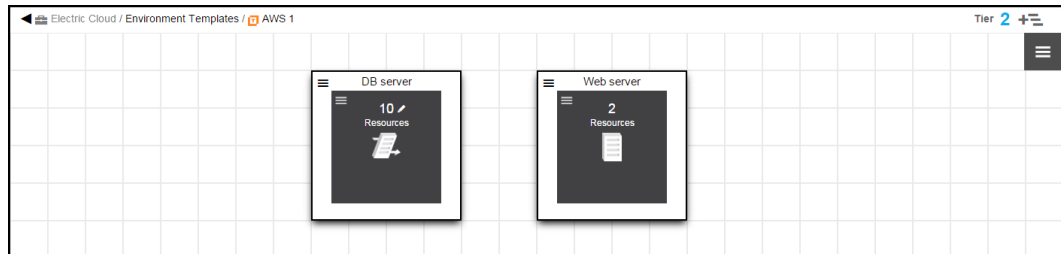
### Example:

New				
✓ Name ▲▼	Platform ▲▼	Up/Down ▲▼	Used in...	
✓ 1. PROD-res	linux	↑	PROD	🔗
✓ 2. QA-res	linux	↑	QA	🔗
✓ 3. heatclinic dsl res	linux	↑	heatclinic-dsl	🔗
✓ 4. heatclinic-res	linux	↑	heatclinic-qe	🔗
✓ 5. jpetstore	linux	↑	jpetstore-qe	🔗
✓ 6. local	linux	↑		🔗
✓ 7. resource-01	linux	↑	hc-store dev	🔗

- e. Select one or more resources in the list, and click **OK**.

The Environment Templates Visual Editor now shows that the "Web server" tier has two static resources.

### Example:



### Creating an Environment Template Based on an Existing Template

Starting from the Environment Templates List, follow these steps to create an environment template that is based on an existing one:

1. Go to the Environment Templates List.
2. Add a resource template.

For detailed instructions, go to [Add an environment template](#) on page 259

3. Click **Copy existing** to create a template based on an existing one.

The list of existing templates opens.











It shows the list of available environment templates. The default is to show the environment templates for all projects.

If you want to see only the environment templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environment templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environment templates in the selected projects.

### Example:

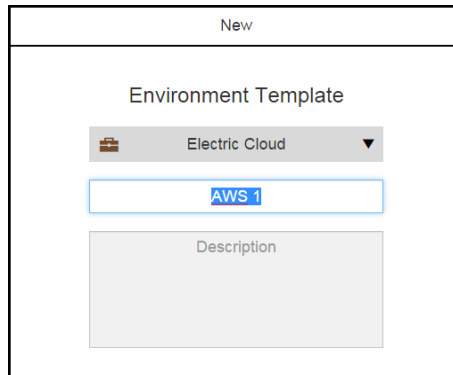
New		
From Environment Template		
 All projects ▼	<input type="text" value="Q Search"/>	
 AWS 1	 Electric Cloud	
 AWS 2	 Electric Cloud	
 AWS 3	 Electric Cloud	



4. Select an environment template.

The **New** dialog box opens.

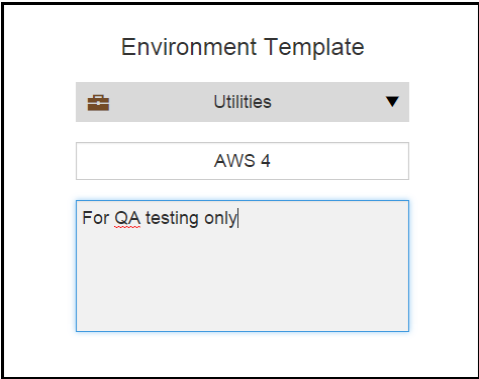
**Example:**



The screenshot shows a dialog box titled "New". Inside, the heading "Environment Template" is centered. Below it is a dropdown menu with a briefcase icon on the left, the text "Electric Cloud" in the center, and a downward arrow on the right. Under the dropdown is a text input field containing "AWS 1". Below the input field is a large, light gray rectangular area labeled "Description".

5. Rename the environment template, and enter an optional description of it.
- You can also change the project to which the environment template belongs.
- Click **OK** to save these settings.

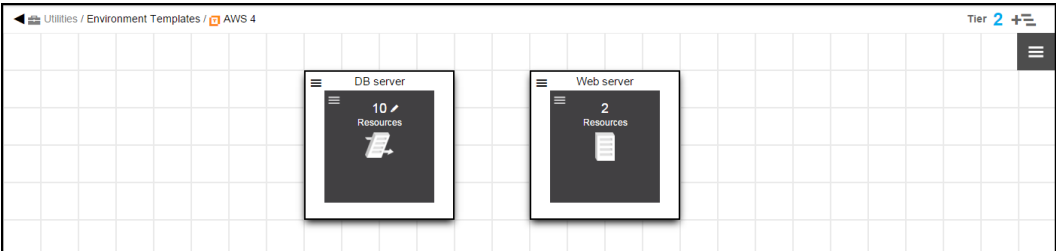
**Example:**



The Environment Templates Visual Editor now shows that the same environment tiers as the original version. The breadcrumb in the upper left corner shows the object hierarchy.

You can now modify the environment template and its objects (resources and resource templates) for your deployments

**Example:**



**Viewing and Editing Environment Templates**

Starting in the Environment Templates List, follow these steps to view and edit the environment template details:



1. Choose an environment template and click the **View Details** button ( ).

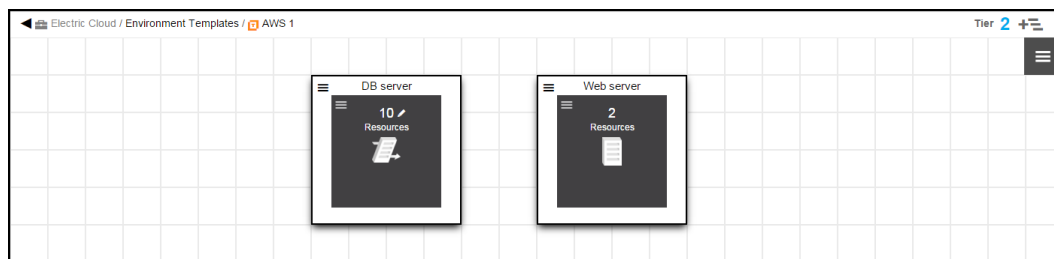
**Example:**


4 Environment Templates		All projects		Select All Delete Add	
6 Environments		4 Environment Templates		1 Resource Templates	
1	AWS 1	Electric Cloud	Jan 27, 2016 00:16	0 Used	0 Live
2	AWS 2	Electric Cloud	Jan 26, 2016 16:42	0 Used	0 Live
3	AWS 3	Electric Cloud	Jan 26, 2016 16:47	0 Used	0 Live
4	AWS 4	Utilities	Jan 27, 2016 00:36	0 Used	0 Live

The Environment Templates for the selected template opens.


The breadcrumb in the upper left corner shows the object hierarchy.

### Example:



- Click to **Menu** button (  ) to open the context menu for the environment template.
  - Click **Details** to view or edit the name and description of the environment template.
  - Click **Properties** to view or edit the environment template properties.
  - Click **Access Control** to go to the Access Control page in the automation platform.
  - Click **Track Changes** to open the Change History of the environment template.
  - Click **Delete** to delete this template.



- To view and edit an environment tier with dynamic resources, click the **Menu** button (  ) for the resources.  
The context menu opens with these options:

- Click **Details** to view and edit the resource details for the environment tier.
- Click **Remove** to remove the resources from the environment tier.

4. To change the resource template used by the environment tier, click **Details** and select a different resource template.

The list of available resource templates opens.

It shows the list of available resource templates. The default is to show the resource templates for all projects.










If you want to see only the resource templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more resource templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no resource templates in the selected projects.

The template being used is selected.

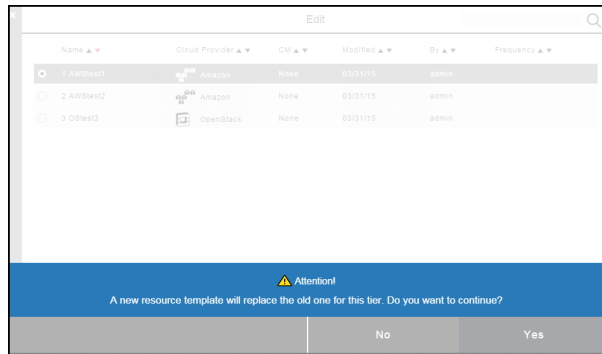
**Example:**

Edit						
 All projects ▼		<input type="text" value="Find Resource"/>				
Name ▲ ▼	Projects ▲ ▼	Cloud Provider ▲ ▼	CM ▲ ▼	Modified ▲ ▼	By ▲ ▼	Used
<input checked="" type="radio"/> 1  rt-aws-chef1	 Default	 Amazon	 Chef	Jan 26, 2016 1...	admin	0x
<input type="radio"/> 2  rt-aws-chef2	 Default	 Amazon	 Chef	Jan 27, 2016 0...	admin	0x

5. Select a different environment template.

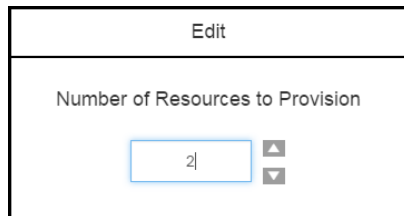
A message appears. Select **Yes** if you want to continue.

### Example:



The Edit dialog box number box opens and shows the number of provisioned dynamic resources.

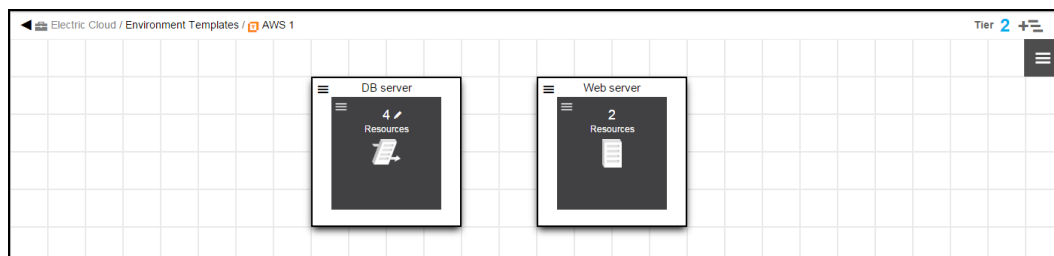
### Example:



6. To change the number of provisioned dynamic resources, enter a new number or use the up/down arrows.
7. Click **OK**.

The Environment Templates Visual Editor now shows the changes that you made.

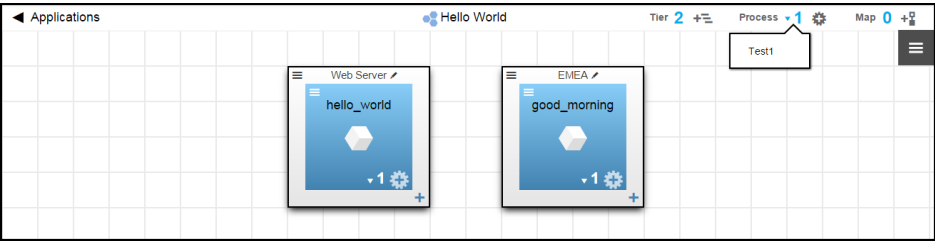
### Example:



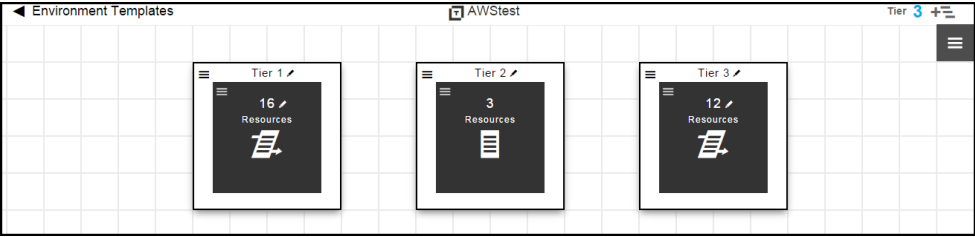
## Deploying Applications With Provisioned Cloud Resources

### About the example in this topic:

The example in this topic consists of an application called "Hello World" application with one application process called *Test1*, which has two steps.



Test1 will be deployed in a dynamic environment called *CloudEnv*. You model the CloudEnv environment using the *AWS*test** environment template.



The *AWS*test** environment template has three tiers:

- Tier 1 and Tier 3 have cloud resources defined in resource templates. These resource can be provisioned when you deploy the application.
- Tier 2 has static resources, which cannot be provisioned.

Starting in the Home page:

1. Go to the Applications List.
  - Starting from the Main menu, click the **Menu** button, and then select **Applications**.
  - Starting from the Home page, click **Applications**.

The Applications List opens.

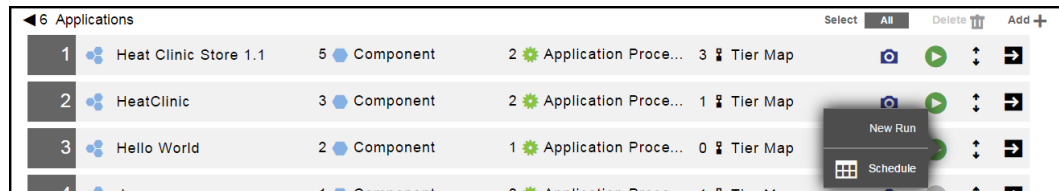
**Example:**

This example uses the "Hello World" application.

6 Applications					Select	All	Delete	Add
1	Heat Clinic Store 1.1	5 Component	2 Application Process	3 Tier Map				
2	HeatClinic	3 Component	2 Application Process	1 Tier Map				
3	Hello World	2 Component	1 Application Process	0 Tier Map				

2. Choose an application, and click the **Run process** button for that application.

### Example:

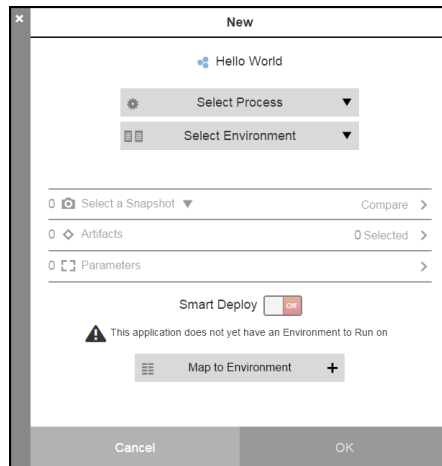


3. Click **New Run**.

The **New** dialog box to deploy the application opens.

See the messages in this dialog box for hints about what you need to do to deploy the application.

### Example:

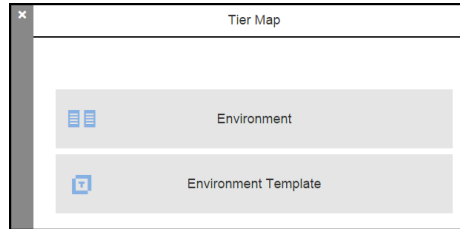


4. Select the application process to deploy.

5. Click **Map to Environment +** to create a tier map for the application.

The **Tier Map** dialog box opens.

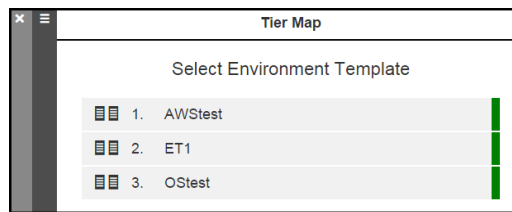
### Example:



6. Select **Environment Template**.

The **Tier Map** dialog box to select an environment tier opens.

### Example:



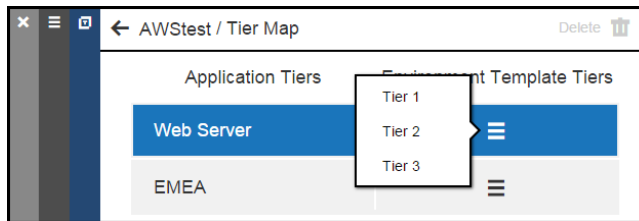
7. Select an environment template.

The <Environment template>/Tier Map dialog box opens.

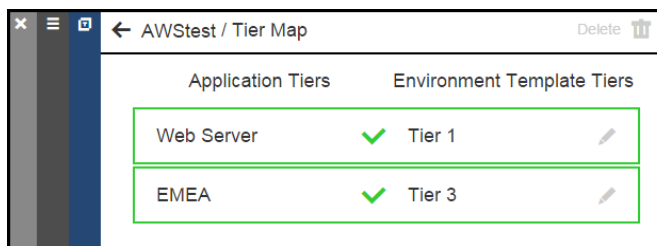


- For each application tier, click the **Menu** button to select an environment tier to which the application tier is mapped.

### Example:



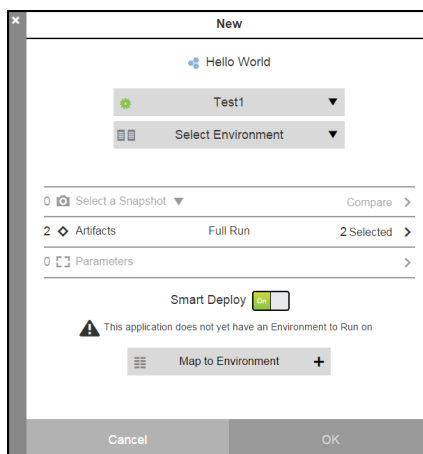
### Example:



- Click **OK**.

The **New** dialog box to deploy the application re-opens.

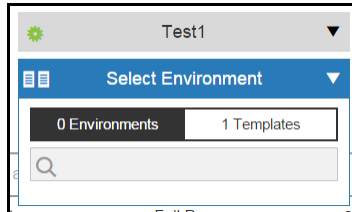
### Example:



10. Click **Select Environment** to select an environment template.

A list of available environments and environment template based on the tier map opens.

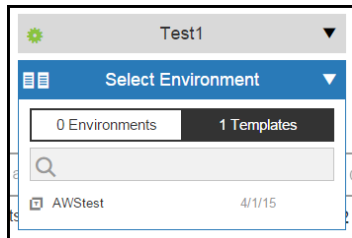
### Example:



11. Select **1 Templates**.

A list of available environment templates appears.

### Example:

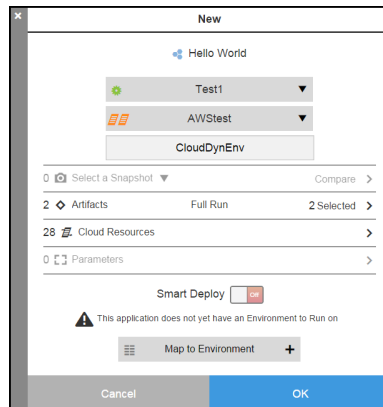


12. Click the environment template that you want to use.

13. Enter a name for the dynamic environment that will be created from the selected environment template.

The **New** dialog box to deploy the application now shows the environment template name below the application process name. It also shows the number of cloud resources provisioned in the environment templates.

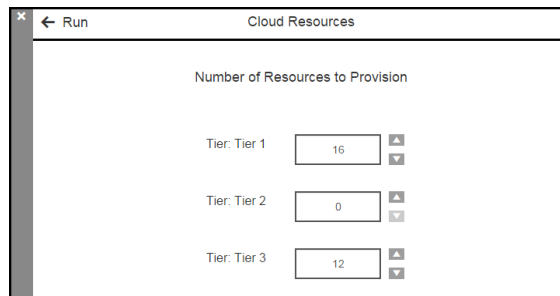
### Example:



14. Click in the **Cloud Resources** row.

The **Cloud Resources** dialog box opens.

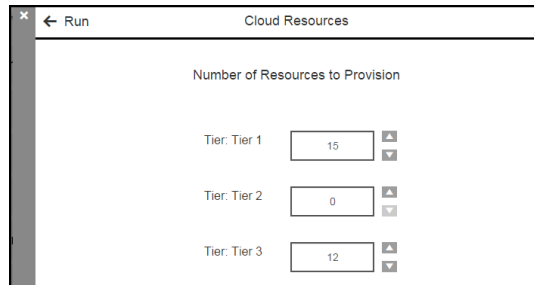
### Example:



15. Change the number of cloud resources to provision

### Example:

In this example, Tier 1 and Tier 3 have one or more resources to provision because they have cloud resources. You cannot provision resources in Tier 2 because it has only static resources.



Number of Resources to Provision	
Tier: Tier 1	15
Tier: Tier 2	0
Tier: Tier 3	12

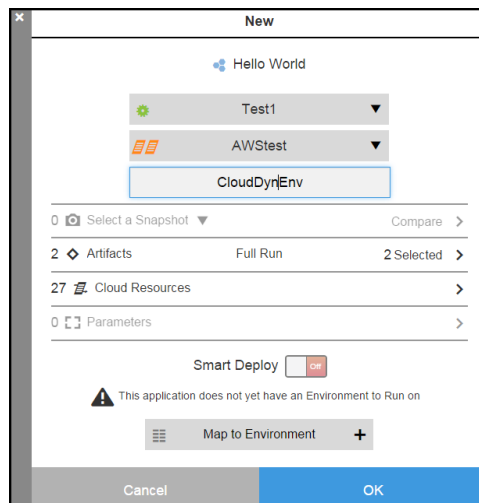
16. Click **OK**.

The **New** dialog box now shows the new number of resources to provision.

The message "This application does not yet have an Environment to Run on" still appears.

When you click **OK**, ElectricFlow first attempts to create the dynamic environment. If this is successful, it deploys the application.

### Example:



Hello World  
 Test1  
 AWStest  
 CloudDynEnv

0 Select a Snapshot Compare  
 2 Artifacts Full Run 2 Selected  
 27 Cloud Resources  
 0 Parameters

Smart Deploy ☐ **OK**  
 ⚠ This application does not yet have an Environment to Run on  
 Map to Environment +

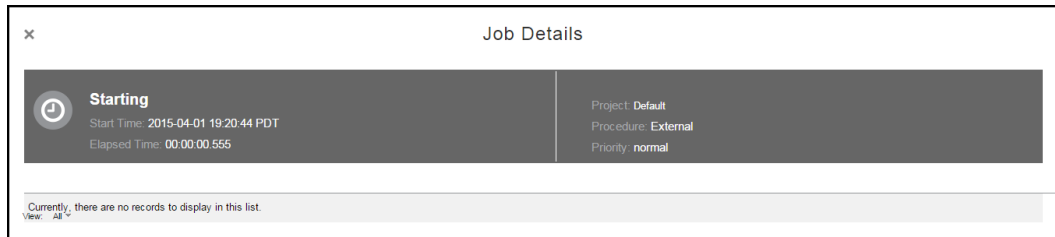
Cancel OK

The Applications List opens.

- To view the job details, click the **View Details** button to open to the Job Details page.

ElectricFlow first runs the job to create the dynamic environment. If this job is successful, it deploys the application.

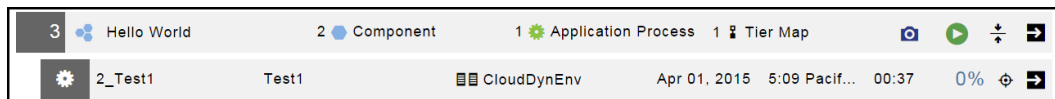
### Example:



You can also see the status of jobs as they progress in the Applications List.

### Example:

This example shows the Application List when the job starts.



If you provision resources that are not available, such as 20 cloud resources in Tier 1 and 3 static resources in Tier 2, the job to create the dynamic environment fails and the application is not deployed.

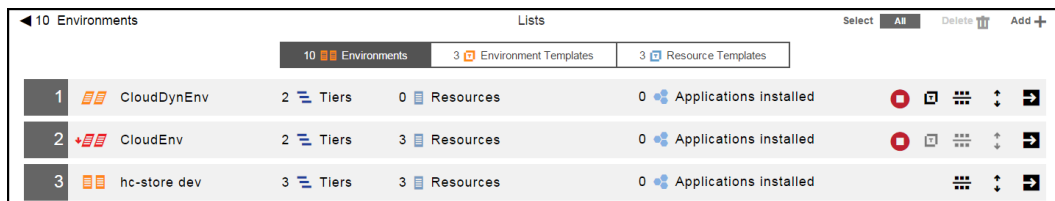
## Retiring Dynamic Environments

After you have deployed your application in a dynamic environment, you can retire it and destroy (decommission) the resources, which makes them unavailable for any future deployments.

Starting in the Environments List:

- Choose a dynamic environment.

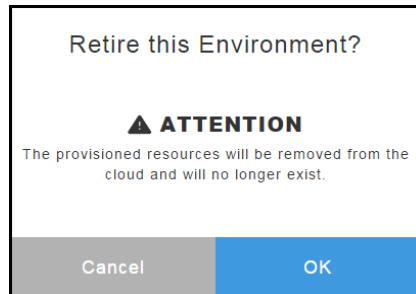
### Example:



2. Click the **Tear down** button for that environment.

A message appears.

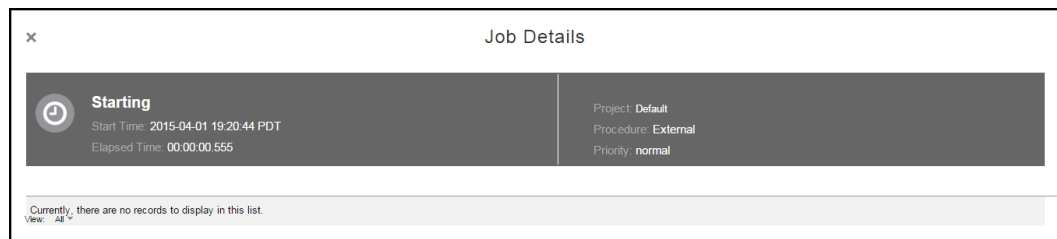
### Example:



3. Click **OK** to verify that you want to retire (decommission) the environment.

The Job Details page opens.

### Example:



4. View the results in the Job Details page.

## Dynamic Environment Example with Amazon and Chef

This example shows what you see in the ElectricFlow UI when your dynamic environment is configured with Amazon as the cloud provider and Chef for the configuration management.

### Resource Templates

In resource templates, you define cloud resources that will be provisioned for dynamic environments. Examples of cloud resources are a HAProxy server, MySQL server, PHP-FPM server, and Resque server.

This is the Resource Template List.

◀ 0 Environments


Lists


Select


All

Delete


Add

8  Environments


0  Environment Templates


4  Resource Templates

1




HAProxy\_Image


0  Pools

 Amazon


Created: 03/31/15

By: admin







2




MySQL\_Image


0  Pools

 Amazon


Created: 03/31/15

By: admin







3




PHP-FPM\_Image


0  Pools

 Amazon


Created: 03/31/15

By: admin







4




Resque\_Image


0  Pools

 Amazon

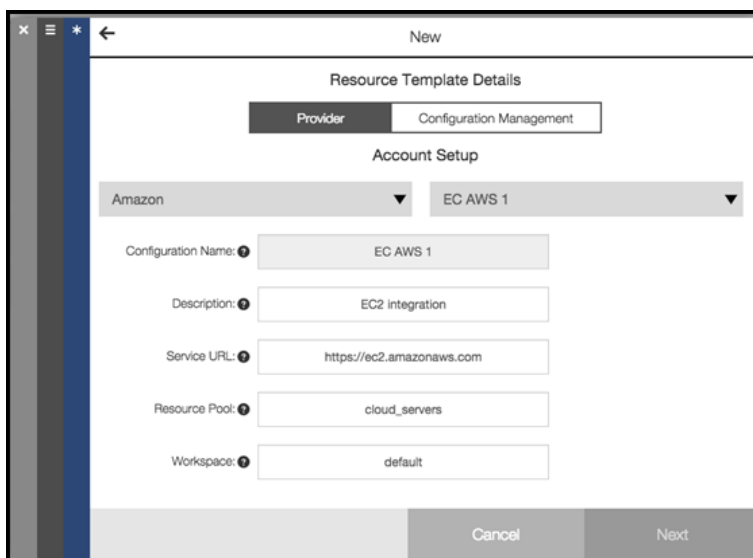
Created: 03/31/15

By: admin





These are the cloud provider settings for a resource template. It is defined by cloud provider account credentials and by an Amazon Machine Image (AMI).



New

Resource Template Details

Provider Configuration Management

Account Setup

Amazon EC AWS 1

Configuration Name: EC AWS 1

Description: EC2 integration

Service URL: https://ec2.amazonaws.com

Resource Pool: cloud\_servers

Workspace: default

Cancel Next

These are the configuration management settings for a resource template. It calls a Chef recipe to configure the cloud resources. You can configure the resources with other recipes or predefined configuration, such as a MySQL stack configuration or a HAProxy load balancer configuration.

The screenshot shows a 'New' dialog box titled 'Resource Template Details'. It has two tabs: 'Provider' and 'Configuration Management'. Under 'Configuration Management', there is an 'Account Setup' section with a 'Chef' dropdown and a 'Select account' dropdown. Below this are three input fields: 'Configuration Name' with the value 'EC-SJ-ChefServer', 'Description' with the value 'Chef configuration', and 'Chef Server URL' with the value 'https://ce.chefserver.internal.com/123'. At the bottom, there is a 'Login as' field and two buttons: 'Cancel' and 'Next'.

Environment Templates

When you create a new environment template, you can add one resource template to an environment tier. These are the resource templates from which you can select.

	Name ▲ ▼	Cloud Provider ▲ ▼	CM ▲ ▼	Modified ▲ ▼	By ▲ ▼	Frequency ▲ ▼
<input type="radio"/>	1 HAProxy_Image	Amazon	None	03/31/15	admin	
<input type="radio"/>	2 MySQL_Image	Amazon	None	03/31/15	admin	
<input checked="" type="radio"/>	3 PHP-FPM_Image	Amazon	None	03/31/15	admin	
<input type="radio"/>	4 Resque_Image	Amazon	None	03/31/15	admin	

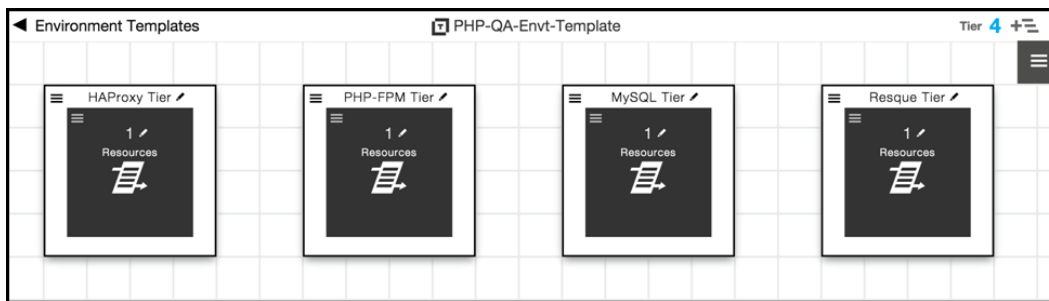
The screenshot shows a 'New' dialog box with a search bar and a list of resource templates. The list has columns for Name, Cloud Provider, CM, Modified, By, and Frequency. The third item, '3 PHP-FPM\_Image', is selected. At the bottom, there are 'Cancel' and 'OK' buttons.

After you select a resource template and click **OK**, you enter the number of resources to provision in an environment tier.



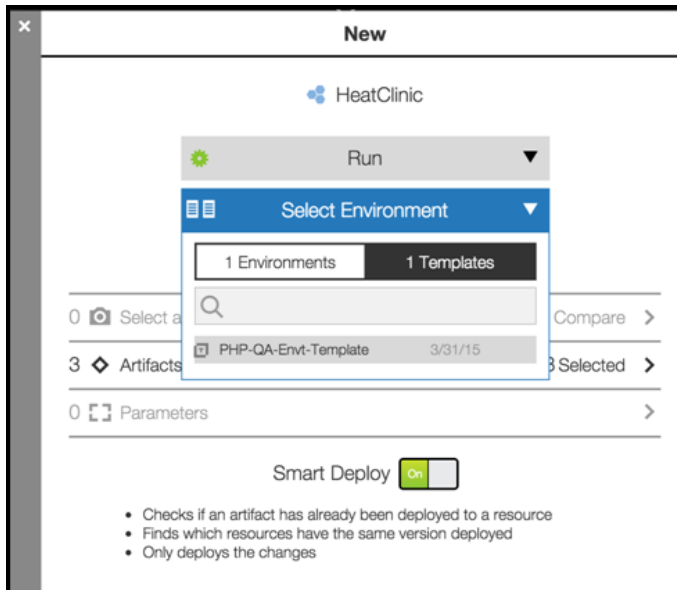


This is an environment template with four tiers. Each tier is configured with a resource template, and resource template has a provisioned resource.



## Deploying Applications to Dynamic Environments

After you select an application to deploy, you select the application process to run and the environment in which to deploy the application.



To deploy the application in a dynamic environment, you can select an environment template. A dynamic environment is created with the provisioned cloud resources. After the resources are provisioned and the dynamic environment is created, the application is deployed.

You can view the status of the provisioning process.

Applications / View Run						admin Running: HeatClinic - Run on 4.1.15-PHP-...		Errors 0	
10_Run_HeatClinic_Default_201503311031...	Mar 31, 2015	10:31 PDT	00:19	0%					
Provisioning - 4.1.15-PHP-QA - HAProx...	Mar 31, 2015	10:31 PDT	00:14	25%					
Provisioning - 4.1.15-PHP-QA - MySQL...	Mar 31, 2015	10:31 PDT	00:14	25%					
Handle Provisioning and Configuring Err...	Mar 31, 2015	10:31 PDT	00:00	0%					

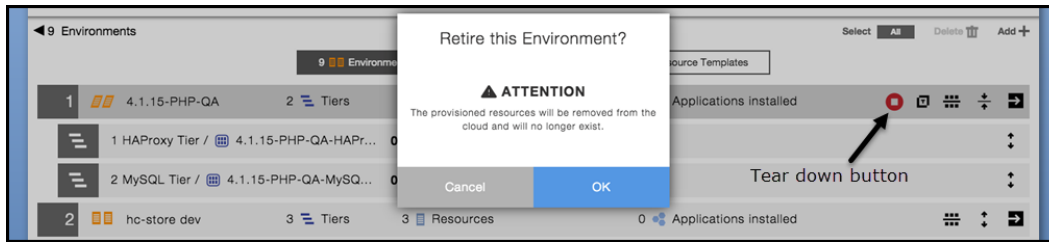
## Retiring Dynamic Environments

After the provisioning process completes, the new dynamic environment appears in the Environments List.

Environments						Lists		Select All Delete Add	
9 Environments	1 Environment Templates	4 Resource Templates							
1 4.1.15-PHP-QA	2 Tiers	0 Resources	0 Applications installed						
1 HAProxy Tier / 4.1.15-PHP-QA-HAPr...	0 Resources								
2 MySQL Tier / 4.1.15-PHP-QA-MySQL...	0 Resources								
2 hc-store dev	3 Tiers	3 Resources	0 Applications installed						

You can retire (decommission) dynamic environments on an on-demand basis to prevent excessive use of cloud resources and reduce costs.

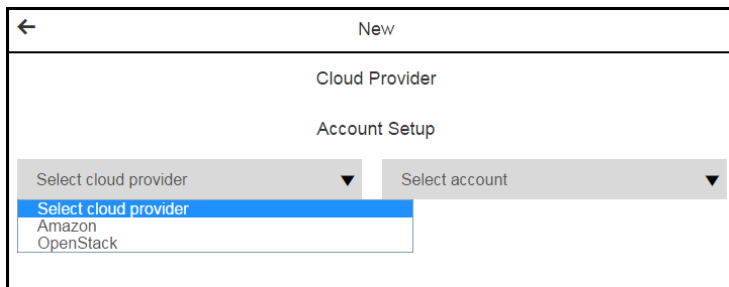
You click the **Tear down** button to retire the selected dynamic environment.



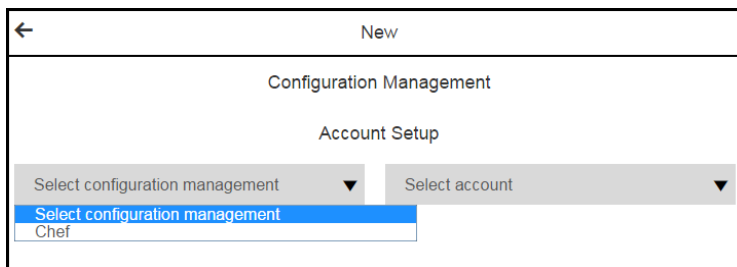
## Developer Task: Creating Custom Plugins

ElectricFlow uses third-party plugins to provision cloud resources in resource templates for Dynamic Environments. Amazon EC2 (EC-EC2) and Openstack (EC-OpenStack) are supported as out-of-the-box cloud provider plugins, and Chef (EC-Chef) is supported as an out-of-the-box configuration management plugin.

To view the supported cloud provider plugins, open the **New Cloud Provider** dialog box and click **Select cloud provider** to view the drop-down menu of cloud providers.



To view the supported configuration management plugins, click **Select configuration management** to view the drop-down menu of configuration management tools.



If you have an existing procedure that you would prefer to use instead of an out-of-the-box third-party plugin to provision cloud resources, you can create a custom plugin based on your deployment scenario.

The process to create custom cloud provider and configuration management plugins uses metadata to loosely couple them to the application you want to deploy. The custom plugins define specific known properties that are automatically recognized by Dynamic Environments.

To create your own plugin for other cloud platforms, go to <https://electric-cloud.github.io/index.html> to get started. This website describes how to create open source plugins and has this information:

- For an introduction to the process of building and developing open source plugins, go to the [Quick Start](#).
- To build and deploy your plugin, go to [Build and Deploy](#).
- For more information, go to [More information](#).
- Go to [Creating Custom Cloud Provider Plugins](#) on page 287 for the details to create custom cloud provider plugins.
- Go to [Creating Custom Configuration Management Plugins](#) on page 292 for the details to create custom configuration management plugins.

## Creating Custom Cloud Provider Plugins

This section applies to developers who want to create custom cloud provider plugins for Dynamic Environments in ElectricFlow.

### How to Create a Custom Cloud Provider Plugin

This procedure assumes that you already have a plugin and want to use it with ElectricFlow. It describes how to define properties in your plugin that ElectricFlow can read.

1. To convert your procedure to a plugin, define the name of the plugin and the ElectricFlow project to which the plugin belongs.

Later in this procedure, you will use these properties to create pre- and post-hooks to the plugin in ElectricFlow.

2. Define the following properties in your plugin under a top-level plugin property called `ec_cloudprovisioning_plugin`, which the system will read to Dynamic Environments.

Property Name	Description
<code>ec_cloudprovisioning_plugin/</code>	Top-level plugin property directory
Properties defined by the custom plugin under <code>ec_cloudprovisioning_plugin</code>	
<code>displayName</code>	<p>Name of the plugin that appears in the <b>New Cloud Provider</b> dialog box.</p> <p>Example: <b>Amazon</b> for the EC-EC2 plugin</p>
<code>hasConfiguration</code>	<p>&lt;Boolean flag —0 1 true false&gt;</p> <ul style="list-style-type: none"> <li>Set this property is set to 0 if the plugin does not have any configuration procedures (<code>CreateConfiguration</code> and <code>DeleteConfiguration</code>).</li> <li>Set this property is set to 1 if the plugin has configuration procedures.</li> </ul>
<code>configurationLocation</code>	<p>Name of the property sheet used by the plugin to store the saved configurations.</p> <p>This value is relative to the plugin's top-level properties.</p> <p>For example, if this value is set as <code>ec2_cfgs</code>, the plugins configurations are read from <code>/plugins/&lt;PLUGIN_KEY&gt;/project/ec2_cfgs</code>.</p>
<code>operations/</code>	Property sheet for the specific operations required by the Dynamic Environment system.
Properties under <code>operations/</code> – These operations are mapped to the plugin operations through the following child properties.	
<code>createConfiguration/</code>	Properties for the procedure that creates the plugin configuration. It is usually called <code>createConfiguration</code> .
<code>deleteConfiguration/</code>	Properties for the procedure that deletes the plugin configuration. It is usually called <code>deleteConfiguration</code> .
<code>provision/</code>	Properties for the procedure that provisions virtual instances.

Property Name	Description
<code>retireResource/</code>	Properties for the procedure that tears down (decommissions) a previously provisioned virtual instance backing the specified resource.
<code>retireResourcePool/</code>	Properties for the procedure that tears down (decommissions) all previously provisioned virtual instances for the specified resource pool.
Properties for the previously listed operations defined in the <code>operations</code> property sheet	
<code>procedureName</code>	Name of the procedure name in the plugin to which the operation is mapped.
<code>ui_formRefs/</code>	Property sheet that references the <code>ui_forms</code> properties defined under the plugin's top-level properties.
<code>parameterRefs/</code>	Property sheet for the input parameters to the procedure that can be used by the Dynamic Environment system.  The parameter list is operation-specific.

Go to [Example: Property Structure for a Cloud Provider Plugin](#) on page 290 for an example of the properties for the EC-EC2 (Amazon) plugin.

3. Save the plugin file in the appropriate location on your ElectricFlow server.
4. To import the plugin file to the automation platform:
  - a. In the automation platform, go to **Administration > Plugins** to open the **Plugin Manager** page.
  - b. Click the **Install from File/URL** tab.
  - c. In the **File Install** field, click **Choose file** to select the plugin file.
  - d. Click **Upload** to install it.  
  
The plugin file appears in the **Currently Installed** tab.
  - e. Find your plugin and click **Promote** in the Actions column to make it available for use by ElectricFlow.
5. In ElectricFlow, to create a resource template:
  - a. Go to [Creating Resource Templates](#) on page 233 for the details.
  - b. In the **Select cloud provider** field, select your plugin as the cloud provider.
  - c. Enter the plugin settings in the form.
  - d. (Optional) Set the configuration management tool.  
  
Go to [Creating Resource Templates](#) on page 233 for the details.

6. In the ectool API, enter the following commands to set pre- and post-hooks linking the plugin to an application that you later deploy in a dynamic environment.

- a. To create a pre-hook, enter

```
ectool createHook postConfigurationHook --hookType POST_CONFIGURATION --
procedureName <hookProcedureName> --procedureProjectName
<hookProjectName> --resourceTemplateName <resourceTemplateName> --
projectName <resourceTemplateProjectName>
```

where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

- b. To create a post-hook, enter

```
ectool createHook preConfigurationHook --hookType PRE_CONFIGURATION --
procedureName <hookProcedureName> --procedureProjectName
<hookProjectName> --resourceTemplateName <resourceTemplateName> --
projectName <resourceTemplateProjectName>
```

where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

7. Create an environment template with the resource template that you created.

### Example: Property Structure for a Cloud Provider Plugin

This is the EC-EC2 (Amazon) plugin property structure.

Property Name	Property Values
ec_cloudprovisioning_plugin/	
displayName	Amazon
hasConfiguration	1
configurationLocation	ec2_cfgs
operations/	createConfiguration/ deleteConfiguration/ provision/ retireResource/ retireResourcePool/
ec_cloudprovisioning_plugin/createConfiguration/	

Property Name	Property Values
procedureName	CreateConfiguration
ui_formRefs/	
ui_formRefs/parameterForm	ui_forms/EC2CreateConfigForm
parameterRefs/	
parameterRefs/ configuration	config
ec_cloudprovisioning_plugin/deleteConfiguration/	
procedureName	DeleteConfiguration
ui_formRefs/	–
parameterRefs/	configuration called config
ec_cloudprovisioning_plugin/provision/	
procedureName	API_RunInstances
ui_formRefs/	parameterForm called ec_parameterForm
parameterRefs/	configuration called config resourcePool called res_poolName count called count
ec_cloudprovisioning_plugin/retireResource/	
procedureName	API_TearDownResource
ui_formRefs/	–
parameterRefs/	resourcePool called res_poolName
ec_cloudprovisioning_plugin/retireResourcePool/	
procedureName	API_TearDownResource
ui_formRefs/	–
parameterRefs/	resourcePool called res_poolName



## Creating Custom Configuration Management Plugins

This section applies to developers who want to create custom configuration management plugins for Dynamic Environments in ElectricFlow.

### How to Create a Custom Configuration Management Plugin

This procedure assumes that you already have a plugin and want to use it with ElectricFlow. It describes how to define properties in your plugin that ElectricFlow can read.

1. To convert your procedure to a plugin, define the name of the plugin and the ElectricFlow project to which the plugin belongs.

Later in this procedure, you will use these properties to create pre- and post-hooks to the plugin in ElectricFlow.

2. Define the following properties in your plugin under a top-level plugin property called `ec_configurationmanagement_plugin`, which the Dynamic Environment system can access.

Name	Description
<code>ec_configurationmanagement_plugin/</code>	Top-level plugin property directory
Properties defined by the custom plugin under <code>ec_configurationmanagement_plugin</code>	
<code>displayName</code>	Name of the plugin that appears in the Dynamic Environment UI  Example: <b>Chef</b> for the EC-Chef plugin
<code>hasConfiguration</code>	<Boolean flag —0 1 true false>  <ul style="list-style-type: none"> <li>When this property is set to 0 or false, the plugin does not have any configuration procedures (<code>CreateConfiguration</code> and <code>DeleteConfiguration</code>).</li> <li>When this property is set to 1 or true, the plugin has configuration procedures.</li> </ul>
<code>configurationLocation</code>	Name of the property sheet used by the plugin to store the saved configurations.  This value is relative to the plugin's top-level properties.  If this value is set as <code>chef_cfgs</code> , the configurations are in <code>/plugins/&lt;PLUGIN_KEY&gt;/project/chef_cfgs</code> .
<code>operations/</code>	Property sheet for the specific operations required by the Dynamic Environment system.
Properties under <code>operations/</code> – These operations are mapped to the plugin operations through the following child properties.	
<code>createConfiguration/</code>	Properties for the procedure that creates the plugin configuration. It is usually called <code>createConfiguration</code> .
<code>deleteConfiguration/</code>	Properties for the procedure that deletes the plugin configuration. It is usually called <code>deleteConfiguration</code> .

Name	Description
<code>converge/</code>	Properties for the procedure that converges the virtual instances to the defined configuration (including policies and roles).
<code>teardown/</code>	Properties for the procedure that deletes the configuration details on the specified dynamic resource or resource pool.  For Chef, properties for the procedure that deletes the Chef API client and Chef node on the specified dynamic resource or resource pool.
Properties for the previously listed operations defined in the <code>operations</code> property sheet	Properties for the previously listed operations defined in the <code>operations</code> property sheet
<code>procedureName</code>	
<code>ui_formRefs/</code>	Property sheet that references the <code>ui_forms</code> properties defined under the plugin's top-level properties.
<code>parameterRefs/</code>	Property sheet for the input parameters to the procedure that can be used by the Dynamic Environment system.  The parameter list is operation-specific.

Go to [Example: Property Structure for a Configuration Management Plugin](#) on page 295 for an example of the properties for the EC-Chef plugin.

3. Save the plugin file in the appropriate location on your ElectricFlow server.
4. To import the plugin file to the automation platform:
  - a. In the automation platform, go to **Administration > Plugins** to open the **Plugin Manager** page.
  - b. Click the **Install from File/URL** tab.
  - c. In the **File Install** field, click **Choose file** to select the plugin file.
  - d. Click **Upload** to install it.  
  
The plugin file appears in the **Currently Installed** tab.
  - e. Find your plugin and click **Promote** in the Actions column to make it available for use by ElectricFlow.

5. In ElectricFlow, to create a resource template:
  - a. Go to [Creating Resource Templates](#) on page 233 for the details.
  - b. In the **Select cloud provider** field, select a cloud provider.
  - c. Enter the account settings for the selected cloud provider.
  - d. Enter the **provision parameters** on the next page.
  - e. In the **Select configuration management** field, select your plugin as the configuration management tool.

Go to [Creating Resource Templates](#) on page 233 for the details.

6. In the ectool API, enter the following commands to set pre- and post-hooks linking the plugin to an application that you later deploy in a dynamic environment.
  - a. To create a pre-hook, enter

```
ectool createHook postConfigurationHook --hookType POST_CONFIGURATION --
procedureName <hookProcedureName> --procedureProjectName
<hookProjectName> --resourceTemplateName <resourceTemplateName> --
projectName <resourceTemplateProjectName>
```

where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

- b. To create a post-hook, enter

```
ectool createHook preConfigurationHook --hookType PRE_CONFIGURATION --
procedureName <hookProcedureName> --procedureProjectName
<hookProjectName> --resourceTemplateName <resourceTemplateName> --
projectName <resourceTemplateProjectName>
```

where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

7. Create an environment template with the resource template you created.

### Example: Property Structure for a Configuration Management Plugin

This is the EC-Chef plugin property structure.

Name	Values
ec_configurationmanagement_plugin/	
displayName	Chef
hasConfiguration	1

Name	Values
configurationLocation	chef_cfgs
operations/	createConfiguration/ deleteConfiguration/ converge/ teardown/
ec_configurationmanagement_plugin/createConfiguration/	
procedureName	CreateConfiguration
ui_formRefs/	parameterForm called forms/CreateConfigForm
parameterRefs/	configuration called config
ec_configurationmanagement_plugin/deleteConfiguration/	
procedureName	DeleteConfiguration
ui_formRefs/	–
parameterRefs/	configuration called config
ec_configurationmanagement_plugin/converge/	
procedureName	_RegisterAndConvergeNode
ui_formRefs/	parameterForm called ec_parameterForm
parameterRefs/	configuration called config
ec_cloudprovisioning_plugin/teardown/	
procedureName	_DeleteNode
ui_formRefs/	–
parameterRefs/	resourceName called resource_name

## Inventory Tracking

Electric Flow uses Inventory Tracking to track what is built, tested, and deployed by the application, including artifacts, artifact versions, resources on which the applications are run, and environments to which the

resources are assigned. If there is an issue when an application is deployed you can find the details about what was deployed.

- Use the Environment Inventory to track and view details of the objects that were deployed and artifacts in the application. It shows the status of the application deployment at a point in time. Go to [Examples: Modeling and Deploying Applications](#) on page 148 and [Environment Inventory](#) on page 297 for more information.
- Use the Application Inventory (on the Applications Run View page) to track and view the deployment results. It shows more details about the application at a point in time. Go to the Applications Run View page in the GUI to see these details. Go to [Example: Modeling and Deploying Applications](#) for an example.

## Tracking at the Component Process Level

Inventory Tracking occurs at the component process level.

When defining a component process, you select one of these process types:

- **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks artifacts deployed to environments. This is the default.
- **Undeploy**—After the first successful job step in a component process with this setting, the automation platform removes the environment inventory record.
- **Other**—Disables Inventory Tracking.

## Environment Inventory


The Environment Inventory is the state of the environment at a point in time.

- When an application is running, you can see its progress as it runs.
- After an application runs, you can see the details for the objects in application.

This example shows the Environment Inventory for the *heatclinic-qe* environment to which the HeatClinic application is deployed. The application has two application processes called Run and Stop.

In the Environments List, choose an environment and click the **Inventory** button to open the Environment Inventory.



Clicking  in the row for an object in the Environment Inventory displays more details about that object, such as:

- Environment name
- Application mapped to this environment
- Number of deployed artifacts in the application
- When the artifacts were deployed
- Status of the deployment: success or failure



1. Go to the heatclinic-qe row, and click to open the Environment Inventory.

◀ 10 Environments					Lists			Select	All	Delete	Add
10 Environments					0 Environment Templates			0 Resource Templates			
1	PROD	1 Tiers	1 Resources	0 Applications installed							
2	QA	1 Tiers	1 Resources	0 Applications installed							
3	hc-store dev	3 Tiers	3 Resources	0 Applications installed							
4	heatclinic-dsl	2 Tiers	2 Resources	0 Applications installed							
5	heatclinic-qe	2 Tiers	2 Resources	1 Applications installed							

This is the Environment Inventory.

◀ Environments / Inventory					heatclinic-qe						
1	HeatClinic	3 Artifacts	1								



2. Click to view the list of components in the Run process of the HeatClinic application.

◀ Environments / Inventory					heatclinic-qe						
1	HeatClinic	3 Artifacts	1								
	Heatclinic	mycompany.war	1	App Server	4 hours ago	1/1					
	Config	env.sh	1	App Server	4 hours ago						
	Cleanup DB	cleanup.sql	1	DB	4 hours ago						

- Click the **Process** button in any of the component rows to view the Run application process runs in the heatclinic-qe environment.

The results of running the Run application process, application process steps, and component process steps now appear in the inventory. An application process step can be based on a component (defined by component processes), a plugin, a command, or a procedure.

The Run application process consists of four process steps: Check, deploy war, cleanup db, and start server.

- The Check step is defined by a command.
- The remaining steps are defined by components in the HeatClinic application.

Object	Status	Date	Time	Duration	Progress
1	Error	Aug 21, 2015	7:00 Pacif...	07:16	100%
2	Success	Aug 21, 2015	7:00 Pacif...	00:32	100%
3	Error	Aug 21, 2015	7:00 Pacif...	01:31	100%
4	Success	Aug 21, 2015	7:00 Pacif...	00:57	100%
5	Error	Aug 21, 2015	7:00 Pacif...	00:28	100%
6	Success	Aug 21, 2015	7:00 Pacif...	01:21	100%
7	Success	Aug 21, 2015	7:00 Pacif...	01:06	100%
8	Success	Aug 21, 2015	7:00 Pacif...	00:08	100%
9	Success	Aug 21, 2015	7:00 Pacif...	03:43	100%
10	Success	Aug 21, 2015	7:03 Pacif...	00:03	100%
11	Success	Aug 21, 2015	7:03 Pacif...	03:40	100%

	Object
1	Application process
2	Application process step defined by a command
3	Application process step defined by a component
4	Component process step

- To open the Job Details page for an application process, an application process step, or component process step, do one of the following:
  - Click the object name to open the Job Details page for that object.
  - Click the **View details** button at the end of the row.





5. For a process step, click to view the results of deploying process steps.

Applications / View Run									
HeatClinic - Run launched by on heatclinic-qe									
Errors 1									
86_Run_HeatClinic_Def...	Error	Aug 21, 2015	7:00 Pacif...	07:16	100%				
Check	Success	Aug 21, 2015	7:00 Pacif...	00:32	100%				
heatclinic-res 1	Success	Aug 21, 2015	7:00 Pacif...	00:32	100%				
deploy war	Error	Aug 21, 2015	7:00 Pacif...	01:31	100%				
Retrieve	Success	Aug 21, 2015	7:00 Pacif...	00:57	100%				
heatclinic-res 2	Success	Aug 21, 2015	7:00 Pacif...	00:57	100%				
Put to webapps	Error	Aug 21, 2015	7:00 Pacif...	00:28	100%				
heatclinic-res	Error	Aug 21, 2015	7:02 Pacif...	00:28	100%				
cleanup db	Success	Aug 21, 2015	7:00 Pacif...	01:21	100%				
Retrieve	Success	Aug 21, 2015	7:00 Pacif...	01:06	100%				
heatclinic-res 2	Success	Aug 21, 2015	7:00 Pacif...	01:06	100%				
drop and create	Success	Aug 21, 2015	7:00 Pacif...	00:08	100%				
heatclinic-res 2	Success	Aug 21, 2015	7:02 Pacif...	00:08	100%				

	Object
1	Click here to view the results of running the application process step in the Job Details page.
2	Click here to view the results of running the component process step in the Job Details page.

## Snapshots

In a software release process, the goal is to have a consistent deployment process that can be run often throughout the release life cycle. When the deployments are run in production, there are no unexpected results. Snapshots are used to implement these deployments.

A snapshot captures both the component versions and the process that were used for deployments. These snapshots make the deployments repeatable and stable.

ElectricFlow supports these types of snapshots:

- Environment snapshot: An environment snapshot is created from an environment where the application is deployed and tested. A snapshot will capture the exact artifact versions, process versions, configuration parameters, and so on used for the deployment to ensure repeatability. This is considered the reliable version of a snapshot for reliability and repeatability.

- **Application snapshot**—An application snapshot is created directly from the application model and does not depend on any environment deployment. When a snapshot is captured from the application model, it locks the application architecture, components, and process versions. If you specify the “Latest” artifact version as part of the component definition in the snapshot, the latest artifact versions will be used every time it is used for deployment. The main purpose of an application-based snapshot is to allow the creation of user-defined versions of the models. The application snapshot name can be used to indicate a specific user-defined version.

For example, in a software delivery process, the developer checks in code, the components are built automatically by a continuous integration system, and the objects in the resulting build are published to a binary artifact management system. When the full complement of component artifacts is available, a release candidate pipeline is initiated. The first stage is to deploy to a development environment. From this deployment, a snapshot is created and used as the model for subsequent deployments to other environments. There will be some differences between the development, QA and production environments, such as database connection strings, credentials, and debug-vs-production artifacts. ElectricFlow can manage these differences in the application model using parameters and properties in templates, only modifying the deployment process flow in a controlled manner.

The process described in the example avoids some of the pitfalls encountered in traditional release scenarios. For example, configuration teams often perform their own builds. This means that the binaries supplied by the CM team may be different than what has already been tested. Release teams may also manually edit configuration files to adjust for differences in the deployment environments. Both of these practices are prone to error and can negatively impact the quality of the final software release.

In ElectricFlow, you can deploy snapshots for more reliable and repeatable software releases. Here are some of the use cases snapshots can serve:

- You can model and save a version of your software release with specific artifact versions and rerun it later, even if the latest release version of it has changed.
- If you save snapshots during development and test phases, you can ensure that the components that were deployed and tested are the same as those in the release candidate. You can redeploy the snapshot any time.
- You can create and save more than one snapshot for different deployment scenarios.
- You can use an application snapshot to capture a version of the model. This can be used to define a future or desired state of the application model as well.
- You can view the snapshots in the Snapshot List. From this list, you can manage all your snapshots, compare two snapshots, or get more information about them.
- Comparing snapshots helps you to deploy releases with reliable and repeatable results during ongoing software release cycles. You can build and test releases using snapshots, and do not have to design new applications for each release. Comparing snapshots also allows you to compare a future or desired state of the application model to any saved version of the model. Go to [Comparing Snapshots](#) on page 305 and [Comparing Results](#) on page 306 for more information.
- You can use snapshots to refine and optimize applications that fit your deployment scenario and ensure that this version is properly developed, tested, and released.

## Example: Creating, Deploying, and Comparing Snapshots

This example shows how to create application and environment snapshots, deploying snapshots, and comparing them during the software release life cycle.

### *Creating Application Snapshots*



1. In the Applications List, choose an application and click the button.
2. Select **Snapshot List**.

The Snapshot List appears.

3. To add a new snapshot, click **There are no Snapshots. Add one +**.

The New Snapshot dialog box appears.

4. Enter the name for the snapshot that must be unique within the application and enter an optional description of it.

This name can be used to indicate the user defined version of the model. For example, in the figure below, see *HeatClinic v1.2*.

Application snapshots can be used for various purposes like creating a baseline version of the model or even for modeling a future state or desired state of the model.

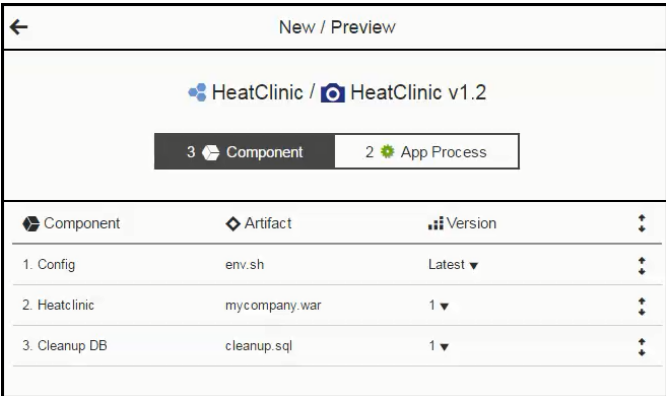
5. Click **Next**.

6. The New/Preview dialog box opens.

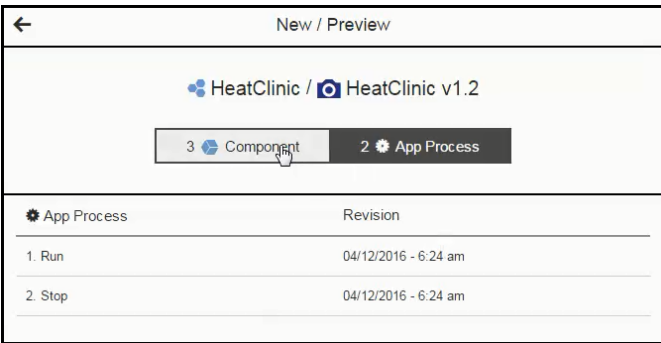
You can toggle between the **Component** and **App Process** views to see the components and application processes for the selected application.

Example:

In the **Component** view, change the version of the Config component to **Latest**.



This is the **App Process** view.



7. Click **OK**.

A message appears stating that the snapshot has been created, and the snapshot list is updated:



## Deploying Application Snapshots



1. In the Applications List, choose an application and click the button (the **Run process** button).
2. Select **New Run**.

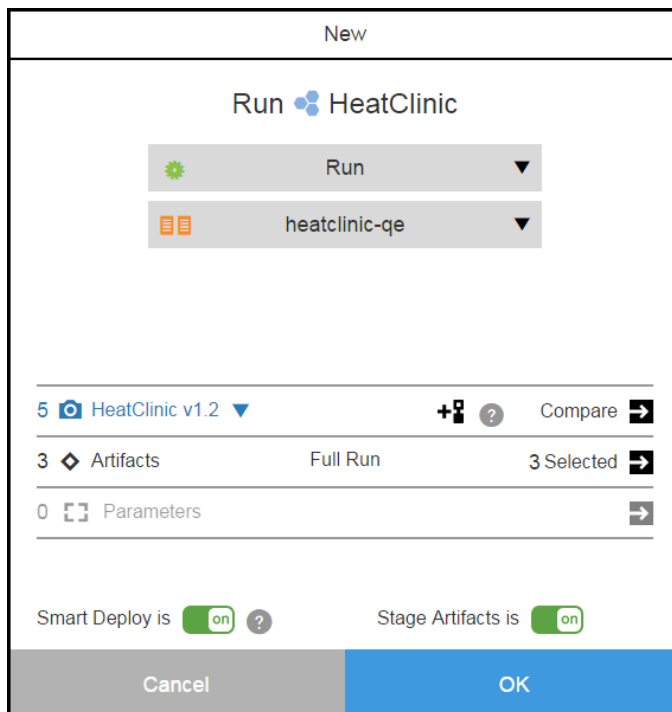
The dialog box to select the settings for the application run opens.

3. Select these settings for the application run:

In the **Select Process** field, select **Run**.

In the **Select Environment** field, select **heatclinic-qe**.

In the **Select a Snapshot** field, select **HeatClinic v1.2**.



**Note:** Clicking next to **Compare** shows the comparison of the selected snapshot to last deployment of the **Run** process in the **heatclinic-qe** environment.

4. To deploy the snapshot, click **OK**.

Creating Environment Snapshots



1. In the Environments List, choose an environment and click the button.

5 Environments		Find...	All projects		Select All	Delete	Add
5 Environments		0 Environment Templates		0 Resource Templates			
1	PROD	Default	1	1	0		
2	QA	Default	1	1	0		
3	heatclinic-dsl	Default	2	2	0		
4	heatclinic-qe	Default	3	2	1		

2. Click the **Inventory** button to open the Environment Inventory.

Example:



3. Choose an application, and click the button.
4. Click **New Snapshot**.

The New Snapshot dialog box opens.

5. Enter the name and a description of the snapshot.
- The name of this environment snapshot is *Heatclinic\_QE2*.

6. Click **Next**.

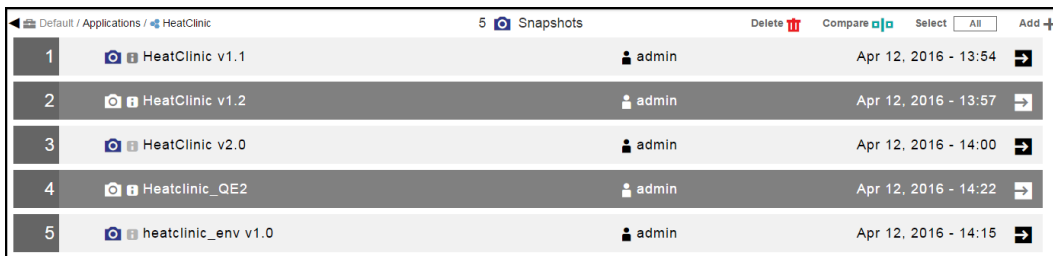
The New/Preview dialog box opens. You can view the snapshot settings in the Component and App Process tabs but cannot change them because the application has been deployed to the heatclinic-qe environment.

7. Click **OK**.

Comparing Snapshots


This example shows how to compare an application snapshot to an environment snapshot..

1. In the Snapshot List, select two snapshots that you want to compare.



ID	Name	User	Time
1	HeatClinic v1.1	admin	Apr 12, 2016 - 13:54
2	HeatClinic v1.2	admin	Apr 12, 2016 - 13:57
3	HeatClinic v2.0	admin	Apr 12, 2016 - 14:00
4	Heatclinic_QE2	admin	Apr 12, 2016 - 14:22
5	heatclinic_env v1.0	admin	Apr 12, 2016 - 14:15



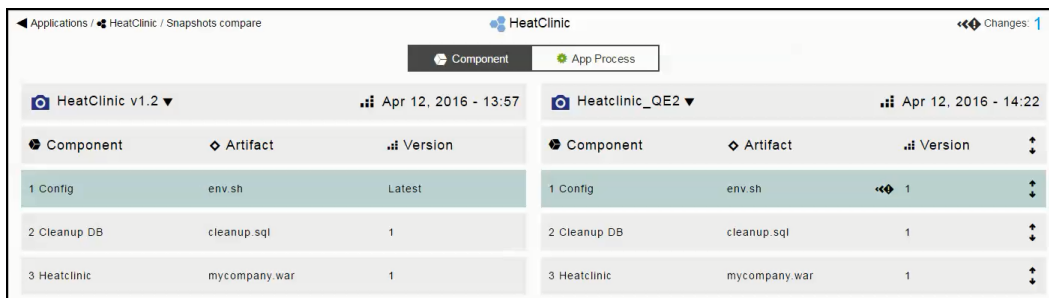
2. Click the  button (**Compare** button).

The Snapshot Comparison page opens.

### Comparing Results

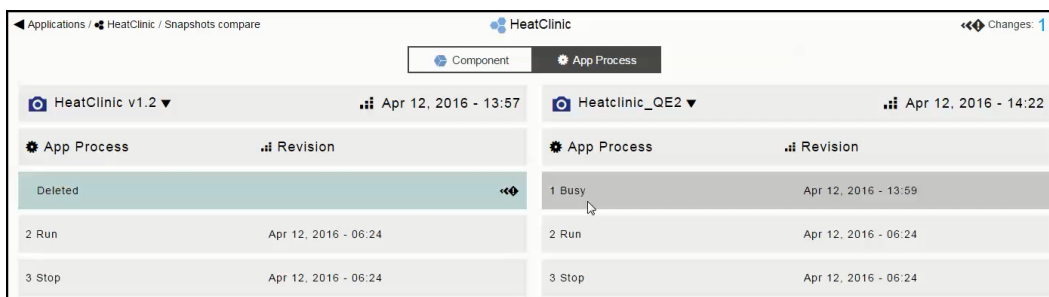
In the Snapshot Comparison page, the Component and App Process views show the differences between the snapshots, Heatclinic v1.2 (the application snapshot) and Heatclinic\_QE2 (the environment snapshot). Heatclinic\_QE2 is the more reliable, repeatable, and update-to-date version of the application.

The **Component** view shows that the Config component is different. Heatclinic v1.2 uses the "Latest" version of the artifact that may not be the same as the artifact version in Heatclinic\_QE2, the more reliable and repeatable version of the snapshots.



HeatClinic v1.2 ▼			Heatclinic_QE2 ▼		
Component	Artifact	Version	Component	Artifact	Version
1 Config	env.sh	Latest	1 Config	env.sh	1
2 Cleanup DB	cleanup.sql	1	2 Cleanup DB	cleanup.sql	1
3 Heatclinic	mycompany.war	1	3 Heatclinic	mycompany.war	1

The **App Process** shows one difference. Heatclinic v1.2 has one less application process than Heatclinic\_QE2.



HeatClinic v1.2 ▼		Heatclinic_QE2 ▼	
App Process	Revision	App Process	Revision
Deleted		1 Busy	Apr 12, 2016 - 13:59
2 Run	Apr 12, 2016 - 06:24	2 Run	Apr 12, 2016 - 06:24
3 Stop	Apr 12, 2016 - 06:24	3 Stop	Apr 12, 2016 - 06:24

**Note:** Clicking the pull-down button next to the snapshot name allows you to select a different snapshot.



## Chapter 1: Pipelines

A pipeline is a representation of your software delivery process on its journey to production, enabling Application Release Automation (ARA) and Continuous Delivery (CD). It takes the software through the hops and milestones (stages) of the software release life cycle, however you define it. You can model and execute one or more applications, procedures, or workflows in a pipeline.

Pipelines are a way to orchestrate the flow of the software release process. You can choose what part of the process in the pipeline to automate, based on your needs. Some examples are:

- From code check-in to production: After developers check in code, it is run through a pipeline that includes build, test, pre-production, and production stages, running various automation tasks in each of the stages like deploying the applications, running test automation suites, and so on, ending when the software is delivered to the production server.
- From system test to production: After the software passes the system tests, it is run through a pipeline to integrate the code from multiple teams, run user acceptance tests, and deploy the software to for beta testing and then all the way to the production.

Starting in ElectricFlow 6.2, multiple project support has been extended to ElectricFlow objects in application deployments, pipelines, and Releases. These objects as well as the objects belonging to them can be in any project within ElectricFlow. (In releases earlier than ElectricFlow 6.2, these objects were limited to the Default project.)

All objects in ElectricFlow have these capabilities for better management and maintenance of end-to-end software releases:

- Projects are top-level security containers that provide access control at the project level. All objects in a project inherit the access control settings from the project to which they belong.
- Projects are also ways to provide logical groupings of objects. If your deployment is large and has many production environments, you can organize production environments by project, with each project having its own access control settings. This makes it easier to manage and maintain multiple environments during the software delivery process.

In this section, you will learn:

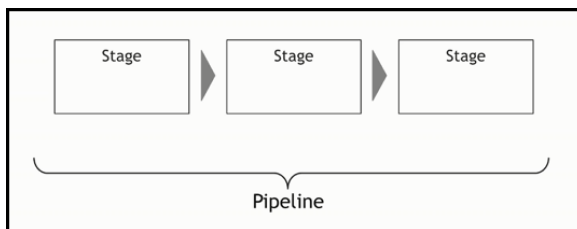
- About pipeline models—See [Pipeline Concepts](#) on page 309.
- How to author and run a pipeline—See [Example: Authoring and Running Pipelines](#) on page 347.
- About pipeline stage summaries—See [Pipeline Stage Summary](#) on page 323.

**IMPORTANT:** When you export a project while a pipeline is in progress, only the full export includes flow runtimes that have been completed. If you want to include in-progress pipeline runs in the path-to-production

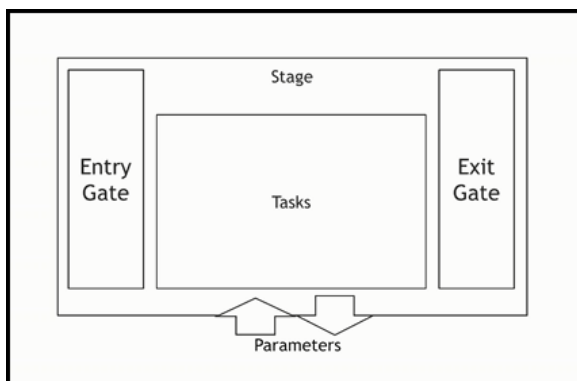
view and the visual indicators showing their percentage completed in the Release dashboard, set the `excludeJobs` argument to 0 or false in the `export` command. When the XML file is imported, the in-progress pipeline runs in the imported project are displayed in the path-to-production view and the Release dashboard. The jobs might be incomplete once the XML is imported.

## Pipeline Concepts

A pipeline allows you to model the complete software delivery process. You can create multiple milestones, referred as to *stages*, in a pipeline. Examples of stages are development (Dev), QA, user acceptance test (UAT), preproduction, production, and so on. Most of the time, these stages will map closely to the environments where applications will be deployed, but do not have to be.



Each stage consists of an entry gate, an exit gate, and the automation tasks to complete the stage.



- An entry gate controls the approvals required before a pipeline can enter a stage. The entry gate ensures all the checks and balances are met before tasks in that stage can begin.
- The exit gate allows you to control when a pipeline can exit a stage and what approvals are needed.
- The tasks allow you to execute the automation logic. This is where you specify what to do.

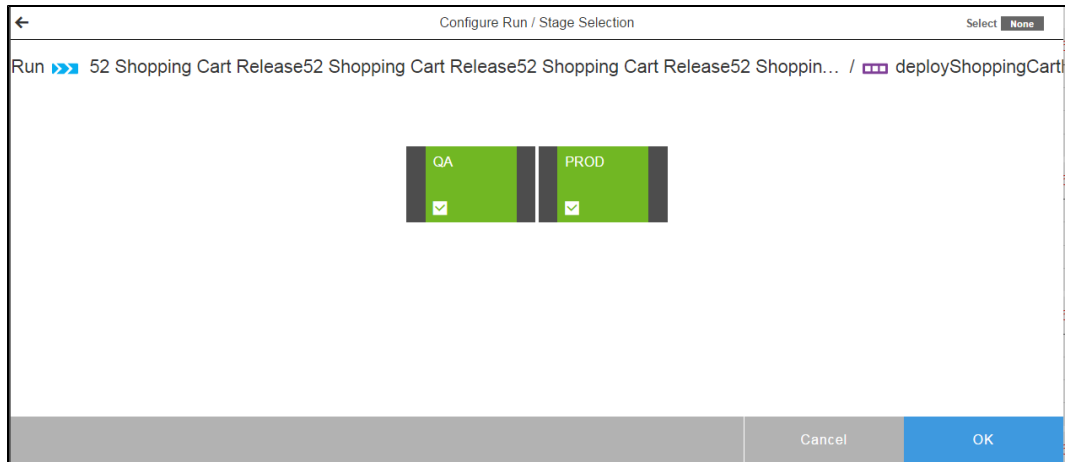
For example, if your stage is a test stage, it contains the tasks that must be executed to ensure that the test automation for your software delivery process is successfully completed.

- Parameters can be created for various objects and automation tasks in the stage. This makes the pipeline reusable, allowing orchestration of the inputs and outputs for the stage and of the properties passed between stages.

- **Run if** and **Wait until** conditions can be set on pipeline objects. Go to [Pipeline "Run if" and "Wait until" Conditions](#) on page 315 for more information.

## Pipeline Start and End Stages and Stage Skipping

You can choose start and end stages in a pipeline. You can also skip pipeline stages. Following are specific examples of how you can use this feature.



### Running or Re-Running a Stage Independently

In traditional release styles, when a deployment to a release stage fails, release management or operations often must fix the issue (such as with the code or environment) and start again from the failed stage to avoid running earlier stages unnecessarily. For example, if stage 2 requires hours of testing, but stage 3 fails because a required server went offline. This functionality lets them determine if the error requires an entire pipeline rerun. Other examples are as follows:

- You can rerun a stage independently to redeploy a stage to update to a newer application release candidate that came out since the last stage run (successfully or not).
- Release management or operations running a release stage can to rerun a failed stage to recover from stage errors (such as a bad process step, failed server, or unavailable resource) that do not affect the final output, so that they can fix the problem and move forward without potentially rerunning potentially expensive stages that do not require a rerun.
- A release stage owner participating in a release with traditional characteristics can rerun the stage that they own with a different application version, because they received an update from the application team that needs testing in the release stage owner's environments.

### Selecting a Subset of Pipeline Stages to Run

This functionality lets you start a pipeline and run stages only to a certain point or from a certain point without it being considered failed or left running and requiring an abort. For example:

- Beginning to middle—Consider a release pipeline that starts with continuous output of release candidates from the development team. In the first two weeks of a release, they continuously deploy different development outputs and test them in the first few stages of the pipeline, but they want it to stop

and be considered a success after the test stage. Once the results are satisfactory, they change the target state to "production" and rerun all stages.

- Middle to end—You can recover from a stage failure by fixing the problem and then rerun the fixed stage to continue to production from the failure point. You can also start after the stage that you fixed manually (such as when a failed manual step to update the documentation was fixed).

### ***Running Multiple Pipeline Stages at Once***

This feature allows stages to run at the same time. With traditional releases, separate teams working on a release will work on their stages at the same time (and often in parallel), but their work still must be tracked and aggregated into the final release status. For example, if stage 4 is production, the operations department can start a time-consuming database backup before stage 3 (UAT) even begins. Other examples are as follows:

- The integration stage is being run to deploy and test the latest work from the developers, who might not test it. At the same time, the test stage is already running functional testing on the previous release candidates.
- The testing stage runs performance tests at the same time that the UAT stage is running user acceptance tests. The release manager examines the outcome of both before approving to move further down the pipeline.

## **Pipeline Scheduling**

You can create schedules for pipeline runs. You can set a start date and can also make a run recurring (for example, daily or weekly).

## **Pipeline Tasks**

Each task can specify automation logic defined by an application process, procedure, or workflow. You can also call integrations to third-party tools using plugins, or you can specify manual tasks performed by one or more users.

### ***Types of Tasks***

- Application process: Use this to deploy applications at the right time in a pipeline.

When artifact staging is enabled for an application, ElectricFlow tries to retrieve artifacts that will be deployed before the application run starts. This ensures that the artifacts are downloaded and available on the target (either the artifact cache (the default) or a directory specified in the component definition). This minimizes the time to retrieve artifacts and reduces downtime during the application deployment. For details about artifact staging, see [Artifact Staging](#) on page 120

For an example of how to deploy applications, go to [Examples: Modeling and Deploying Applications](#) on page 148.

- Procedure: Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level. Examples are scripts, command sets, or other automation logic objects. For details, see [Pipeline Task Definitions in the UI](#) on page 320.
- Manual task: Use this when a task should be performed manually. The appropriate notifications are sent to the user or group who performs that task and to the user or group who responds when the task is completed. For more information about completing a manual task and restarting its pipeline, see [Example: Visibility in a Release Pipeline from the Release Dashboard](#) on page 413.

- **Workflow:** Use this to run a set of procedures in CI life cycles at the platform level. A workflow can combine all procedures for a build-test-deploy life cycle. For details, see [Workflow Overview](#) on page 1213

After the workflow is completed, it returns the workflow state to the pipeline as `ERROR` or `SUCCESS`:

- **ERROR:** This means that the `ERROR_LOG` has entries, `/myWorkflow/outcome` or `/myWorkflow/result` is `error`, the workflow ended in a state that includes *Error* or *Fail* in its name, or it has any failed jobs.
- **SUCCESS:** `/myWorkflow/outcome` or `/myWorkflow/result` exist and are not equal to `error`.
- **Plugin:** Use this to run third-party procedures that interface with external systems. Plugin tasks let you integrate and orchestrate third-party tools. For example, you can run Selenium automation at the right time by using the Selenium plugin. For details about plugin tasks, see [Plugin Pipeline Tasks](#) on page 343.
- **Utility:** Use this to run a utility function, which is a higher-order operation than a third-party plugin, as a stage task. You can also define an application or component process step as a utility function. For information about defining an application process step or a component process step as a utility function, see [Examples: Modeling and Deploying Applications](#) on page 148 or [Examples: Modeling and Deploying Applications](#) on page 148.
- **Deployer:** This is a special type of task used when you want to deploy applications in a release but will provide the details in the release definition. When using deployer tasks, the system automatically knows the applications to deploy, which are provided as part of a release definition instead of separate deploy tasks for each application. For details, see [Release Management](#) on page 405.

## Task Skipping

You can skip specific tasks at runtime by using the **Enabled** check box for those tasks in a task list. This check box is checked by default.

## Parallel or Serial Tasks

All tasks including manual tasks can be run in serial, in parallel, or in a combination of both. By default, tasks in a pipeline stage or within a deployer task run serially in the order in which they were defined. In complex application processes with numerous pre- and post-deployment tasks, sometimes tasks without dependencies should be run in parallel to reduce runtimes.

Parallelizing tasks shortens the time to complete a stage or deployment. In a short deployment window to complete large numbers of deployments, this feature can dramatically impact how many deployments can be completed in that window. For example, in a stage with two manual tasks, each of which requires a separate user to perform actions that do not depend on the other user, these tasks can run at the same time. For a release with 80 applications, in which each application has two manual tasks to prompt users, and each user response takes 15 minutes, the total wait time for these tasks is 40 hours with serial tasks and 20 hours with parallel tasks.

For information about creating parallel tasks, see [Running Pipeline Tasks in Parallel](#) on page 362

## Multiple Deployers

Using more than one Deployer in a pipeline stage lets you deploy applications in parallel rather than in series. This lets you control Deployer behavior depending on the applications to be deployed and is useful for complex

releases in which you must coordinate the release of applications. Multiple Deployers give you the flexibility to run other types of tasks between deployments, such as infrastructure configuration.

Following are a few examples of how Deployers are used:

- A release has 10 applications. The first 4 are infrastructure applications (RPMs) that must run. After deployment of these 4 applications, a test is run to confirm successful infrastructure deployment. The remaining 6 applications can then be deployed.
- A release has 10 applications. Applications 1-5 can run in parallel, and applications 6-10 can run in parallel, but 6-10 have a dependency that 1-5 must be installed first. The applications can be broken into two Deployers that run serially, and the application deployments within them running in parallel.

### **Error Handling in Tasks and Parallel Task Groups**

When defining a task or a group of parallel tasks, you must specify whether the pipeline continues or stops if the task or parallel task group fails because of an error. To do so, you must select either **Continue running** or **Stop running** under the **On Error** field.

- **Continue running:** If the task fails, the pipeline continues to the next gate or stage task.
- **Stop running:** If the task fails, the pipeline aborts. This is the default behavior. This behavior is usually used in Continuous Delivery pipelines.

For a manual task, the pipeline determines whether it stops running or continues running based on the rejection or completion of the task. If the task is rejected and **Continue running** is selected, the pipeline continues to the next gate or stage task.

## **Entry and Exit Gates**

Gates at the entries and exits of the stages control the pipeline's progress:

- An entry gate controls whether a stage may begin and its tasks may be executed.
- An exit gate controls whether the stage may be completed and the pipeline may progress.

Gate approvals are optional; if a gate has no approvals, the pipeline's progress continues. Gate approvals can be either manual (where the approver must physically click the approval to move to the next stage) or automated (based on whether specific criteria are met) or a combination of both.

### **Manual Gate Approvals**

During a pipeline run, you can use the pipeline stage summary to see pipeline progress at each stage. You can review the user-generated information in the summary to make approval or rejection decisions at a gate. If a gate has approvals, one or more of these actions occurs:

- Email notifications are sent to the specified approvers.
- If the approver approves the request, the pipeline's progress continues.
- If the approver rejects it, the pipeline ends with an appropriate error (except if **On Rejection** is set to **Continue running**).

You can configure specific users or groups to be allowed to manually approve the criteria at a gate as follows:

- You can set the approvals so that approval from only approver is sufficient for the pipeline to progress. In this case, you can have one approval rule and have all the approvers assigned to that rule.
- If you want all the key individuals to approve sequentially, you can specify multiple approval rules, each for a specific user.
- In addition to specific users, you can apply approval rules to groups. Approval or rejection from any user in the group lets the pipeline progress or stops it.
- When defining a gate, you must specify whether the pipeline continues or stops if the approval is rejected. To do so, you must select one of the following under the **On Error** field:
  - **Continue running:** If the user rejects the gate approval, the pipeline completes the task and then continues to the next gate or stage task with a known error.
  - **Stop running:** If the user rejects the gate approval, then the pipeline aborts. This behavior usually occurs in continuous delivery pipelines.

For example, if your pipeline has multiple stages for testing, you might want to set entry and exit criteria for each stage to ensure that the code is testing properly in the software delivery life cycle.

- In the system test stage, the QA engineer must approve the start of the system testing workflow. That user or someone else in the QA group can review the system test results before approving the exit criteria.
- Before anything can enter the production stage, you should have entry gate approvals by various individuals.

For information about adding manual gate approvals, see [Creating a Manual Approval Rule in a Gate](#) on page 373.

### **Automated Gate Approvals**

Automated approvals lets you set criteria that must be met before code is promoted to later stages. For audits, automated approvals let you show that these criteria were met. You can specify promotion criteria that are fully automated based on whether a condition is met or a combination of automated conditions and manual approvals. You can specify automated criteria that are based either on the outcome of a procedure or your choice or the outcome of a condition that you specify.

#### **Procedure-Based Criteria**

Procedure-based criteria allow you to call any procedure. These criteria let you query third party systems and implement complex gating rules. The job status corresponding to the procedure being executed determines the gate task outcome. A job outcome of `Success` (finished with no errors) is considered to be approved. A job outcome of `Warning`, `Failure`, or any other non-success job status is considered to be rejected. You can call procedures and pass in all the required parameters. For information about adding procedure-based gate approvals, see [Creating a Procedure-Based Approval Rule in a Gate](#) on page 374.

#### **Condition-Based Criteria**

You can create criteria based on custom conditions of your choice that evaluate to true or false to approve or reject gates. A condition is a Javascript expression that leverages properties. You can specify criteria based on any intrinsic properties that are appropriate for a release pipeline and a pipeline runtime. For example, you can create a property on the pipeline runtime based on the output of a test suite and write an expression to evaluate

whether the property is 50 or greater (pass) or less than 50 (fail). For examples of Javascript expressions, see the *Using Context-Relative Shortcuts with Pipelines and Related Objects* KB article at <https://helpcenter.electric-cloud.com/hc/en-us/sections/200516863-Commander-KB>.

For information about adding condition-based gate approvals, see [Creating a Condition-Based Approval Rule in a Gate](#) on page 377.

### Automated Gate Approval Examples

- Simple automated gate criteria—The previous stage finishes with a successful status, and the next stage should proceed.
- Sophisticated automatic gate criteria—Based on a custom calculation or script result, the next stage should proceed. For example, if the performance test results show no more than a 5% degradation over the last main release or if all failed unit tests are marked exempt.
- Combination of automated criteria and manual approval—Based on performance tests passed and QA manual approval. For example:
  - Test results-based condition—Move to the next stage if greater than 90 percent of tests have passed.
  - If 80-90 percent of tests passed, require manual approval.
  - If less than 80 percent of tests passed, reject the gate.
- External trigger. For example, wait until a ServiceNow ticket is approved to trigger gate approval and promote to the next stage.

## Pipeline "Run if" and "Wait until" Conditions

Before ElectricFlow 6.5, pipelines ran sequentially from the first stage to the last stage, without skipping a stage, task, or approval gate. When there was an error, the pipeline had to restart from the beginning. Starting in ElectricFlow 6.5, the pipeline runs can start or end at any point as well as skip a specific stage, task, or gate using **Run if** and **Wait until** conditions.

In the UI, you can set run the **Run if** and **Wait until** conditions on pipeline stages, tasks, and gates.

You can also set the **Run if** and **Wait until** conditions on pipeline stages, tasks, and gates using API commands through the command-line interface or through the DSL IDE while authoring pipelines.

- A **Run if** (run condition) is a property reference that the pipeline evaluates before executing the next stage, task, or approval gate. The pipeline waits until one or more dependent run conditions are met.

In an API command, this condition is "fixed text" or text embedding property references that are evaluated into a logical `TRUE` or `FALSE`. An `"0"` or `"false"` is interpreted as `FALSE`. An empty string or any other result is interpreted as `TRUE`. By default, this condition is not set and is `FALSE`.

The property reference can be a JavaScript expression, for example, this expression could test whether the name of a step is equal to the value of a property called "restartStep":

```
$/javascript (myStep.stepName == myJob.restartStep)]
```



- A **Wait until** condition (precondition or *wait condition*), is a property that allows a stage, task, or gate to be created with "pause", which then pauses the pipeline at that point. The pipeline waits until one or more dependent conditions are met. When the pipeline status is eligible to transition from pending to runnable, this condition is evaluated.

In an API command, this condition is fixed text or text embedding a property reference that is evaluated to `TRUE` or `FALSE`. An empty string, a `"0"` or `"false"` is interpreted as `FALSE`. Any other result string is interpreted as `TRUE`. The pipeline does not progress until the condition is `TRUE`. By default, this condition is not set and is `FALSE`.

You cannot use timestamps in preconditions on any object that supports preconditions. This includes stages, gates, and tasks as well as procedures and process steps.

**Run if** and **Wait until** conditions can be used to:

- Control a stage task based on the previous task.
- Skip some pipeline states based on some specific conditions, such as if a Linux installer file was not successfully built, tested, and verified.
- Execute certain approvals only if certain conditions are met. For example, during a functional test suite, the pipeline meets a rule or gate approval criteria if 90% of the functional tests have passed. If not, the pipeline waits for manual approval by assigned users before it can proceed.

For examples of how to set **Run if** and **Wait until** conditions on pipeline objects, go to [Pipeline Objects and Conditions](#) on page 328.

## Pipeline UI

This section shows how pipelines are represented in the ElectricFlow UI.

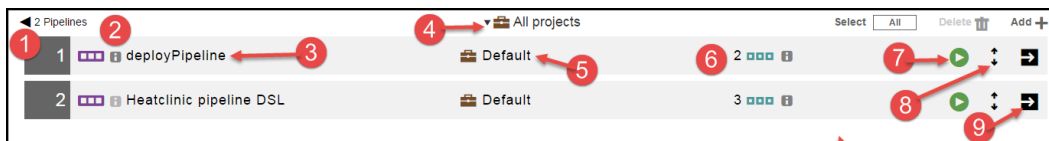
All of the information described in the previous sections is summarized in the pipeline definition in the Pipelines List.

### Pipelines List

The Pipelines List shows all the pipelines that you have permission to view.

To open it from the Home page, click **Pipelines > All Pipelines**.

This is a Pipelines List:

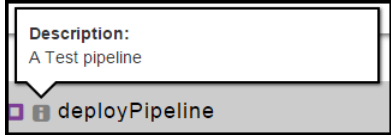


Each row in the list is a *pipeline definition*, consisting of the pipeline name, the project to which the pipeline belongs, and the number of stages in the pipeline.

For each pipeline, you can perform these actions:

- Clicking the green **Run pipeline** button (number 7) starts a pipeline run.
- Clicking the **Expand** button (number 8) shows the previous pipeline runs.

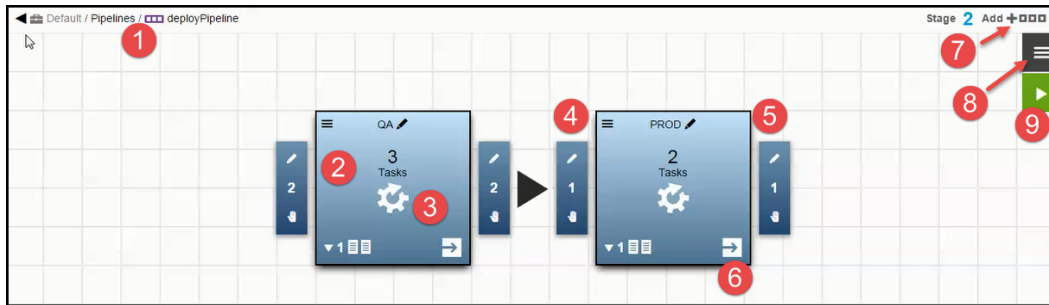
- Clicking the **View Details** button (number 9) opens the Pipelines Visual Editor.
- Selecting **All** or **None** and then clicking the **Delete** button removes the selected pipelines from the list.
- Clicking the **Add+** button adds a pipeline.

1	Breadcrumb identifying the object you are viewing and the total number of pipelines.
2	<p>Clicking <b>i</b> shows information about the object. In this example, clicking <b>i</b> shows the pipeline description:</p> 
3	Name of the pipeline.
4	<p>The default is to show the applications for all projects.</p> <p>To see only the objects for a specific project, click the down arrow in the <b>All projects</b> field and then select one or more projects in one of these ways:</p> <ul style="list-style-type: none"> <li>• Click on the name of one or more projects.</li> <li>• Enter the search criteria in the Search field. The projects that match the criteria appear in the list.</li> </ul> <p>If there are no matches, a message appears stating that there are no resource templates in the selected projects.</p>
5	The project to which the pipeline belongs.
6	Number of stages in the pipeline.
7	Click the <b>Run pipeline</b> button to run the pipeline when the button is green.
8	Click the <b>Expand</b> button to view the previous pipeline runs.
9	Click the <b>View details</b> button to go to the Pipelines Visual Editor.

### *Pipelines Visual Editor*

In the Pipeline Visual Editor, you can author and edit a pipeline as well as view the underlying platform-level details.

This is a pipeline with two stages: QA and PROD.



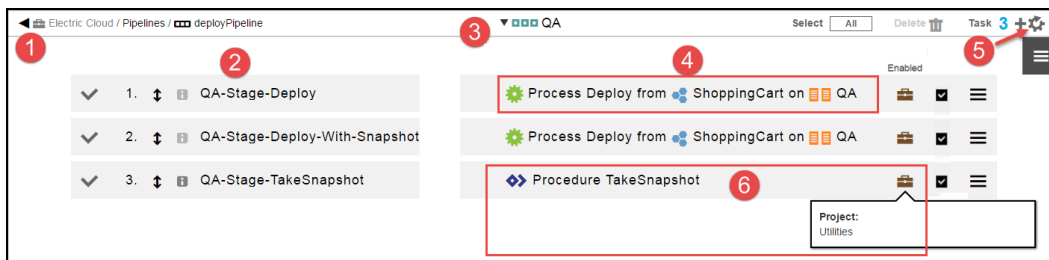
You can perform these actions:

- Clicking the **Add new stage** button (number 7) will add a new stage to the pipeline.
- Clicking the **Menu** button (number 8) will open a menu where you can get more details about the pipeline and take actions on the pipeline.
- Clicking the **Run pipeline** button (number 9) will start a pipeline run.
- In a stage, clicking the **Define stage tasks** button (number 6) will open a dialog box where you can define tasks for the stage.

1	Breadcrumb showing the object hierarchy, path to the pipeline, and the pipeline name.
2	Stage in the pipeline, a milestone or checkpoint in the software delivery process.
3	Tasks in a stage, the automation logic for a stage. See <a href="#">Pipeline Tasks</a> on page 311.
4	Entry gate, consisting of the approvals to enter a stage. See <a href="#">Entry and Exit Gates</a> on page 313.
5	Exit gate, consisting of the approvals to exit a stage. See <a href="#">Entry and Exit Gates</a> on page 313.
6	Click the <b>Define stage tasks</b> button to open the task list for the stage.
7	Click the <b>Add new stage</b> button to add a stage.

8	<p>Click the <b>Menu</b> button to open the menu where you get more details about the pipeline and take actions on the pipeline.</p> <p>Clicking <b>Details</b> opens the <b>Pipeline Details</b> dialog box where you can edit the pipeline name and description.</p> <p>Clicking <b>Properties</b> opens the <b>Properties</b> dialog box where you can view, add, and delete the properties associated with the pipeline.</p> <p>Clicking <b>Parameters</b> opens the <b>Parameters</b> dialog box where you can view, add, and delete the parameters attached to the pipeline.</p> <p>Clicking <b>Access Control</b> opens the Access Control page where you can view, add, and edit the privileges for the pipeline.</p> <p>Clicking <b>Track Changes</b> shows the <a href="#">Change History</a> for the pipeline and the objects in it. ElectricFlow tracks the changes to tracked objects including applications, procedures, workflows, workspaces, resources, and project-owned components such as library components and records a Change History of the historical states of the system and the changes between them.</p> <p>Clicking <b>Delete</b> deletes the pipeline after you verify that you want to do this.</p>
9	<p>Click the <b>Run pipeline</b> button to run the pipeline. The Pipeline Runs List shows the real-time progress of the pipeline run. Clicking in a stage will open the Stage Summary where you can view task details and progress of each task.</p> <p>You can also view the results of previous pipeline runs.</p>


The task list for the stage shows all the tasks for the stage that are executed in sequential order.



1	Breadcrumb showing the object hierarchy, path to the pipeline, and the pipeline name.
2	Name of the task.
3	Name of the stage.
4	The task type and the specific details for it. See <a href="#">Pipeline Tasks</a> on page 311.  This task is defined by an application process called Deploy from the "Shopping Cart" application. The application process is deployed in the QA environment.
5	Click the <b>Add task</b> button to add a task to the to the stage.
6	The task type and the specific details for it. See <a href="#">Pipeline Tasks</a> on page 311.  This task is defined by a procedure called TakeSnapshot in the Default project. Clicking on the <b>Project</b> button shows the project to which the procedure belongs.

### *Pipeline Task Definitions in the UI*

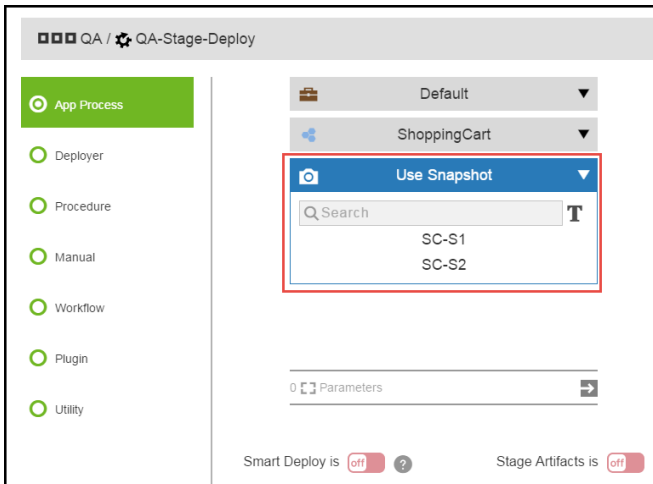
Tasks are defined in the Task Definitions dialog box described in this section. There are two ways to get to this dialog box:

- When you want to add a task, click the **Add task** button.
- When you want to view or edit a task in the task list, select a task and click the  button in its row.

Depending on the task type that you select, different fields appear on the right side of the dialog box.

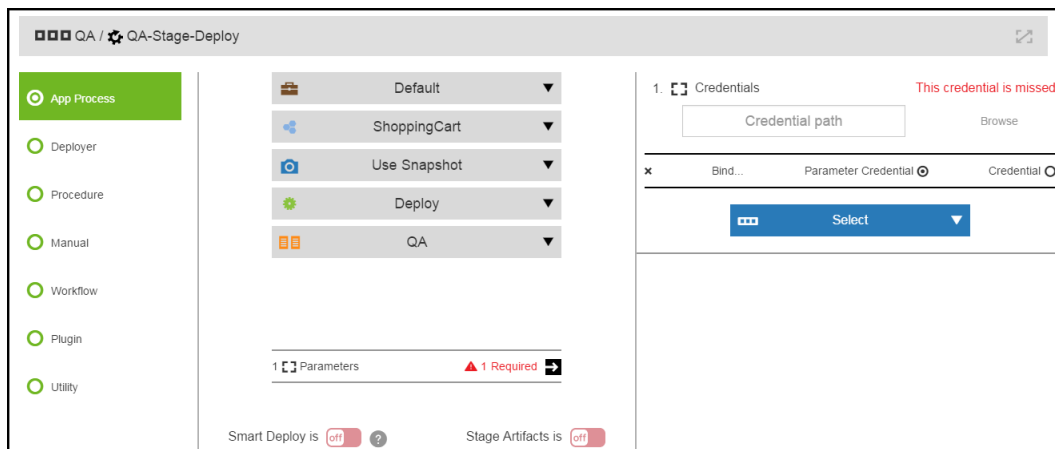
If you want to deploy an application, select **App Process**. You need to select an application, a snapshot, an application process, and the environment where the application process will run. If the parameters were created for application process, the Parameters field is enabled. You can also enable or disable **Smart Deploy**, where the system deploys only the artifacts that have not been deployed to a resource, specific versions of the artifacts, or artifacts that have not yet been deployed to new resources.

This example shows how to use a parameter to specify the snapshot. When you click in the "Select a Snapshot" field, these options appear:



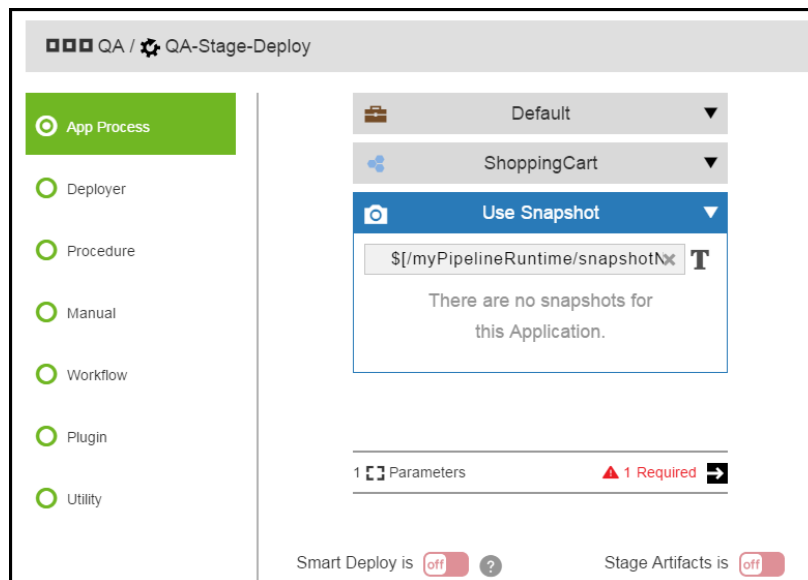
There are two ways to specify a snapshot:

- Select a specific snapshot for the application, such as **SC-S1**.



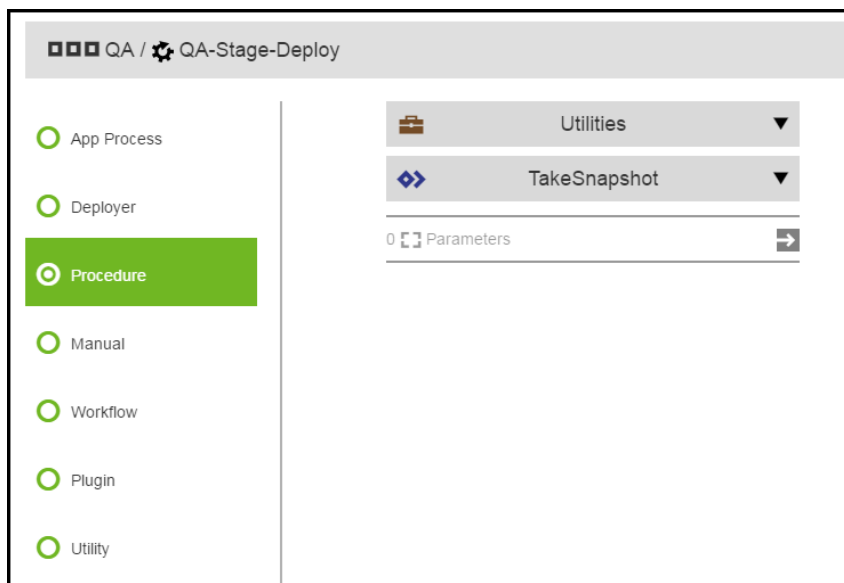
- Enter the snapshot as a parameter.

Enter this parameter: `$/myPipelineRuntime/snapshotName`.



If you want to run a set of best practices, subroutines, modules, or functions that you can create and reuse (such as a script), select **Procedure**. You need to select a project and a procedure in that project. If the parameters were created for procedure, the Parameters field is enabled.

This example shows that the task is a procedure called TakeSnapshot in the Utilities project.



## Pipeline Stage Summary

A pipeline stage summary shows various status and metrics relevant to the pipeline when a pipeline stage is executed. For example, the summary could be the scan results from the code coverage tool or links to reports that are generated during the pipeline run. You can view the pipeline stage summaries during the pipeline run or for completed pipeline runs.

From the Pipeline Runs view, you can click on a specific stage to see that stage's summary. The stage summary shows two sets of stage-specific information.

- Deployment summary consisting of:
  - A system-generated deployment summary.
  - Applications deployed through the pipeline and the environments where they are deployed.
- User-generated summary consisting of:
  - Links to web sites for reports and other information about the deployed artifacts.
  - Property information about the pipeline stage and the objects in it.

## Creating User-Generated Data for the Stage Summary

If the task in a stage is defined by a procedure, a workflow, or an application process that includes a procedure as a process step, you can create user-generated data using ectool.

### *Stage Summary Information as Links to a Web Site*

To create links to web site:

1. Create a procedure and the underlying steps with commands like the following:

```
ectool setProperty "/myPipelineStageRuntime/ec_summary/report" --value "<html><a href='\"http://www.myreportserver.com\"' target='\"_blank\"'>Global Report</a></html>"
```

2. Call this procedure from a task in the stage.

### *Generic Property Information*

1. Create a procedure and the underlying steps with commands like the following:

To create a summary property:

```
ectool setProperty "/myPipelineStageRuntime/ec_summary/testCoverage" "test value"
```

To create a property entry:

```
ectool setProperty "/myPipelineStageRuntime/ec_summary/testCoverage" --value "80%"
```

2. Call this procedure from a task in the stage.

Go to the following sections to see examples of user-generated data in the stage summary.

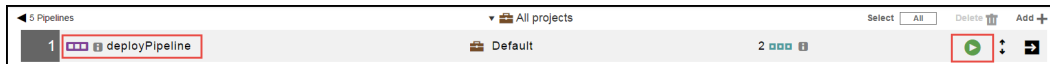


## Viewing the Stage Summary During a Pipeline Run

To view the stage summary of a stage during its pipeline run, start the pipeline run by selecting a pipeline in the



Pipelines list and clicking the button:

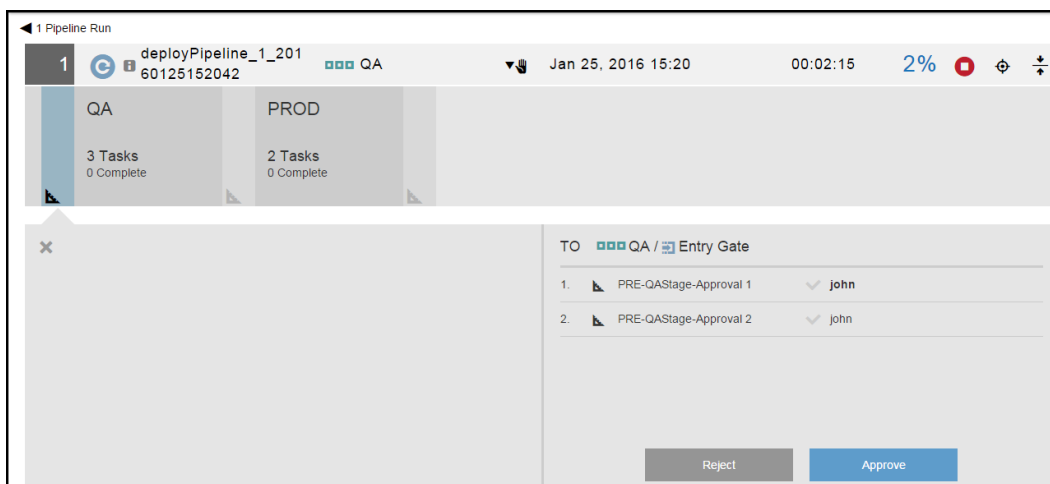


This pipeline requires input before the applications to be deployed through the pipeline. Enter the required parameters for pipeline, and click **OK**.

4 Parameters to run deployPipeline	
1. QA Stage Control Param	<input type="text" value="NORMAL"/>
2. PROD Stage Control Param	<input type="text" value="NORMAL"/>
3. Specify Snapshot to Use	<input type="text" value="SC-S1"/>
4. Specify Sleep Time	<input type="text" value="Value"/>

The pipeline runs. You can view its progress on the Pipeline Run page.

When manual approvals are required at the entry and exit gates to a stage, the system waits for the approvers to approve or reject before proceeding to the next step in the pipeline.



As the pipeline progresses through a stage, you can view its progress by clicking in the stage, which opens the pipeline stage summary.



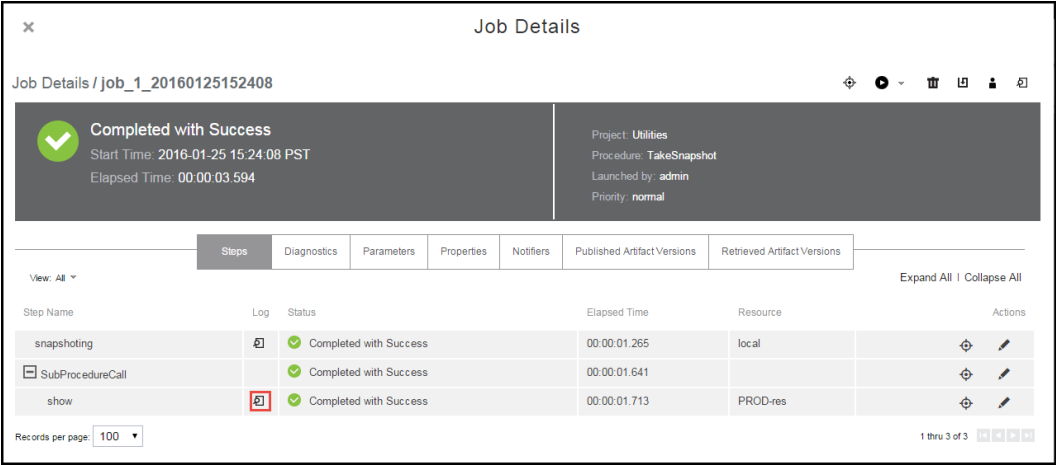


For the QA stage, the stage summary shows this information:

- **Environment summary**—The first two tasks (numbers 1 and 2 above) show what application processes were deployed and where they were deployed. The summary consists of the application, the application process being deployed, and the environment to which the application is deployed.
- **User-generated summary**—You can create two types of summary data, property information (consisting of text and/or numbers) and links to web sites (number 3 above).

In this example, the property information is testCoverage at 80%, and the link to the report is Global Report. When you click Global Report, the web site <http://www.myreportserver.com> opens.


The stage summary also shows information about the tasks:

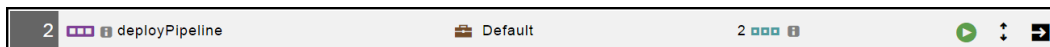
1	The first task is QA-Stage-Deploy. It is defined by the ShoppingCart application. The Deploy application process was deployed in the QA environment. The green check mark means that the task was successfully completed.
2	The second task is QA-Stage-Deploy-with-Snapshot. It is also defined by the ShoppingCart application. The "Deploy" application process was deployed in the QA environment. The green check mark means that this task was also successfully completed.
3	<p>The third task is QA-Stage-TaskeSnapshot. It is defined by a procedure called TakeSnapshot.</p> <p></p> <p>When you click on the task name or click the  button, the Job Details page opens, showing that the procedure consists of two steps. Both steps were successfully completed.</p> <p>You can dig deeper by clicking on the Log button in the Log column on the Job Details page.</p> 

## Viewing the Stage Summary for a Completed Pipeline Run

To view the stage summary of a stage in a completed pipeline run, start by selecting a pipeline in the Pipelines



List and clicking the  button:



Clicking on the name of pipeline shows the list of current and completed pipeline runs.

2	deployPipeline	Default	2		
3206	deployPipeline_4_2016012515	Jan 25, 2016 15:32	00:00:55	100%	
3139	deployPipeline_3_2016012515	Jan 25, 2016 15:31	00:00:08	18%	
3042	deployPipeline_2_2016012515	Jan 25, 2016 15:30	00:00:49	63%	
2042	deployPipeline_1_2016012515	Jan 25, 2016 15:20	00:09:49	100%	

To troubleshoot the pipeline, select the pipeline run that completed with errors. Click the name of the pipeline run to view a representation of the pipeline, and then click in a stage to view the stage summary for that stage.

This is an example of a stage summary:

1 Pipeline Run

1

deployPipeline\_2\_20160125153042

Jan 25, 2016 15:30

00:00:49

63%

QA

3 Tasks  
3 Complete  
00:00:04

PROD

2 Tasks  
0 Complete

Stage Summary

QA-Stage-Deploy ShoppingCart - Deploy on QA ✓

QA-Stage-Deploy-With-Snapshot ShoppingCart - Deploy on QA ✓

report Global Report

testsRun 100

3 Tasks

Find...

1. QA-Stage-Deploy Process 100%

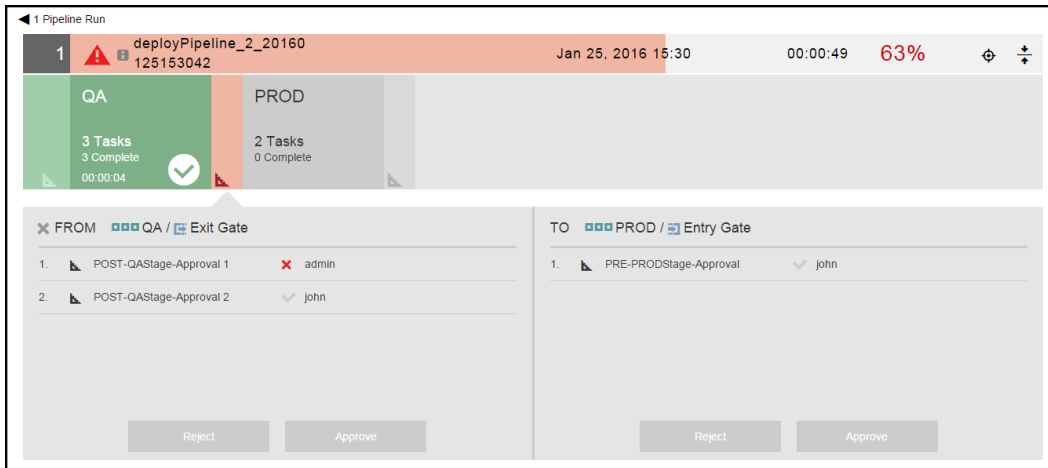
2. QA-Stage-Deploy-With-Snapshot Process 100%

3. QA-Stage-TaskSnapshot Procedure TakeSnapshot 100%



To find out why the pipeline was completed with errors, click the button (number 1 above) in the stage summary.

The summary of the Exit Gate for the QA stage shows that one of the required approvals were rejected, so the pipeline stopped with errors.



## Credentials in Pipelines

Credentials are passed to pipelines through applications in pipeline stages. If an application has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (**Parameter Credential**) or a credential binding to a pipeline task (**Credential binding**), or select a user-defined credential that is attached to the project associated with the pipeline.

A credential must be explicitly attached to the object using it so the server can perform an access control list (ACL) check at the definition time and limit the visibility of the password. To support accessing credentials at the pipeline task level, these tasks need to have the appropriate credentials attached. This is done implicitly by the UI when you are binding credentials to the pipeline tasks. If you are using ectool, use the `attachCredential` API command to perform the same operation.

## Pipeline Objects and Conditions

You can set **Run if** and **Wait until** conditions in pipelines through the UI or using API commands.

- The **Run if** condition, also referred to as a *run condition*, allows a stage, gate, or task to run only if the condition is satisfied. If not, the stage, gate, or task is skipped.

Examples:

- A quality gate has these **Run if** conditions:
  - If 90% or more of the test cases pass, the pipeline continues running.
  - If 70% to 90% of the test cases pass, human intervention is required.
  - If less than 70% of the test cases pass, the error handling condition of the gate ( **Stop running** (the default) or **Continue running**) determines what happens next.
- The performance testing task can be skipped if it was executed in a specific environment.

- The **Wait until** condition, also referred to as a *precondition*, means that a stage, gate, or task will not run (is not runnable) unless the condition is satisfied.

Example:

- A stage, gate, or task cannot be run until approval from an external ticketing system or change management system is received.

You cannot use timestamps in preconditions on any object that supports preconditions. This includes stages, gates, and tasks as well as procedures and process steps.

This topic describes how to set **Run if** and **Wait until** conditions:

- [In the UI](#)
- [Using API commands](#)

For examples of Javascript expressions for **Run if** and **Wait until** conditions, see the [KBEC-00360—Using Context-Relative Shortcuts to Properties on Pipelines and Their Child Objects](#) KB article.

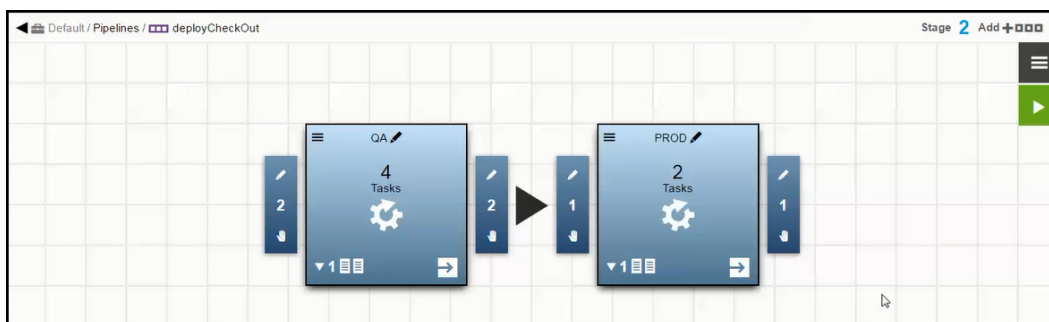
## In the UI

You can set **Run if** and **Wait until** conditions for pipeline stages, gates, and tasks. Setting these conditions for a pipeline stage, gate, or task consists of the following:

1. [Modeling a pipeline](#)
2. [Setting the "Run If" and "Wait until" conditions for the stage](#)
3. [Setting the "Run If" and "Wait until" conditions for a task](#)
4. [Setting the "Run If" and "Wait until" conditions for a gate](#)
5. [Running the pipeline](#)

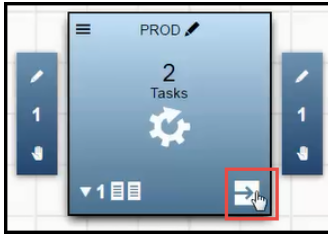
### Modeling a Pipeline

Create a pipeline called `deployCheckOut`, and define the stages for it. Then define tasks for each stage.

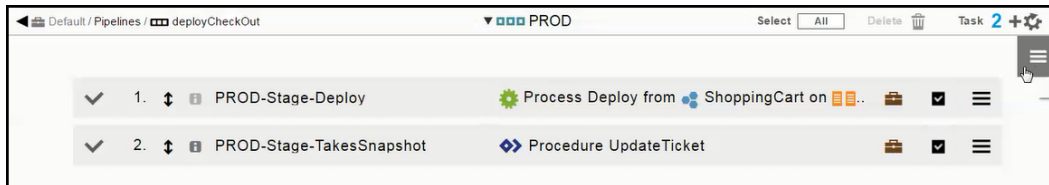


### Setting the "Run If" and "Wait until" Conditions for the Stage

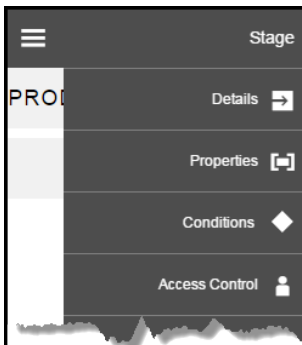
In the PROD stage, click the **Define stage tasks** button in the lower right corner of the stage.



The task list opens.



To set the **Run if** and **Wait until** conditions for the PROD stage, click in the upper right corner of the task list, and select **Conditions**.



The Conditions dialog box opens.

Conditions

Run if

Run condition

Wait until

Wait condition

Enter the Run condition in the **Run if** field and the Wait condition in the **Wait until** field.

Conditions

Run if

\$/myPipelineRuntime/rundev]

Wait until


\$/myPipelineRuntime/qaready]

Click **OK** to save the conditions.

*Setting the "Run If" and "Wait until" Conditions for a Task*

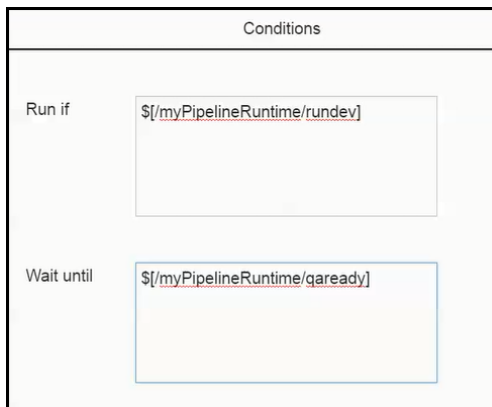
Return to the task list for the PROD stage.

Default / Pipelines / deployCheckOut		PROD		Select	All	Delete	Task 2	+	⚙
✓	1.	↓	PROD-Stage-Deploy	Process Deploy from ShoppingCart on ..	📁	🔍	✓	☰	
✓	2.	↓	PROD-Stage-TakesSnapshot	Procedure UpdateTicket	📁	🔍	✓	☰	

Click  in the row for the first task (PROD-Stage-Deploy), and select **Conditions**.



In the Conditions dialog box, enter the Run condition in the **Run if** field and the Wait condition in the **Wait until** field, and click **OK** to save your entries.

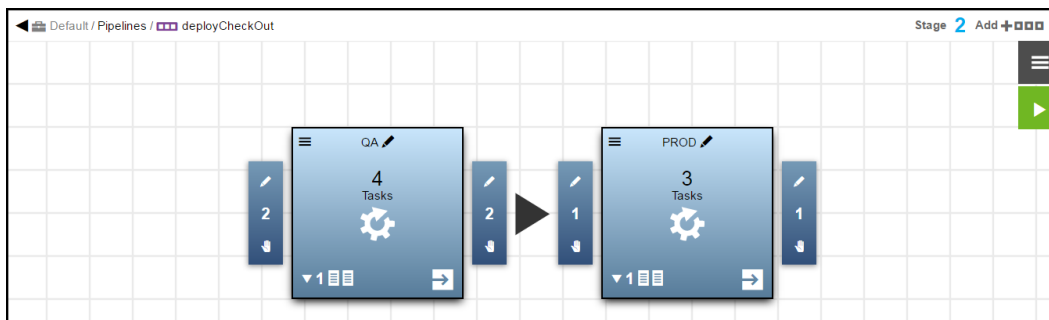



The Conditions dialog box has a title bar labeled "Conditions". It contains two input fields. The first field is labeled "Run if" and contains the text "\${myPipelineRuntime/rundev}". The second field is labeled "Wait until" and contains the text "\${myPipelineRuntime/qaready}".

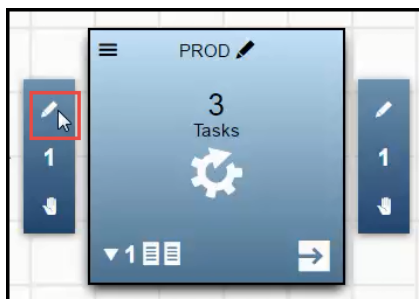
### *Setting the "Run If" and "Wait until" Conditions for a Gate*

#### Setting Gate Conditions

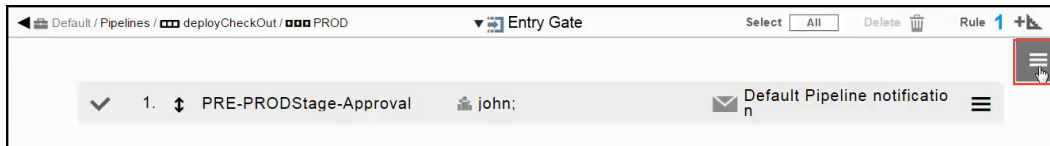
Return to the Pipelines Visual Editor.




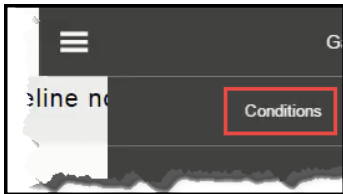
Click the **Edit** button (  ) in the entry gate to the PROD stage.



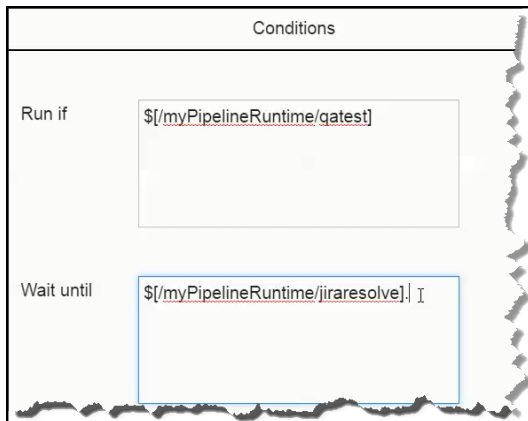
The list of rules for the entry gate opens.



Click  in the upper right corner of the rule list, and select **Conditions** to define the **Run if** and **Wait until** gate conditions.

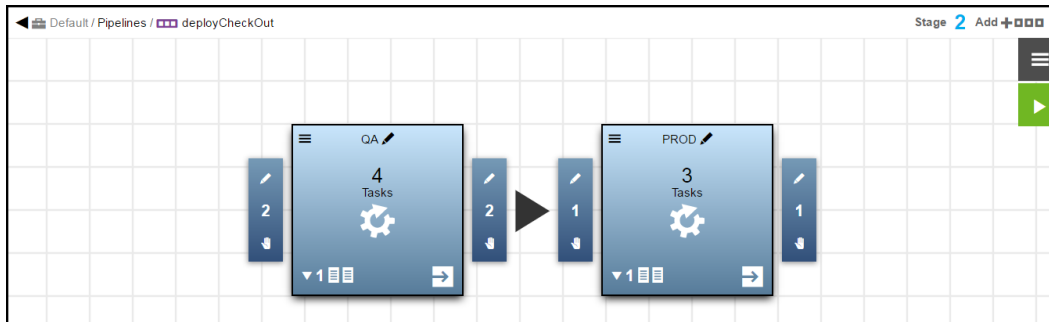



In the Conditions dialog box, enter the Run condition in the **Run if** field and the Wait condition in the **Wait until** field, and then click **OK**.

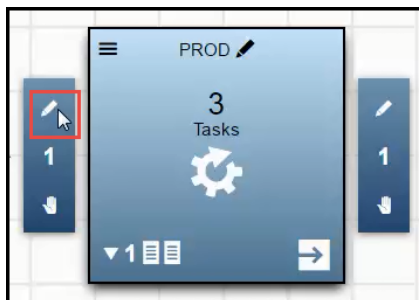


### Setting the "Run If" and "Wait until" Conditions for a Rule in a Gate

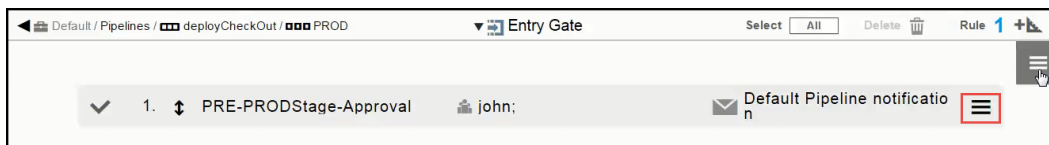
Return to the Pipelines Visual Editor.




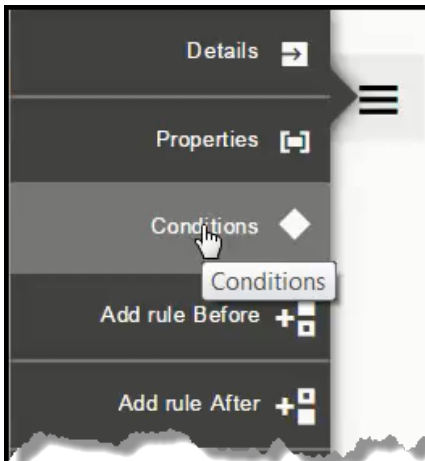
Click the **Edit** button (  ) in the entry gate to the PROD stage.



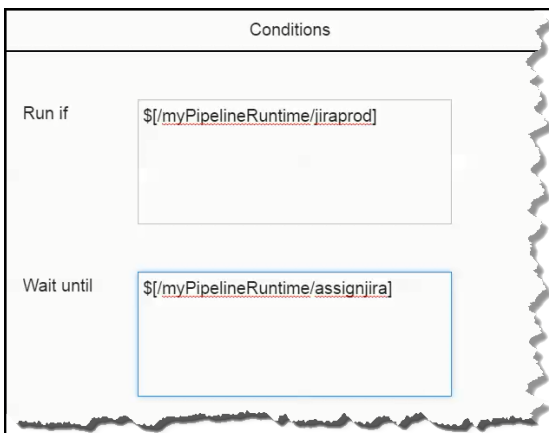
The list of rules for the entry gate opens.



Click  in the row for the PRE-PRODStage-Approval rule, and select **Conditions** to define the **Run if** and **Wait until** gate conditions.



In the Conditions dialog box, enter the **Run if** condition in the **Run if** field and the **Wait until** condition in the **Wait until** field, and then click **OK**.



### Running the Pipeline

When the pipeline runs, it waits until the **Run if** and **Wait until** conditions are met before the pipeline can progress to the PROD stage. Before the first task in the PROD stage starts, the pipeline again waits until the **Run if** and **Wait until** conditions are met before starting the task.

## Using API Commands

You can set the **Run if** and **Wait until** conditions using the API commands through the command-line interface or through the DSL on pipeline stages, tasks, and gates.

### Stages

To create the **Run if** and **Wait until** conditions in a stage, use these API commands:

```
ectool createStage <projectName> <stageName> [<condition>]
ectool createStage <projectName> <stageName> [<precondition>]
```

To set a **Run if** condition where the name of the next stage is "Preflight", enter:

```
ectool createStage "Default" "Preflight" --condition "$[/javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)]"
```

To set a **Wait until** condition where the "Automated Tests" stage is completed before running the "Preflight" stage, enter:

```
ectool createStage "Default" "Preflight" --precondition "$[/myPipelineRuntime/automatedTestCompleted]"
```

To modify the **Run if** and **Wait until** conditions in a stage, use these API commands:

```
ectool modifyStage <projectName> <stageName> [<condition>]
ectool modifyStage <projectName> <stageName> [<precondition>]
```

To modify a **Run if** condition where the name of the next stage is "UATdemo", enter:

```
$ec->modifyStage("Default", "Preflight", {condition => "$[/javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.UATdemo)]"});
```

To modify a **Wait until** condition so that the "Automated Tests" stage is completed before running the "UAT demo" stage, enter:

```
$ec->modifyStage("Default", "UAT demo", {precondition => "$[/myPipelineRuntime/automatedTestCompleted]});
```

When you use DSL to model the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the stage object. This example shows that the dev stage has a **Run if** condition and a **Wait until** condition. The **Run if** condition is that `$[/myPipelineRuntime/rundev]` is TRUE for the dev stage to start. The **Wait until** condition is that `$[/myPipelineRuntime/qaready]` is TRUE for the pipeline to progress to the next stage.

```
pipeline('heatclinic_pipeline'){
  ...
  stage('dev'){
    ...
    condition = '$[/myPipelineRuntime/rundev]'
    precondition = '$[/myPipelineRuntime/qaready]'
    ...
    task('uninstall'){
      ...
    }
    ...
  }
}
```

## Tasks

To create the **Run if** and **Wait until** conditions in a task, use this API commands:

```
ectool createTask <projectName> <taskName> [<precondition>]
ectool createTask <projectName> <taskName> [<condition>]
```

To create a task with **Run if** and **Wait until** conditions, enter:

```
ectool createTask "Default" "Deploy WAR file" --condition "$[/javascript (myTask.taskName == myTask.deployWar)]" --precondition "$[/myTask/automatedTestComplete]"
```

To modify the **Run if** and **Wait until** conditions in a task, use these API commands:

```
ectool modifyStage <projectName> <taskName> [<condition>]
ectool modifyStage <projectName> <taskName> [<precondition>]
```

To modify **Run if** and **Wait until** conditions for a task, enter:

```
ectool modifyStage "Default" "Preflight" --condition "$[/javascript (myTask.taskName == myTask.deployWar)] --precondition "$[/myTask/autoTestComplete]"
```

When you use DSL to author the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the task object. This example shows that the **uninstall** task has a **Run if** condition and a **Wait until** condition defined within the **dev** stage task.

```
pipeline('heatclinic_pipeline'){
  ...
  stage('dev'){
    ...
    task('uninstall'){
      condition = '$[/javascript myFlowRuntime.flowRuntimeStates[taskName=t1].param == 1]'
      precondition = '$[/javascript new Date().getHours() > 15]'
      subprocedure = 'build'
      subproject = 'default'
    }
    ...
  }
}
```

## Gates

To create **Run if** and **Wait until** conditions in a gate, use these API commands:

```
ectool createGate <projectName> <stageName> [<condition>]
ectool createGate <projectName> <stageName> [<precondition>]
```

To create a gate with **Run if** and **Wait until** conditions, enter:

```
ectool createGate "Default" "Preflight" --condition "$[/javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)]" --precondition "$[/myGate/autoTestCompleted]"
```

To modify **Run if** and **Wait until** conditions in a gate, use these API commands:

```
ectool modifyGate <projectName> <stageName> [<condition>]
ectool modifyGate <projectName> <stageName> [<precondition>]
```

To create a gate with **Run if** and **Wait until** conditions, enter:

```
ectool modifyGate "Default" "Preflight" --condition "$[/javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)]" --precondition "$[/myGate/autoTestCompleted]"
```

You can define more than one task in a gate by using the API commands.

When you use DSL to author the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the stage object. This example shows that the build stage has two gates, an entry gate (PRE) and an exit gate (POST). The tasks for each gate are embedded within each one.

```
pipeline('heatclinic_pipeline'){
  ...
  stage('build'){
    ...
    gate('PRE'){
      condition = '[$[myPipelineRuntime/runqa]'
      task('pre-gate-task1'){
        ...
      }
    }

    gate('POST'){
      precondition = '[$[myPipelineRuntime/qaready]'
      task('post-gate-task1'){
        ...
      }
    }

    task('stage-task1'){
      }
    ...
  }
}
```

**Note:** Before ElectricFlow 6.5, gates are implicitly created when you create a stage. You can define tasks for a stage. If you want to define an approval task for a gate, you have to define a task with a gate type (PRE or POST) and a task type of APPROVAL. DSL scripts created before ElectricFlow 6.5 will still work, but **Run if** and **Wait until** conditions cannot be applied to them.

## Example: Authoring a Pipeline with Manual and Utility Tasks

This example shows how to add tasks to a pipeline while defining a stage. The tasks include a manual task and a utility task. You add a manual task to a pipeline while defining a stage.

1. Choose a stage in the pipeline.
2. Click the **Define stage tasks** button in the lower right corner of the stage.

The task list opens. When the task list has one or more items, it shows the tasks in sequential order for the stage.

3. Add a task to the stage.
4. Enter the name of the new task in the Name field, and enter an optional description in the Description field.

5. Set the position of the task.
  - a. Select **Before** or **After**.
  - b. Click the down arrow to select the task that the new task will precede or follow.

Example:



6. If you want to add another task, click **+ Add another** and repeat the previous two steps to add it.
7. If you do not, click **Done**.

The list shows the tasks in the order that they will be executed.

Example:



8. Click **Requires Definition** for the task you added.

The dialog box to define the task opens.



9. Enter the settings to define the task as a manual task, and click **OK** to save the task definition.

Example:

- a. Select **Manual** to define the task as a manual task requiring human action in the **Instruction** field.

The instructions can include property references using the "\$ [ ]" notation for file links, which is needed when referencing a task instruction in an email notification template. For example, a manual task could have this instruction:

Please check the Clover report, and make sure there is at least 80% code coverage before you approve.

*`http://myserver.com/reports/${myPipelineRuntime/ec_summary/report_name}`*

- b. Click in the **Assignees** field.
- c. Enter the name of the users or groups assigned to the task, and select the one or more users or groups.

Example:


You can also use the "\$ [ ]" notation to specify the parameter

- d. Click **OK** to save the task definition.

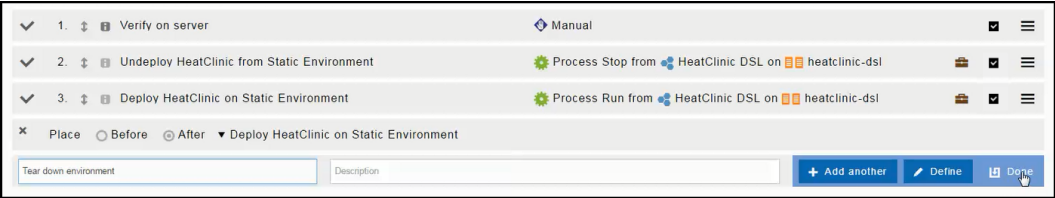
The task list now shows the task as a manual approval requiring human intervention.

Example:



- 10. Click  to add another task to the stage.
- 11. Enter the name of the new task in the Name field, and enter an optional description of it in the Description field.
- 12. Set the position of the task.

Example:



- 13. Click **Done**.

The task list now shows the new task.

Example:



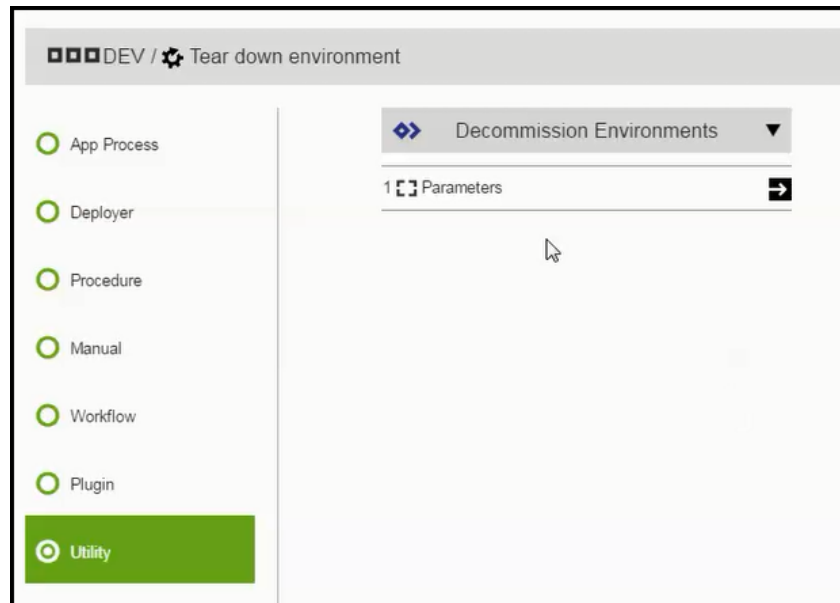
- 14. Click **Requires Definition** for the task you added.

15. Enter the settings to define the task as a utility task, and click **OK** to save the task definition. A utility task, also referred to as a utility function, is a higher-order operation than a third-party plugin, that you can use in pipeline modeling.
  - a. Select **Utility** to define the task as a utility task.
  - b. Click the down arrow in the "Select procedure" field and select **Decommission Environments**.



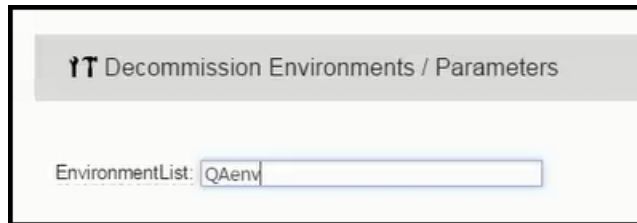
- c. Click in the Parameters field to enter the parameters for the selected utility function.

Example:



The dialog box to enter the parameter values opens.

- d. Enter the parameter values and **OK**



The task list now shows a manual task as the first task and a utility task as the last task in the stage.

Example:

✓	1. ⚙️ Verify on server	Manual	✓	⋮
✓	2. ⚙️ Undeploy HeatClinic from Static Environment	Process Stop from HeatClinic DSL on heatclinic-dsl	✓	⋮
✓	3. ⚙️ Deploy HeatClinic on Static Environment	Process Run from HeatClinic DSL on heatclinic-dsl	✓	⋮
✓	4. ⚙️ Tear down environment	Decommission Environments	✓	⋮

## Plugin Pipeline Tasks

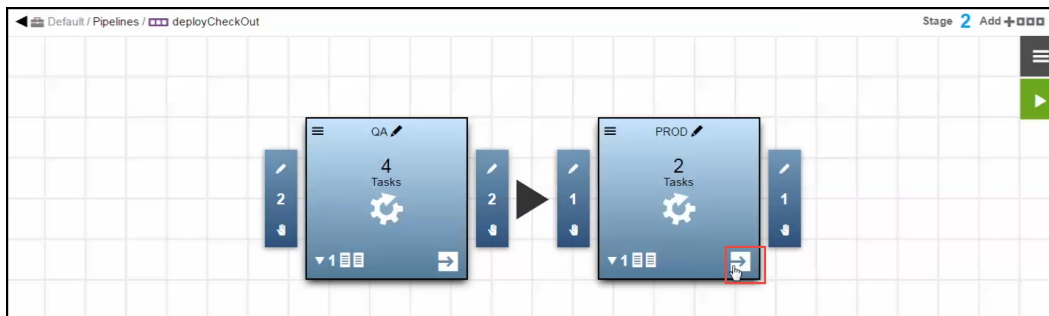
Plugin tasks allow you to orchestrate third-party tools at the appropriate time in your pipeline. The following third-party tools can be used with ElectricFlow:

- Application Servers—Examples are IIS, JBoss, and Tomcat.
- Builds—Examples are EMake, Maven, or Visual Studio.
- Code Analysis—Examples are Clover CMD, Coverity, or Klocwork.
- Databases—Examples are DBI, Oracle, or SQLServer.
- Defect Tracking—Examples are Bugzilla, JIRA, or Rally.
- Notification—An example is Twitter.
- Reporting—An example is Reports.
- Resource Management—Examples are Chef, EC2, or OpenStack.
- Scripting/Shell operations—Examples are Groovy, Python, or Ruby.
- Source Code Analysis—Examples are ECSCM-ClearCase, ECSCM-Git, or ECSCM-Perforce.
- System —Examples are Artifact or FileSysRepo.
- Test —Examples are HPQualityCenter, Jasmine, or Selenium.
- Utility—Examples are FileOps or SendEmail.

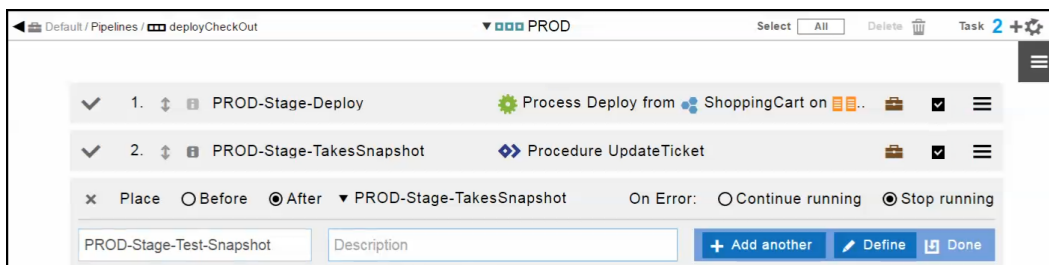
## Plugin Tasks

This example shows how to add a task to a pipeline stage and define it using a test plugin.

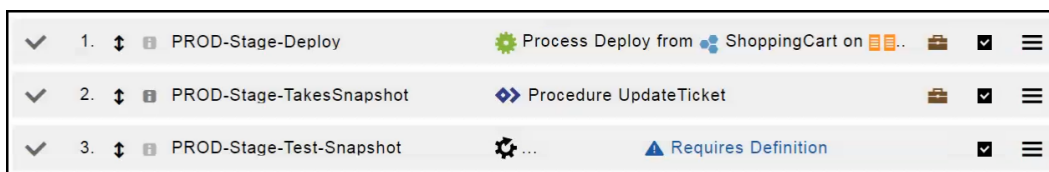
In the Pipelines Visual Editor for the deployCheckout pipeline, click the **Define stage tasks** button in the lower right corner of the PROD stage.



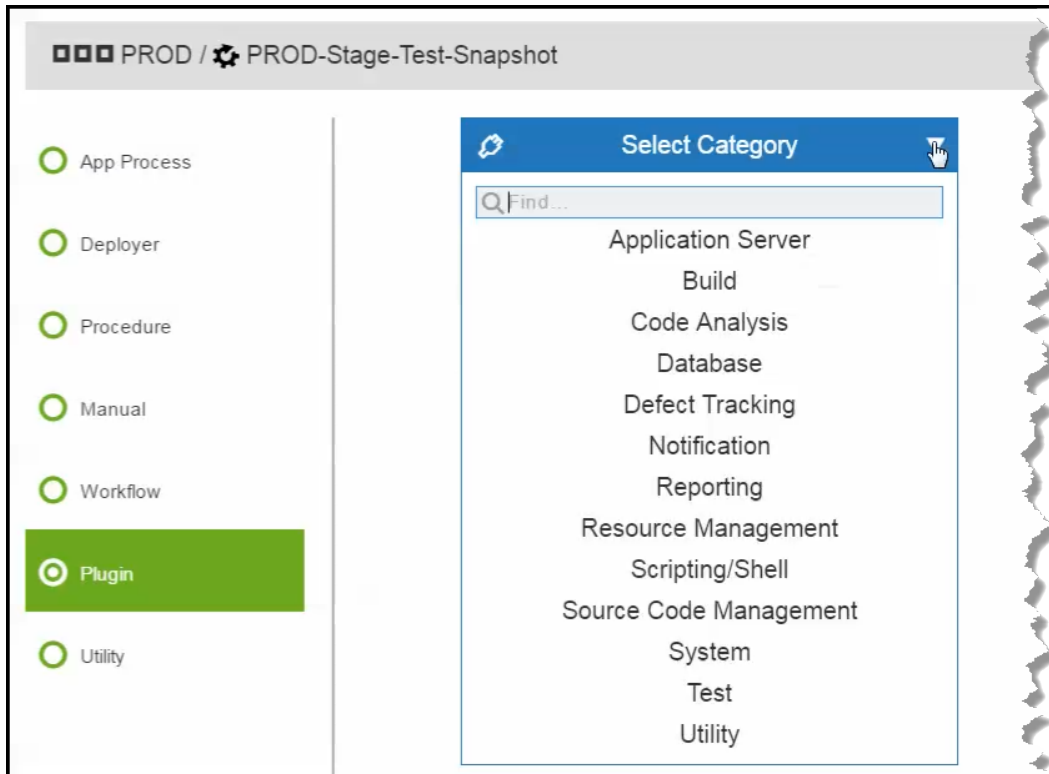
In the task list for the PROD stage, add a task named "PROD-Stage-Test-Snapshot" after the "PROD-Stage-Takes-Snapshot" task, and click **Done**.



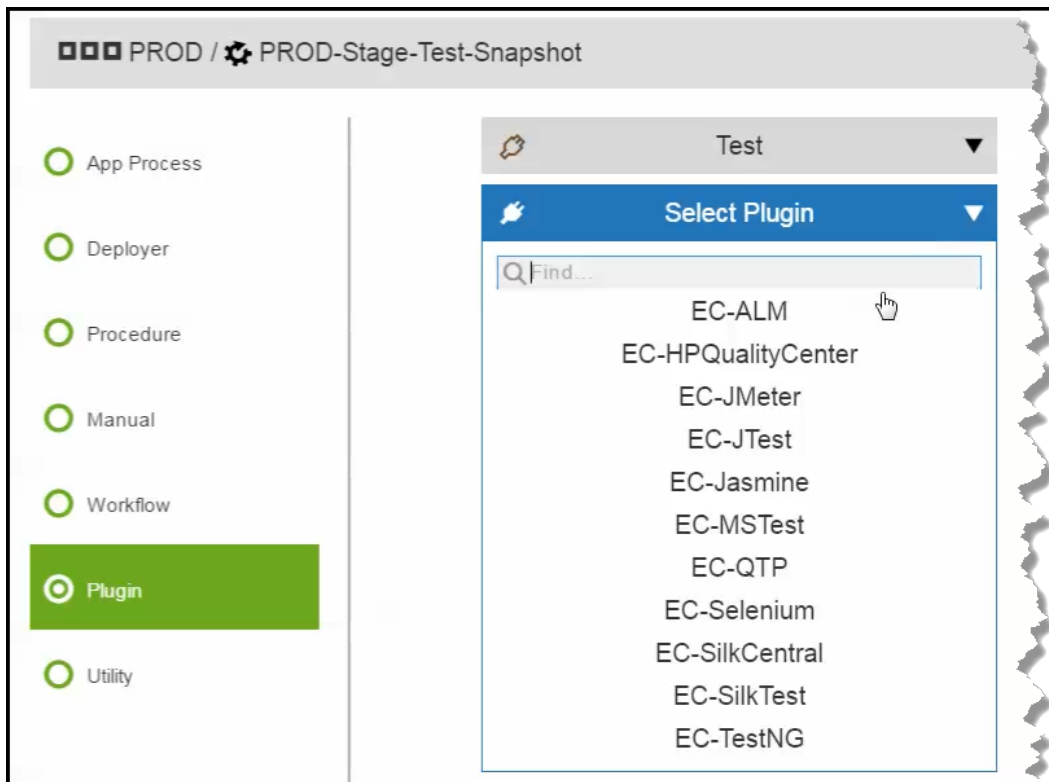
The task list is updated. Click **Requires Definition** to define the task.



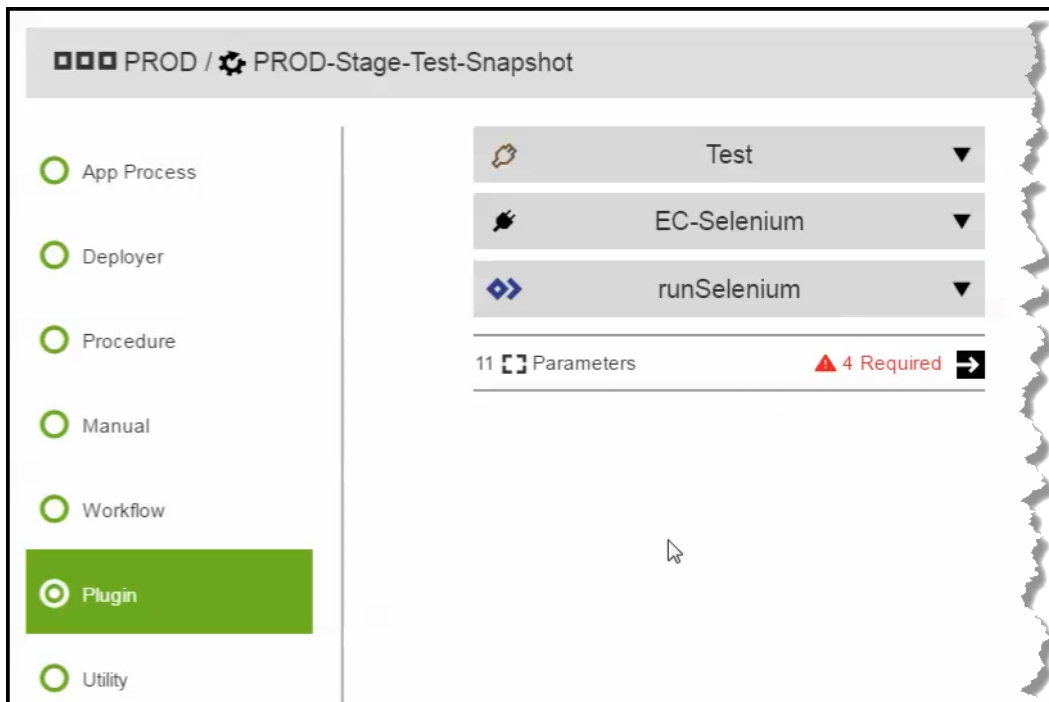
In the dialog box to define the task, select **Plugin** as the task type and then click in the **Select Category** field to view the list of available plugin types.



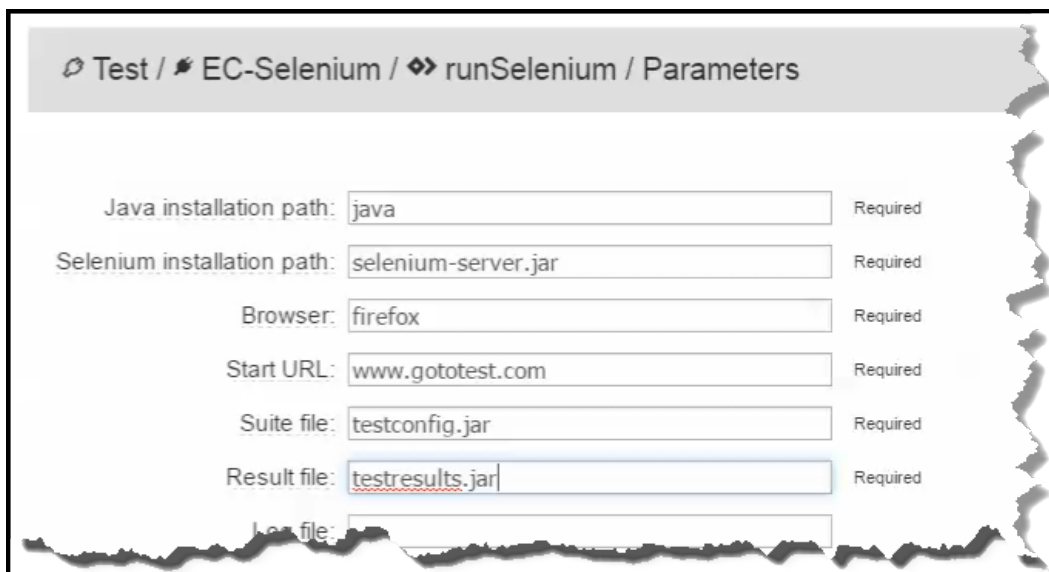
Select **Test**, and then click in the **Select Plugin** field to view the list of available test plugins.



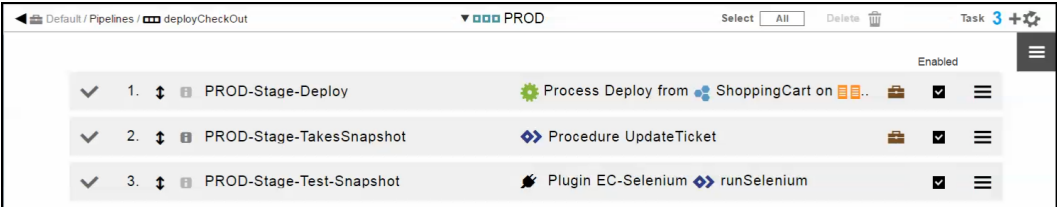
Select **EC-Selenium**, and then select **runSelenium** in the Procedure field. There are four required parameters for this procedure.



Click to go to the dialog box where you enter the plugin parameters, enter the parameters, and click **OK**.



The task list for the PROD stage now shows three tasks, including the plugin task.



## Example: Authoring and Running Pipelines

This example shows how to define and run a pipeline and view the results. In this section, you will learn how to

1. Create a pipeline.
2. Edit the stage details.
3. Define the tasks in the stage.
4. View and edit the pipeline definition.
5. Run the pipeline.
6. Approve the entry to or exiting from a stage.
7. View pipeline runs.

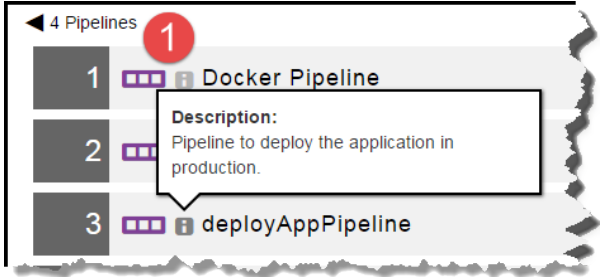
## Parts of a Pipelines List

Following are the key parts of a list of pipelines:

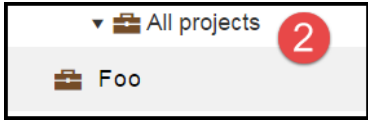









1

This is the breadcrumb that identifies the object that you are viewing and the total number of pipelines. Clicking **i** shows the description of the pipeline.

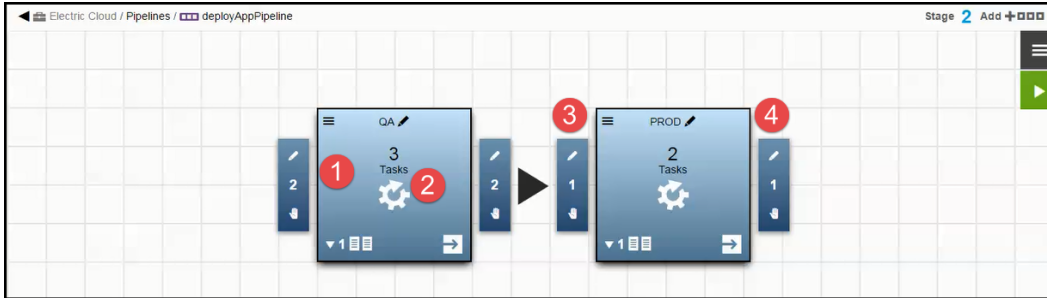




2	<p>Clicking the down arrow next to <b>All Projects</b> opens a drop-down menu that shows the list of available pipelines. The default is to show the pipelines for all projects.</p>  <p>To see only the objects for a specific project, click the down arrow in the <b>All projects</b> field and then select one or more projects in one of these ways:</p> <ul style="list-style-type: none"> <li>• Click on the name of one or more projects.</li> <li>• Enter the search criteria in the Search field. The projects that match the criteria appear in the list.</li> </ul> <p>If there are no matches, a message appears stating that there are no resource templates in the selected projects.</p>
3	<p>This is the pipeline definition, which includes a description of the pipeline, the project to which it belongs (<b>Default</b>), and the number of stages in the pipeline.</p>  <p>Clicking <b>i</b> next to the pipeline name shows a description of the pipeline.</p> <p>Clicking <b>i</b> next to the number of stages shows a list of the stage names in the pipeline.</p>  <p>Clicking  starts a pipeline run.</p>  <p>Clicking  shows the list of pipeline runs.</p>  <p>Clicking  shows the details of the pipeline run.</p>

## Parts of a Pipeline

Following are the key parts of a pipeline. This pipeline has two stages: QA and PROD:



Element	Name
1	Stage
2	Tasks
3	Entry gate
4	Exit gate

**IMPORTANT:** When an application, a pipeline, or a release is cloned across different projects, you might need to fix the references after the objects are cloned. For example, if a pipeline with an application reference in the "default" project is cloned to a different project, the application reference needs to be fixed after the pipeline is cloned.

## Creating a Pipeline

You can create a pipeline from scratch or based on an existing pipeline. To create a pipeline component from scratch:

1. Start in the Home page and then go to the pipelines list in one of these ways:
  - Click on the **Main menu** button in the upper left corner and then select **Pipelines > All Pipelines**.
  - Click **Pipelines**.


The pipelines list opens.

2. Click **Add +** to add a pipeline.
  - a. To create a new pipeline:
    - i. Click **Create new pipeline**.
    - ii. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description.

**Example:**

New

Pipeline


 Select Project ▼

Name

Description

New

Pipeline

 Default ▼

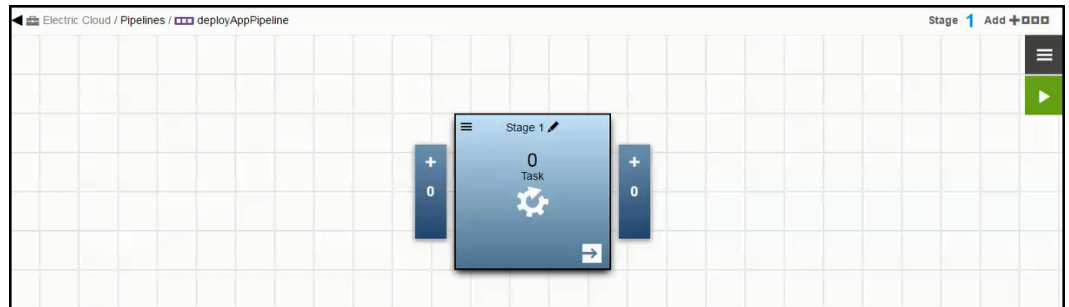
deployAppPipeline

A New test pipeline

iii. Click **OK**.

The pipelines visual editor reappears. It shows a pipeline with one stage.

### Example:



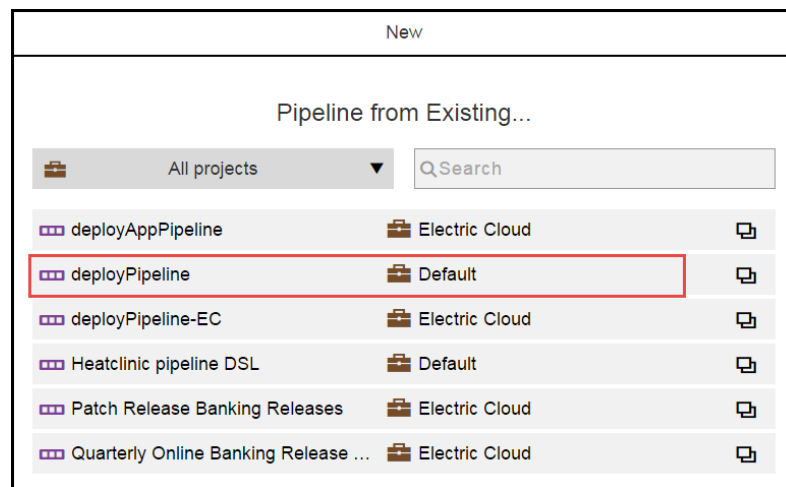
b. To create a pipeline based on an existing pipeline:

i. Click **Create from Existing**.

The list of existing pipelines opens.

It shows the list of available pipelines. The default is to show the pipelines for all projects. To see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects in one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more pipelines by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.

### Example:



ii. Select a pipeline.

- iii. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description.

### Example:

The screenshot shows a 'New Pipeline' dialog box. At the top, it says 'New'. Below that is the title 'Pipeline'. There is a dropdown menu for the project, currently set to 'Default'. Below the dropdown is a text input field containing the text 'deploy61Pipeline'. At the bottom is a larger text area for the description, containing the text 'A new test pipeline'.

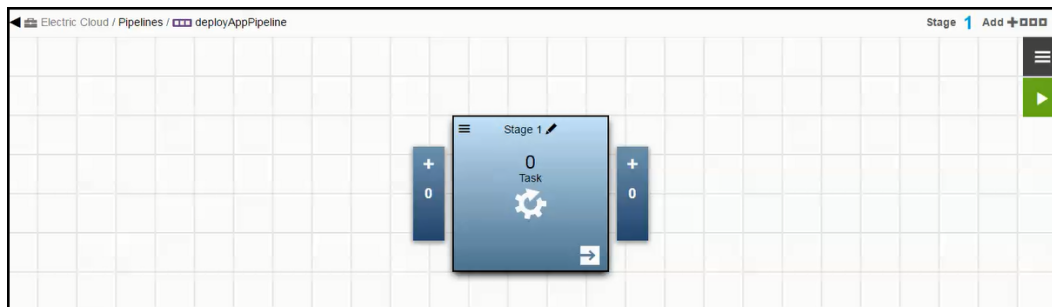
- iv. Click **OK**.

The pipelines visual editor re-appears and shows a pipeline with the same stages, tasks, and gates as the existing pipeline.

## Editing Pipeline Details

When you create a pipeline from scratch, it adds a stage automatically.

### Example:

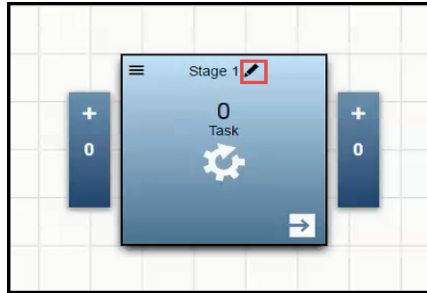


You can change the stage name and add a description of the stage. To do so:

1. Click the (edit) button next to the stage name.



### Example:



2. Enter the stage name and a stage description.

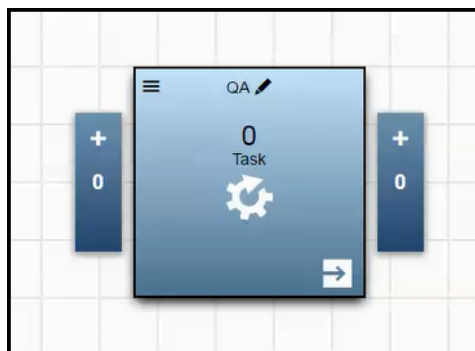
### Example:

A screenshot of the 'Pipelines Stage Details' dialog box. The title bar at the top reads 'Pipelines Stage Details'. Below the title bar is a text input field containing the text 'QA'. Underneath this is a larger text area containing the text 'QA group'. At the bottom of the dialog are two buttons: a gray 'Cancel' button on the left and a blue 'OK' button on the right with a white hand cursor icon pointing at it.

3. Click **OK**.

The pipeline now shows the updated stage name.

### Example:

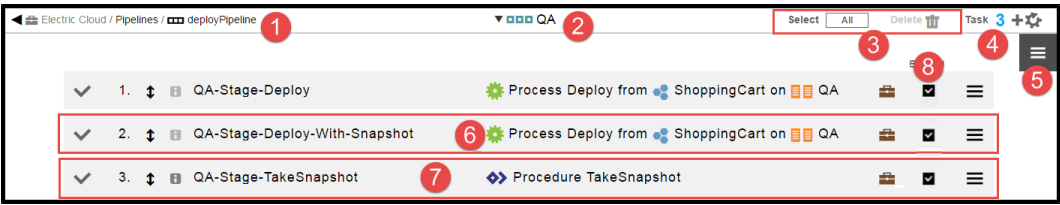






## Defining the Tasks in a Pipeline Stage

This section describes how to define the tasks in a stage. You can add any number of tasks, reorder tasks, run tasks in parallel, delete tasks, and so on.

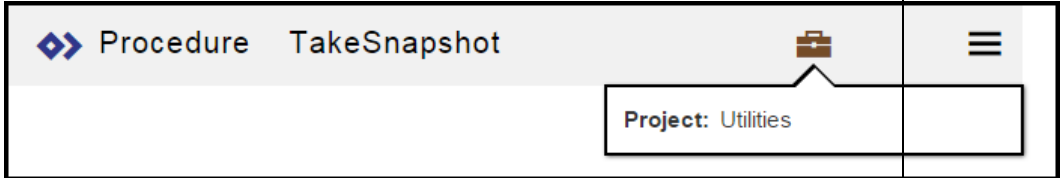

Parts of a Task List in a Pipeline Stage

Following are the key parts of a task list:




1	Breadcrumb showing the path to the pipeline.
2	Name of the stage. When you click the down arrow, a list of the stages in the pipeline opens. Select a stage to go to a different stage and view its task list.
3	Click the <b>Select</b> button to select <b>All</b> or <b>None</b> of the items in the list. Click the <b>Delete</b> button to delete the selected items.
4	Number of tasks in the stage. Click the  (Add Task) button to add a task to the stage.
5	Click the  (menu) button to open the menu to see details about the stage and take actions on the stage.
6	Task definition consisting of the task defined by an application process. This example consists of a task named QA-Stage-Deploy and an application process called Deploy, which is part of the ShoppingCart application that is mapped to  the QA environment. Clicking the  (menu) button lets you see details about the task and take actions on the task.



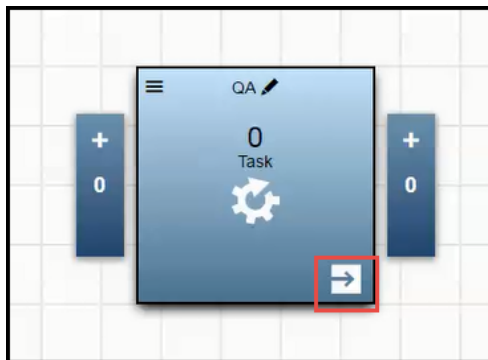
7	<p>Task definition consisting of the task defined by a procedure. In this example, it consists of a task named QA-Stage-TakeSnapshot and a procedure named TakeSnapshot in the Utilities project. Clicking the project button shows the project to which the procedure belongs.</p>  <p>Clicking the  (menu) button lets you see details about the task and take actions on the task.</p>
8	<p>Determines whether to skip the task at run time. This lets you skip tasks that were executed successfully in the prior run. This check box is checked by default.</p>

### Adding Pipeline Tasks

Starting in the pipelines visual editor:

1. Choose a stage in the pipeline.
2. Click the  button in the lower right corner of the stage to begin defining tasks.

### Example:



The task list opens. When the task list has one or more items, it shows the tasks in sequential order for the stage.

3. If the stage has no tasks, do the following in a empty row:
  - a. Enter the name of the task in the Name field.
  - b. (Optional) Enter a description for the task in the Description field.
  - c. Select the **On Error** condition. When the stage task fails, the pipeline either continues running and proceeds to the next task (**Continue running**) or stops running and aborts (**Stop running**). This gives you more control in the pipeline. The default is to **Stop running**.

### Example:

Enter **QA-Stage-Deploy** in the **Name** field.

- d. Click **+ Add another**.

The task you just added is saved, and a new task is automatically added after it.

4. Enter the name of the new task in the **Name** field.
5. (Optional) Enter a description for the task in the **Description** field.
6. Set the position of the task.
  - a. Select **Before** or **After**.
  - b. Click the down arrow to select the task that the new task will precede or follow.
7. Select the **On Error** condition. When the stage task fails, the pipeline either continues running and proceeds to the next task (**Continue running**) or stops running and aborts (**Stop running**). The default is to **Stop running**.

### Example:

- If you want to add another task, click **+ Add another** and repeat the previous three steps to add it. (If you do not, click **Done**.)

### Example:

The screenshot shows a task configuration window with a list of tasks and a configuration bar at the bottom. The list contains two tasks:

Order	Task Name	Status	Options
1.	QA-Stage-Deploy	Requires Definition	⬆ ⬆ ⚙️ ⚙️ ⚠️ Requires Definition 🔴 ☑️ ☰
2.	QA-Stage-Deploy-With-Snapshot	Requires Definition	⬆ ⬆ ⚙️ ⚙️ ⚠️ Requires Definition 🔴 ☑️ ☰

Below the list is a configuration bar with the following elements:

- Place** (selected)
- Before** (radio button)
- After** (radio button)
- Parallel to** (radio button)
- QA-Stage-Deploy-V** (dropdown menu)
- Continue** (radio button)
- Stop** (radio button)
- ...on Error** (radio button)
- Name** (text input)
- Description** (text input)
- + Add another** (button)
- Define** (button)
- Done** (button)

The list shows the tasks in the order that they will be executed.

### Example:

The screenshot shows a task configuration window with a list of tasks. The list contains three tasks:

Order	Task Name	Status	Options
1.	QA-Stage-Deploy	Requires Definition	⬆ ⬆ ⚙️ ⚙️ ⚠️ Requires Definition 🔴 ☑️ ☰
2.	QA-Stage-Deploy-With-Snapshot	Requires Definition	⬆ ⬆ ⚙️ ⚙️ ⚠️ Requires Definition 🔴 ☑️ ☰
3.	QA-Stage-Deploy-Task eSnapshot	Requires Definition	⬆ ⬆ ⚙️ ⚙️ ⚠️ Requires Definition 🔴 ☑️ ☰

- Click **Requires Definition** for the first task in the list.

The dialog box to define the task opens. For more information about the task types, see [Pipeline Tasks](#) on page 311.

10. Enter the settings to define the task, and click **OK** to save the task definition.

Example:

- a. Select **App Process** to define the task as an application process.
- b. In the **Select Project** field, select the **Default** project.
- c. Select the **ShoppingCart** application, and then select **Use Snapshot**

When you click in the **Select a Snapshot** field, a **Search** field opens where you can enter the criteria to search for a snapshot as well as the names of existing snapshots.

- d. Select **SC-S1** as the snapshot to use.
- e. Select the **Deploy** process and the **QA** environment where application will be deployed.


### Example:



The screenshot shows the configuration interface for the QA-Stage-Deploy task. The breadcrumb at the top indicates the path: QA / QA-Stage-Deploy. On the left, a sidebar lists task types: App Process (selected), Deployer, Procedure, Manual, Workflow, Plugin, and Utility. The main area displays five dropdown menus for configuration: Project (Default), Application (ShoppingCart), Snapshot (SC-S1), Process (Deploy), and Environment (QA). Below these is a 'Parameters' section with a text input field and a plus icon. At the bottom, there are two toggle switches: 'Smart Deploy is off' and 'Stage Artifacts is off'.

Go [here](#) for more information about the different ways to define a stage task [Pipeline Concepts](#) on page 309

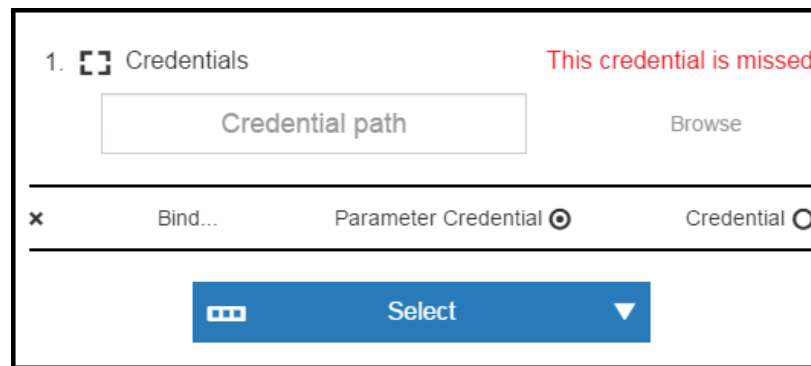
- f. The **Parameters** field is disabled because the **Deploy** process does not have any required parameters.


### Example:



1  Parameters ▲ 1 Required 

If the process has a required parameter for the pipeline run, such as a credential parameter, a message with the number of required parameters (such as **1 Required**) appears in the **Parameters** field. You can enter the path to the credential, browse to it, select the **Parameter Credential** or **Credential** binding, or select a user-defined credential that is attached to the project associated with the pipeline.



1.  Credentials This credential is missed

Browse

---

× Bind... Parameter Credential ☒ Credential ☐

... Select ▼

11. Click **Requires Definition** for the second task in the list, define the task, and click **OK**.

The dialog box to define the task opens.

Example:

- a. Select **App Process** to define the task as an application process.
- b. In the **Select Project** field, select the **Default** project.
- c. Select the **ShoppingCart** application.
- d. Select the **Deploy** process and the **QA** environment where the **ShoppingCart** application will be deployed.

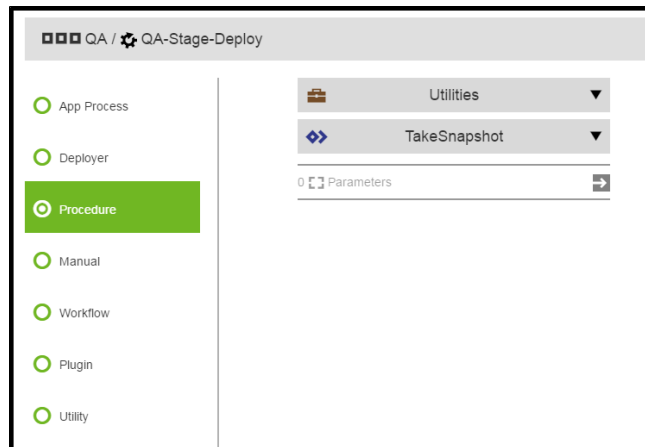
If the **Deploy** process has one or more required parameter for the pipeline run, the **Parameter** field is enabled. Go [here](#) for more information.

12. Click **Requires Definition** for the third task in the list, define the task, and click **OK** to save the task definition.

Example:

- a. Select **Procedure**.
- b. When you click in the **Select Project** field, a drop-down list of available projects opens. Select the **Utilities** project.
- c. When you click in the **Select Procedure** field, a drop-down list of available procedures opens. Select the **TakeSnapshot** procedure.

### Example:



If the **TakeSnapshot** procedure has required parameters for the pipeline run, the **Parameter** field is enabled. Go [here](#) for more information.

### Changing the Order in Which Pipeline Tasks Are Executed

This section describes how to change the order in which the tasks are executed. Starting in the task list:

1. Choose the task that you want to move.
2. Click and drag the (up/down) button next to the task name to move the task to its new position.



### Example:

✓	1.	↕	QA-Stage-Deploy-With-Snapshot	⚙️	Process	Deploy	from	Shoppin...	QA	☑	☰
✓	2.	↕	QA-Stage-TaskeSnapshot	⚙️	Procedure	TakeSnapshot				☑	☰
✓	3.	↕	QA-Stage-Deploy	⚙️	Process	Deploy	from	Shoppin...	QA	☑	☰

The task is now in the first in the list.

✓	1.	↕	QA-Stage-Deploy	⚙️	Process	Deploy	from	Shoppin...	QA	☑	☰
✓	2.	↕	QA-Stage-Deploy-With-Snapshot	⚙️	Process	Deploy	from	Shoppin...	QA	☑	☰
✓	3.	↕	QA-Stage-TaskeSnapshot	⚙️	Procedure	TakeSnapshot				☑	☰



Note that you can also click the button on any task and click **Change Order** to reorder it.

### Running Pipeline Tasks in Parallel

By default, tasks are executed in order. You can run tasks without dependencies in parallel to reduce runtimes and make a stage more efficient. To make a set of sequential tasks run in parallel:

1. Click to highlight at least two tasks that you want to run in parallel.

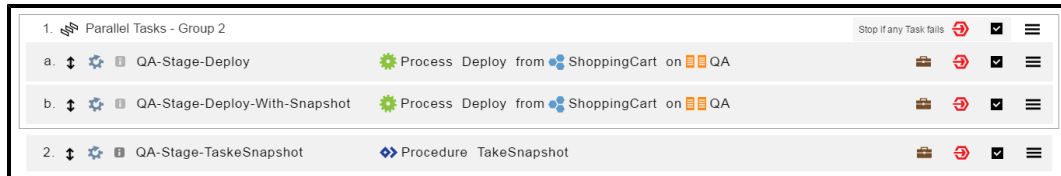
### Example:

1.				QA-Stage-Deploy		Process	Deploy	from		ShoppingCart	on		QA			
2.				QA-Stage-Deploy-With-Snapshot		Process	Deploy	from		ShoppingCart	on		QA			
3.				QA-Stage-TaskeSnapshot		Procedure	TakeSnapshot									

- Click the  button.

A parallel tasks group is created, which contains the tasks that will now run in parallel.

### Example:



Note that you can add new tasks to an existing parallel tasks group. To do so, drag the (up/down)



button next to the task name to move the task to the group. Also note that you can rename a parallel



tasks group by clicking the button for the group and then clicking **Details** to fill in a new name.

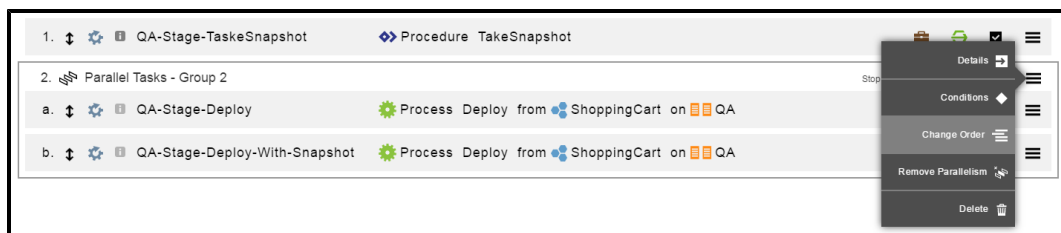
### Changing the Order of Pipeline Tasks that Include a Group of Parallel Tasks

You can change the execution order of tasks that include a group of parallel tasks. To do so:




- Click the button for the group and choose **Change Order**.

### Example:



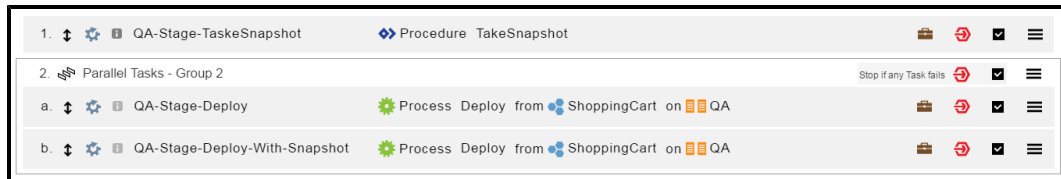



- Click either the **Before** or **After** radio button as appropriate, then click the pipeline rules (  )

menu, then click another task, and then click **Done**.

The tasks are now reordered.

### Example:




Note that you can also click and drag the  (up/down) button next to a group to reorder it.

### Setting the Error or Rejection Handling for a Parallel Task Group

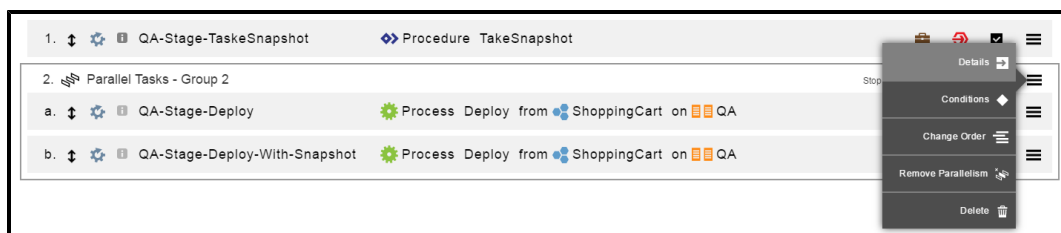
When defining a group of parallel tasks, you can specify whether the pipeline continues or stops if any task in the group fails because of an error or rejection. By default, if any task fails or is rejected, the pipeline aborts. This behavior is usually used in Continuous Delivery pipelines.

To set the error or rejection handling:



- Click the  button for the group and then click **Details**.

### Example:



The **Stage Task Details** page appears.

### Example:

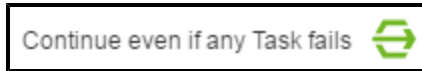
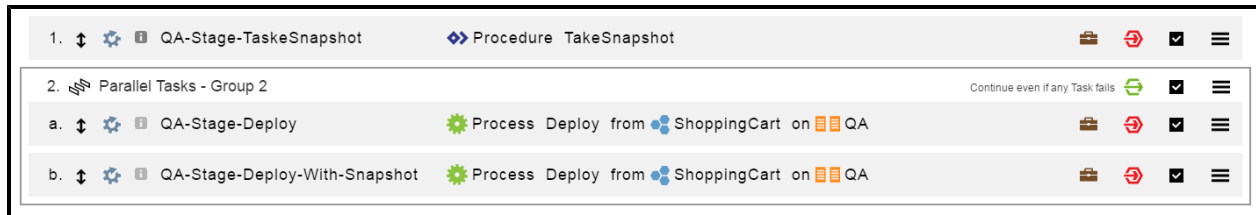
The screenshot shows a dialog box titled 'Edit' with a close button (X) in the top-left corner. The main heading is 'Stage Task Details'. Below this, there is a text input field containing 'QA-Stage-TaskeSnapshot'. Underneath the input field is a description box that reads 'Takes a snapshot from the QA stage using API'. At the bottom of the dialog, there is a section for selecting an action on error or rejection. It contains two radio buttons: 'Continue' (which is selected) and 'Stop'. To the right of these radio buttons is a red icon of a hand with a lightning bolt, and further right is the text '...on Error or Rejection'. At the very bottom of the dialog are two buttons: 'Cancel' on the left and 'OK' on the right.

2. Select one of the following options:

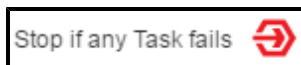
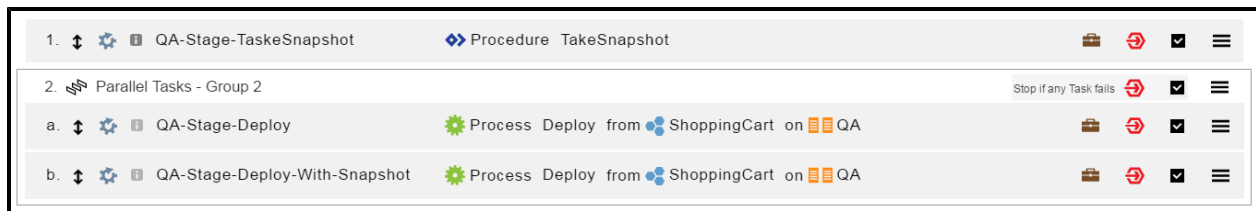
- **Continue:** If any task fails or is rejected, the pipeline continues to the next gate or stage task.
- **Stop:** If any task fails or is rejected, the pipeline aborts.

3. Click **OK**.

If you changed from **Stop** (the default) to **Continue**, the Error or Rejection icon for the group changes to

**Example:**

If you changed from **Continue** to **Stop**, the Error or Rejection icon for the group changes to

**Example:****Adding “Run if” and “Wait until” Conditions to a Parallel Task Group**

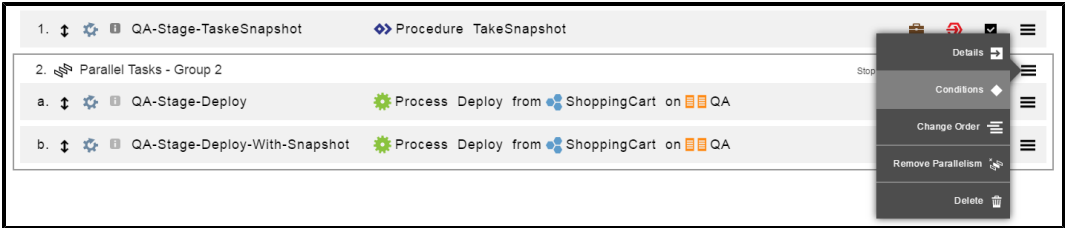
For a parallel task group, you can specify “Run if” and “Wait until” conditions to control the group behavior based on a precondition of your choice. Skipping a group causes all of its tasks to be skipped.

You can specify preconditions by entering a JavaScript expression. To do so:



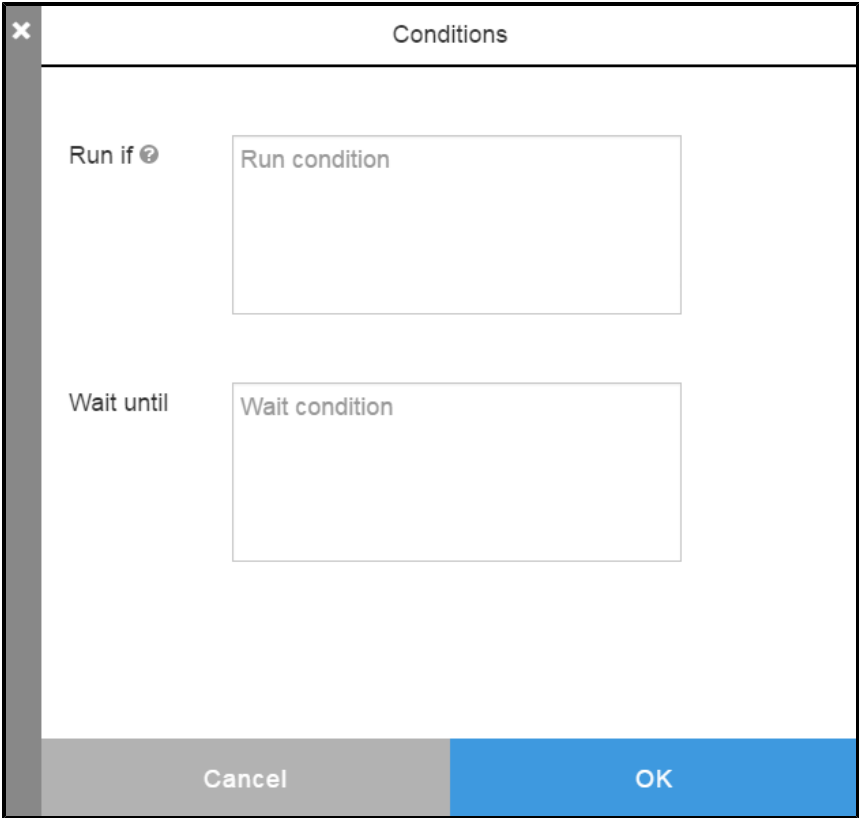
1. Click the button for the group and then click **Conditions**.

**Example:**

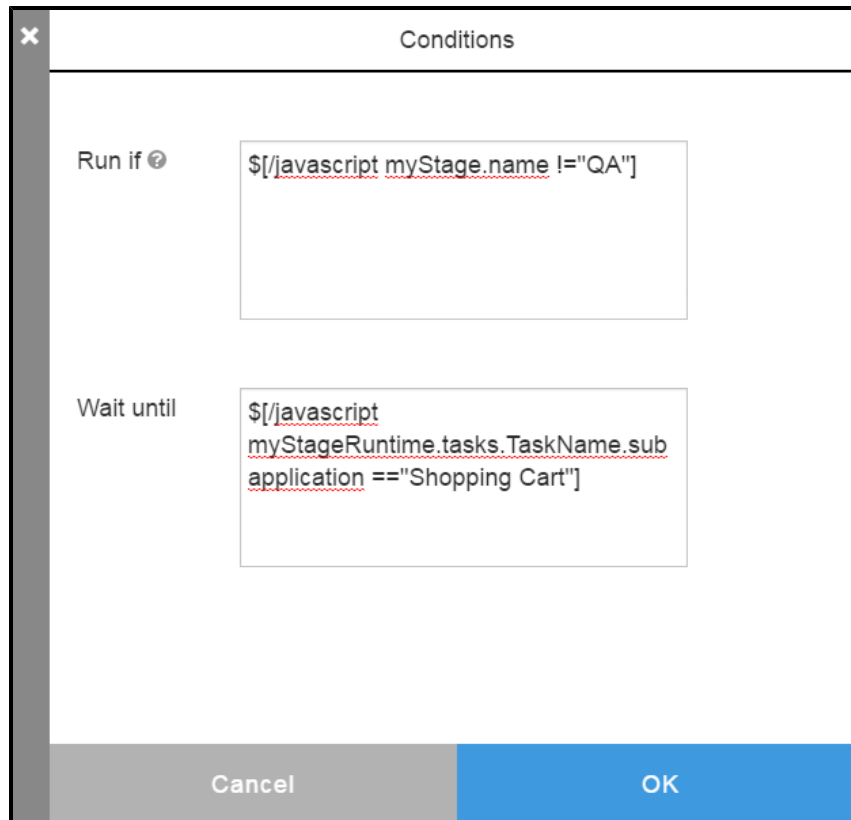


The **Conditions** page appears.

**Example:**



2. Enter a JavaScript expression into the **Run if** field or the **Wait until** field (or both).

**Example:**

Conditions

Run if ⓘ `$[/javascript myStage.name != "QA"]`

Wait until `$[/javascript myStageRuntime.tasks.TaskName.sub application == "Shopping Cart"]`

Cancel OK

For more examples of Javascript expressions for “Run if” and “Wait until” conditions, see the [KBEC-00360—Using Context-Relative Shortcuts to Properties on Pipelines and Their Child Objects](#) KB article.

3. Click **OK**.

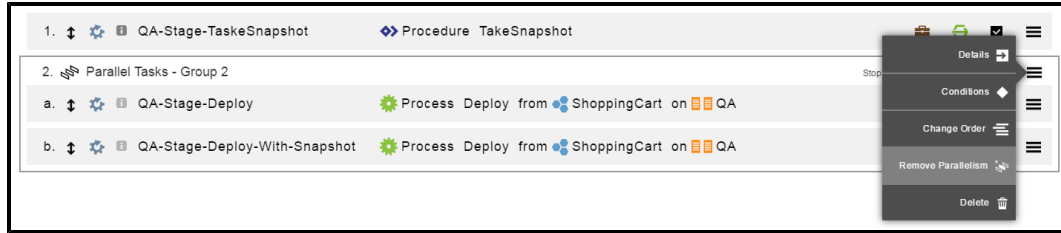
**Unparallelizing Pipeline Tasks**

You can return parallel tasks in a group to sequential execution. To do so:

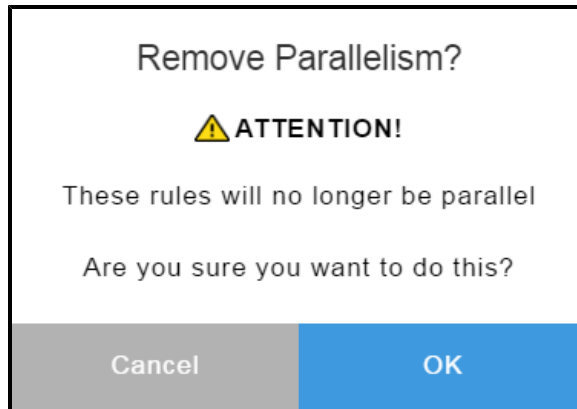


1. Click the button for the group and then click **Remove Parallelism**.

**Example:**



A confirmation popup appears:



2. Click **OK**.

The tasks will once again run in sequence.

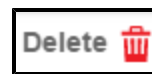
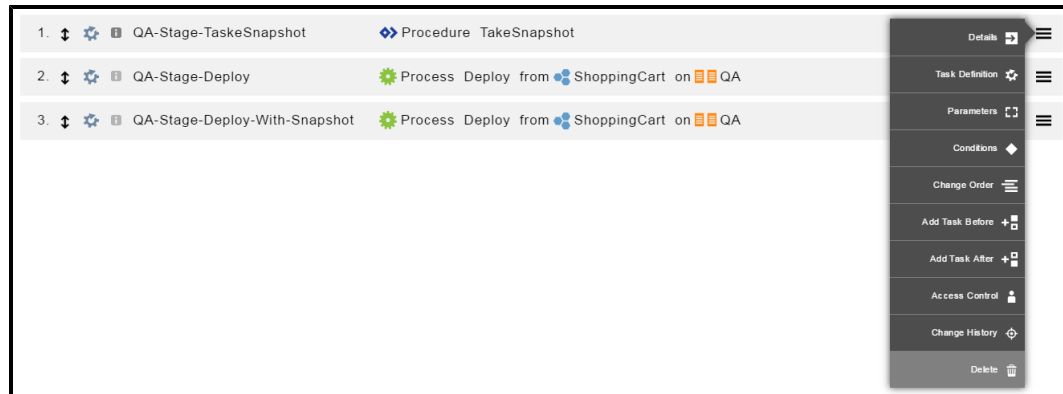
### ***Deleting a Pipeline Task from a Stage***

You can delete a pipeline task from a stage. To do so:



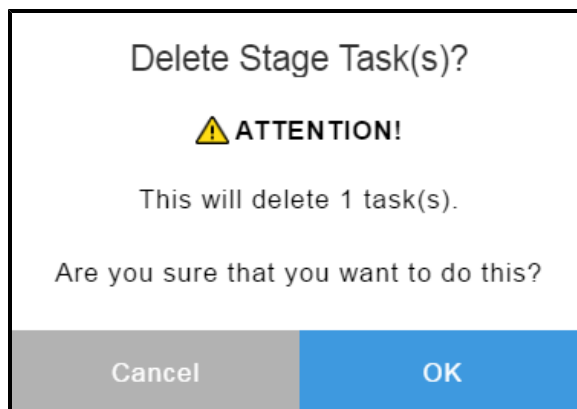
1. Click the button for the task and then click **Delete**.

**Example:**



(You could also click to highlight the task and then click the button.)

A confirmation popup appears:



2. Click **OK**.

Note that you can also use this method to delete a parallel tasks group and all of its tasks.

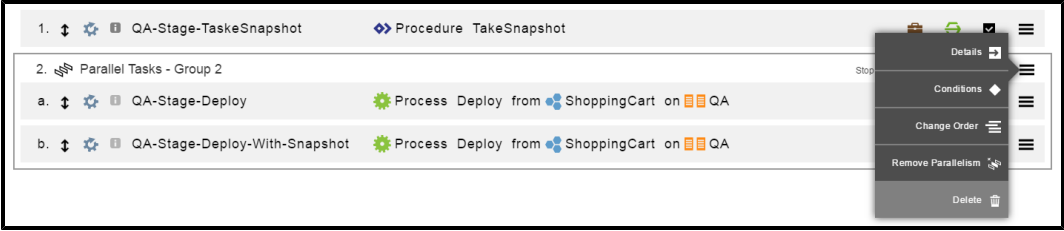
### ***Deleting a Parallel Task Group and All of Its Tasks from a Stage***

You can delete a parallel task group from a stage. This also deletes all of its tasks. To do so:

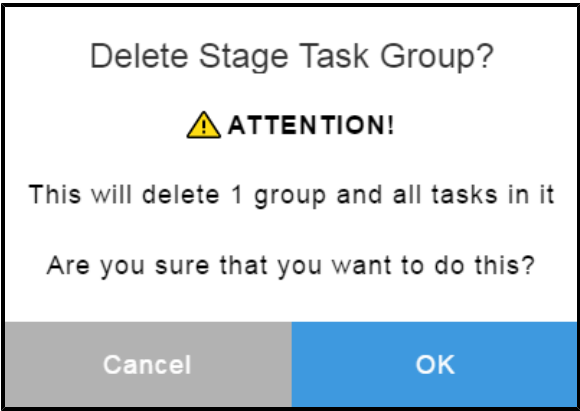


1. Click the button for the parallel task group and then click **Delete**.

### **Example:**



(You could also click to highlight the group and then click the button.)  
A confirmation popup appears:



2. Click **OK**.

## Viewing and Editing the Pipeline Definition

To edit a pipeline definition, you edit its tasks. To view or edit the pipeline definition:

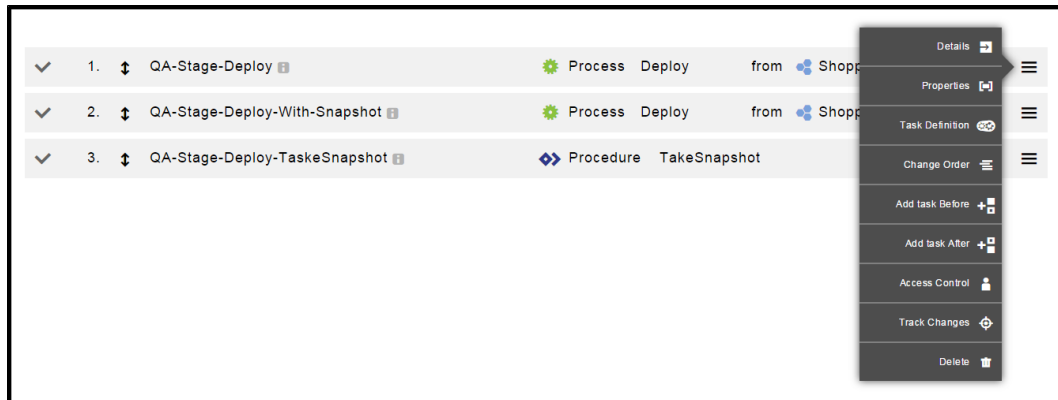


1. Go to the pipelines list.



2. Choose a task and then click the button at the end of the row.

### Example:



3. Click **Task Definition**.

The task definition appears.

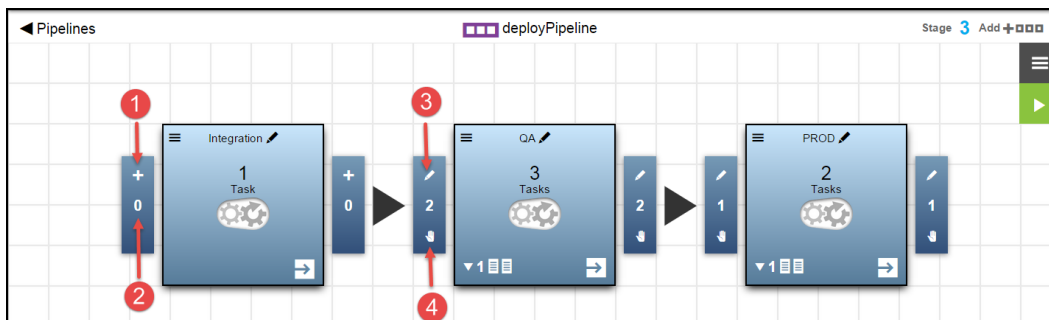
4. Change the settings that you want to modify and then click **OK**.




## Defining Gate Approvals

This section describes how to create approval rules on the entry and exit gates. A gate approval can be either manual (where the approver must physically click the approval to move to the next stage) or automated (based on whether specific criteria are met). You can use a combination of both types of approvals on a gate. You can also change the order of approval rules, run approval rules in parallel, change the order of approval rules that include parallelized rules, and unparallelize approval rules.

### Gates for Pipelines

The following example shows entry and exit gates in a pipeline in the ElectricFlow UI:




1	The  button adds approvals to a gate that has none.
2	Number of approvals in the gate.
3	The  button adds an approval to the gate or edits the approvals.
4	The hand icon means “needs attention.” This means that the gate will require attention when the pipeline gets to this entry gate. 

### Creating a Manual Approval Rule in a Gate


This example shows how to create a single manual approval rule in which one approver needs to take action.

Starting in the Pipelines Visual Editor:

1. Go to the gate where you want to add the approval rule.
2. Click the  button on the gate to add a gate approval rule.



The page to add or edit approval rules for the gate opens. Following is an undefined approval rule:

 Gate Rule
 ○ Continue ⇌
● Stop ⚠
...on Rejection

+ Add another
✎ Define
📄 Done

3. In the **Name** field, enter **POST-QAStage-Approval1**.
4. In the **Description** field, enter a suitable description of the rule.

5. Click **Define**.

The gate approval definition screen dialog appears:

6. Make sure that the **Approval** button is selected (the default).

7. In the **Assignees** field, add the user named **john**. Start typing the user or group name to find available users or groups.

Keep **Default Pipeline Notification** as is. Note that you can add multiple approvers or groups.


8. Click **OK**.

For the gate, there is now one approval rule that user john must approve for the pipeline to progress:

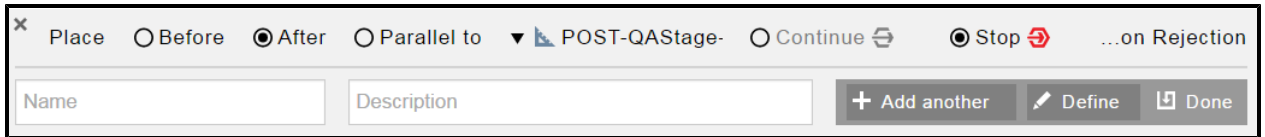
### *Creating a Procedure-Based Approval Rule in a Gate*

This example shows how to create a procedure-based rule. This type of rule contains criteria that let you call any procedure. The job status corresponding to the procedure being executed determines the gate task outcome. A job outcome of **Success** (finished with no errors) is considered to be approved. A job outcome of **Warning**, **Failure**, or any other non-success job status is considered to be rejected.

Starting in the Pipelines Visual Editor:

1. Go to the gate where you want to add the approval rule.
2. Click the  button to add another approval rule.

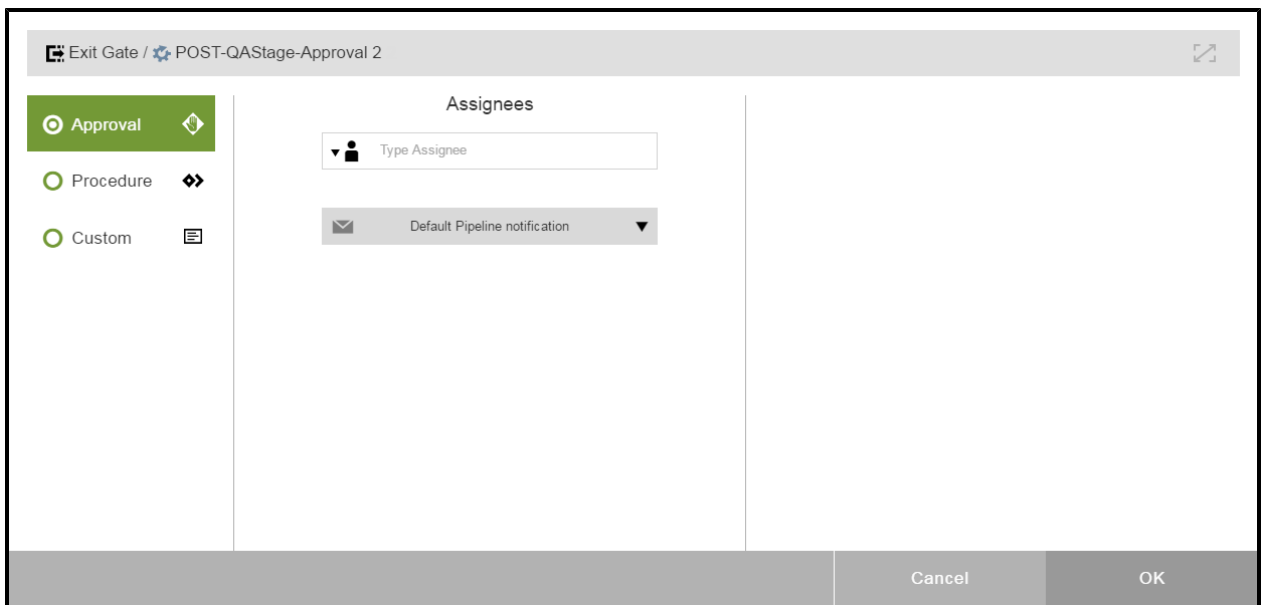
The page to add or edit approval rules for the gate opens. This is an undefined approval rule for subsequently-added approval rules. You can choose the placement of this rule relative to the rule above it:



A dialog box for configuring an approval rule. At the top, there are radio buttons for 'Place', 'Before', 'After' (selected), and 'Parallel to'. To the right of these is a dropdown menu showing 'POST-QAStage-' and a 'Continue' button. Further right are 'Stop' (selected) and '...on Rejection' options. Below this is a section with two input fields: 'Name' and 'Description'. At the bottom right are three buttons: '+ Add another', 'Define' (with a pencil icon), and 'Done' (with a checkmark icon).

3. In the **Name** field, enter **POST-QAStage-Approval 2**.
4. In the **Description** field, enter a suitable description of the rule and then click **Define**.

The exit gate approval definition dialog appears:



A dialog box titled 'Exit Gate / POST-QAStage-Approval 2'. On the left is a sidebar with three options: 'Approval' (selected with a green circle), 'Procedure' (with a diamond icon), and 'Custom' (with a list icon). The main area is titled 'Assignees' and contains a dropdown menu labeled 'Type Assignee' and a button with an envelope icon labeled 'Default Pipeline notification'. At the bottom right are 'Cancel' and 'OK' buttons.

- Click the **Procedure** button.

The dialog box for defining a procedure-based approval appears:

Exit Gate / POST-QAStage-Approval 2

Approval

**Procedure**

Custom

Select Project

Select Procedure

0 Parameters

Cancel OK

- Select the **Default** project from the **Select Project** menu.
- Select the **Echo params procedure** procedure from the **Select Procedure** menu.

The Parameters button becomes active:

Exit Gate / POST-QAStage-Approval 2

Approval

**Procedure**

Custom

Default

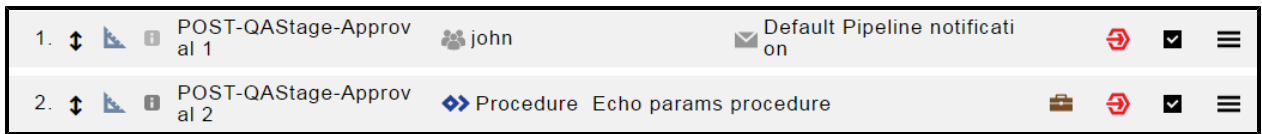
Echo params procedure

3 Parameters ▲ 1/1 Required

Cancel OK

- Click **Parameters**, enter values of your choice for **param1**, **param2**, and **param2**, and then click **OK**.


The procedure-based approval rule appears in the page to add or edit approval rules for the gate:



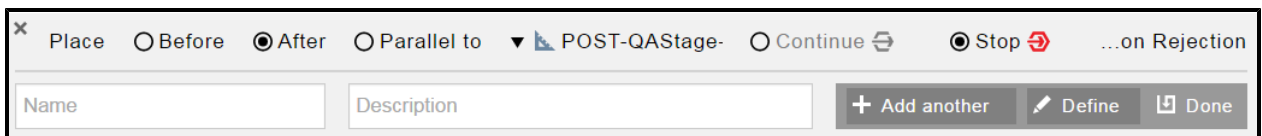
### Creating a Condition-Based Approval Rule in a Gate

This example shows how to create a condition-based rule. You can create gate criteria based on custom conditions of your choice that evaluate to true or false to approve or reject gates. A condition is a Javascript expression that leverages properties. For example, you can create a property on the pipeline runtime based on the output of a test suite and write an expression to evaluate whether the property is 50 or greater (pass) or less than 50 (fail). You can specify criteria based on any intrinsic properties that are appropriate for a release pipeline and a pipeline runtime. For details about the intrinsic properties for each object in ElectricFlow Deploy, see the *Intrinsic Properties in ElectricFlow Deploy Objects* document at [http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html).

Starting in the Pipelines Visual Editor:

- Go to the gate where you want to add the approval rule.
- Click the  button to add another gate approval rule.

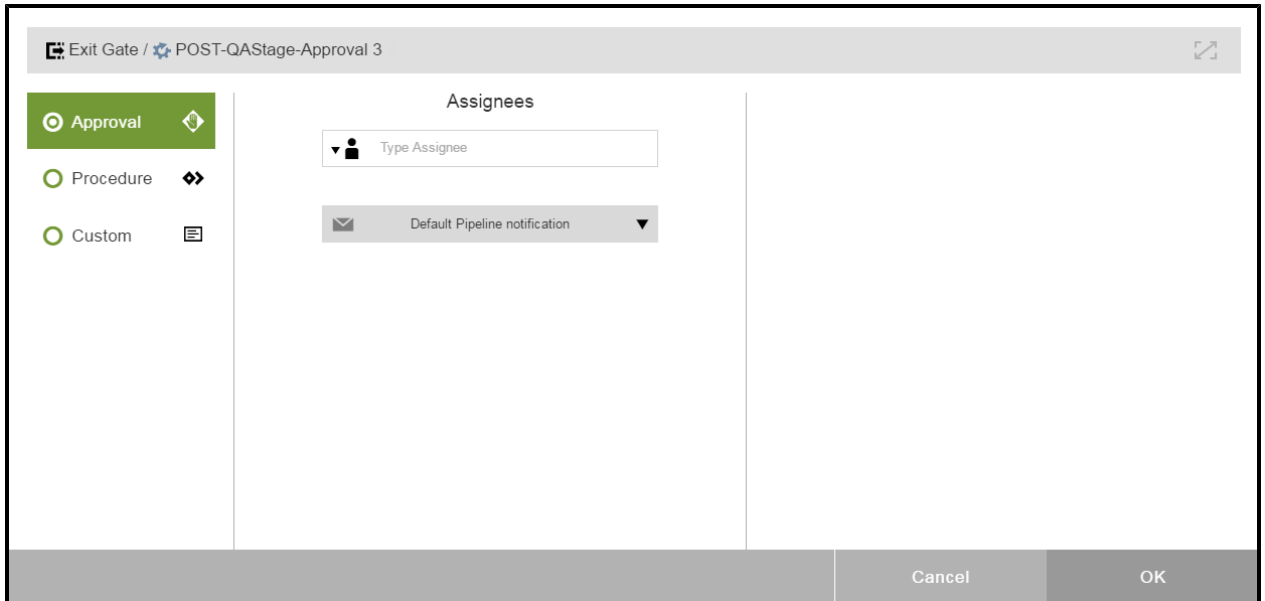
The page to add or edit approval rules for the gate opens:



- In the **Name** field, enter **POST-QAStage-Approval 3**.

4. In the **Description** field, enter a suitable description of the rule and then click **Define**.


The exit gate approval definition dialog appears:



The dialog box titled "Exit Gate / POST-QAStage-Approval 3" shows the "Approval" tab selected in the left sidebar. The main area is titled "Assignees" and contains a "Type Assignee" input field with a dropdown arrow and a "Default Pipeline notification" dropdown menu. The bottom right corner has "Cancel" and "OK" buttons.

5. Click the **Custom** button.

The dialog box for defining a condition-based approval appears:



The dialog box titled "Exit Gate / POST-QAStage-Approval 3" shows the "Custom" tab selected in the left sidebar. The main area is titled "Gate Condition ?" and contains a large empty rectangular box with a green circular icon in the bottom right corner. The bottom right corner has "Cancel" and "OK" buttons.

6. In the **Gate Condition** field, enter one of the following conditions.

- To check the outcome of the previous task in the same stage using the task name:

```
$/javascript myStageRuntime.tasks.test.outcome == "skipped"]
```

- To set the evidence property in the task, which will appear in the comment after the task has completed:

```
$/javascript
setProperty("/myTaskRuntime/evidence", "test value")
true;
]
```

7. Click **OK**.


The condition-based approval rule appears in the page to add or edit approval rules for the gate:

1. ↑ ↓	POST-QAStage-Approval 1	john	Default Pipeline notification	🔗	✓	☰
2. ↑ ↓	POST-QAStage-Approval 2	Procedure Echo params procedure		🔗	✓	☰
3. ↑ ↓	POST-QAStage-Approval 3	Custom \$[/javascript myStageRuntime.tasks.test.outcome == "skipped"]		🔗	✓	☰

For more examples of Javascript expressions for conditions, see the *Using Context-Relative Shortcuts with Pipelines and Related Objects* KB article at <https://helpcenter.electric-cloud.com/hc/en-us/sections/200516863-Commander-KB>.

## Changing the Order of Approval Rules

You can change the execution order of approval rules. To do so:

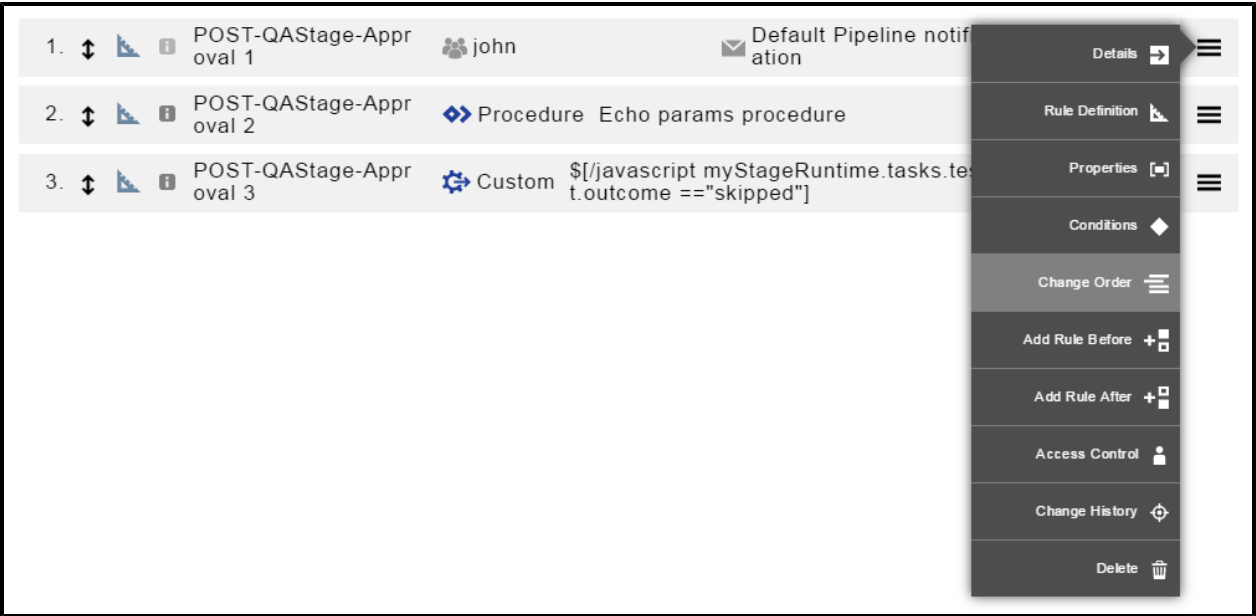
- Go to the gate where you want to change the order of approval rules containing parallelized rules.
- Click the  button on the gate.

The page to add or edit approval rules for the gate opens:

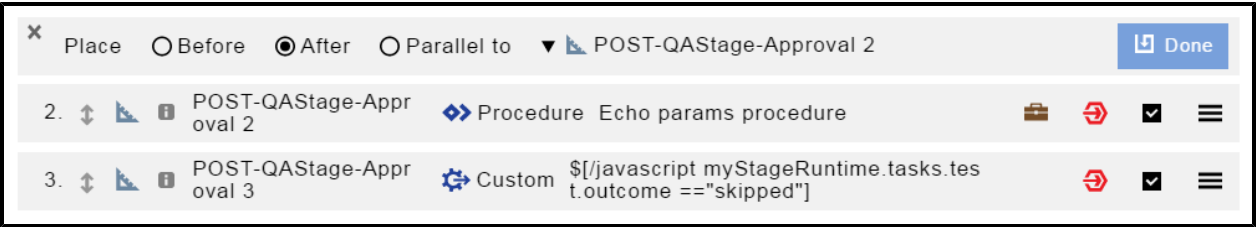
1. ↑ ↓	POST-QAStage-Approval 1	john	Default Pipeline notification	🔗	✓	☰
2. ↑ ↓	POST-QAStage-Approval 2	Procedure Echo params procedure		🔗	✓	☰
3. ↑ ↓	POST-QAStage-Approval 3	Custom \$[/javascript myStageRuntime.tasks.test.outcome == "skipped"]		🔗	✓	☰



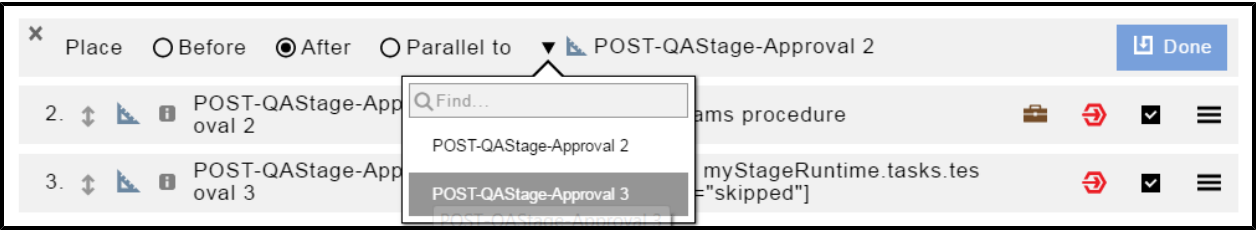
- 
3. Click the  menu for the **POST-QAStage-Approval 1** rule and choose **Change Order**:



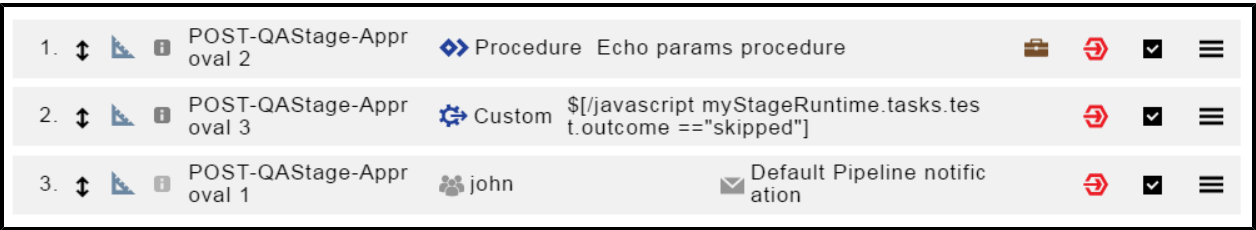
A menu appears that lets you reorder the group of parallel rules in relation to the other rules:




4. Click the pipeline rules (  ) menu, then click **POST-QAStage-Approval 4**, and then click **Done**:



The **POST-QAStage-Approval 1** rule will now run after the **POST-QAStage-Approval 3** rule:




Note that you can also click and drag the  (up/down) button next to a rule name to reorder it.

**Running Approval Rules in Parallel**

By default, approval rules are executed in numerical order. This means that gates must be approved in sequence, which can cause delays in pipeline execution if an approver does not act on an approval request in a timely manner. To mitigate this risk, you can configure any combination of sequential approval rules in parallel.

To make a set of sequential approval rules run in parallel:


1. Go to the gate where you want to parallelize the approval rules.
2. Click the  button on the gate.

The page to add or edit approval rules for the gate opens:

1.			POST-QAStage-Approval 2		Procedure	Echo params procedure					
2.			POST-QAStage-Approval 3		Custom	<code>\$/javascript myStageRuntime.tasks.test.outcome == "skipped"]</code>					
3.			POST-QAStage-Approval 1		john			Default Pipeline notification			

3. Click to highlight the **POST-QAStage-Approval 2** and **POST-QAStage-Approval 3** rules.


1.			POST-QAStage-Approval 2		Procedure	Echo params procedure				
2.			POST-QAStage-Approval 3		Custom	[\$[javascript myStageRuntime.tasks.test.outcome == "skipped"]				
3.			POST-QAStage-Approval 1		john			Default Pipeline notification		

4. Click the  button.

The rules will now run in parallel:


1.  Parallel Rules - Group 1											
a.			POST-QAStage-Appr oval 2		Procedure	Echo params procedure					
b.			POST-QAStage-Appr oval 3		Custom	<code>\$/javascript myStageRuntime.tasks.tes t.outcome == "skipped"]</code>					
2.			POST-QAStage-Appr oval 1		john			Default Pipeline notific ation			



Note that you can rename a parallel rules group by clicking the  menu for the group and choosing **Details** to fill in a new name.

### Changing the Order of Approval Rules that Include a Group of Parallelized Rules

You can change the execution order of approval rules that include parallelized rules. To do so:

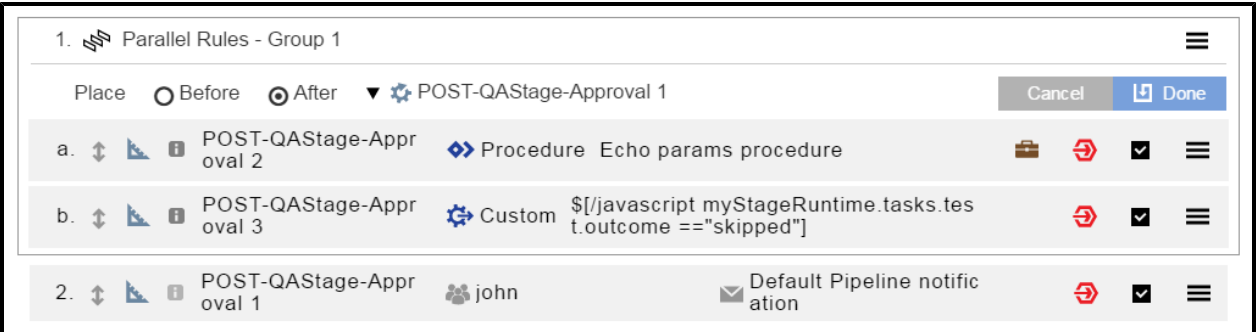
- 1. Go to the gate where you want to change the order of approval rules containing parallelized rules.
- 2. Click the  button on the gate.

The page to add or edit approval rules for the gate opens.

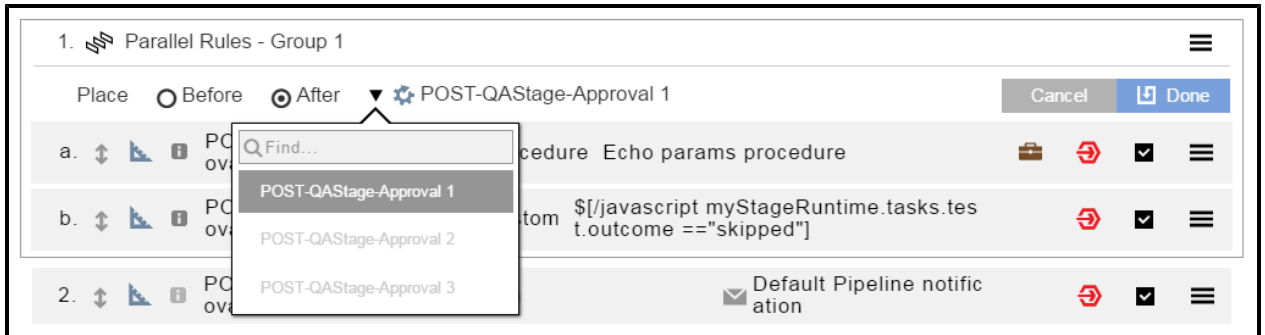
- 
- 3. Click the  menu for the **Parallel Rules—Group 1** group and choose **Change Order**:



A menu appears that lets you reorder the group of parallel rules in relation to the other rules:




4. Click the pipeline rules (  ) menu, then click **POST-QAStage-Approval 1**, and then click **Done**:



The rules in the **Parallel Rules—Group 1** group will now run after the **POST-QAStage-Approval 1** rule:



Note that you can also click and drag the  (up/down) button next to a rule name group to reorder it.

### Unparallelizing Approval Rules

You can return parallel approval rules to sequential execution. To make a set of parallel rules run in sequence:

- 1. Go to the gate with the parallel rules.
- 2. Click the button on the gate.



The page to add or edit the approval rules for the gate opens:

1. POST-QAStage-Approval 1johnDefault Pipeline notification

2. Parallel Rules - Group 1

a. POST-QAStage-Approval 2ProcedureEcho params procedure

b. POST-QAStage-Approval 3Custom\$[/javascript myStageRuntime.tasks.test.outcome == "skipped"]

- 3. Click to highlight the group of parallel rules.

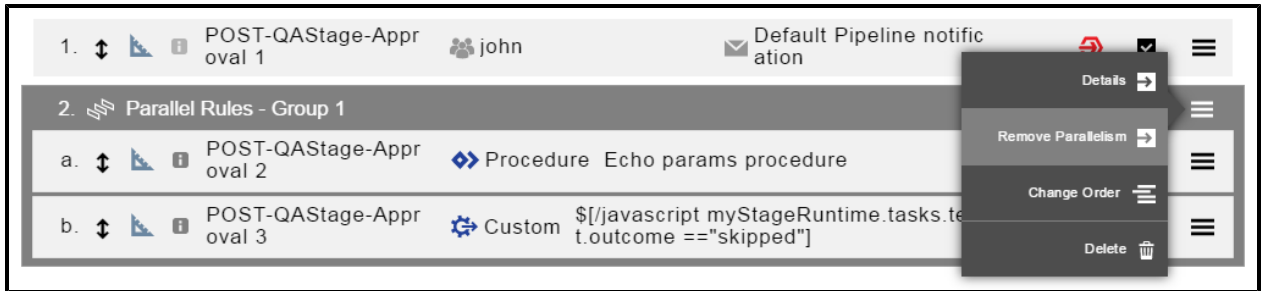
1. POST-QAStage-Approval 1johnDefault Pipeline notification

2. Parallel Rules - Group 1

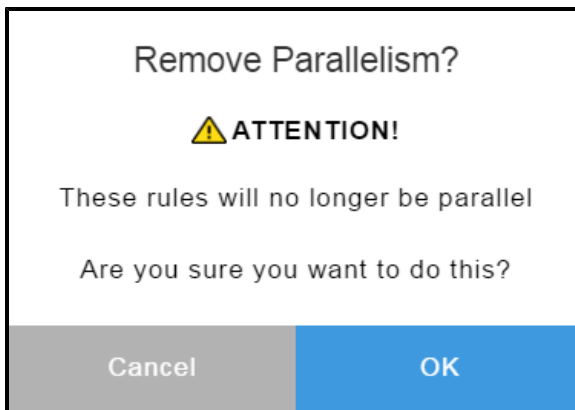
a. POST-QAStage-Approval 2ProcedureEcho params procedure

b. POST-QAStage-Approval 3Custom\$[/javascript myStageRuntime.tasks.test.outcome == "skipped"]

4. Click the menu (☰) button for the group, and then click **Remove Parallelism**.

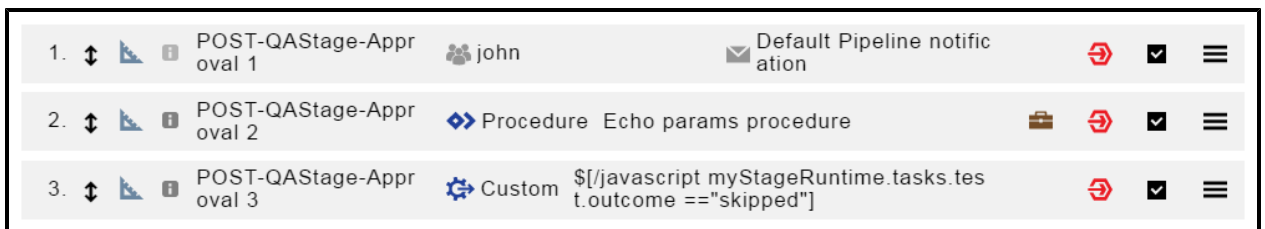


A confirmation popup appears:



5. Click **OK**.


The rules will once again run in sequence:



### *Deleting an Approval Rule from a Gate*

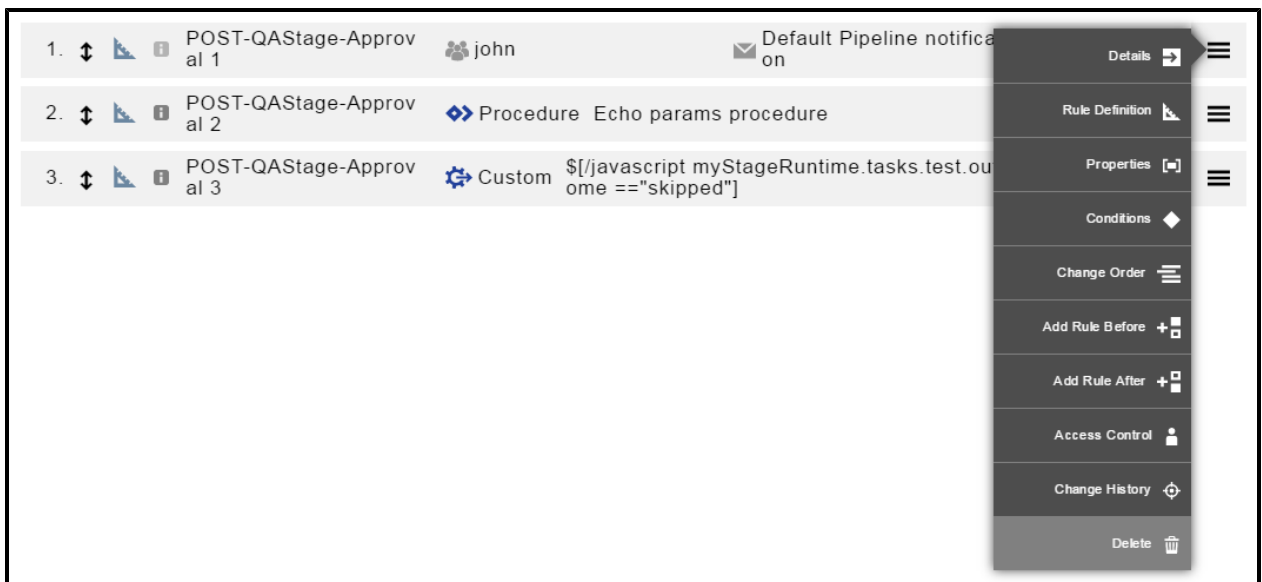
You can delete an approval rule from a gate.

To do so:

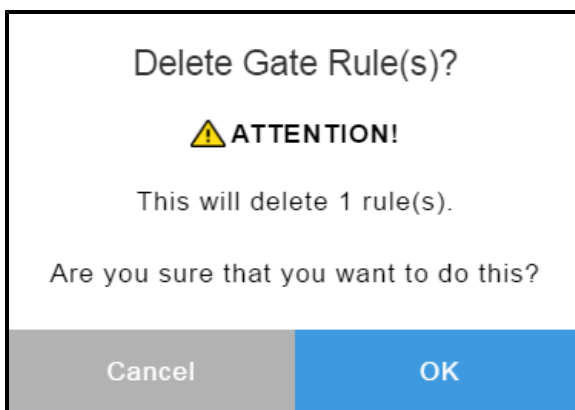
1. Go to the gate with the parallel rules.
2. Click the  button on the gate.

The page to add or edit the approval rules for the gate opens.

3. Click the  menu for the **POST-QAStage-Approval 1** rule and choose **Delete**.



A confirmation popup appears:



4. Click **OK**.

## Running Pipelines

This section shows how to run a pipeline. It also has examples showing different pipeline run scenarios.



Starting from the Pipelines Visual Editor:




1. Click the **Run pipeline** button (  ) to start a pipeline run.

You can optionally select a previous pipeline run to use the parameters from that run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.


2. If the pipeline has required parameters to run the pipeline, enter the parameter values.

3. View the real-time progress of the pipeline run.

**Note:** These are the "Attention Needed" icons:

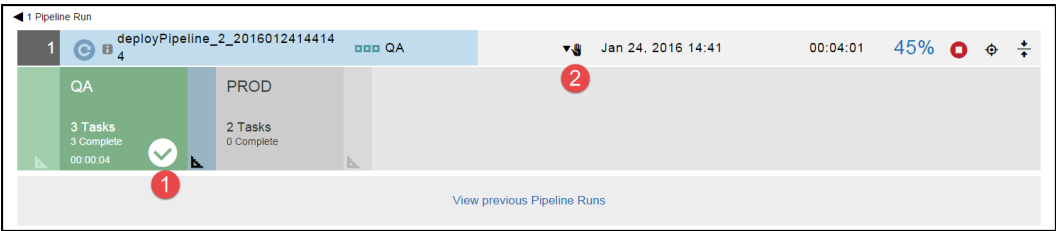



Attention needed.  
The current user is in the  
approvers list.



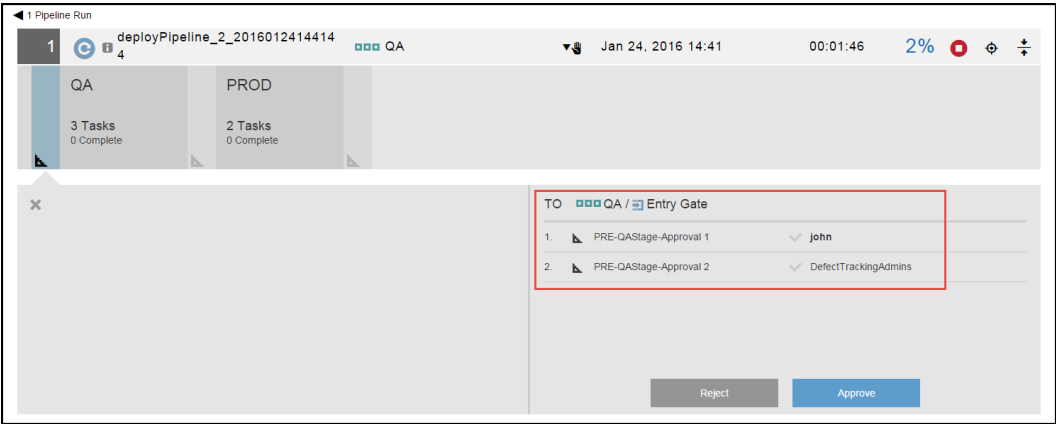
Attention needed.  
The current user is not in  
the approvers list.

The following example shows that exit gate of the QA stage and/or the entry gate of the PROD stage has gate approvals that needs to be approved before the pipeline can enter the PROD stage.

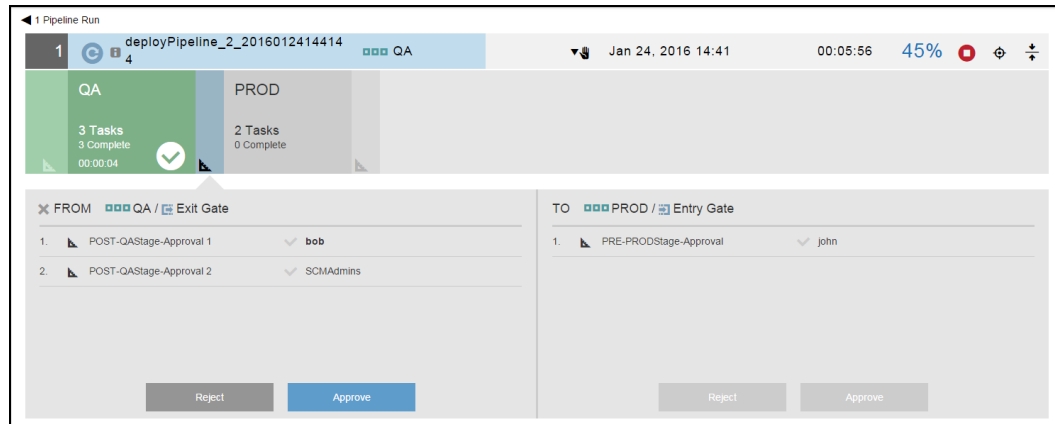


1	Click the  button to see the gate approvals and the required reviewers.
2	Click to see who the required reviewers are at the entry gate to the PROD stage.

For the entry gate of the QA stage, the required approvers are the user named john and then the group named DefectTrackingAdmins.



For the exit gate of the QA stage, the required approvers are a user named bob (user) or a group named SCMAAdmins and then a user named john.



- Click in a stage to see the details of the pipeline stage summary.

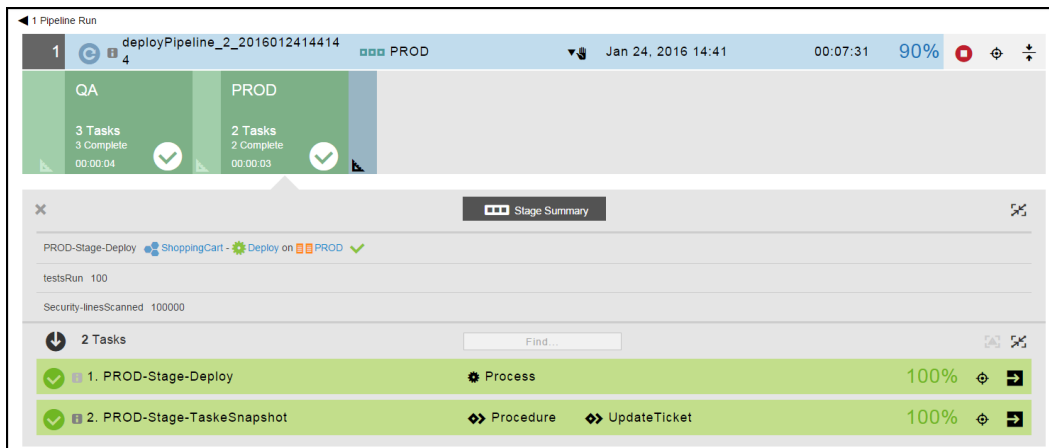
For examples of pipeline stage summaries, see [Pipeline Stage Summary](#) on page 323.

- Click **View previous Pipeline Runs** to see the previous runs of this pipeline.

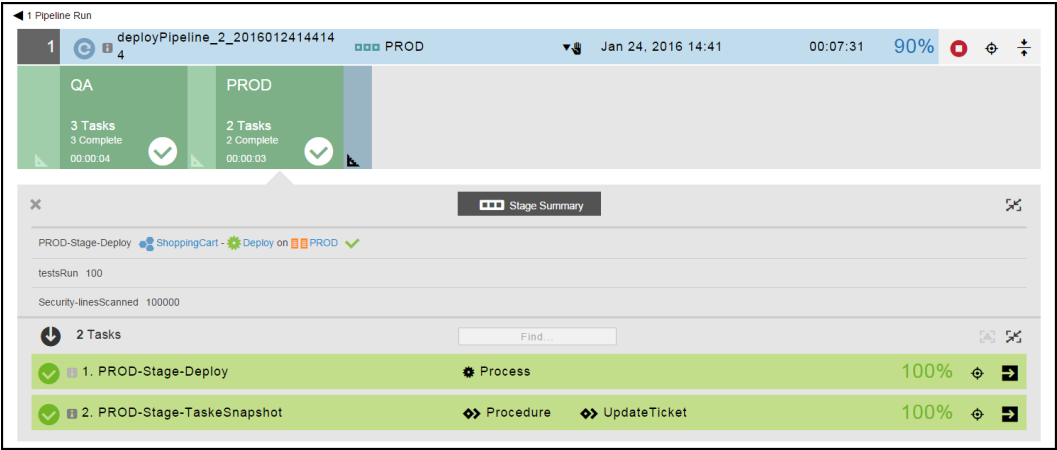
For an example, see [Example: Viewing Previous Pipe Runs](#) on page 391.

## Examples: Viewing the Details of a Pipeline Run

While a pipeline is running, you can click a stage to view its progress and open the pipeline stage summary.

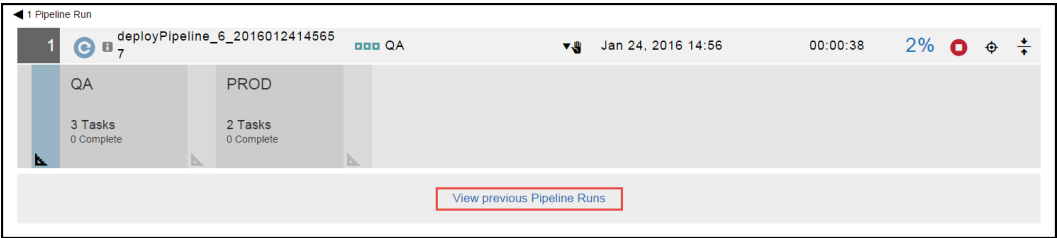


For a task, click the ( ) button to see the Job Details page:

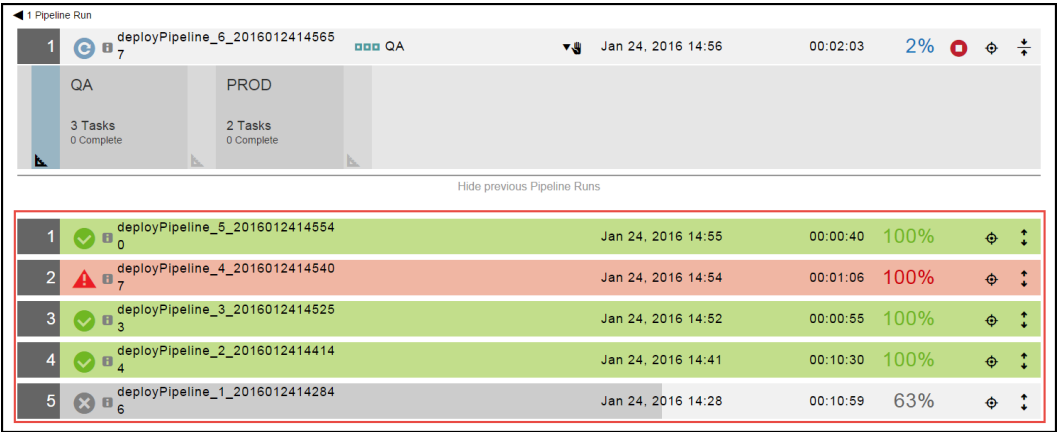


**Example: Viewing Previous Pipe Runs**

Click **View previous Pipeline Runs** to see the previous runs of this pipeline.

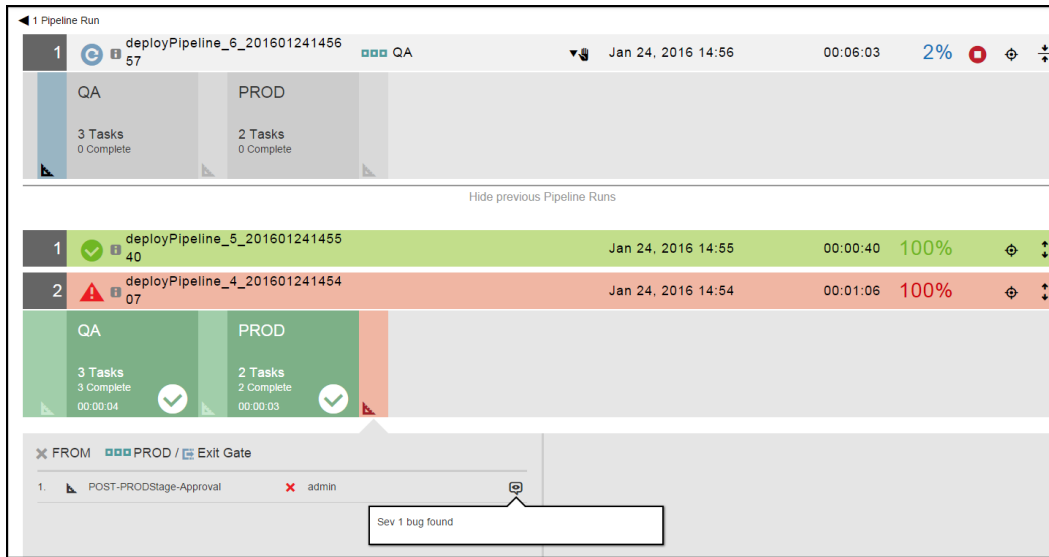


The previous pipeline runs appear.



Click the button for one or more previous pipeline runs.

In this example, the pipeline was not completed successfully. The approval at the exit gate of the PROD stage was rejected because a Sev 1 bug was found in the software release.



## Viewing Pipeline Runs

The Pipeline Runs List summarizes the pipeline runs. Each row is an pipeline instance that has an icon and is color-coded to indicate the status. You can use filters and the Search field to find certain pipeline runs. See [What's in the Pipeline Runs List](#) on page 392 and [Searching the Pipeline Runs List](#) on page 395 for more information.

When you expand a row, you can view the details about the pipeline runs as well as the stage and task summaries for a pipeline instance. See [Running Pipelines](#) on page 387 for more details.

## Opening the Pipeline Runs List

Click on the **Main menu** button on the Home page, and then click **Pipelines > Pipeline Runs** to open the Pipeline Runs page.


By default, the list shows all the running or completed pipeline runs that you have the permission to view.

## What's in the Pipeline Runs List

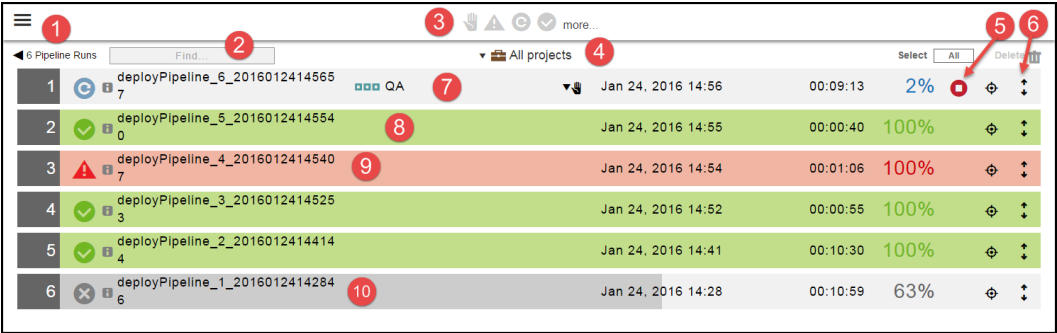
Each row shows the status of the pipeline run, the pipeline ID and name, the user running the pipeline, when the pipeline was run, and how long the pipeline run lasts.

For each pipeline run, you can take the these actions:










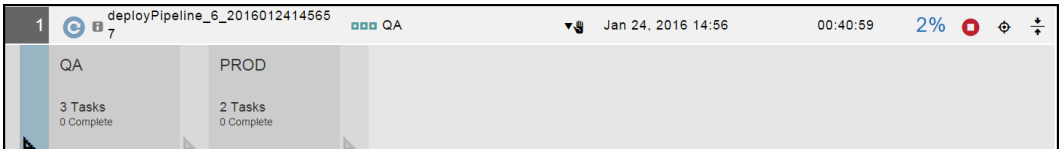
- Clicking the **Expand** button (  ) shows the pipeline run details and results of previous runs.
- Entering part or all of a pipeline name in the **Find** field (number 8 below) starts the search for pipelines matching the criteria. See [Searching the Pipeline Runs List](#) on page 395 for how to search in the Pipeline Runs List.
- Clicking on one of the filters (number 9 below) shows the pipeline runs whose status matches the filter. See [Searching the Pipeline Runs List](#) on page 395 for how to search in the Pipeline Runs List.

This is the Pipeline Runs List:



1	Breadcrumb identifying the object you are viewing and the total number of pipeline runs.
2	<b>Find</b> field. Enter the search criteria to find specific pipelines.

3	<p>Filters presenting the status of the pipeline run.</p> <div></div> <p>Needs attention. Manual approval may be required to complete the current stage and go to the next stage.</p> <div></div> <p>Completed with errors</p> <div></div> <p>Running</p> <div></div> <p>Completed with success</p> <div></div> <p>Completed with warnings. The pipeline run could still be running, or it may have completed running.</p> <div></div> <p>Pipeline aborted. When you click the <b>Abort</b> button during a pipeline run, the pipeline will be aborted after the currently running tasks finish and no new tasks will be started.</p>
---	--

4	<p>Clicking the down arrow next to <b>All Projects</b> opens a drop-down menu.</p> <p>It shows the pipeline runs for a specific pipeline. The default is to show the pipeline runs for all projects.</p> <p>If you want to see only the pipeline runs for a specific project, click the down arrow in the <b>All projects</b> field to select one or more projects one of these ways:</p> <ul style="list-style-type: none"> <li>• Click on the name of one or more projects.</li> <li>• Enter the search criteria in the Search field. The projects that match the criteria appear in the list.</li> </ul> <p>You can also search for one or more pipeline runs by entering the search criteria in the <b>Search</b> field next to the <b>All projects</b> field. If there are no matches, a message appears stating that there are no pipeline runs in the selected projects.</p>
5	Clicking the <b>Abort</b> button causes the current task to complete. No new tasks are started, and the current pipeline run stops.
6	<p>  </p> <p>Click the button to show more details about the pipeline run. Clicking it in this row shows results in displaying more details about the pipeline run.</p> 
7	This pipeline run is in progress. This shows that the pipeline is currently in the QA stage, an approver needs to do something to keep the pipeline running, when the pipeline is running and how long, and the percentage complete. You can abort the pipeline (number 5 above) and also see more details about this pipeline run (number 6 above).
8	The pipeline run was completed successfully.
9	The pipeline run was completed with errors.
10	The pipeline run was aborted.

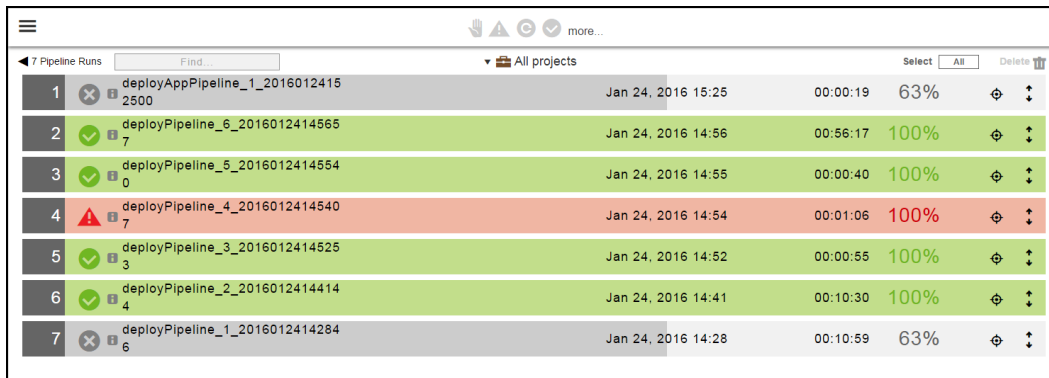
## Searching the Pipeline Runs List

To focus on specific pipeline runs, ElectricFlow provides several ways to quickly filter and search for pipeline runs, using a combination of filters and the **Find** field. You can also use these methods with the search operations on other ElectricFlow features.



- [Filtering with Filter Icons](#) on page 396
- [Searching With the Find Field](#) on page 397
- [Filtering by Projects](#) on page 397
- [Filtering and Searching With the All Methods](#) on page 398

When no filter icons are selected, the **Find** field is empty, and **All projects** is selected, all of the pipeline runs appear in the list, such as:



	Find...	All projects	Select	Delete
1	✖ deployAppPipeline_1_20160124152500	Jan 24, 2016 15:25	00:00:19 63%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
2	✔ deployPipeline_6_2016012414565	Jan 24, 2016 14:56	00:56:17 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
3	✔ deployPipeline_5_2016012414554	Jan 24, 2016 14:55	00:00:40 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
4	⚠ deployPipeline_4_2016012414540	Jan 24, 2016 14:54	00:01:06 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
5	✔ deployPipeline_3_2016012414525	Jan 24, 2016 14:52	00:00:55 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
6	✔ deployPipeline_2_2016012414414	Jan 24, 2016 14:41	00:10:30 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
7	✖ deployPipeline_1_2016012414284	Jan 24, 2016 14:28	00:10:59 63%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆

### Filtering with Filter Icons

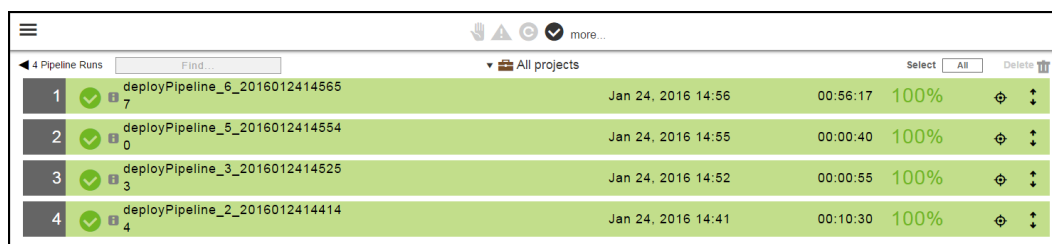
When you select a filter, the Pipeline Runs List is updated and shows only the pipeline runs with a status matching the filter. These examples show how to filter pipeline runs using the filter icons:

- Running



	Find...	All projects	Select	Delete
1	⏸ deployPipeline_2_201... deployPipeline	Integrat... admin	08/11/2015 - 2:24 PM 0 Day, 00:35:07	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
2	⏸ deployPipeline_1_201... deployPipeline	Integrat... admin	08/11/2015 - 1:30 PM 0 Day, 01:29:34	⬅ ⬆ ⬇ ⬆ ⬇ ⬆

- Completed with success



	Find...	All projects	Select	Delete
1	✔ deployPipeline_6_2016012414565	Jan 24, 2016 14:56	00:56:17 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
2	✔ deployPipeline_5_2016012414554	Jan 24, 2016 14:55	00:00:40 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
3	✔ deployPipeline_3_2016012414525	Jan 24, 2016 14:52	00:00:55 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆
4	✔ deployPipeline_2_2016012414414	Jan 24, 2016 14:41	00:10:30 100%	⬅ ⬆ ⬇ ⬆ ⬇ ⬆

- Completed with errors

1 Pipeline Runs					
Find...		All projects		Select	All Delete
1	7	deployPipeline_4_2016012414540	Jan 24, 2016 14:54	00:01:06	100%

- Pipeline aborted. When you click the **Abort** button during a pipeline run, the pipeline will be aborted after the currently running tasks finish and no new tasks will be started.

2 Pipeline Runs					
Find...		All projects		Select	All Delete
1	2500	deployAppPipeline_1_2016012415	Jan 24, 2016 15:25	00:00:19	63%
2	6	deployPipeline_1_2016012414284	Jan 24, 2016 14:28	00:10:59	63%

### Searching With the Find Field

Start typing the name of the pipeline in the Find field.

For example, if you enter "my" as the search criteria, there are no pipelines that match the search criteria. The Pipeline Runs Lists returns with nothing in the list.

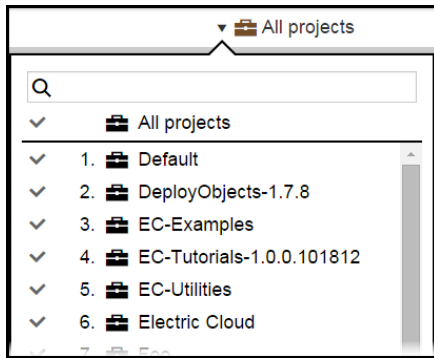
Pipeline Runs					
myl		All projects		Select	All Delete

To find a pipeline starting with "deploypip" in the Pipeline Runs List, start to enter "deploypip" and notice that ElectricFlow updates the list and shows the pipelines with names that match the search criteria.

6 Pipeline Runs					
deploypl		All projects		Select	All Delete
1	7	deployPipeline_6_2016012414565	Jan 24, 2016 14:56	00:56:17	100%
2	0	deployPipeline_5_2016012414554	Jan 24, 2016 14:55	00:00:40	100%
3	7	deployPipeline_4_2016012414540	Jan 24, 2016 14:54	00:01:06	100%
4	3	deployPipeline_3_2016012414525	Jan 24, 2016 14:52	00:00:55	100%
5	4	deployPipeline_2_2016012414414	Jan 24, 2016 14:41	00:10:30	100%
6	6	deployPipeline_1_2016012414284	Jan 24, 2016 14:28	00:10:59	63%

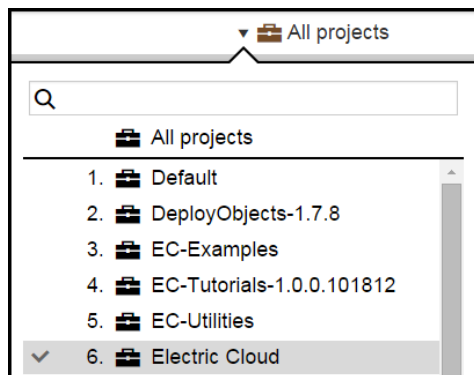
### Filtering by Projects

Clicking the down arrow next to the **All projects** opens a drop-down list of all the projects you have permission to access.

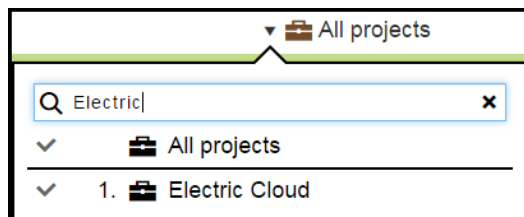


You can select the pipelines for specific projects one of these ways:

- Select one or more specific projects in the drop-down list, and then click outside the drop-down list.



- Enter search criteria to find a specific project, and then click outside the drop-down list.



The pipeline runs for the pipeline in the Electric Cloud project now appear in the Pipeline Runs List.

3 Pipeline Runs						
Find...		Electric Cloud		Select	All	Delete
1	✓	deployPipeline-EC_3_2016012416 3336	Jan 24, 2016 16:33	00:00:40	100%	⬅ ➡
2	⚠	deployPipeline-EC_2_2016012416 3246	Jan 24, 2016 16:32	00:00:34	72%	⬅ ➡
3	✓	deployPipeline-EC_1_2016012416 3141	Jan 24, 2016 16:31	00:00:49	100%	⬅ ➡

### Filtering and Searching With the All Methods

You can use all three methods to search for specific pipeline runs.

This example shows how to do this:



- Select (Completed with success) .
- In the **Find** field, enter "deployPipeline-EC".
- Select the "Electric Cloud" project.

The pipeline runs that were completed successfully, start with "deployPipeline-EC", and are in the "Electric Cloud" project now appear in the Pipeline Runs List.

2 Pipeline Runs		deployPipeline-EC	Electric Cloud		Select	All	Delete
1	✓	deployPipeline-EC_3_2016012416 3336	Jan 24, 2016 16:33	00:00:40	100%	⊕	⬆
2	✓	deployPipeline-EC_1_2016012416 3141	Jan 24, 2016 16:31	00:00:49	100%	⊕	⬆

## Troubleshooting Pipelines

This section shows how to troubleshoot your pipeline runs. If your pipeline result is not green, you may have a problem that you want to resolve. This topic describes some of the common steps that you may need to use when determining where there are issues in the pipeline process.

### *Example: Error Due to Gate Approvals*

Starting in the Pipelines List:

1. Choose a pipeline to troubleshoot.  
In the example in this topic, choose the deployPipeline.

- To view details about a specific pipeline run, choose a run and click the **View Details** button in the row.

3	deployPipeline	Default	2			
000	✓	deployPipeline_6_20160124145657	Jan 24, 2016 14:56	00:56:17	100%	⊕ ▶
000	✓	deployPipeline_5_20160124145540	Jan 24, 2016 14:55	00:00:40	100%	⊕ ▶
000	⚠	deployPipeline_4_20160124145407	Jan 24, 2016 14:54	00:01:06	100%	⊕ ▶
000	✓	deployPipeline_3_20160124145253	Jan 24, 2016 14:52	00:00:55	100%	⊕ ▶

Clicking the **View Details** buttons on any task will show you the details of the underlying work that was done to complete the task.

The pipeline run summary appears. There is an error in the exit gate of the PROD stage.

1	⚠	7	deployPipeline_4_2016012414540	Jan 24, 2016 14:54	00:01:06	100%	⊕ ⚙
QA	PROD						
3 Tasks 3 Complete 00:00:04	2 Tasks 2 Complete 00:00:03						

- To get more information about the exit stage, click in the exit gate.

Clicking in the exit gate will show the approval status of gate.

In this example, the pipeline was not completed successfully. The approval at the exit gate of the PROD stage was rejected because a Sev 1 bug was found in the software release.

1	⚠	7	deployPipeline_4_2016012414540	Jan 24, 2016 14:54	00:01:06	100%	⊕ ⚙
QA	PROD						
3 Tasks 3 Complete 00:00:04	2 Tasks 2 Complete 00:00:03						
<div>             FROM PROD / Exit Gate           </div> <div>             1. POST-PRODStage-Approval <span>✗</span> admin           </div> <div>             Sev 1 bug found           </div>							

### Example: Error in a Pipeline Stage

Starting in the Pipelines List:

1. Choose a pipeline to troubleshoot.
2. To view details about a specific pipeline run, choose a run and click the **View Details** button in the row.

2	PipelineV3	3 <b>erro</b> Stage	
	PipelineV3_3_20150824140712	8/24/15 - 02:07 pm	100%
	PipelineV3_2_20150824140427	8/24/15 - 02:04 pm	100%
	PipelineV3_1_20150824140105	8/24/15 - 02:01 pm	100%

Clicking the **View Details** buttons on any task will show you the details of the underlying work that was done to complete the task.

The pipeline run summary appears. There is an error in the Post-PROD stage.

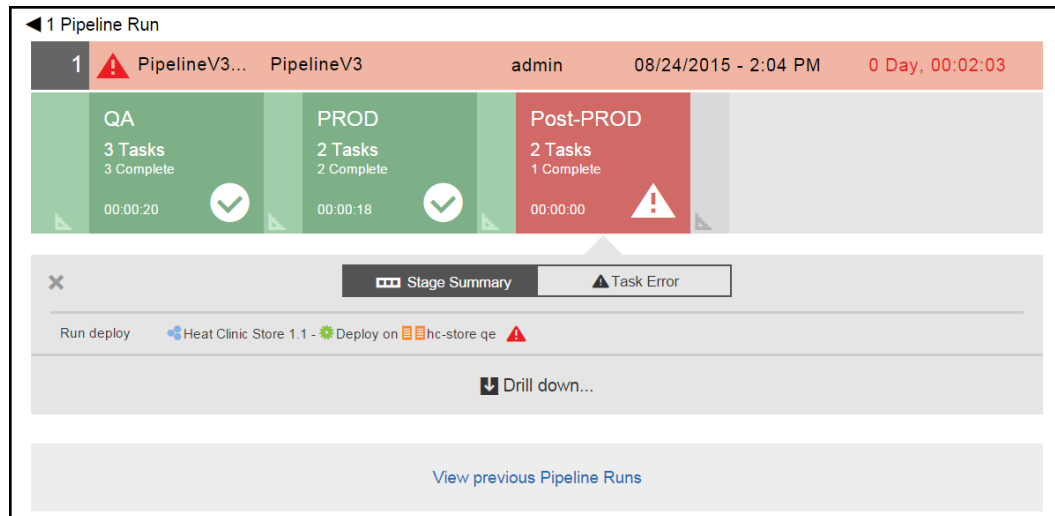
1 Pipeline Run				
1	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:04 PM 0 Day, 00:02:03
QA	PROD	Post-PROD		
3 Tasks 3 Complete	2 Tasks 2 Complete	2 Tasks 1 Complete		
00:00:20	00:00:18	00:00:00		
<a href="#">View previous Pipeline Runs</a>				

3. To get more information about the Post-PROD stage, click in the stage.

Clicking in the Post-PROD stage will show the Stage Summary and Task Error details.

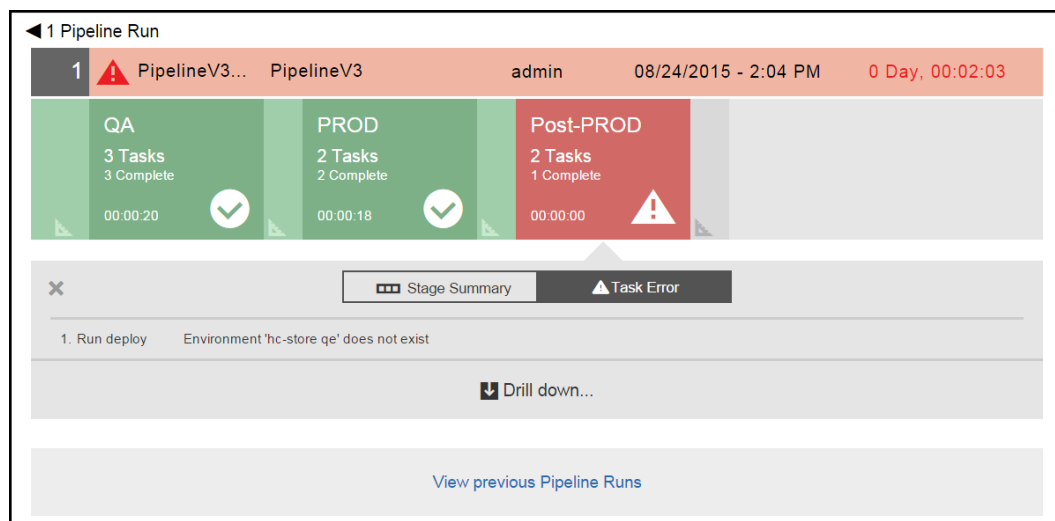
The Stage Summary shows the task definition.

In this pipeline, the task is an application process.



The Task Error information appears.

The error occurred in the "Run deploy" task. The problem is that the environment to which the application is mapped does not exist.



- Click **Drill down** to see more stage details.

1 Pipeline Run

1 PipelineV3... PipelineV3 admin 08/24/2015 - 2:04 PM 0 Day, 00:02:03

QA 3 Tasks 3 Complete 00:00:20

PROD 2 Tasks 2 Complete 00:00:18

Post-PROD 2 Tasks 1 Complete 00:00:00

Task Error

Run deploy Heat Clinic Store 1.1 - Deploy on hc-store qe

Drill down / 2 Tasks

1. Run deplo... 100% Process

2. Final build 0% Procedure

View previous Pipeline Runs

Notice that the "Run deploy" task failed and that the "Final build" task never ran because of the "Run deploy" task.

- Click the **View details** button.

The Job Details page opens and shows that the "Run deploy: tasks was completed with errors. The problem is that the environment in the task definition does not exist.

Job Details

Job Details / job\_87428235903189741340

Completed with Errors

Start Time: 2015-08-24 14:06:30 PDT

Elapsed Time: 00:00:00.000

Project: Default

Procedure: External

Priority: normal

Job error [NoSuchEnvironment]: environment 'hc-store qe' does not exist

Steps Diagnostics Parameters Properties Notifiers Published Artifact Versions Retrieved Artifact Versions

View: All Expand All | Collapse All

Currently, there are no records to display in this list.



6. Click **View previous Pipeline Runs** to see the previous runs of this pipeline.

1 Pipeline Run

Find...

#	Status	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:04 PM	0 Day, 00:02:03
1	⚠️	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:04 PM	0 Day, 00:02:03

QA 3 Tasks 3 Complete 00:00:20 ✓

PROD 2 Tasks 2 Complete 00:00:18 ✓

Post-PROD 2 Tasks 1 Complete 00:00:00 ⚠️

Stage Summary Task Error

Run deploy Heat Clinic Store 1.1 - Deploy on hc-store qe ⚠️

Drill down / 2 Tasks Find...

#	Status	Task Name	Process	Progress
1	⚠️	1. Run deplo...	Process	100%
2	✓	2. Final build	Procedure	0%

Hide previous Pipeline Runs

#	Status	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:07 PM	0 Day, 00:01:43
1	⚠️	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:07 PM	0 Day, 00:01:43
2	✓	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:01 PM	0 Day, 00:01:43

7. Choose a pipeline in the Previous Pipeline Runs list, and click the **Expand** button.

1 Pipeline Run

Find...

#	Status	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:04 PM	0 Day, 00:02:03
1	⚠️	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:04 PM	0 Day, 00:02:03

QA 3 Tasks 3 Complete 00:00:20 ✓

PROD 2 Tasks 2 Complete 00:00:18 ✓

Post-PROD 2 Tasks 1 Complete 00:00:00 ⚠️

View previous Pipeline Runs

#	Status	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:07 PM	0 Day, 00:01:43
1	⚠️	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:07 PM	0 Day, 00:01:43
2	✓	PipelineV3...	PipelineV3	admin	08/24/2015 - 2:01 PM	0 Day, 00:01:43

The pipeline run summary for that pipeline appears.

8. Repeat Step 3 to Step 7 to do more troubleshooting.

# Chapter 1: Release Management

The Release module captures, executes, visualizes, and controls the life cycle of multiple application enterprise releases. Using the Release capability, outputs from multiple teams can be coordinated to produce a final release to be pushed to production. You can create a Release model consisting of multiple applications deployed on different systems, such as traditional, cloud, mainframes, and remote servers. You can then run the Release pipeline reliably and repeatedly until the software release is complete.

You can use the Release feature to deliver software releases through traditional methods where changes from multiple applications are bulked up and are released together as a unit through a pipeline on a regular cadence (schedule) such as weekly, monthly, quarterly, or other frequency. In such traditional scenarios, the Release capability allows you to manage dependencies between multiple applications. In addition, you can even use the Release feature to cater to Continuous Delivery-style releases where code check-in from a developer can traverse all the way to production through various pipeline stages and approval gates. The Release feature allows ElectricFlow to manage all the releases in one platform, regardless of the release methodologies used by the release team. Anyone can quickly get a status of a release and then access the Release details. This information can also be used to troubleshoot and improve the software release process.

- Visibility and coordination

The *Release Dashboard*, also referred to as the *Release List*, allows the release team to get a bird's eye view of all the releases that are planned, active, or completed. For a specific release, you can easily see its status, what the milestones are, if the release is blocked for some human intervention, and the Release's progress.

- Path to Production (or what is where)

For each stage in the Release pipeline, the Path-to-Production view shows the applications deployed in the release, the deployed versions, and the environments to which they are deployed. The details in this view include the application versions, the snapshots, and the environments that are not in compliance with the bill of materials throughout the Release.

- Control

ElectricFlow keeps track of the data from the multiple teams involved in the release. The Release feature captures, validates, coordinates, and tracks all the details in one place, where everyone can access the *Release definition*, bill of materials (which applications to release), the pipeline controlling the release process, and environment to use across stages, approval conditions, release configurations, and so on.

When the Release is run, ElectricFlow automatically coordinates the pipeline information needed to deploy applications in each stage. If you need to add an application, change an application version, or deploy to a different environment, you need to change only the bill of materials. You do not need to revise the pipeline definition or pipeline tasks.

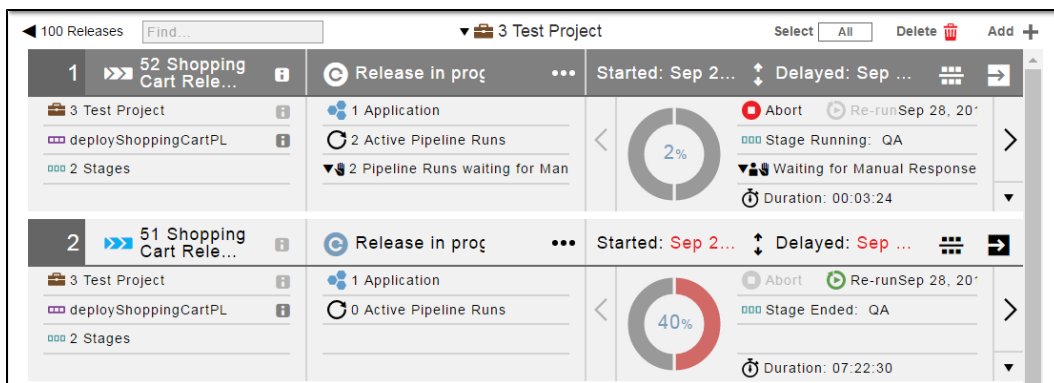
You can reuse the pipeline to deliver multiple releases of the same software.

The *Release manifest*, also referred to as the *Release definition*, specifies the release process flow for the application or applications to be released, which include:

- The pipeline controlling the process.
- The applications in the pipeline for multiple-tiered deployments.
- How to deploy tasks and processes using run-time parameters and other settings, such as smart deploy and artifact staging.
- Where versioned objects will be deployed (multiple-tiered environments).
- The approvers for manual process steps, manual tasks, and pipeline gates.

## Multiple Pipeline Runs in a Release

You can launch multiple instances of a pipeline associated to a release:



You can navigate through multiple pipeline runs:

The screenshot displays the Release Management interface. At the top, there's a search bar with 'Find...' and a dropdown for '3 Test Project'. Below this is a list of releases. The first release is '52 Shopping Cart Re...' with 'Release in pro' status, 'Started: Sep ...', and 'Delayed: Sep...'. It shows '1 Application' and '0 Active Pipeline Runs'. The second release is '51 Shopping Cart Re...' with 'Release in pro' status, 'Started: Sep ...', and 'Delayed: Sep...'. It shows '1 Application', '2 Active Pipeline Runs', and '2 Pipeline Runs waiting for Man...'. The third release is '50 Shopping Cart Re...' with 'Release in pro' status, 'Started: Sep ...', and 'Delayed: Sep...'. It shows '1 Application' and '0 Active Pipeline Runs'. The fourth release is '48 Shopping Cart Re...' with 'Release in pro' status, 'Started: Sep ...', and 'Delayed: Sep...'. It shows '1 Application' and '0 Active Pipeline Runs'. On the right, a detailed view of the '51 Shopping Cart Release' is shown. It features a progress circle at 20%, 'Stage Ended: QA', 'Aborted by admin', and 'Duration: 00:09:28'. Below this, a table lists '3 Pipeline Runs' with columns for status, user, stage, and time.

1.	2.	3.
Hand icon	Hand icon	Warning icon
...	...	...
QA	QA	QA
Sep 28, 2016 - 18:26	Sep 28, 2016 - 18:26	Sep 28, 2016 - 09:47

You can pass pipeline parameters when starting a release:

New

Run 51 Shopping Cart Release

2 Stages
Configure

3 Parameters
2/2 Required

1. QA Stage Control Param

NORMAL

2. PROD Stage Control Param

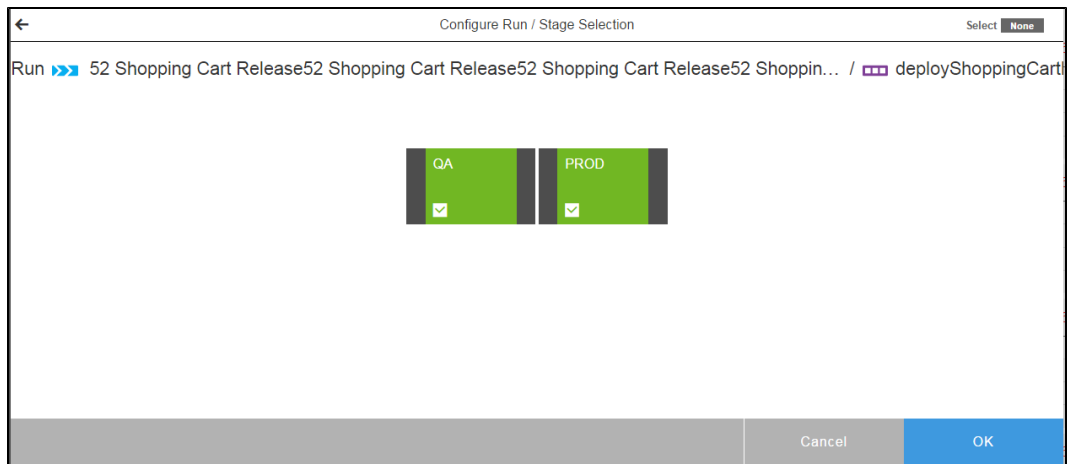
NORMAL

3. Specify Sleep Time

Value

Cancel
Run

You can also select the pipeline stages to run in a release:



## Release Scheduling

You can create schedules for releases. For example, where teams are responsible for each stage and they want to execute only the releases for their stage. With the ability to schedule releases and configure stages to run, each team can set up their own independent schedules that run on a particular stage. They can set a start date and can also make a release recurring (for example, daily or weekly).

## Release Concepts

Releases allow you to orchestrate multiple applications across multiple environments and to manage the software release life cycle using one platform. It brings together everything you need to take your software through its journey to production, regardless of your software release processes. You can manage traditional release processes (culminating in one big software release at the end of the software delivery life cycle), CI scenarios (build-test automation), CD scenarios (deployment automation), or a combination of these methods using a single platform. Dependencies can also be managed and controlled with this platform.

## Modeling Releases

You can model a Release by defining the Release process that consists of

- The bill of materials consisting of the multiple applications that you want to deploy.
- One or more environments where the applications will be deployed or installed during the Release run.
- Pipelines and any inputs to the applications (parameters created for them) specifying how the applications will be deployed. Pipelines are the paths to production, and all the other objects in the Release are linked to the selected pipeline.
- The pipeline approval gates that determine when tasks in the stage can start or when the pipeline can enter or exit a stage.
- Approvers and task assignees perform specific activities as the Release runs. Individual users and teams are notified when an action needs to be taken.

The Release feature leverages the pipeline capability and a special type of pipeline task called a *Deployer* to deliver an *auto-flexing* mechanism where the same pipeline can be used across multiple releases. For example, you have a standardized process for your major releases, and the only things that normally change are the applications and their released versions. In this case, you do not want to specify the exact applications to deploy as part of the pipeline tasks, which do not allow for pipeline reusability. This is where a Deployer task in the pipeline and Release capability work together to provide reusability.

The Deployer task, previously mentioned in [Pipelines](#) on page 308, is a special type of task specified in the task list of a pipeline stage. It gets the actual list of applications (and the number of applications) to deploy from the bill of materials in the Release definition. This list is considered the payload of the Release. At runtime, the list of applications to deploy is passed to the pipeline through the Release object. The pipeline then deploys the applications in sequential order. So you can create one pipeline that works for different software releases.

You can have more than one Deployer task in a pipeline stage. Using more than one deployer task in a pipeline stage lets you deploy applications in parallel rather than in series.

In a pipeline stage, you can define a task using out-of-the-box third-party integrations (plugins) such as:

- Artifact repositories such as Git, Perforce, Subversion, Microsoft Team Foundation Server (MS TFS), Accrue, ClearCase, Repo, and Vault
- Issue tracking products that provide application developers with requirements tracking such as HP Application Lifecycle Management (HP ALM), Bugzilla, ClearQuest, Fortress, JIRA, HP Quality Center (HPQC), Rally, IBM Rational Team Concert, TeamForge, and TestTrack
- IT service management (ITSM) products such as ServiceNow
- Project management products such as Rally

For a complete list of supported plugins, go to the Electric Cloud [Plugins Directory](#).

For details about tasks in pipeline stages, go to [Pipeline Tasks](#) on page 311, [Defining the Tasks in a Pipeline Stage](#) on page 354, and [Viewing and Editing the Pipeline Definition](#) on page 371.

ElectricFlow provides multiple project support for objects in application deployments, pipelines, and Releases. These objects as well as the objects belonging to them can be in any project within ElectricFlow.

All objects in ElectricFlow have these capabilities for better management and maintenance of end-to-end software releases:

- Projects are top-level security containers that provide access control at the project level. All objects in a project inherit the access control settings from the project to which they belong.
- Projects are also ways to provide logical groupings of objects. If your deployment is large and has many production environments, you can organize production environments by project, with each project having its own access control settings. This makes it easier to manage and maintain multiple environments during the software delivery process.

## Setting Up Releases

This section describes how to set up releases. To get started defining the Release process, you select a pipeline on which the process is based. This pipeline needs to have a Deployer task in its stages. Then you select the applications that you want to deploy (the bill of materials), the environment where the applications will be deployed, and any inputs to the applications. For instructions, go to [Release Definition](#) on page 417.

To get a bird's eye view of all the releases that are planned, active, or completed, go to [Release Dashboard](#) on page 434. To view the bill of materials, go to [Path-to-Production View](#) on page 448 To view the pipeline's progress during the Release run, go to [Pipeline Stage Summary](#) on page 323. For instructions on how to set up objects in a release:

- Go to [Examples: Modeling and Deploying Applications](#) on page 148 to set up applications.
- Go to [Master Component Examples](#) on page 83 for examples of how to create and add parameters to your applications. The steps apply to applications with master and normal components.
- Go to [Pipelines](#) on page 308 to set up pipelines.

ElectricFlow supports resource exclusivity at the platform level. This allows a procedure to lock a resource for a job step and execute the tasks. The job step acquires and retains exclusive use of a resource, ensuring that the resource is always available for the step. Go to [Reserving a Resource for Job Step Duration](#) on page 1280 for more information.

**IMPORTANT:** When an application, a pipeline, or a release is cloned across different projects, you might need to fix the references after the objects are cloned. For example, if a pipeline with an application reference in the "default" project is cloned to a different project, the application reference needs to be fixed after the pipeline is cloned.

**IMPORTANT:** When you export a project while a pipeline is in progress, only the full export includes flow runtimes that have been completed. If you want to include in-progress pipeline runs in the path-to-production view and the visual indicators showing their percentage completed in the Release dashboard, set the `excludeJobs` argument to 0 or false in the `export` command. When the XML file is imported, the in-progress pipeline runs in the imported project are displayed in the path-to-production view and the Release dashboard. The jobs might be incomplete once the XML is imported.

## Controlling the Releases

ElectricFlow provides these ways to ensure that the Release runs are successful:

- Manual gates:

For each stage in the Release pipeline, an entry gate controls when the tasks can start. If the conditions and approvals are met, the process flow can proceed and the tasks can be executed. The process flow can complete the stage and proceed to the next stage when the exit conditions and approvals are met.

ElectricFlow sends notifications to the appropriate approvers, users, and/or groups.

Go to [Visibility and Status of Release Pipelines](#) on page 411 for an example process flow.

- Preconditions:

You can set **Run if** and **Wait until** conditions on stages, tasks, and gates in pipelines. Go to [Pipeline Concepts](#) on page 309 for more information.

You can set conditions in process branching when authoring application and component processes. These conditions determine the path that the Release takes through the process flow. Go to [Process Branching](#) on page 125 for how to set conditions on the transitions between process steps.

You can set preconditions on procedure steps. Go to [Step—create new or edit existing step](#) on page 772 for how to set preconditions in procedure steps.

- ServiceNow integration: Use the ServiceNow plug to integrate IT service management (ITSM) with ElectricFlow.
- Plugins: You can use third-party plugins to execute the conditions and rules for approvals and quality gates.
- Postp: You can use postp to get data from the log files, make it appear on the Job Details page, and use it to take action on the Release run. Go to [Postp](#) on page 412 for more details.

## Visibility and Status of Release Pipelines

### From the Release Dashboard


The Release dashboard orchestrates all the information about the planned, active, or completed releases and displays the releases that you have permission to view in one place. At any time, you can quickly see the current status of the release, where it is in the process flow, any errors during the runtime, when human intervention is required to take some action or perform a task, approvals, and the start and end dates for the release. Go to [Release Dashboard](#) on page 434 for more information, and go to [Example: Visibility in a Release Pipeline from the Release Dashboard](#) on page 413 for an example how to drill down from the top Pipeline Run view to the specific job details of the release tasks.

For a Release that is in progress or has been completed, clicking the Release status opens the Pipeline Run view. You can view the Stage Summary for the latest Release or view previous pipeline runs. The Stage Summary shows the pipeline's progress through each stage and evidence that the tasks were executed. Clicking in a stage task or a gate displays its Stage Summary. Go to [Pipeline Stage Summary](#) on page 323 for more information.

- When the Release is in progress, you can view the progress of the pipeline as it runs. Go to [Viewing the Stage Summary During a Pipeline Run](#) on page 324 for an example of this.
- You can also view a completed pipeline run. Go to [Viewing the Stage Summary for a Completed Pipeline Run](#) on page 326 for an example of how to do this.
- Clicking **View previous Pipeline Runs** displays the last five pipeline runs. After selecting one of these runs, you can view the Stage Summary to view more details about the pipeline run.
- If the pipeline has errors, you can also view what the error is and where it occurred in the pipeline in the Task Error view.





For example, you can view the progress and evidence of the Deployer task run. Clicking  displays the payload of the Release. This is the actual list of applications (and the number of applications) to deploy that is specified in the bill of materials in the Release definition.

From the Release dashboard, you can go to the Path-to-Production view for a running or completed release. This view shows the bill of materials for the release. You can easily see the artifacts and snapshots that are in compliance with the Release manifest. Go to [Path-to-Production View](#) on page 448 for more information.

### From the Environment Inventory

The environment inventory shows what is deployed in an environment at any time. Go to [Environment Inventory](#) on page 297 for more information.

### From the Change History

The Change Tracking feature tracks the changes between every state of non-runtime objects, such as environments and resources. ElectricFlow records a *Change History* of the historical states of environment objects, including environment tiers and resources, and records changes between them. Go to [Change Tracking](#) on page 980 for more information.

### Postp

Postp, a postprocessor included with ElectricFlow, is used for data collection and for report generation. For visibility in a Release run, you can get live streaming data from the log files using the standard output settings. Using postp commands in pipeline tasks (defined by application processes, procedures, or workflows), you can make this data appear in the Job Details page in ElectricFlow.

Compile Agent 64		✔ 146 compiles
Compile		✔ 955 compiles
Windows - undo subst		⌛ Skipped
Signal to unit tests & install		✔ Completed with Success
Plugin build & unit test		⌛ Skipped
Server tests		⊛ Running
Server unit tests		⊛ Running
Startup tests		⌛ Skipped
Common tests		✔ 2982 tests
Server tests (junit)		⊛ <u>14410 tests</u> <u>4 errors</u> <u>1 warning</u>
Server tests (integration)		⊕ 415 tests
Save logs		

This example shows:

- During the Compile step, there were 955 compiles.
- In the "Command tests" step, 2982 tests were run.
- For the "Server tests (junit)" step, 14410 tests were run with 4 errors and 1 warning. Clicking on the links in this step provides details and evidence about how the job ran and what actions to take next.

Clicking on the **log** button for any of these steps will display the log file details.

For more information about using postsp:

- Go to [Defining the Tasks in a Pipeline Stage](#) on page 354 and [Viewing and Editing the Pipeline Definition](#) on page 371 to define, view, and edit pipeline tasks in the pipeline definition.
- Go to [Postprocessors: Collecting Data for Reports](#) on page 1142 and [Postsp extension](#) on page 1277 to set up data collection, generate reports, and display data from the log files.

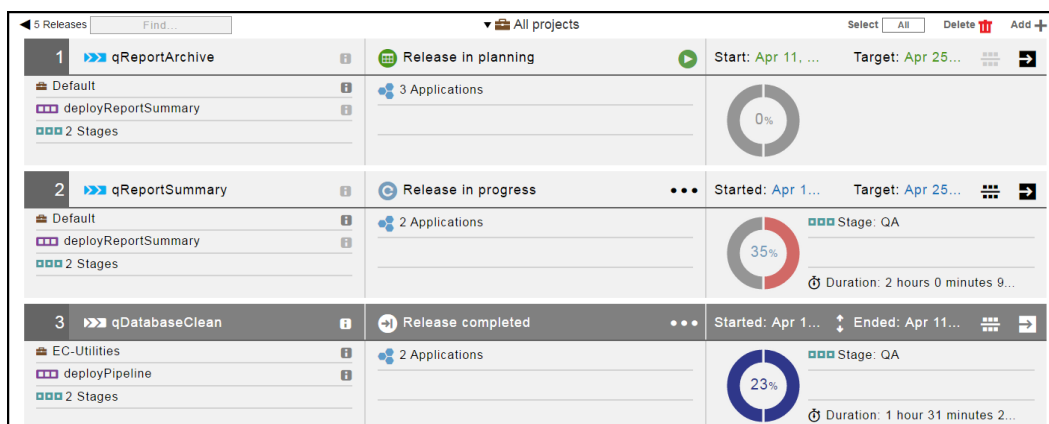
## Example: Visibility in a Release Pipeline from the Release Dashboard

### *For an In-Progress Release*

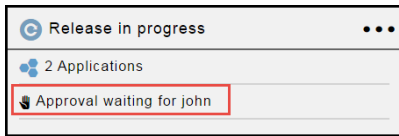
You can view the progress of the pipeline during the Release run starting in the Release Dashboard:

1. In the Release dashboard, clicking on the status of an in-progress or completed Release opens the Pipeline Run view for the Release pipeline.

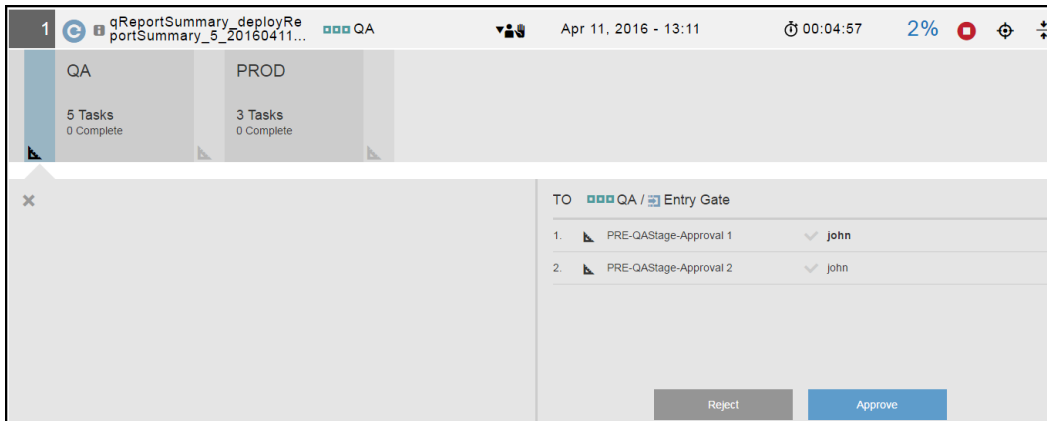
Example: Clicking **Release in progress** for the second pipeline shows the progress of a currently running Release.



- When human intervention is needed at a gate (indicated by the hand icon), clicking **Approval waiting for john** displays the Stage Summary for an entry gate.

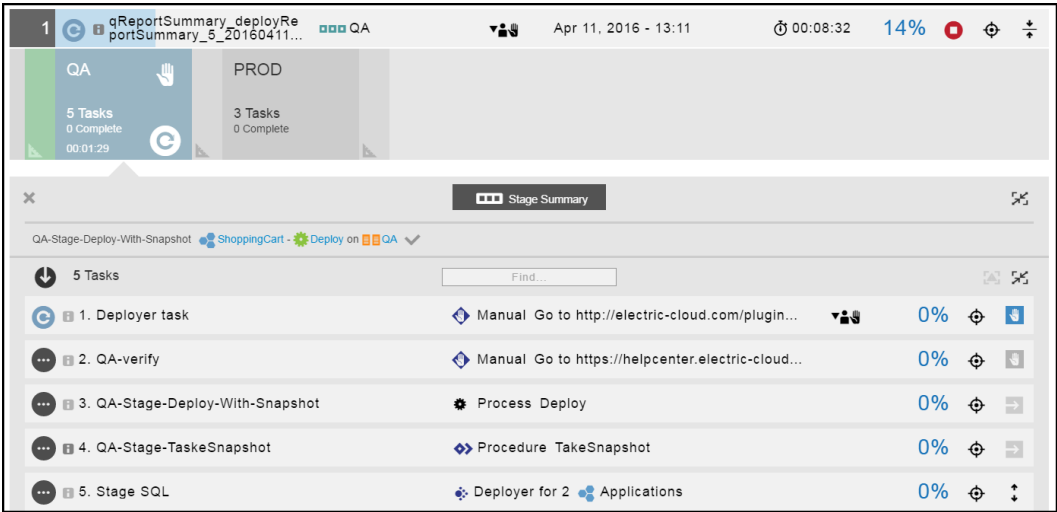


The Stage Summary for the enabled entry gate shows the required approvals.



After the approval rules or conditions are approved, the pipeline continues.

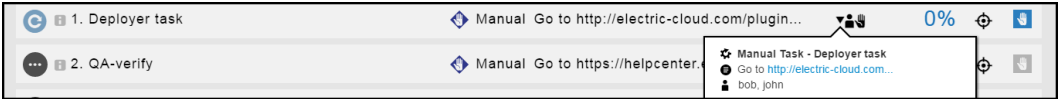
3. When a pipeline stage is running, it is enabled. Clicking in it displays the Stage Summary, which shows the tasks in the stage and their progress.



- a. In the Stage Summary, the top section shows information about the tasks deployed in the pipeline stage, which you can show or hide. You can also display user-generated information such as:
- Links to web sites for reports and other information about the deployed artifacts
  - Property information about the pipeline stage and the objects in it



- b. The next section shows the tasks in the pipeline stage. If the pipeline is in progress, click the down arrow in the row to view details for the manual task:



- c. After completing the manual task, click **Complete** as the outcome, add a comment, and click **OK** in the Manual dialog box.



To view details about a completed manual task, click to view the details. The Manual dialog



box opens. When the manual task has required input, click in the Parameters row to view the manual task details. The Manual dialog box now shows the **action** and **evidence** fields. The **action** field describes what was done to approve the manual task, and the **evidence** field describes what was done to approve it.

4. When human intervention is needed at the exit gate (indicated by the hand icon), an exit gate is enabled. Clicking in the exit gate displays the approvals required to complete the pipeline stage.
5. If the entry gate to the next stage has approval conditions before the tasks in it can start, this entry gate is enabled. Clicking in the entry gate displays the approvals required to start the tasks in a pipeline stage.
6. The sequence continues as the pipeline progresses.
7. Click **View previous Pipeline Runs** to view the previous five runs.



Clicking displays the pipeline, where you can click in a gate or stage to view more details. Clicking



hides this pipeline.



To view details about a manual task, click to view the details of the manual task. The Manual dialog



box opens. When the manual task has required input, click in the Parameters row to view the manual task details. The Manual dialog box now shows the **action** and **evidence** fields. The **action** field describes the what was done to approve the manual task, and the **evidence** field describes what was done to approve it.



To view details about the other pipeline tasks, click to view the Job Details

### **For a Completed Release**

Go to [Running and Completing Releases](#) on page 451 for an example of running and completing a Release.

## Release Definition

The Release process is defined in the Release definition, which consists of the underlying pipeline, the applications to deploy (the payload), where the applications will be deployed (the environments), and any inputs (parameters) to the application (referred to as configurations). The Release definition also includes notes that can be entered by team members, task assignees, and approvers as well as planned start and end dates for Releases.

This section has examples of Release definitions and shows how to define a Release.

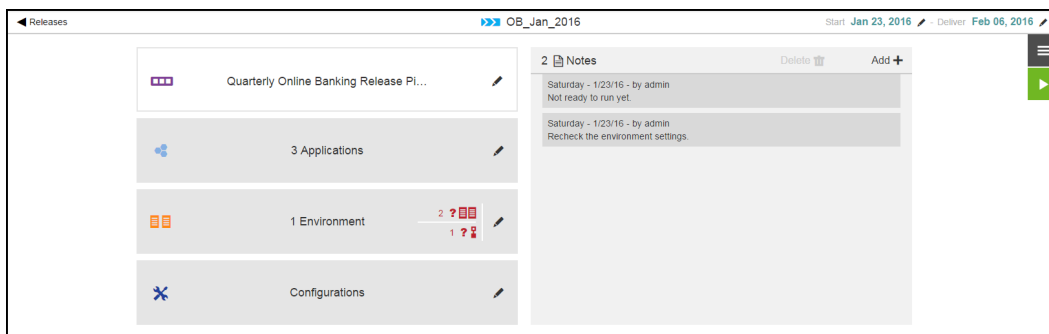
### Example: Completed Release Definition

This release definition shows:

- The Release called "Q1 2016 Release—OB" is based on the *pipeline* called "Quarterly Online Banking Release Pipeline."
- The **Applications** field shows that there are three applications to be deployed in this release. Clicking in the **Applications** field displays the list of applications to be deployed, which is passed to the Deployer task in the pipeline by the Release.

When artifact staging is enabled for an application, ElectricFlow tries to retrieve artifacts that will be deployed before the application run starts. This ensures that the artifacts are downloaded and available on the target (either the artifact cache (the default) or a directory specified in the component definition). This minimizes the time to retrieve artifacts and reduces downtime during the application deployment. For details about artifact staging, see [Artifact Staging](#) on page 120

- The **Environments** field shows that the applications will be deployed in three environments. Clicking in the **Environments** field displays the environments where the applications in each stage will be deployed.
- Clicking in the **Configurations** field displays the inputs to the applications (parameters) to be entered at runtime.
- Two notes have already been added to the Release definition.



### Example: Traditional Multiple Application Release

This example shows how to define a multiple application Release.

1. From the Home page, click **Releases**.
2. In the Release Dashboard, click **Add+** to add a Release.

3. In the New dialog box, click **Create new release**.

**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

The screenshot shows a 'New' dialog box with a title bar containing a close button, a maximize button, and a back arrow. The main content area is titled 'Release'. It contains a 'Select Project' dropdown menu with a briefcase icon, a text input field labeled 'Name' with a blue border, and a larger text area labeled 'Description'.

4. Enter the name of the new Release and select a project to which the Release belongs.

The screenshot shows the 'New' dialog box with the 'Select Project' dropdown menu now showing 'Utilities' with a briefcase icon. The 'Name' text input field now contains the text 'OB\_Jan\_2016'. The 'Description' text area remains empty.

5. Click **OK**.

The Release Dashboard displays the new Release at the top.

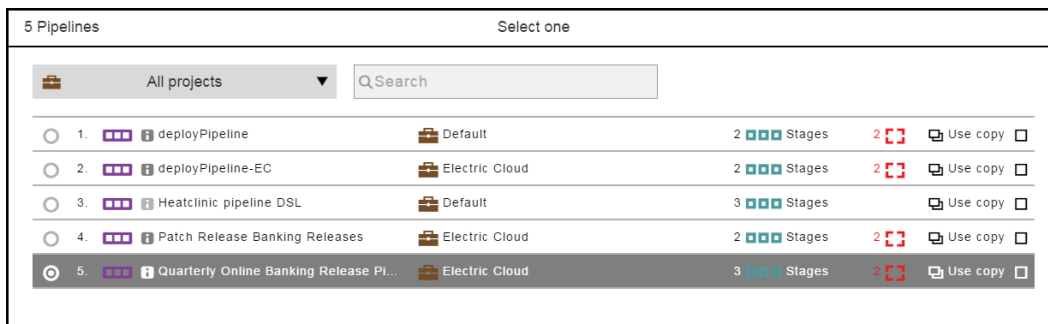
6. In the Release Dashboard, click the new Release name.

The Release Definition page is displayed:

The screenshot shows the 'Release Definition' page for a release named 'OB\_Jan\_2016'. The top bar includes a back arrow, the word 'Releases', the release name 'OB\_Jan\_2016' with a status indicator, and dates 'Start Jan 23, 2016' and 'Deliver Feb 06, 2016'. The main content area is divided into two sections. On the left, there is a vertical list of components: 'Pipeline' (with a purple icon), 'Applications' (with a blue icon), 'Environments' (with a green icon), and 'Configurations' (with a yellow icon). On the right, there is a 'Notes' section with a header '0 Notes', a 'Delete' button, and an 'Add +' button. Below the header is a large text area for notes. A green play button is visible on the far right.

7. Click **Pipeline**.

A list of pipelines opens.



It shows the list of available pipelines. The default is to show the pipelines for all projects. To see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects in one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more pipelines by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.



## 8. Select a pipeline.

The pipeline called "Quarterly Online Banking Release Pipeline" is selected.

After the pipeline is selected, the **Next** button is enabled because the applications in the pipeline have



required inputs (parameters), as indicated by . This means that there are two required inputs to deploy the applications through the pipeline. If any input is a credential parameter, you can enter the path to the credential, browse to it, select the Parameter Credential or Credential binding, or select a user-defined credential that is attached to the project associated with the pipeline.

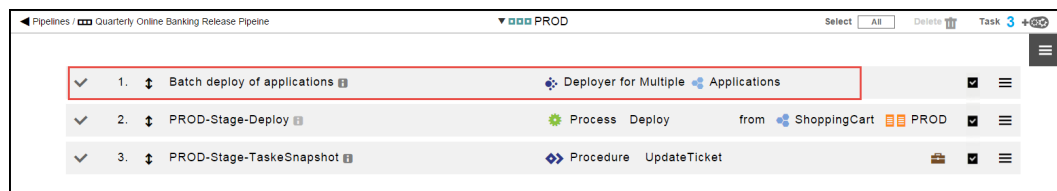
Enter the required inputs, and click **OK**.

If the applications did not have any required inputs, the **OK** button would be enabled instead.

### More about this pipeline:

This pipeline has a Deployer task, as shown in the task list for the pipeline.

Remember that the Deployer task is specified in the task list of a pipeline stage but gets the actual list of applications to deploy from the Release payload (the bill of materials of the Release definition). At runtime, this list is passed to the pipeline through the Release object, and the pipeline deploys the applications in sequential order.



9. If the applications in the selected pipeline have inputs, a dialog box showing the inputs to the pipeline will be displayed.

If any input is a credential parameter, you can enter the path to the credential, browse to it, select the Parameter Credential or Credential binding, or select a user-defined credential that is attached to the project associated with the pipeline.

If any of required parameters do not have values, enter the appropriate values and click **OK**.

4 Parameters on Quarterly Online Banking Release Pip...

1. QA Stage Control Param  
NORMAL
2. PROD Stage Control Param  
NORMAL
3. Specify Snapshot to Use  
SC-S1
4. Specify Sleep Time  
Value

The Application field is now enabled in the Release Definition page.

Releases

OB\_Jan\_2016

Start Jan 23, 2016 - Deliver Feb 06, 2016

Quarterly Online Banking Release Pl...

Applications

Environments

Configurations

0 Notes

Delete

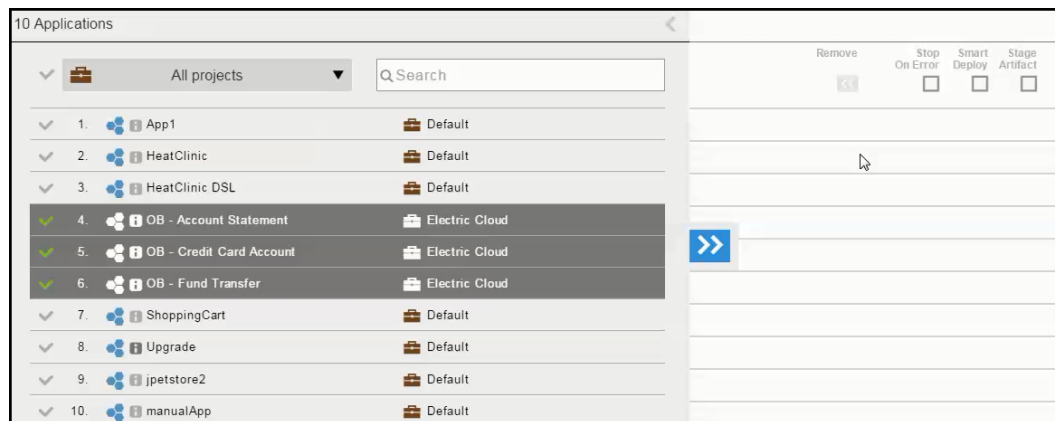
Add +

10. Click **Applications**.

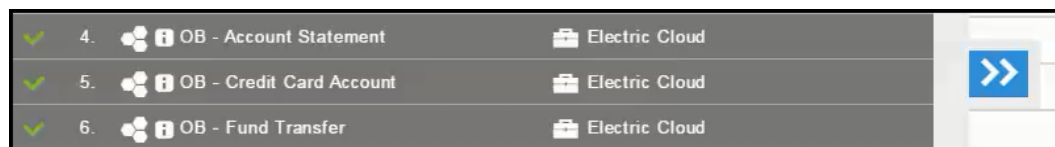
The dialog box where you specify the applications to be deployed through the pipeline opens.



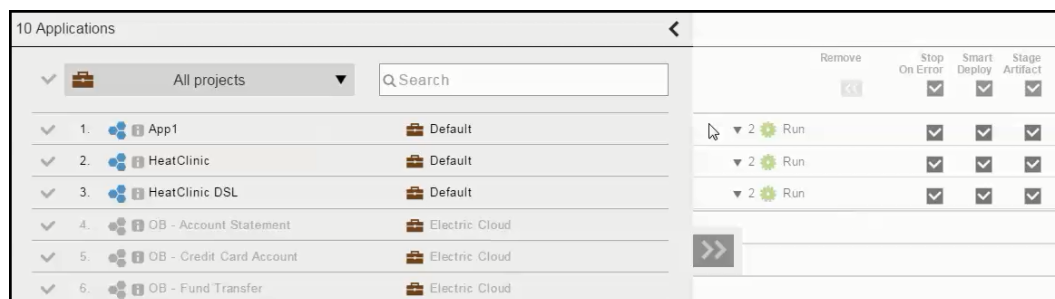
11. Select the applications that you want to deploy in the release, and then click the button to move them to the right side of the dialog box, which is the list of applications to be deployed through the pipeline.



These applications are selected:



Clicking button moves the selected applications to the right side and displays the number of required parameters at run time and the application process to be deployed.



Remove		Stop On Error	Smart Deploy	Stage Artifact
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
▼ 2 	Run	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
▼ 2 	Run	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
▼ 2 	Run	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

It shows the list of available applications. The default is to show the applications for all projects.

If you want to see only the applications for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more applications by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no applications in the selected projects.

12. Click < to set how you want the applications to be deployed during the Release run.

For each application, you can select these settings:

- **Stop on Error:** Select this error handling setting to abort the Release run when the Deployer task fails. The default is **Stop on Error**. If the application fails, the release pipeline aborts.

When this setting is not selected (continue on error, which is similar to the **Continue running** option in a pipeline stage or gate), the Deployer continues to the next application with a known error if the current application fails. This allows the release to continue running when an application run has errors and fails. For example, in a release with multiple applications, some applications can fail and not be deployed with other that were successfully deployed as delivered in the release.

- **Smart Deploy:** Select this setting if you want the Release to deploy the application only with artifacts that have not been deployed to a resource or with selected versions of the artifact have not been deployed to new resources since a previous run.
- **Stage Artifacts:** Select this setting if you want the Release to retrieve artifacts that will be deployed in an application run before the deployment starts.


In this example, all the settings are selected for the selected applications. The Release will stop if any of the applications fails.

3 Applications Selected					
<div> <div>Q Search</div> </div>			Remove <<	Stop On Error <input checked="" type="checkbox"/>	Smart Deploy <input checked="" type="checkbox"/>
✓	↓	1. OB - Account Statement	Electric Cloud	▼ 2 Run	<input checked="" type="checkbox"/>
✓	↓	2. OB - Credit Card Account	Electric Cloud	▼ 2 Run	<input checked="" type="checkbox"/>
✓	↓	3. OB - Fund Transfer	Electric Cloud	▼ 2 Run	<input checked="" type="checkbox"/>

**Note:** The default is that ElectricFlow uses smart deploy to deploy the applications in the pipeline. If you want to use smart deploy for all the applications, you do not need to change the settings.

3 Applications Selected					
<div> <div>Q Search</div> </div>			Remove <<	Smart Deploy <input type="checkbox"/>	
✓	↓	1. OB - Account Statement	Electric Cloud	▼ 2 Run	<input checked="" type="checkbox"/>
✓	↓	2. OB - Credit Card Account	Electric Cloud	▼ 2 Deploy	<input checked="" type="checkbox"/>
✓	↓	3. OB - Fund Transfer	Default	▼ 2 Deploy	<input type="checkbox"/>



13. If the applications have snapshots, click the down arrow next to , and select a specific snapshot for each application, and click **OK**.

Using a snapshot as part of the Release definition is a best practice. Using snapshots, you can lock the exact versions of the artifacts to be deployed, which provides consistency and predictability. But you do not have to select a specific snapshot for an application. If a snapshot is not selected for an application here, the exact artifact versions to use would be based on how that application is modeled. That is, if the application model uses the *latest* artifact version for a component, the latest version would be used every time the Release runs when a snapshot is not selected.

When the Release runs, this list of applications (the payload) is passed to the Deployer task in the pipeline, and the applications are deployed through the pipeline sequentially. You can change the order in which the applications will be deployed by reordering the application input in the payload.

14. Click **Environments** to select the where the applications in each stage will be deployed.

The "Environment selection" dialog box opens.

Each cell in the table represents an environment where application in a stage will be deployed.

### About the filters in the "Environment selection" dialog box:



When you mouse over the filter icons, the tool tip text appears, from left to right:

- View only cells with missing environments.
- View only cells with missing tier maps.
- View only cells marked "N/A".
- View only empty cells.

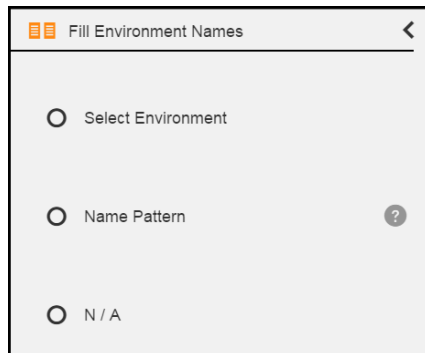
15. Select one or more cells in the table one of these ways:

- For one cell (one application-stage combination)—You can select one cell by clicking in it. This allows you to select the environment for a specific application-stage combination.
- For multiple cells (all the applications in a stage)—If the environment in a stage is the same for all the applications, you can select all the cells in a column (stage) by clicking in the header cell with the stage name.

**Note:** After one or more cells is selected, the **Fill** button in the upper right corner is enabled.

16. Click the > button in the upper left corner of the dialog box..

The "Fill Environment Names" section opens on the left side of the dialog box.



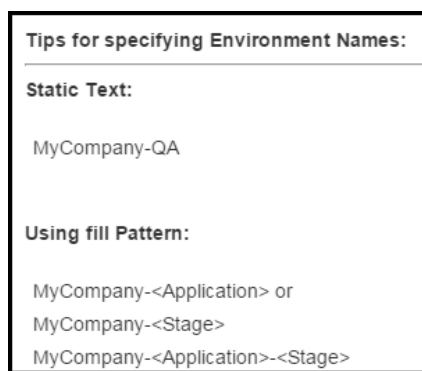
17. Select an environment using one of these options:

- **Select Environment**—Click the down arrow to select an environment or environment template.

Clicking **Select Environment** opens the list of available environments in the **Environments** tab. These are static environments that are authored before deploying the application in the stage.

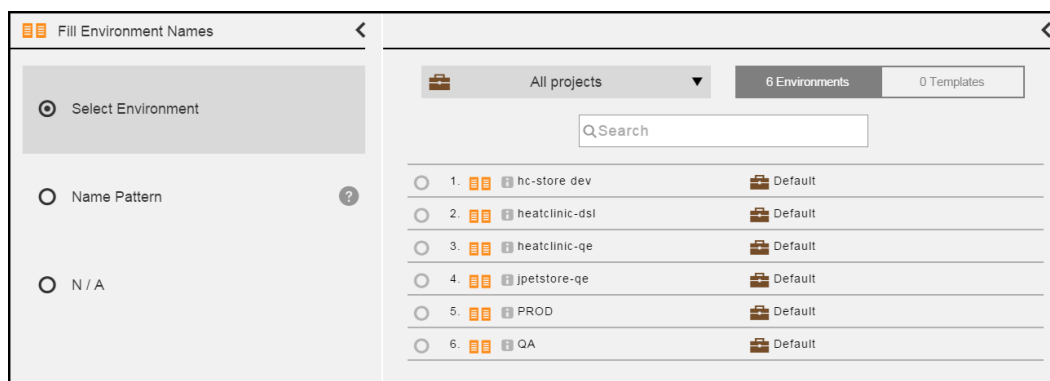
Clicking on the **Templates** tab opens a list of environment templates. These are dynamic environments with provisioned cloud resources that can be spun up during the application deployment. For more information about dynamic environments, see [Modeling Dynamic Environments](#) on page 228.

- **Name Pattern**—Click ? for tips on how to specify environment names. The tips describe how to specify environment names using static text or a fill pattern.



- **N/A**—Select this to not run the application in the stage. You should set environment mapping to **N/A** for stages where you do not want an active deployment even though the deployer is attached to a stage.

In this example, the "hc-store dev" environment is selected from the Environments list.



It shows the list of available environments. The default is to show the environments for all projects.



If you want to see only the environments for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environments by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environments in the selected projects.

18. Click **OK** to close the "Fill Environment Names" section.
19. Click **OK** to save the settings.
20. Click **Configurations** to enter the inputs (parameters) for the applications in a stage.

If any of the required parameters have not been entered on one of the cells for an application in a stage,



you will see this:

You can enter the value for it now or at runtime.

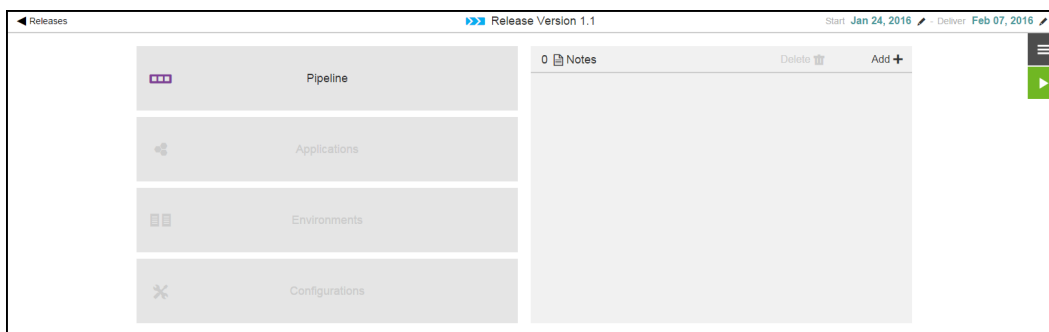
21. Click **OK**.

The next step is to run the Release. Go to [Running and Completing Releases](#) on page 451 to learn more about running and completing the Release.

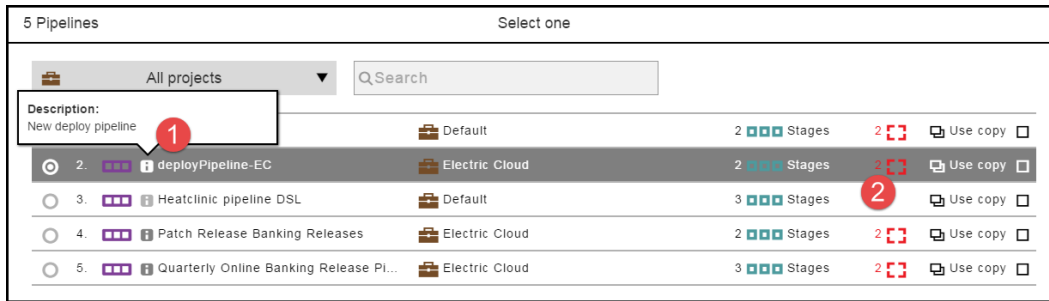
## Example: Continuous Delivery Style Releases for One Application

This example shows that when you define a Release, you do not have to enter all the details. However, any configuration issues have to be resolved before the Release run.

After a Release is added, the Release definition opens:



Click in the **Pipeline** field. A dialog box opens where you can select a pipeline:



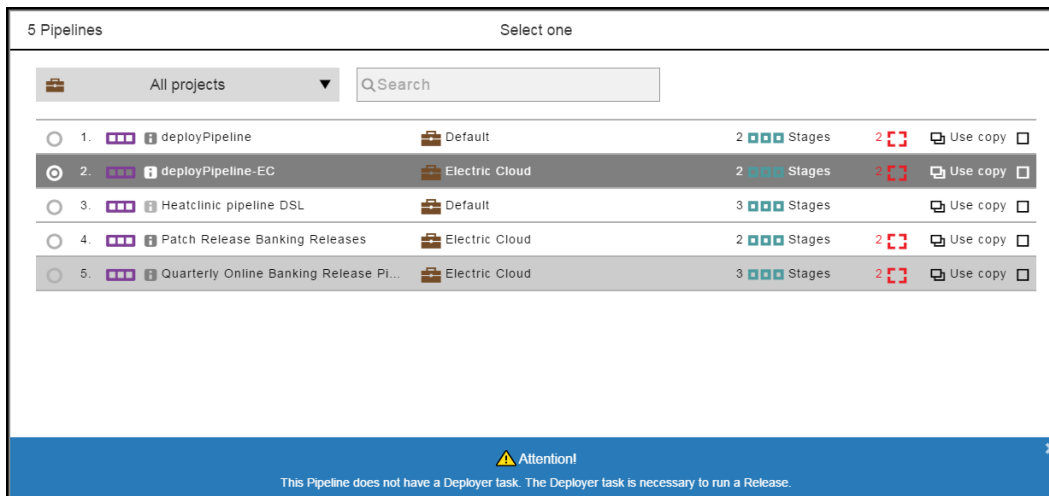
**Note:** When you click the button (number 1 above), a description of the deployPipeline appears. The icon on the right (number 2 above) means that two required parameters are attached to the pipeline.

It shows the list of available pipelines. The default is to show the pipelines for all projects. To see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects in one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more pipelines by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.

Select the **deployPipeline** application, and click **Next**.



If the pipeline does not have a Deployer task, a message appears reminding you that you need to define a Deployer task to run the Release. Close the message to continue, and click **Next**.

If the pipeline has a Deployer task, the message does not appear so you need to only click **Next**.

In the example, the pipeline has four required parameters. Some of them have default values that you can keep or change. Others do not, and you have to enter a value for them.

4 Parameters on deployPipeline-EC

1. QA Stage Control Param  
NORMAL
2. PROD Stage Control Param  
NORMAL
3. Specify Snapshot to Use  
SC-S1
4. Specify Sleep Time  
Value

After you enter the values, click **OK**.

Now click in the **Applications** field. The dialog box to select one or more applications opens:

8 Applications

▼ All projects Q Search Remove << Smart Deploy ☐

1.	Heat Clinic Store 1.1	Default
2.	HeatClinic	Default
3.	HeatClinic DSL	Default
4.	OB - Account Statement	Electric Cloud
5.	OB - Credit Card Account	Electric Cloud
6.	OB - Fund Transfer	Default
7.	ShoppingCart	Default
8.	jpetstore2	Default

It shows the list of available applications. The default is to show the applications for all projects.

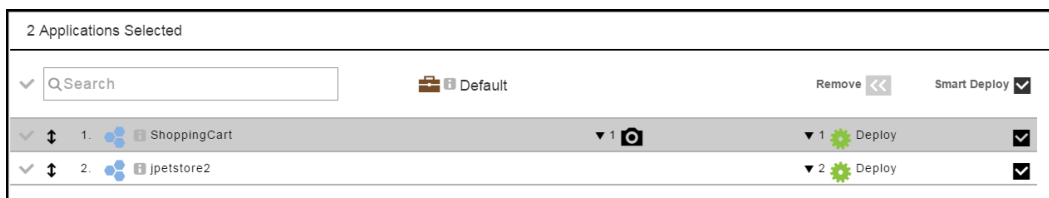
If you want to see only the applications for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

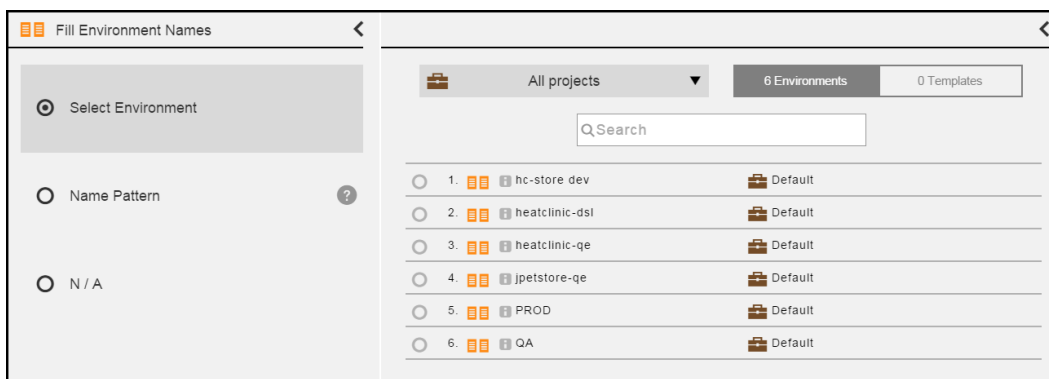
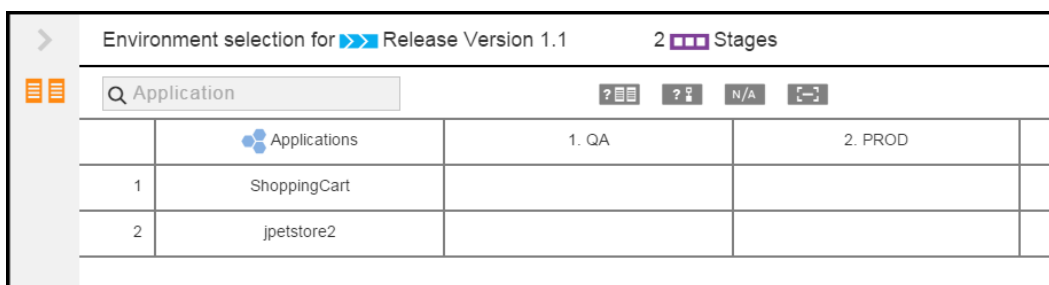
You can also search for one or more applications by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no applications in the selected projects.



Select one or more applications, click the button to add them to the pipeline, click **OK**, and click <:



Now click in the **Environments** field. The dialog box to select an environment where the applications in each stage will be deployed opens:



It shows the list of available environments. The default is to show the environments for all projects.

If you want to see only the environments for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environments by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environments in the selected projects.

### About the filters in the "Environment selection" dialog box:



When you mouse over the filter icons, the tool tip text appears, from left to right:

- View only cells with missing environments.
- View only cells with missing tier maps.
- View only cells marked "N/A".
- View only empty cells.

For detailed instructions about how to select the environments in which the applications in each stage will be deployed, go [here](#).

In this example, the environments are selected as follows:

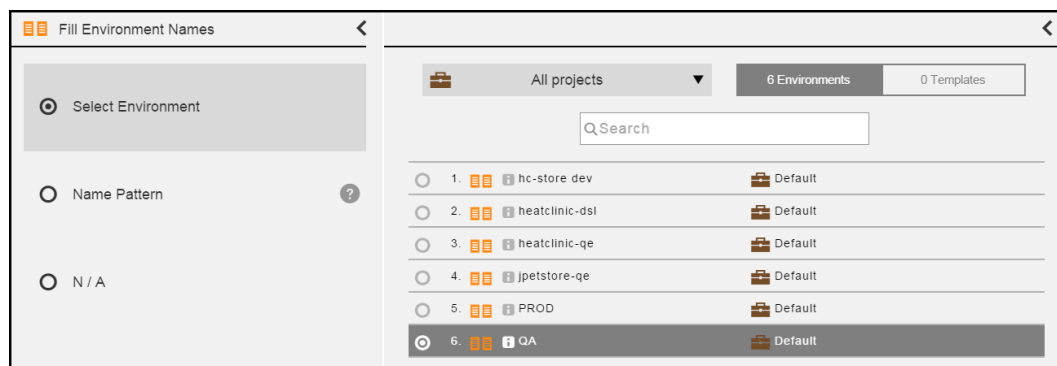
- ShoppingCart application in the QA stage:

In the ShoppingCart row, select the cell in the QA column and double-click in it. Notice that the **Fill** button is now enabled.

A panel opens to the left where you can select the environment where the ShoppingCart application will be deployed.

Select the environment to which the ShoppingCart application is deployed: **QA**.

Click **OK** to save your selection.



- jpetstore2 application in the QA stage:

In the jpetstore2 row, select the cell in the QA column and click in it. Notice that the **Fill** button is now enabled.

A panel opens to the left where you can select the environment where the jpetstore2 application will be deployed.

Select the environment to which the jpetstore2 application is deployed: **jpetstore-qe**.

Environment selection for >>> Release Version 1.1 2 Stages				
Q Application		?	?	N/A
	Applications	1. QA	2. PROD	
1	ShoppingCart	QA	PROD	
2	jpetstore2	jpetstore-qe	PROD	

Click **OK**.

- All the applications in the PROD stage:

Click in the header cell for the PROD stage.

A panel opens to the left where you can select the environment where the applications will be deployed.

Select the environment to which the applications will be deployed: **PROD**.

Click **OK**.

Now click in the **Configurations** field. The dialog box to enter the required parameters for the pipeline to run opens:

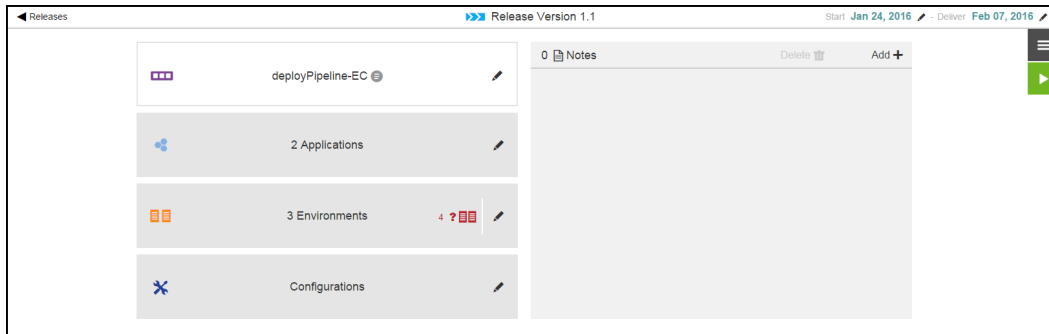
Release Configuration for >>> Release Version 1.1 2 Stages				
		Clear		
	Applications	1. QA	2. PROD	
1	ShoppingCart			
2	jpetstore2			

If any of the required parameters have not been entered in a cell (an application to be deployed in a stage) with



in it, you can click in the cell to enter the inputs (parameters) for the application in a specific stage. You can enter the value for it now or at runtime. Then click **OK** to save your entries.

The Release definition now looks like this:



The next step is to run the Release. Go to [Running and Completing Releases](#) on page 451 to learn more about running and completing the Release.

## Release Dashboard


The Release Dashboard, also referred to as the Release List, provides a way for the release team, task assignees, and approvers to quickly see the status of all the planned, active, or completed releases at any time. They can quickly see the current status, specific tasks and who is assigned to them, and the start and end dates for the stages in one place on one platform.

### Accessing the Release Dashboard

To open the Release Dashboard from the Home page, do one of the following actions:

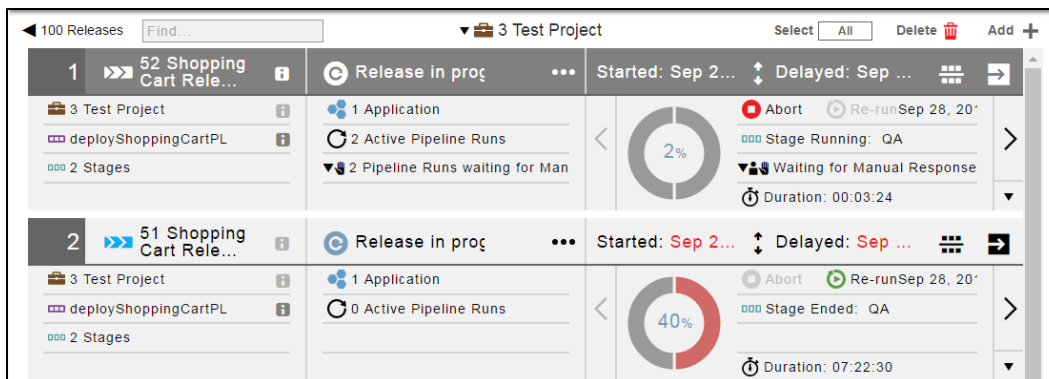
- Click **Releases**.



- Click the **Main Menu** button (  ) and select **Releases**.

### Release Dashboard

The Release Dashboard shows all the Releases that you have permission to view:



By default, the releases for all projects are displayed.

To see only the objects for a specific project, click the down arrow in the **All projects** field and then select one or more projects in one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.


If there are no matches, a message appears stating that there are no resource templates in the selected projects.

The Release Dashboard has this information:



**Each row in the Release Dashboard contains this information:**

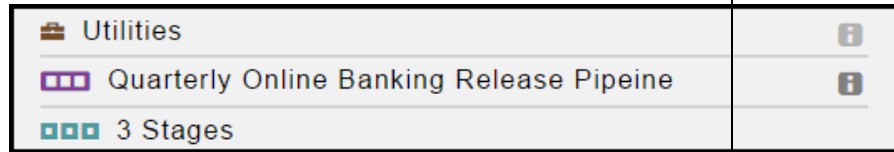
Release name	Example: <div> Q1 2016 Trading System</div>
--------------	--

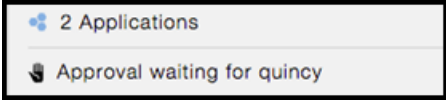
<p>Release status</p>	<p>The status can be:</p> <ul style="list-style-type: none"><li>• Release in planning</li><li>• Release in progress</li><li>• Release completed</li></ul> <p>Examples:</p> <div> Release in planning</div>
-----------------------	--

<p>Start and target (end) dates for the Release</p>	<p>Example:</p> <div><p>Start: 10/30/15      Target: 01/18/16</p></div> <p>The default time frame between the start and target (end) dates is two weeks.</p> <p>The color of the dates indicates the Release status.</p> <ul style="list-style-type: none"><li>• Green: The Release has not started yet, and the start and end dates are within the planned time frame.</li><li>• Medium blue: The Release is in progress, and the dates are the actual start and end dates.</li><li>• Dark blue: The Release is completed, and the dates are the actual start and end dates.</li><li>• Red: The date is past the planned end date.</li></ul>
---	--

Project to which the pipeline belongs,  
name of the pipeline underlying the  
software release, and the number of  
stages in this pipeline

Example:

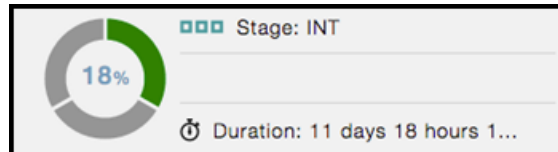


<p>Number of applications in the pipeline and any notifications for actions to be taken before the pipeline progresses</p>	<p>Example:</p> <div>A screenshot of a user interface element. It consists of a light gray rectangular box with a thin black border. Inside the box, there are two lines of text. The top line features a blue icon of two overlapping squares followed by the text "2 Applications". The bottom line features a gray icon of a hand with a checkmark followed by the text "Approval waiting for quincy".</div> <p>This pipeline requires human intervention to progress. The user named quincy needs to approve something at an entry or exit gate of a stage before the pipeline progresses.</p>
--	---

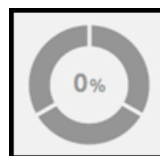
Visual indicator showing how far the Release has progressed with the percentage completed, the current stage, and how long the Release has been running.

The visual indicator is split into sections equal to the number of stages in the pipeline. If pipeline has three stages, it is split into three segments.

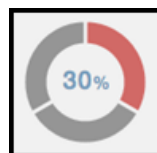
This example shows that the Release is running without errors, is at the INT stage, and has been running for over 11 days. The duration is the total time that the Release has been running before the Release is ended.



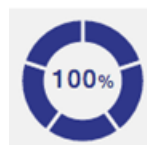
If the Release is still in the planning phase, the percentage completed is 0%, and the segments are all gray.



If the pipeline is running with errors, the part of the segment representing the current completed stage is red.



If the pipeline run is completed, the visual indicator is blue and the percentage completed is 100%.



**Buttons and Icons in the Release Dashboard**








Entering part or all of a pipeline name in the **Find** field on the top of the dashboard starts the search for Releases matching the search criteria.

Selecting **All** or **None** and then clicking the **Delete** button removes the selected pipelines from the list.

SelectAllDelete

Clicking the **Add+** button adds a Release.



<p>Clicking this button opens to Path-to-Production view, which displays the applications being deployed in the Release and the environments where they are deployed. The details in this view include the application versions and the environments that are not in compliance with the bill of materials throughout the Release. Go to <a href="#">Path-to-Production View</a> on page 448 for more information.</p>	
<p>Clicking this button opens the Release Definition dialog box. Go to <a href="#">Release Definition</a> on page 417.</p>	
<p>Clicking this button starts a Release run.</p> <p>You can optionally select a previous release run to use the parameters from that run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.</p>	
<p>Clicking this button allows you to end, re-run, or abort the Release pipeline.</p> <p><b>Note:</b> To go to the Pipeline Run page, click the  button in the upper left corner of the Release Dashboard, and select <b>Pipelines &gt; Pipeline Runs</b>. For more information about the Pipelines Runs page, go to <a href="#">here</a>.</p> <p>For more information about running and ending (completing) the Release, go to <a href="#">Running and Completing Releases</a> on page 451.</p>	<p>Select one of these actions:</p>  <ul style="list-style-type: none"> <li>• <b>End Release</b>—Clicking this ends the Release. You cannot end the pipeline that is currently running. If you want to end it, you must wait for this run to complete or abort it in the Pipeline Run page. When the pipeline is aborted, tasks that are currently running will finish, and no new tasks will be started.</li> <li>• <b>Run Pipeline</b>—Clicking this starts a new pipeline run.</li> <li>• <b>Abort All Runs</b>—Clicking this aborts all pipeline runs.</li> <li>• <b>Schedules</b>—Clicking this lets you create a release schedule.</li> </ul>

## Path-to-Production View

The *Path-to-Production* view shows the applications deployed in the Release, which versions are deployed, and the environments to which they are deployed. The details in this view include the application versions, snapshots, and the environments that are not in compliance with the *bill of materials* throughout the Release.

To go to the Path-to-Production view:

1. Go to the Release Dashboard.
2. Find a Release that is in progress or completed.



The button should be enabled.

### Example:

Select one of these Releases:





3. Click the button to open to Path-to-Production view.

This is a Path-to-Production view showing the bill of materials.

Releases / Path to Production									
Bill of Materials		UAT	STG	PROD					
3 Applications			1	1					
1.	OB - Account Statements	2.5	2.5	2.5					
2.	OB - Credit Card Accounts	2.0	1.0	1.0					
3.	OB - Fund Transfer	2.0	2.0	2.0					

This information is in the bill of materials:

1	Release name and pipeline name	<p>Example:</p> 
2	Stage	<p>Each column shows the details for each stage in all the applications.</p> <p>Stage names are defined from the associated Pipeline. The stages in this example are <i>UAT</i>, <i>STG</i>, and <i>PROD</i>.</p>
3	Summary	<p>The bill of materials has three applications.</p> <p>In this example, the STG and PROD stages each</p>  <p>have a compliance issue indicated by .</p>
4	Application	<p>Each row shows the details for each application across all the environments.</p> <p>The application names are defined from the associated pipeline.</p> <p>The applications in this example are:</p> <ul style="list-style-type: none"> <li>• OB—Account Statements</li> <li>• OB—Credit Card Statements</li> <li>• OB—Fund Transfer</li> </ul>
5	UAT stage	<p>In this example, the UAT stage has no compliance issues.</p> <p>The versions of the applications deployed in the Release match what is in the bill of materials.</p>
6	STG and PROD stages	<p>In this example, the STG and PROD stages have compliance issues.</p> <p>The "OB—Credit Card Accounts" application version 2.0 is supposed to be deployed in the STG and PROD stages.</p> <p>However, version 1 of the application is deployed instead.</p>

To get more details about compliance issues:



- Mousing over shows a message explaining the noncompliance. Use this information to troubleshoot and resolve the noncompliance.



- Clicking shows the environment to which the application is deployed, the deployment date, and information about the deployed components and artifacts.

Bill of Materials		UAT	STG	PROD
3 Applications			1	1
1. OB - Account Statements	2.5	✓ 2.5	✓ 2.5	✓ 2.5
2. OB - Credit Card Accounts	2.0	✓ 2.0	✗ 1.0	✗ 1.0
3. OB - Fund Transfer	2.0	✓ 2.0	✓ 2.0	✓ 2.0

You can take these actions in the bill of materials:



- Clicking the button shows less detail.



- Clicking the button shows all the details.



- Clicking the button starts opens to Search field, where you can enter the part of an application name to find specific applications, which is especially helpful when you have a long list.

## Release Summary

The Release summary feature allows Release-specific information from pipeline stage tasks to be displayed in the Release Dashboard. You can add Release summary information by creating properties under the `ec_releaseSummary` property sheet that exists on the run time associated with the Release.

These examples show how to do this from ectool:

```
ectool setProperty /myReleaseRuntime/ec_releaseSummary/summary1 --value "<property value in plain text>"
```

or

```
ectool setProperty /myReleaseRuntime/ec_releaseSummary/summary2 --value "<html><a href='\"http://electric-cloud.com/\">Electric Cloud</a></html>"
```

For a pipeline that is run from a release, after the task in a pipeline stage is completed, you can view the summary property in the Release Dashboard:



## Running and Completing Releases

After a Release is defined, you can run it multiple times on the journey to production. At the end of the software release life cycle, when the Release process has been successfully completed and the software is ready for production, you can end the Release. Once the Release has ended, it cannot be run again.

### Running the Release

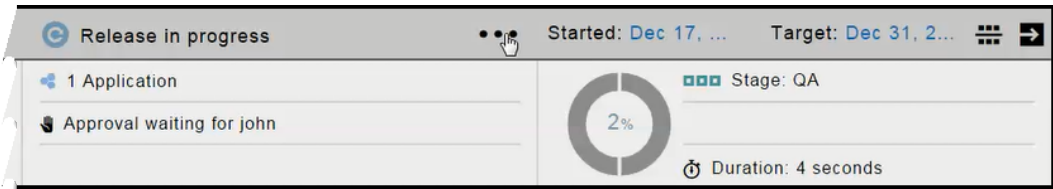
This example shows how to run a Release called Q1\_TimeBaseRelease.



You can start the Release run when the Release status is "Release in planning" and the **Run** button ( ) is enabled.



The Release status changes to "Release in progress" and the **Run** button ( ) has been replaced by the button. Clicking on it shows a pop-up window with more actions. The Start and Target dates are in blue because the Release is in progress.



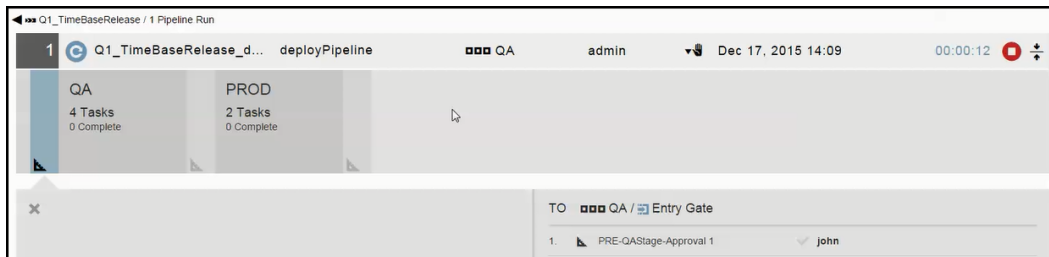
When is displayed, human intervention is required for the pipeline to progress to the first stage.



Approval waiting for john

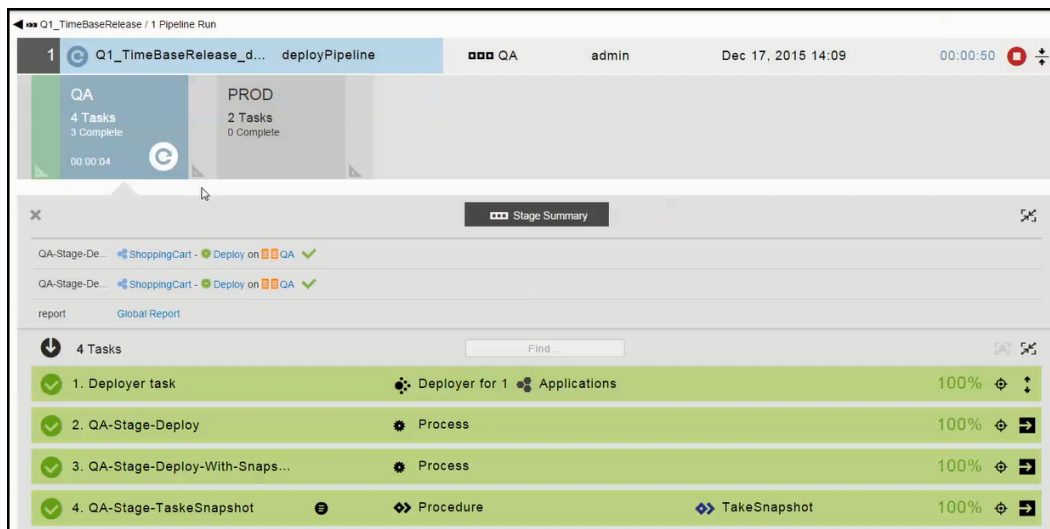
Clicking on

causes the Pipeline Run view for the deployPipeline to be displayed.



The pipeline can progress after the user named john approves the entry to the QA stage of the pipeline.

As the pipeline progresses, you can click in the QA stage to view the pipeline stage summary:



The pipeline continues to progress to the PROD stage after the required approvers respond at the exit gate. Progress continues until this Release run is completed.

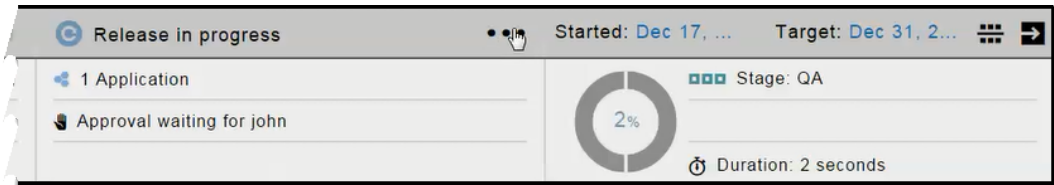



After the Release is completed, you can start a new Release run by clicking the button and selecting **Re-run Pipeline**. You can re-run the Release as many as times as you want during the software release life cycle.

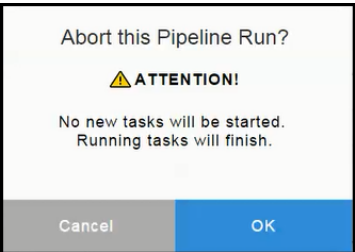
## Aborting a Release Run

There are two ways to abort a Release run.

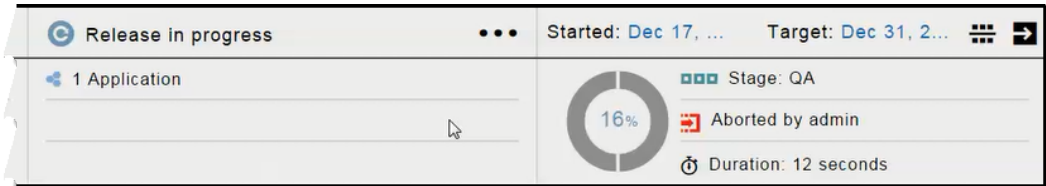
- During the first Release run, you can abort it from the Release Dashboard.



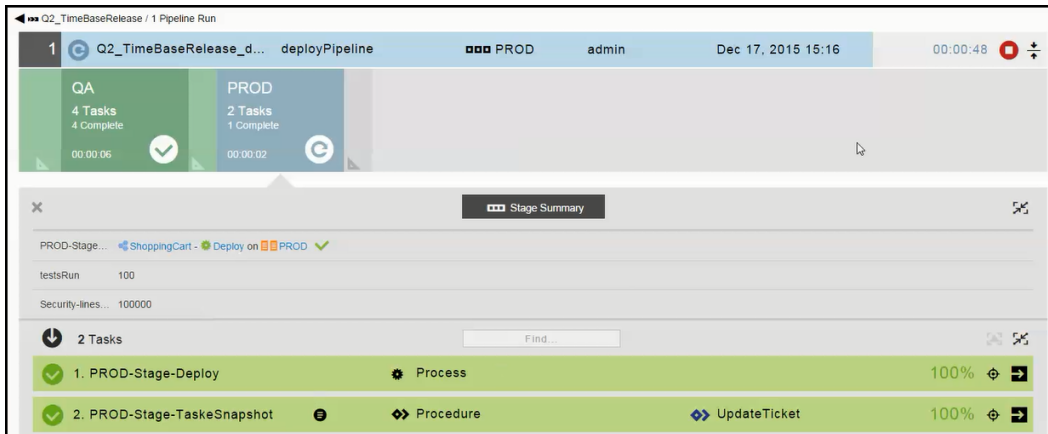
Clicking the  button and selecting **Abort Pipeline** will abort the pipeline. The tasks that are currently running will finish, and no new tasks will be started. This message appears:



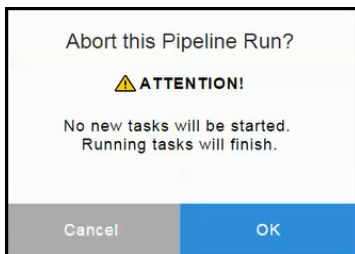
This is the Release status after the Release run is aborted.



- During subsequent Release runs, you can abort the current Release run from the Pipeline Run view.



Clicking the Abort ( ) button will abort the pipeline. The tasks that are currently running will finish, and no new tasks will be started. This message appears:



After you click **OK**, the Pipeline Run view now displays this status:

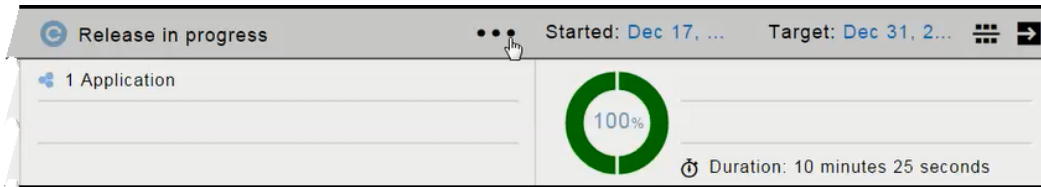


## Completing the Release

When you complete the Release, no other actions can take place on it, and this action cannot be undone (reversed). The Release cannot be run again.

You cannot end the pipeline that is currently running. If you want to end it, you must wait for this run to complete or abort it in the Pipeline Run view. For more information, go to [Aborting a Release Run](#) on page 452.

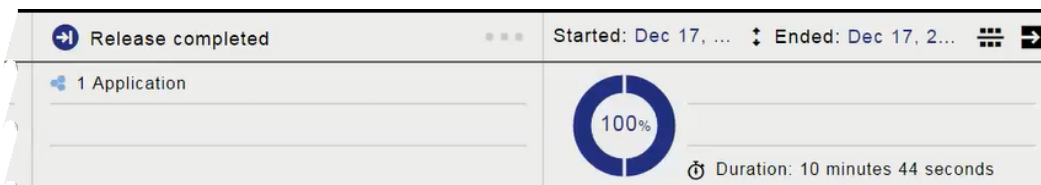
If the Release run is complete, you can complete the Release from the Release Dashboard.



Clicking the  button and selecting **End Release** ends the Release. This message appears:



After you click **OK**, the Pipeline Run view now displays this status:



The Release status is now:

- The icon next to "Release completed" indicates that the Release has been completed (ended).
- The "percentage complete" icon on the right is split into two sections because the pipeline has two stages. It shows that the Release run is 100% complete.
- The Target date has been replaced by the Ended date.
- The Start and Ended dates are in dark blue because the Release is completed.
- The Duration is the total time for the Release.

## Chapter 1: Using the ElectricFlow DSL

The ElectricFlow domain-specific language (DSL) is an intuitive, easy-to-use computer language that allows you to model continuous delivery (CD) and Application Release Automation (ARA) solutions. It has these capabilities:

- Easy to understand
- Self documenting
- Process-as-code: You can define your processes as high-level code that can be versioned, tested, and reused.
- [User defined versions for any object](#)
- Modeling of applications, pipelines, and releases using simple, logical constructs
- Based on the Groovy language
- Supports various means of code reuse
- Access to all the ElectricFlow API commands

This is a snippet of a DSL script:

```
pipeline 'ProductABCPipeline', {  
  description = 'pipe line from dev to prod'  
  stage 'dev', {  
    description = 'dev stage'  
    task 'run build', {  
      ...  
    }  
  }  
  stage 'test', {  
    description = 'test stage'  
    task 'manual regression', {  
      ...  
    }  
    task 'QE automation', {  
      ...  
    }  
  }  
}
```

### Why Use DSL?

ElectricFlow DSL is the easiest of the ElectricFlow programming constructs to use.

For example, this is a comparison of DSL (the easiest to use) and `ec-perl` (the most difficult to use):

DSL	ec-perl
Declarative (what)	Script-based, imperative (how)
Concise	Relatively verbose
Do not need to understand Groovy to read DSL	Need to understand Perl
The entire DSL script is sent only once to the server for evaluation	Client-server chattiness: Each API invocation is separate call to the server

This is the DSL version of the helloProcedure in JSON:

```
project "Hello Project", {  
  procedure "Hello Procedure", {  
    step "Hello World",  
    command: "echo 'Hello World from EF DSL!'"  
  }  
}
```

```
ectool -format json evalDsl -dslFile helloProcedure.groovy
```

This is the ec-perl version of the helloProcedure:

```
use strict;
use ElectricCommander;
$|= 1;
my $ec = new ElectricCommander({ format=>'json' });
$ec->createProject("Hello Project");
$ec->createProcedure("Hello Project",
    "Hello Procedure");
$ec->createStep("Hello Project",
    "Hello Procedure",
    "echo 'Hello World from ec-perl'");
```

```
ec-perl helloProcedure.pl
```

You create models or scripts to represent the ElectricFlow objects using the DSL methods and let the ElectricFlow DSL engine take care of invoking the correct API to create or update the object if it already exists. The DSL is based on Groovy scripting language; however, you do not need to know Groovy in detail to use it.

The benefits of using DSL scripts are:

- You can create one master model or script and run it one or more times for different scenarios to build, test, and deploy your software or application by passing different parameter values for evaluating the script.
- You can automate software delivery processes to produce repeatable, scalable, and efficient results.
- You can quickly and easily create and deploy applications using DSL scripts. Using these scripts enables a higher-order command-line interface (CLI) with richer syntax than the CLI on your system.
- Users with little to no programming experience levels can create and run DSL to perform specific operations. They do not need to know how to use the ElectricFlow API or UI to create and deploy an application.
- Using DSL scripts make Continuous Delivery and Continuous Integration possible at scale.

## Using DSL for Object Versioning

In addition to all of the previous benefits, DSL also provides the crucial functionality of *object versioning*. You can easily generate a DSL file for any ElectricFlow object either by using the API or UI for the Deploy and Release objects. See [Generating DSL Scripts](#) on page 468 for more information on how to generate DSL scripts.

These DSL files can then be used for further editing or stored in a version management system of your choice. DSL is a great way for creating and using user-defined versions of any ElectricFlow object.

## Running DSL

You can run DSL one of these ways:

- From the command-line interface
- Using REST

- From a step command
- Using the DSL IDE. Go to [DSL IDE](#) on page 469 for the details.

### From the Command-Line Interface

Use the `evalDsl` command to evaluate and run a DSL script. See the `evalDsl` command in the "API Commands—Miscellaneous Management" section of the ElectricFlow API Guide for a list of the supported arguments.

These `ectool` examples show how to evaluate a DSL script.

- When specifying the DSL text, enter `ectool evalDsl <dsl>`. For example:

```
ectool evalDsl "project 'My WAR file' "
```

- When specifying the path to the DSL script on the client, enter `evalDsl --dslFile <dslFile>`. For example:

```
ectool evalDsl --dslFile c:/dslScripts/myWarFile.dsl
```

### Using REST

Go to `http://<ElectricFlow_server>:8000/rest/v1.0/server/dsl`, where `<ElectricFlow_server>` is the hostname (the fully qualified domain name [FQDN]) or IP address of the ElectricFlow server.

1. Select the **dsl** method.
2. For the Request, select or enter the following information for the Request and then click **Try it out!**.

For **Response Content Type**, select **application/json**.

For **Project**, enter **Default**.

For **Application**, enter **TestApp**.

For **artifactLocation**, enter **my artifact location**.

The response appears in the **Response Body** field and includes the project ID, project name, and workspace name.

Request	Response
<b>URL:</b> <code>http://localhost:8000/rest/v1.0/server/dsl</code> <b>HTTP Method:</b> POST <b>Content-Type:</b> application/json <b>Payload:</b> <pre>{   "dsl":   "project 'Default', {     application 'TestApp', {       artifactLocation = 'my artifact location'     }   } }" }</pre>	<pre>{   "project": {     "projectId": "7e238199-bef1-11e5-ae75-34e6d71279c8"     "projectName": "Default"     ...     "workspaceName": ""   } }</pre>

### From a Step Command

You can enter the DSL script as a step command in a procedure.



```
Command
Command(s): 1 project 'sandbox', {
              2   procedure 'command_procedure', {
              3     step 'step1', {
              4       shell = 'ec-perl'
              5       command = "sleep 5"
              6     }
              7
              8     step 'step2', {
              9       shell = 'ec-perl'
             10       command = "sleep 5"
             11     }
             12   }
             13 }
             14
             15 project 'pipeline_test_project', {
             16   pipeline 'testpipeline', {
             17     description = 'Simple pipeline with 1 stage and 1 task'
             18     enabled = true
             19     stage 'stage1', {
             20       description = 'dev stage'
             21       task 'procedure_task', {
             22         subprocedure = 'command_procedure'
             23         subproject = 'sandbox'
             24       }
             25     }
             26   }
             27 }
```

You can use `ectool` to evaluate and run this DSL script by entering `ectool evalDsl --dslFile {0}`.

## Modeling with DSL

The DSL provides an alternative to the UI for authoring and managing ElectricFlow objects. It allows you to perform all the same operations as the RESTful APIs or Perl APIs but much easier and simpler.

- Create and call procedures
- Model and deploy applications
- Create and manage resources
- Create environment models and add resources to them
- Model and run pipelines
- Model and run releases
- Create and manage artifacts
- Create and manage object properties

For the list of supported DSL methods, go to the "DSL Methods" section in the *ElectricFlow API Guide*.

For more information about the ElectricFlow DSL, go to:

- [ElectricFlow DSL: Process-As-Code for All Your Automation Needs](#)
- [Process as Code: An Introduction to the ElectricFlow Automation DSL](#)

## Getting Started with DSL

[Getting Help on DSL Methods](#) on page 461

[Creating and Running DSL Scripts](#) on page 461

[Common Use Cases](#) on page 462

[Generating a DSL Script for an Existing ElectricFlow Object](#) on page 462

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[Passing Parameters or Arguments to Your DSL Script using a File](#) on page 463

[Evaluating Your DSL Script in a Specific Application Context](#) on page 464

[Using ElectricFlow APIs in DSL](#) on page 464

[Understanding Transactions in DSL](#) on page 464

[Adding Support for Augmenting the Groovy Runtime classpath for ectool evalDsl](#) on page 466

[Debugging Your DSL Script](#) on page 467

## Getting Help on DSL Methods

To get information on the DSL methods, use the `evalDsl --describe` argument as follows:

- Obtaining the complete list of DSL methods for ElectricFlow objects:

```
ectool evalDsl dsl --describe 1
```

- Obtaining DSL method details for a specific ElectricFlow object, such as an application:

```
ectool evalDsl application --describe 1
```

- Obtaining details for a specific API, such as `getProcedure`:

```
ectool evalDsl getProcedure --describe 1
```

## Creating and Running DSL Scripts

### *Using ectool*

To create and run a DSL script using `ectool`:

1. Use a text editor or Groovy IDE to create a script using ElectricFlow DSL methods, and save it.
2. Log into `ectool`.
3. You can use these arguments with `evalDsl`. Enter `evalDsl` to run the DSL script.
  - `debug`—ElectricFlow generates debug output as the DSL script is evaluated when the `debug` argument is set to `1` or `true`.
  - `describe`—ElectricFlow prints a description of the DSL text when the `describe` argument is set to `1` or `true`.
  - `parameters`—Parameters are passed to the script by ElectricFlow as JSON text.

### *Using ec-perl*

To create and run a DSL script using `ec-perl`:

1. Use any text editor or Groovy IDE to create a script using ElectricFlow DSL methods, and save it.
2. If you did *not* use `ec-perl` in for the previous step, start `ec-perl`.

3. Enter `evalDsl` to run the DSL script.

You can use these arguments to get more information about results as the script runs.

- `debug`—ElectricFlow generates debug output as the DSL script is evaluated when the `debug` argument is set to `1` or `true`.
- `describe`—ElectricFlow prints a description of the DSL text when the `describe` argument is set to `1` or `true`.
- `parameters`—Parameters passed to the script by ElectricFlow as JSON text.

## Common Use Cases

### *Generating a DSL Script for an Existing ElectricFlow Object*

To generate a DSL script for an existing ElectricFlow object, which was created through a Perl API, a RESTful API, or the UI, enter

```
ectool generateDsl <path>
```

where `<path>` is the path to the ElectricFlow object for which you want to generate the DSL script.

For example, if you have a resource named `/oca/` in your ElectricFlow instance:

1. Run the following command to redirect the output to a file (for example, `myScript.dsl`):

```
ectool generateDsl /resources/local> myScript.dsl
```

This command generates output redirected to the specified file, which looks similar to the following:

```
resource 'local', {  
  description = 'Local resource created during installation.'  
  artifactCacheDirectory = null  
  hostName = '192.168.10.10'  
  hostType = 'CONCURRENT'  
  port = '7800'  
  proxyCustomization = null  
  proxyHostName = null  
  proxyProtocol = null  
  repositoryNames = null  
  resourceDisabled = '0'  
  shell = null  
  trusted = '0'  
  useSSL = '1'  
  workspaceName = null  
  zoneName = 'default'  
}
```

2. Use the script file created in the previous steps with the `evalDsl` command to create or update the resource in ElectricFlow.

You can also edit the file to add or update resource attributes before using the script with `evalDsl`.

```
ectool evalDsl --dslFile myScript.dsl
```

## Passing Parameters or Arguments to Your DSL Script

ElectricFlow DSL lets you create a template script using script parameters instead of hard-coding all the values in the script. You can then invoke the same script with different parameter values each time to create different ElectricFlow object instances. For example, you could use the following script to create a resource that uses SSL in the *secure* zone:

```
zone 'secure'
  resource() {
    resourceName = args.resourceName
    hostName = args.resourceIP
    hostType = 'CONCURRENT'
    resourceDisabled = '0'
    trusted = '1'
    useSSL = '1'
    zoneName = 'secure'
  }
```

The script has the values `args.resourceName` and `args.resourceIP` for the `resourceName` and `hostName` resource attributes respectively. These argument or parameter values can be passed from the command line to the DSL script in JSON form using the following command:

For Linux:

```
ectool evalDsl --dslFile myScript.dsl --parameters '{"resourceName":"MyFirstResource",
"resourceIP":"192.168.10.12"}'
```

For Windows:

```
ectool evalDsl --dslFile myScript.dsl --parameters "{\"resourceName\":\"MyFirstResource\", \"resourceIP\":\"192.168.10.12\"}"
```

Note the special handling required on Windows for passing command-line arguments that contain double quotes and spaces. To allow spaces and other special characters in a command-line argument, Windows requires wrapping the value in quotes. Also, if the value itself contains quotes, you must escape those quotes by using a backslash '\'. For alternate method for passing parameter values for DSL, see [Passing Parameters or Arguments to Your DSL Script using a File](#) on page 463.

## Passing Parameters or Arguments to Your DSL Script using a File

Parameters to a DSL script can be passed using a file that contains the parameters in JSON format as follows:

```
ectool evalDsl --dslFile myScript.dsl --parametersFile myParams.json
```

Where the file `myParams.json` may contain:

```
{
  "resourceName" : "MyFirstResource",
  "resourceIP" : "192.168.10.12"
}
```

Go to [Passing Parameters or Arguments to Your DSL Script](#) on page 463 for details about using parameters in a DSL script.

## ***Evaluating Your DSL Script in a Specific Application Context***

ElectricFlow DSL supports a simple and intuitive nested structure to represent the logical structure of ElectricFlow objects. This allows the DSL methods to be evaluated in a specific context, such as with respect to an ElectricFlow project, application, or pipeline.

For example, the following is a very simple script that can create an application with an application tier in a project:

```
// ElectricFlow DSL engine will create project 'Default' unless it already exists
project ('Default') {
  //'Deploy world' application will be created within 'Default' project unless it already exists
  application('Deploy world') {
    //'Web Tier' application tier will be created within 'Deploy world' application unless it already exists
    applicationTier('Web Tier')
  }
}
```

## ***Using ElectricFlow APIs in DSL***

All ElectricFlow APIs available through `ec-perl` are available for use in your DSL script with the exception of `publishArtifactVersion` and `retrieveArtifactVersions`. The syntax for invoking an ElectricFlow API in DSL is as follows:

```
<methodName> (argumentName1: value1, argumentName2:value2, ... )
```

For example, the `getProcedure` API can be invoked as:

```
def proc = getProcedure (procedureName: 'RunInstances', projectName: 'DeployUtilities')
```

## ***Understanding Transactions in DSL***

By default, all operations invoked in a single DSL script run in one transaction. This means that if an error is encountered in the script, the entire script is rolled back. For example, in the following script:

```
// -- Transaction begins here
project ('MyTestProject')
application('MyTestApp') {
  applicationTier('Tier1') {
    process('Deploy') {
      processStep('step1',
        applicationTierName: 'Tier1',
        processStepType: 'command',
        errorHandling: 'failProcedure',
        subproject: '/plugins/EC-Core/project',
        subprocedure: 'RunCommand',
        actualParameter: [ shellToUse: 'sh', commandToRun: 'echo hi' ])
    }
  }
}
// -- Transaction ends here
```

if an error is encountered while the script creates the process step `step1` after creating the process, then the application tier, the application, then the entire transaction is rolled back to avoid a partially created application,

application tier, and process. However, as with other ElectricFlow APIs, if the system considers the error to be *retryable* (such as a database locking error), then the entire DSL is re-evaluated.

When using certain ElectricFlow APIs in the DSL script, you must run them in a separate transaction. To do so, enclose the required part of the script in a *transaction*. For example, if you request a procedure to start in the DSL script and want to monitor its progress in the same script, you must commit the request in a separate transaction before monitoring begins. This lets the system pick up the request for execution. The following example shows how to do so:

```
// -- Transaction one begins here
procedure projectName: 'Hello Project', procedureName: 'testRunProcedure'
def resp
```

```
// -- Transaction one ends here
// -- Transaction two begins here
```

#### **transaction**

```
{

// calling the runProcedure in its own transaction
// so that the procedure kicks off when this script is
// running and we can monitor its progress.

    resp=runProcedure(
        projectName: 'Hello Project',
        procedureName: 'testRunProcedure',
        actualParameter: [
            friend: 'James',
        ]
    )
}
// -- Transaction two ends here
// -- Transaction three begins here

// Now let's grab the jobId launched to run the procedure
def id=resp.jobId

// Let's wait for it to finish
def String status=''
while(status != "completed") {
    status=getProperty(propertyName: 'status', jobId: id).value;
    println "status: $status"
    sleep (1000)
}

// -- Transaction three ends here
def resp

// Calling the runProcedure in it's own transaction
// so that the procedure kicks off when this script is
// running and we can monitor its progress.
transaction{
    resp=runProcedure(
        projectName: 'Hello Project',
        procedureName: 'testRunProcedure',
```

```
        actualParameter: [
            friend: 'James',
        ]
    )
}

// Now let's grab the jobId launched to run the procedure
def id=resp.jobId

// Let's wait for it to finish
def String status=''
while(status != "completed") {
    status=getProperty(propertyName: 'status', jobId: id).value;
    println "status: $status"
    sleep (1000)
}
```

The above script has three transactions:

1. Before the transaction block
2. The transaction block itself within which the procedure run request happens
3. After the transaction block where it polls for the procedure to complete

When evaluating such a DSL script, whether the script is retried after a retryable error depends on where the error occurs. If it occurs before the transaction block is encountered, then the script is retried. But if it occurs after the transaction block is encountered, then the script is not retried.

### ***Adding Support for Augmenting the Groovy Runtime classpath for ectool evalDsI***

You can use external .jar files with DSL. ElectricFlow DSL is based on Groovy so that you can take advantage of all Groovy and Java capabilities. You can use any Groovy or Java libraries in your DSL script. The libraries can be made available to the ElectricFlow DSL runtime engine when the DSL script is executed using the `serverLibraryPath` parameter.

This example from the *HttpBuilder—Easy HTTP client for Groovy's* wiki shows how to use the HTTPBuilder classes in a DSL script:

1. Create a file named `httputil.groovy` with the following content. The script uses the `groovyx.net.http.HTTPBuilder` class to make an HTTP GET request.

```
import groovyx.net.http.HTTPBuilder
import static groovyx.net.http.Method.GET
import static groovyx.net.http.ContentType.JSON

def result = [:]
def http = new HTTPBuilder( 'http://ajax.googleapis.com' )
http.request( GET, JSON ) {
    uri.path = '/ajax/services/search/web'
    uri.query = [ v:'1.0', q: 'Calvin and Hobbes' ]

    response.success = { resp, json ->
        assert json.size() == 3
    }
}
```

```

        json.responseData.results.each {
            result.put(it.titleNoFormatting, it.visibleUrl)
        }
    }
}
result

```

2. Create a directory named `/opt/dslSamples/lib` and make it accessible from the ElectricFlow server with the following `.jar` files:

```

http-builder-0.6
json-lib-2.3-jdk15.jar
xml-resolver-1.2.jar

```

3. Evaluate script using the following command:

```
ectool evalDsl --dslFile httputil.groovy --serverLibraryPath /opt/dslSamples/lib
```

When the DSL is evaluated on the ElectricFlow server, any `.jar` files contained in the directory specified for `serverLibraryPath` will be available to the ElectricFlow DSL runtime engine.

Any Groovy files and Java class files contained in the directory specified for `serverLibraryPath` will also be available to the script evaluated by `evalDsl`. For example, if the directory contains a Groovy class `my.sample.dsl.DslUtil` in the directory structure `my/sample/dsl/DslUtil.groovy`, the script can use the Groovy class by importing the class in the script as with any other class.

### Debugging Your DSL Script

You can use debug logging as well as the `println` method for debugging DSL scripts.

#### Using Debug Logging

You can use the `debug` argument to return debug messages in the `evalDsl` response for your script while it is evaluated by the ElectricFlow DSL engine. These messages are useful for debugging DSL scripts. For example:

```
ectool evalDsl --dslFile myScript.dsl --debug 1
```

or

```
ectool evalDsl "project 'My WAR file'" --debug 1
```

#### Using the `println` Method

You can use the standard Groovy `println` method in your DSL script to print messages to the client console while it is evaluated by the ElectricFlow DSL engine. The line numbers for lines that produced `println` output are included. For example, entering `ectool evalDsl --dslFile myfile.dsl`, where `myfile.dsl` contains:

```

def result
for (int i =0; i< 10; i++) {
    println 'Creating project: ' + 'ABTest-' + i
    result = project 'ABTest-' + i, resourceName: 'res1'
}
result

```

returns the following output:



```
<response requestId="1" nodeId="10.0.1.15">
  <value>
Result: project[name=ABTest-9,id=7777e4ff-7941-11e6-94c1-34e6d71279c8]
Console output:
Line 0003: [OUT] Creating project: ABTest-0
Line 0003: [OUT] Creating project: ABTest-1
Line 0003: [OUT] Creating project: ABTest-2
Line 0003: [OUT] Creating project: ABTest-3
Line 0003: [OUT] Creating project: ABTest-4
Line 0003: [OUT] Creating project: ABTest-5
Line 0003: [OUT] Creating project: ABTest-6
Line 0003: [OUT] Creating project: ABTest-7
Line 0003: [OUT] Creating project: ABTest-8
Line 0003: [OUT] Creating project: ABTest-9
  </value> </response>
```

If you also use the `debug` argument, the `println` output is interleaved with the debug logging to the console. The line numbers for lines that produced `println` output and debug logging are included. The `println` output is similarly interleaved with debug logging for exceptions where the debug logs are returned in the `evalDsl` response. For example, entering `ectool evalDsl --dslFile myfile_that_throws_exception.dsl --debug 1`, where `myfile_that_throws_exception.dsl` contains:

```
project 'printingInInvalidDsl'
println("Causing NPE now..")
def a
a.name //will cause NPE
println("Should not print")
```

returns the following output:

```
ectool error [InvalidScript]: Unknown exception during DSL eval at line 4: Cannot get
property 'name' on null object
Line 0001: DSL method 'project'
Line 0001: Checking if project exists with args {projectName=printingInInvalidDsl}
Line 0001: project exists: false
Line 0001: Invoking 'createProject' with args {projectName=printingInInvalidDsl}
Line 0001: Done invoking 'createProject'
Line 0002: [OUT] Causing NPE now..
Details:
Cannot get property 'name' on null object
```

## Generating DSL Scripts

There are two ways to generate DSL scripts:


- Through `ectool`
- Through the ElectricFlow UI

### Through `ectool`

Use the `ectool generateDsl <path> [optionals]` API command to generate an XML file representing the contents of an ElectricFlow object, such as a project, procedure, application, environment, master component, environment or resource template, pipeline, or release. Go to the `generateDsl` command in the ElectricFlow API Guide for the full syntax and for `ectool` examples.

## Through the ElectricFlow UI



To quickly and easily generate and export a DSL script from the ElectricFlow UI, click the  button in the following UIs and select the **DSL export** option:

- Visual editors for Applications, Environments, Master Components, Environment and Resource Templates, and Pipelines
- Release Definition

For an example showing how to export DSL scripts from the UI, go to [DSL IDE](#) on page 469.

## DSL IDE

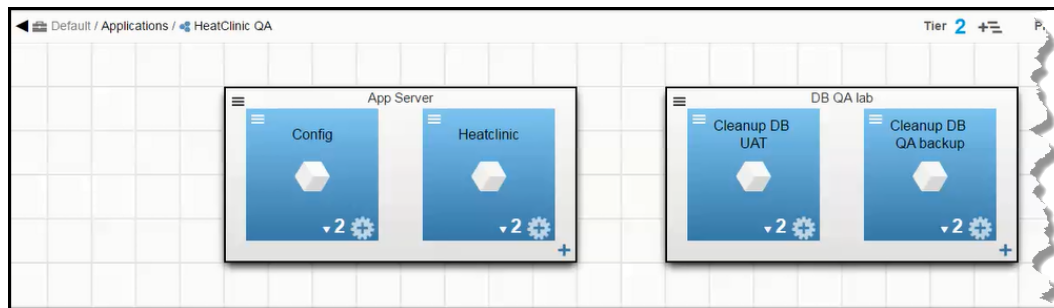
The modeling process is simplified by using the DSL IDE because it allows you to run DSL code from the platform UI rather than having to go to an external IDE or command-line interface to run the `evalDsl` API call. The DSL IDE is an ElectricFlow plugin that can be invoked from the ElectricFlow platform UI.

The following example shows how you can generate and export a DSL script for an existing object in the UI (an application), modify it, and run it through the DSL IDE to apply your changes. For instructions to use the DSL IDE, go to the EC-DSLIDE plugin Help file.

1. Navigate to an object in the UI.

### Example:

Go to an application called "HeatClinic QA" and view it in the Applications Visual Editor.




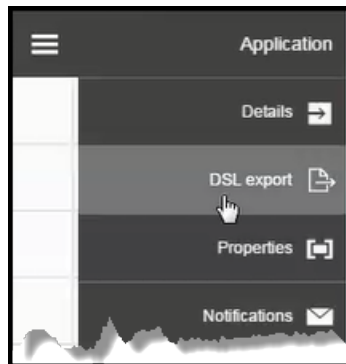


2. Click the  button for that object and select the **DSL export** option to generate a DSL script and export it.

### Example:



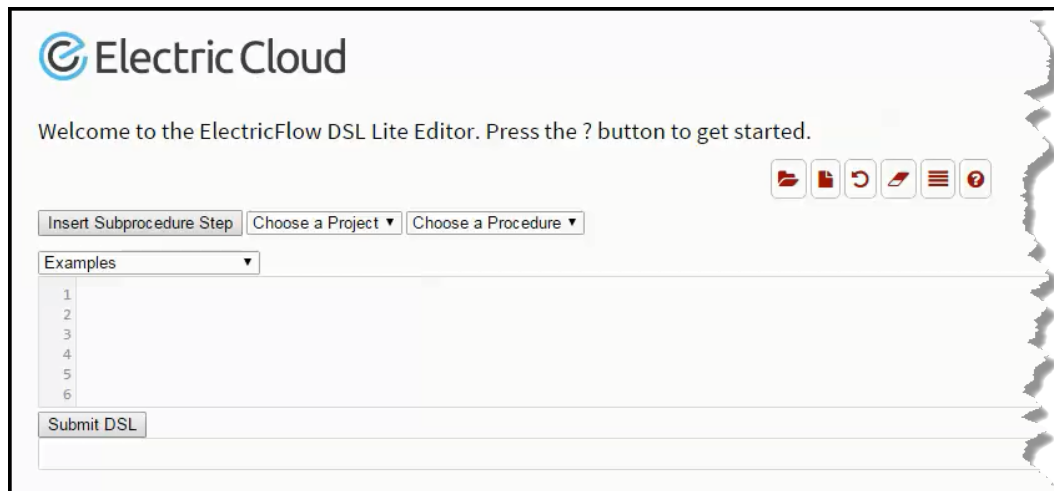
Click the  button in the upper right corner of the Applications Visual Editor.



3. Click **DSL IDE** in the platform UI to invoke the DSL IDE in ElectricFlow.

The DSL IDE opens.

### Example:



4. Copy the content from the DSL script and paste it into DSL IDE editor window.

**Example:**

This is a snippet of the DSL script that was exported:

```
application 'HeatClinic QA ', {
  description = 'QA test version of the HeatClinic application'
  projectName = 'Default'

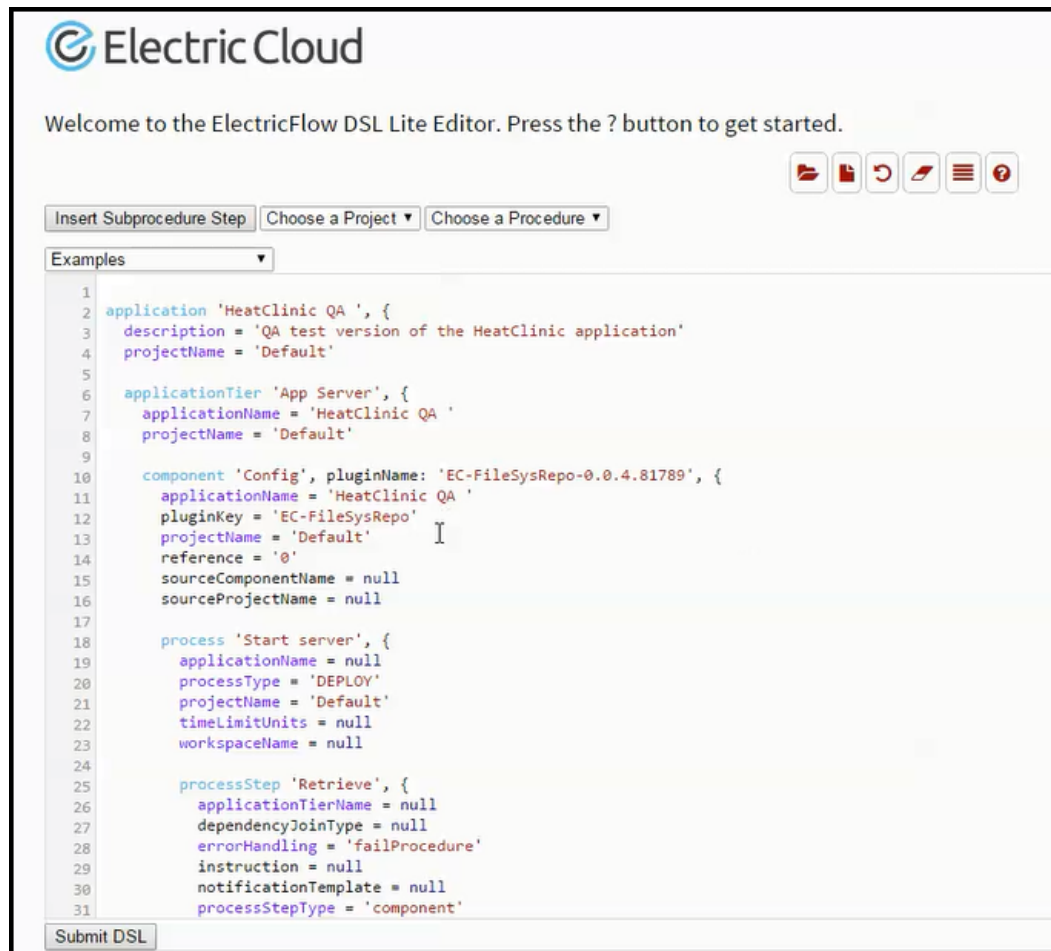
  applicationTier 'App Server', {
    applicationName = 'HeatClinic QA '
    projectName = 'Default'

    component 'Config', pluginName: 'EC-FileSysRepo-0.0.4.81789',
    {
      applicationName = 'HeatClinic QA '
      pluginKey = 'EC-FileSysRepo'
      projectName = 'Default'
      reference = '0'
      sourceComponentName = null
      sourceProjectName = null

      process 'Start server', {
        applicationName = null
        processType = 'DEPLOY'
        projectName = 'Default'
        timeLimitUnits = null
        workspaceName = null

        processStep 'Retrieve', {
          applicationTierName = null
          dependencyJoinType = null
          errorHandling = 'failProcedure'
          instruction = null
          notificationTemplate = null
          processStepType = 'component'
        }
      }
    }
  }
}
```

Copy and paste the content into the DSL IDE:



##### 5. Modify the object.

#### Example:

Change the name of the application tier from "DB QA lab" to "DB QA":

```
302 applicationTier 'DB QA lab', {
303   description = ''
304   applicationName = 'HeatClinic QA '
305   projectName = 'Default'
```

Go to the "Cleanup DB QA backup" component in this application tier, and change the component name from "Cleanup DB QA backup" to "Cleanup DB QA".

```
461 component 'Cleanup DB QA backup', pluginName: 'EC-FileSysRepo-0.0.5.103139', {
462   applicationName = 'HeatClinic QA '
463   pluginKey = 'EC-FileSysRepo'
464   projectName = 'Default'
```

6. Click **Submit DSL**.

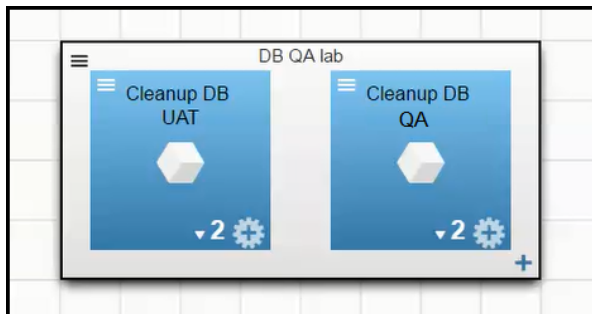
The IDE processes the script line by line.

### Example:

```
Line 0002: DSL method 'application'
Line 0003: Setting argument 'description' to 'QA test version of the HeatClinic application'
Line 0004: Setting argument 'projectName' to 'Default'
Line 0006: DSL method 'applicationTier'
Line 0006: Handling 'application' before processing 'applicationTier'
Line 0006: Checking if application exists with args {applicationName=HeatClinic QA, description=QA test version of the HeatClinic application}
Line 0006: application exists: true
Line 0006: Invoking 'modifyApplication' with args {applicationName=HeatClinic QA, description=QA test version of the HeatClinic application}
Line 0006: Done invoking 'modifyApplication'
Line 0007: Setting argument 'applicationName' to 'HeatClinic QA '
Line 0008: Setting argument 'projectName' to 'Default'
Line 0010: DSL method 'component'
```

7. Go to the UI page in the first step to view the changes you made.

### Example:



## Troubleshooting and FAQs

### Troubleshooting

Issue	What to Do	Links to Related Topics
Get help on the DSL methods	<p>To get the complete list of supported DSL methods, enter the following command:</p> <pre>ectool evalDsl --describe 1</pre> <p>To get help on a particular DSL method, enter the following command:</p> <pre>ectool evalDsl &lt;dsl_method_name&gt; --describe 1</pre> <p>Example: <code>ectool evalDsl procedure --describe 1</code></p>	<a href="#">Getting Started with DSL on page 460</a>
The DSL script completes successfully using the <code>evalDsl</code> command; however, the ElectricFlow objects are not created or updated as expected.	<p>Use the <code>debug</code> option to trace and debug the script processing using the following command:</p> <pre>ectool evalDsl &lt;dsl&gt; --debug 1</pre> <p>The <code>debug</code> option will allow <code>evalDsl</code> to generate debug output that you can use to follow the DSL script processing by <code>evalDsl</code> and identify any possible issue with the DSL script.</p>	<a href="#">Creating and Running DSL Scripts on page 461</a>

### FAQs

#### I am comfortable with Perl and am already using the ElectricFlow Perl API for my scripting purposes. Do I need to switch to ElectricFlow DSL?

Answer: ElectricFlow DSL being a dynamic scripting language provides a cleaner and much easier syntax for non-technical users to understand. However, ElectricFlow Perl API and the RESTful API are both supported as well, and you can continue to use them both if they suit your scripting needs.

#### ElectricFlow DSL is based on Groovy. So, are all Groovy constructs available for use in a DSL script?

Answer: Yes, most Groovy constructs such as closures, named arguments, and so on can be used in your DSL script.

## Is there a way to create a DSL script for the ElectricFlow objects that I have created through the UI or using the ElectricFlow Perl API?

Answer: Yes, you can use the `generateDsl` command to create a DSL script for any ElectricFlow object.

Command: `ectool generateDsl [path]`

Example: `ectool generateDsl /projects/Default/applications/MyApp`

## How to create or update access control for an object

You should use one of the following patterns for defining access control for objects in your DSL script. These patterns allow the DSL runtime engine to deterministically find the correct ElectricFlow object for creating or updating access control entries (ACEs).

- Access control entries can be nested inside the DSL method of the object for which the access control is being defined. For example, the following script provides the user named "joe" full access to project called *Foo*.

```
project 'Foo', {  
    aclEntry principalName: 'joe',  
             principalType: 'user',  
             readPrivilege: 'allow',  
             modifyPrivilege: 'allow',  
             changePermissionsPrivilege: 'allow'  
}
```



- Use the `objectType` argument to declare the type of object for which the access control is being defined if the access control method is not enclosed within the DSL method for the object. This can be used to define ACEs for objects such as server and other system objects because they do not have a DSL method similar to other regular objects.

```
// Removing any previously set ACL for 'Everyone'
deleteAclEntry (
    principalType: 'group',
    principalName: 'Everyone',
    objectType : 'server',
    systemObjectName : 'server'
)
```

```
aclEntry principalName: 'joe',
    principalType: 'user',
    objectType : 'server',
    systemObjectName : 'server',
    readPrivilege: 'allow',
    modifyPrivilege: 'allow',
    changePermissionsPrivilege: 'allow'
```

or

```
aclEntry principalName: 'joe',
    principalType: 'user'
    objectType : 'systemObject',
    systemObjectName : 'resources',
    readPrivilege: 'allow',
    modifyPrivilege: 'allow',
    changePermissionsPrivilege: 'allow'
```

# Chapter 1: Security

ElectricFlow provides security by assigning roles and privileges to specific users and groups on:

- System objects including applications, environments, projects, jobs, and schedules.
- Actions performed on deployment models.

ElectricFlow uses access control, project-level security, and credentials and impersonation to enforce roles and privileges when executing deployment steps.

For an example of how to define roles and privileges when a specific user is allowed to deploy an application only to a specific environment, go to [Use Case: Attaching Credentials in Deployment Automation](#) on page 487.

## Access Control

ElectricFlow uses access control to provide security for all system objects. This mechanism controls how users and groups use the system. Users must log in to view information or to perform operations (actions). After users log in, their system access is limited based on:

- The user name
- The groups to which the user belongs
- The permissions specified for various ElectricFlow objects.

Go to [Access Control](#) for more information about how ElectricFlow enforces access control and for security examples using access control.

For instructions on how to set up access control, go to these topics:

- [Access Control](#) on page 683 GUI page
- [Access Control—defining entries](#) on page 685
- [Privileges—create new or edit existing privileges](#) on page 686

## Project-Level Security

Multiple Project support is available on applications, pipelines, Releases, environments, Master Components, resources, and environment templates as well as platform objects (for example, artifacts, procedures, jobs, schedules, and workflows) These objects as well as the objects belonging to them can be in any project within ElectricFlow.

This significantly improves object management at scale by allowing:

- ACL inheritance—All objects in a project inherit the access control settings from the project, providing better security for all the objects. They can be managed in their own projects and will inherit the ACLs setup at the project level. This significantly simplifies permissions management.
- Logical grouping—This allows users to better manage Deploy and Release objects under various projects that are logically mapped by users, roles, geography, department, and so on, resulting in easier maintenance.

For more information about specific objects, go to the appropriate sections in the *ElectricFlow User Guide*.

For an example showing how to select a project for an application in the GUI, go to [Examples: Modeling and Deploying Applications](#) on page 148. You can also use API commands to do this:

- Use the `createApplication` API command to create a new application for a specific project.
- Use the `createProcess` command to create an application or component process for a specific project.

See the ElectricFlow API guide on the [ElectricFlow documentation page](#) for more information about using these API commands.

Also go to [Examples: Modeling and Deploying Applications](#) on page 148 to see how to author and deploy an application in the GUI.

For an example showing how to select a project for a Release in the GUI, go to [Release Definition](#) on page 417. You can also use the `createRelease` API command to define a Release for a specific project.

## Credentials and User Impersonation

[What is a Credential?](#) on page 478

[Defining a Credential](#) on page 479

[Why Use Credentials?](#) on page 479

[Credential Access Control](#) on page 479

[Using Credentials for Impersonation at the Platform Level](#) on page 480

[Accessing Credentials From a Step at the Platform Level](#) on page 482

[Credential References](#) on page 483

[Best Practices for Retrieving Credentials](#) on page 484

### What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, *stored* or *dynamic*:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project

Details page.

- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

## Defining a Credential

After a credential is created, no one can view the password for the credential's account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click **Create Credential**.

Click the **Help** link on the New Credential page if you need more information about what to enter in the fields.

## Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.

In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

## Credential Access Control

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and *attached* credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly *attached* to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:

- Set the impersonation credential for a step, procedure, project, or schedule.

You can also set the impersonation credential for an application process, component process, or a process step.

Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.

- Explicitly attach the credential to a step or schedule using the UI or the `attachCredential` API.

To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.

## Using Credentials for Impersonation at the Platform Level

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.

However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:

- If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
- You may need to run jobs as particular users to access ClearCase views for those users.
- There may be certain steps that require special privileges.

For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called *impersonation*, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this *impersonation* is implemented using credentials. The use of credentials creates special security challenges.

**Note:** It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

## Setting the Impersonation Credential in the Automation Platform

### Attaching Impersonation Credentials to Steps, Procedures, and Projects

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:

1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

### Attaching Impersonation Credentials to Schedules

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule's credential receives the lowest priority.

### Attaching Impersonation Credentials to Jobs

You can specify a credential when you launch a job manually one of these ways:

- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

### Attaching a New Impersonation Credential

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.

4. Do one of the following:
  - a. For a **procedure**:
    - i. Click **Create Procedure** to go to the New Procedure page.
    - ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
  - b. For a **step**:
    - i. Select a procedure to go to the Procedure Details page.
    - ii. Select a step name to go to the Edit Step page.
    - iii. On the Edit Step page, scroll down to the Impersonation section.
  - c. For a **schedule**:
    - i. Select the Schedules subtab.
    - ii. Select a schedule to go to the Edit Schedule page.
    - iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a **Help** link in the upper-right corner.

## Accessing Credentials From a Step at the Platform Level

The ElectricFlow server supports an operation called `getFullCredential` that can return a password when called from inside a step. The ectool interface for this operation is:

```
getFullCredential <credential name>  
[--value <password|user>]
```

Without the `--value` option, the response is the same as that returned by `getCredential`, with the addition of a "password" element.

With `--value`, the simple text password or user name value is returned on *stdout* so it can be used directly without XML parsing.

The `getFullCredential` API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

## Attaching a Credential to a Procedure Step, Procedure, or Schedule

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:

1. Go to an "Edit" page.

For example, to create a credential for a step, a step must already exist.
2. Select a step that needs a credential. The Edit Step page opens.
3. Scroll to the lower section of the page and click **Attach Credential**.

If you are an ectool command-line user, use the `attachCredential` API command. For more information on the command-line interface, go to the *ectool* Help topics within the online Help system.

## Passing Credentials as Parameters

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named `InnerProj`.
2. Within that project create a procedure named `InnerProc` with a parameter 'cred' of the type credential.
3. Within that procedure create a step named `InnerStep` with:
  - Command: `ectool getFullCredential cred`
  - Attached Parameter Credential: `cred`
4. Create a project named `OuterProj` with two credentials: `cred1` and `cred2`.
5. Within that project create a procedure named `OuterProc` with two parameters, `cred1` and `cred2`, of the type credential.
6. Within that procedure create two subprocedure steps that both call `InnerStep` from the `InnerProj` project:
  - `OuterStep1` with Attached Parameter Credential `cred1`, and `cred1` in the Parameters section
  - `OuterStep2` with Attached Parameter Credential `cred2`, and `cred2` in the Parameters section

If you are an ectool command-line user, you can use the `createFormalParameter` and `attachParameter` API commands. For more information on the command-line interface, go to the *ectool* Help topics within the online Help system.

## Credential References

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.

For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step's transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A *relative* path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An *absolute* path includes a project name like `"/projects/MyProject/credentials/rootCred"` and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.



## Best Practices for Retrieving Credentials

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

### First Class

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

### Second Class

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:

#### Does the step's command use properties?

If so, someone could potentially change the property value to change the step behavior.

For example, suppose the step's command is defined like this:

```
echo $[/myProject/x]
```

Anyone with write access to property x can hijack the step by placing the value "nothing; myCommand" in the property.

After property substitution, the final command will be:

```
echo nothing; myCommand
```

that will cause "myCommand" to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

#### Does the step execute code or commands that can be modified?

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.

For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

### Avoid passing passwords on the command line

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via `stdin`.

## Credentials and Impersonation in Application and Component Processes

You apply credentials and impersonation to control who can deploy applications and where the applications are deployed.

- You can attach one or more credentials to component or application process steps.
- You can attach only one impersonation credential to an application process, component process, or a process step.
- When you attach an impersonation credential in ElectricFlow, it specifies the user who can deploy the application and the environment in which the application is deployed.
- When you attach an impersonation credential to a platform-level object (such as a procedure), it specifies the account (user) that can run the job or job step. If you want to specify another condition, you have to attach another credential to the object.

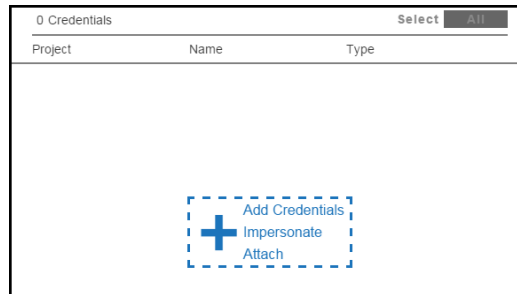
#### IMPORTANT:

When you impersonate a credential, make sure that the impersonated user has the absolute path to the bin directories in the `$PATH` environment.

If you define a process step with a command, you must enter the absolute path in the **Post Processor** and **Shell** fields in the "Define Step" dialog box.

1. Click in the **Add Credentials** field.

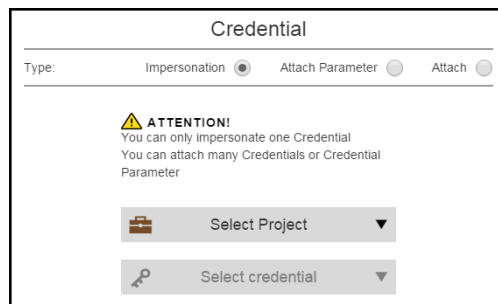
#### Example:



The **Component Process Step / Add** dialog box opens.

2. To impersonate one credential:

### Example:



- a. Select **Impersonate** in the **Type** field.
- b. Click the **Select Project** field to select a project. You can select a credential from a project that is different than the one containing the application.
- c. Click the **Select Credential** field to open a drop-down list of credentials for the process step.
- d. Select a credential.
- e. Click **OK**.

The **Credentials** dialog box now shows the one credential for impersonation.

3. To attach one or more credential parameters to the process step:

### Example:

The screenshot shows a dialog box titled "Credential". At the top, there are three radio buttons under the label "Type": "Impersonation", "Attach Parameter" (which is selected), and "Attach". Below the radio buttons, there is a yellow warning icon followed by the text "ATTENTION!". Underneath this, it says "You can only impersonate one Credential" and "You can attach many Credentials or Credential Parameter". At the bottom, there is a button with a key icon and the text "Select credential parameter" followed by a downward arrow.

- Select **Attach Parameter** in the **Type** field.
- Click the **Select Credential Parameter** field to open a drop-down list of credentials for the process step.
- Select a credential.
- Click **OK**.

The **Credentials** dialog box now shows the attached credentials

4. To attach one or more credentials to the process step:

### Example:

The screenshot shows a dialog box titled "Credential". At the top, there are three radio buttons under the label "Type": "Impersonation", "Attach Parameter", and "Attach" (which is selected). Below the radio buttons, there is a yellow warning icon followed by the text "ATTENTION!". Underneath this, it says "You can only impersonate one Credential" and "You can attach many Credentials or Credential Parameter". At the bottom, there are two buttons: one with a briefcase icon and the text "Select Project" followed by a downward arrow, and another with a key icon and the text "Select credential" followed by a downward arrow.

- Select **Attach** in the **Type** field.
- Click the **Select Project** field to select a project. You can select a credential from a project that is different than the one containing the application.
- Click the **Select Credential** field to open a drop-down list of credentials for the process step.
- Select a credential.
- Click **OK**.

The **Credentials** dialog box now shows the attached credentials.

## Use Case: Attaching Credentials in Deployment Automation

When modeling an application, you can attach credentials these ways:

- For credentials, attach one or more credentials to component or application process steps.
- For credentials for impersonation, attach only one impersonation credential to these objects:
  - Component process
  - Component process step
  - Application process
  - Application process step

When you deploy the application, ElectricFlow applies the credentials based on the user permissions and deploys the application in one or more environments.

## Example

This example describes how to define roles and privileges when an application is deployed to more than one environment and specific users are limited to specific environments.

You can attach impersonation credentials to an application in the GUI. The application has these credentials:

- Development (dev)
- Quality Engineering (qe)
- Production (prod)

Users have these privileges:

- User A is allowed to deploy the application to build a MySQL database in any environment and has admin privileges.
- User B is allowed to only deploy the application in the quality (qa) environments and is not trusted in the development (dev) and production(prod) environments.

The following user permissions determine what users are allowed to do in ElectricFlow. You can configure these credentials only from the GUI.

- You configure User A's profile in the automation platform and give User A higher-order privileges than other users. User A has the following credentials, including a credential for impersonation:

For each environment in ElectricFlow, set a property using a reference such as

`${myEnvironment/dbConfigName}` and define a unique value, which can be passed as a credential to a process or process step.

- In the development (dev) environment, set `dbConfigName = dbUser_dev`.
  - In the quality engineering (qe) environment, set `dbConfigName = dbUser_qa`.
  - In the production (prod) environment, set `dbConfigName = dbUser_prod`.
- When you configure User B's profile in the automation platform, User B is only given the credentials to deploy in the quality (qa) environment. You do not need to set properties to be passed as credentials when the application is deployed.

Attaching the same credentials from the automation platform is more complicated. Instead of setting only one credential for User A and one for User B, you need to create three unique credentials for the environments in

addition to credentials for the various user and environment combinations, such as User A and the development environment.

## Credentials in Pipelines

Credentials are passed to pipelines through applications in pipeline stages. If an application has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (**Parameter Credential**) or a credential binding to a pipeline task (**Credential binding**), or select a user-defined credential that is attached to the project associated with the pipeline.

A credential must be explicitly attached to the object using it so the server can perform an access control list (ACL) check at the definition time and limit the visibility of the password. To support accessing credentials at the pipeline task level, these tasks need to have the appropriate credentials attached. This is done implicitly by the UI when you are binding credentials to the pipeline tasks. If you are using ectool, use the `attachCredential` API command to perform the same operation.

## Credentials in Releases

In the Release definition, credentials appear in these objects:

- Pipelines: How the credential is applied to the Release depends on the selected pipeline.

If the pipeline has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (**Parameter Credential**) or a credential binding to a pipeline task (**Credential binding**), or select a user-defined credential that is attached to the project associated with the pipeline.

- Applications: How the credential is applied to the Release depends on the applications in the selected pipeline.

If any input to an application is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (**Parameter Credential**) or a credential binding to a pipeline task (**Credential binding**), or select a user-defined credential that is attached to the project associated with the pipeline.

See the steps to [select a pipeline](#) and to [select credential inputs for an application in the pipeline](#) in the [Release Definition](#) on page 417 for examples of these operations.

# Chapter 1: Credentials and User Impersonation

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[Using Credentials for Impersonation at the Platform Level](#) on page 492

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## What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, *stored* or *dynamic*:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project Details page.
- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

## Defining a Credential

After a credential is created, no one can view the password for the credential's account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click **Create Credential**.

Click the **Help** link on the New Credential page if you need more information about what to enter in the fields.

## Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.

In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

## Credential Access Control

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and *attached* credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly *attached* to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:

- Set the impersonation credential for a step, procedure, project, or schedule.

You can also set the impersonation credential for an application process, component process, or a process step.

Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.

- Explicitly attach the credential to a step or schedule using the UI or the `attachCredential` API.

To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.



## Using Credentials for Impersonation at the Platform Level

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.

However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:

- If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
- You may need to run jobs as particular users to access ClearCase views for those users.
- There may be certain steps that require special privileges.

For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called *impersonation*, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this *impersonation* is implemented using credentials. The use of credentials creates special security challenges.

**Note:** It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

## Setting the Impersonation Credential in the Automation Platform

### *Attaching Impersonation Credentials to Steps, Procedures, and Projects*

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:

1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the

project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

### *Attaching Impersonation Credentials to Schedules*

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule's credential receives the lowest priority.

### *Attaching Impersonation Credentials to Jobs*

You can specify a credential when you launch a job manually one of these ways:

- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

### *Attaching a New Impersonation Credential*

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.
4. Do one of the following:
  - a. For a **procedure**:
    - i. Click **Create Procedure** to go to the New Procedure page.
    - ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
  - b. For a **step**:
    - i. Select a procedure to go to the Procedure Details page.
    - ii. Select a step name to go to the Edit Step page.
    - iii. On the Edit Step page, scroll down to the Impersonation section.
  - c. For a **schedule**:
    - i. Select the Schedules subtab.
    - ii. Select a schedule to go to the Edit Schedule page.
    - iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a **Help** link in the upper-right corner.

## Accessing Credentials From a Step at the Platform Level

The ElectricFlow server supports an operation called `getFullCredential` that can return a password when called from inside a step. The `ectool` interface for this operation is:

```
getFullCredential <credential name>

[--value <password|user>]
```

Without the `--value` option, the response is the same as that returned by `getCredential`, with the addition of a "password" element.

With `--value`, the simple text password or user name value is returned on *stdout* so it can be used directly without XML parsing.

The `getFullCredential` API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

## Attaching a Credential to a Procedure Step, Procedure, or Schedule

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:

1. Go to an "Edit" page.

For example, to create a credential for a step, a step must already exist.

2. Select a step that needs a credential. The Edit Step page opens.
3. Scroll to the lower section of the page and click **Attach Credential**.

If you are an `ectool` command-line user, use the `attachCredential` API command. For more information on the command-line interface, go to the *ectool* Help topics within the online Help system.

## Passing Credentials as Parameters

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named `InnerProj`.
2. Within that project create a procedure named `InnerProc` with a parameter 'cred' of the type `credential`.
3. Within that procedure create a step named `InnerStep` with:
  - Command: `ectool getFullCredential cred`
  - Attached Parameter Credential: `cred`
4. Create a project named `OuterProj` with two credentials: `cred1` and `cred2`.
5. Within that project create a procedure named `OuterProc` with two parameters, `cred1` and `cred2`, of the

type credential.

6. Within that procedure create two subprocedure steps that both call `InnerStep` from the `InnerProj` project:
  - `OuterStep1` with Attached Parameter Credential `cred1`, and `cred1` in the Parameters section
  - `OuterStep2` with Attached Parameter Credential `cred2`, and `cred2` in the Parameters section

If you are an `ectool` command-line user, you can use the `createFormalParameter` and `attachParameter` API commands. For more information on the command-line interface, go to the *ectool*/ Help topics within the online Help system.

## Credential References

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.

For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step's transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A *relative* path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An *absolute* path includes a project name like `"/projects/MyProject/credentials/rootCred"` and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.

## Best Practices for Retrieving Credentials

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

### First Class

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

## Second Class

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:

### *Does the step's command use properties?*

If so, someone could potentially change the property value to change the step behavior.

For example, suppose the step's command is defined like this:

```
echo $[/myProject/x]
```

Anyone with write access to property x can hijack the step by placing the value "nothing; myCommand" in the property.

After property substitution, the final command will be:

```
echo nothing; myCommand
```

that will cause "myCommand" to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

### *Does the step execute code or commands that can be modified?*

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.

For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

### *Avoid passing passwords on the command line*

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via `stdin`.

## Performance Consequences of Change Tracking

Change Tracking affects how ElectricFlow runs. The impact can be from low (minimal changes to the times to update the database) to high (significantly longer times to update the database).

ElectricFlow needs to store additional information in the database about the tracked objects in the Change History. In addition to storing normal information about ElectricFlow operations, ElectricFlow stores a separate archival copy of every state of every tracked object as well as the indexing information used to retrieve the Change History of tracked objects and the objects they own. This increase in database usage has performance consequences.

For most of ElectricFlow operations, the performance consequences of Change Tracking are insignificant, typically a few percent slower in one of these situations:

- None of the affected objects are tracked (job records and similar runtime-only objects are not tracked).
- Only a small number of tracked objects are changed by operations.

However, for operations that affect a very large number of tracked objects in a single operation (such as importing, cloning, or deleting a large project for which change tracking is enabled), the performance consequences *will be* significant. The performance consequences are similar when enabling or disabling Change Tracking for a large project, because both operations require the server to write to the database the records for every tracked object owned by the project.

For these Change Tracking-intensive operations, the system performance will typically be significantly slower because several times as much data is being read and written between the ElectricFlow server and the database. In our testing, we have seen a wide range of degrees of performance decrease from 1.25x to 10x slower when Change Tracking is enabled on a large project, compared to a project on which Change Tracking is disabled. The decrease in performance is typically from 2x to 6x.

### Use Case 1: Importing and Cloning Large Projects with Change Tracking Enabled

ElectricFlow does the following to increase the performance of Change Tracking-intensive operations in a large project with this configuration:

- The project contains over 20,000 audited objects.
- Change Tracking is enabled.

To increase the performance when a large project is imported or cloned, ElectricFlow automatically decreases the amount of Change History indexing information that it saves, reducing the level of detail for these operations in the Change History. While this can improve the system performance, it can also make it harder when you want to revert an object to a specific state or to find information in the Change History while troubleshooting or debugging an issue. If you want suppress this behavior, use

```
--reducedDetailChangeHistory false in the import or clone API command.
```

By default, the objects listed in the table below and the tracked objects that they own are always tracked when Change Tracking is enabled (except when Change Tracking is globally disabled).

During an upgrade from ElectricFlow 5.0.x to ElectricFlow 6.0, when the ElectricFlow server starts, the server writes to the database a record for every tracked object and the objects that it owns. The objects listed in the

table get new audit records. If any of the objects owns many tracked objects (such as properties), the startup process will be slow.

Objects (Entities)	Path
server	/server
system objects	/systemObjects/*
users	/users/*
groups	/group/*
plugin	/plugins/*
email configuration	/emailConfigs/*
workspaces	/workspaces/*
zones	/zones/*
gateways	/gateways/*
agents	/agents/*
resources	/resources/*
resource pools	/resourcesPools/*
repositories	/repositories/*
directories	/directories/*

## Use Case 2: Change Tracking of Non-Project-Owned Objects

In this context, *non-project-owned objects* include all objects not contained within a project. Such objects include resources, artifacts, users, groups, zones, and other objects as well as the property sheets, properties, access control lists (ACLs), and ACL entries (ACEs) for them. In releases earlier than ElectricFlow 6.2, Change Tracking was enabled by default for non-project-owned objects, and there was no way to disable Change Tracking for them. When users upgraded from earlier versions of ElectricFlow to ElectricFlow 6.0.x, the upgrade process initialized and created Change Tracking-related data for them in the database. The performance impact was usually low, except when there was a very large number (in the several hundred thousands) of non-project-owned objects, such as many properties under the `/server` directory; in this situation, the performance of the

first startup was significantly slower. The best solution to this situation is to relocate most of the projects under a project and disable Change Tracking for that project, which may not be a practical short-term solution.

Starting in ElectricFlow 6.2, Change Tracking can be disabled for all non-project-owned objects. (Change Tracking for these objects is enabled by default.) Using this feature is not recommended as a long-term solution; instead we recommend moving most of the objects under a project that has Change Tracking disabled. (Repeatedly disabling and enabling Change Tracking for non-project-owned project is expensive and time-consuming.)

In ElectricFlow 6.2, when there are many non-project-owned objects, the best way to disable Change Tracking for all non-project-owned objects is to change the `database.properties` configuration file to disable Change Tracking for these objects before starting the server running a pre-ElectricFlow 6.2 release. In the `database.properties` file, make sure that it has this line:

```
COMMANDER_DB_NON_PROJECT_AUDITING_ENABLED=false
```

Then install ElectricFlow 6.2 and start the server, running the system this way until most of the non-project-owned objects are relocated to a non-tracked project, and re-enable Change Tracking for non-project-owned objects, which requires restarting the server.

## Estimating Database Growth

Here is one way to estimate the rate at which the database grows for Change Tracking:

Most of the information needed to estimate the database growth rate can also be parsed from an exported XML file of the project (such as a full import), except for the version count.

The likely rate of database growth is based on these factors:

- How many objects of different types will be tracked
- How big they are
- How often their state changes

The rate of database consumption is then the sum over all different types of tracked objects of the product of these three factors.

## Common Usage Patterns

For most customer usage patterns, the most common objects (the ones that dominate on first factor) are ACLs and their ACEs, properties, or all of these objects. Typically:

- ACLs and ACEs: ACLs are consistently small, and usually have only a few ACEs.
- Properties: While most of them are small, some properties can be very large. The average property size is large.

For most users, a good quick estimate can be based on properties, especially properties that are large or are modified often.

## Estimating Process

If you expect to enable Change Tracking for all projects, determine the values for these factors and calculate the database growth rate:



Database growth rate = Factor 1 x Factor 2 x Factor 3

- Factor 1: How many objects of different types will be tracked

The following procedure is only for properties:

1. Join the `ec_property` table in the database joined to the `ec_property_sheet` table by `ec_property.parent_sheet_id = ec_property_sheet.id`.
2. Search for properties where the `ec_property_sheet.entity_type` value is one of the entity types corresponding to a database table that has a matching `ec_*_aud` table.
3. Determine the number of tracked objects per property type.

For most usage patterns, the great majority of properties will belong to entity types like `job` and `jobStep` that are not change tracked and so have no corresponding `ec_*_aud` table.

If you are already using ElectricFlow 5.3 or later, these properties and properties belonging to projects for which Change Tracking is disabled are also recognizable by having `ec_property_tracked` set to `false`.

- Factor 2: How big they are (size)

The following procedure is only for properties.

For small properties:

1. Search for objects that are less than 450 bytes in the `ec_property.string` column.
2. Add an overhead value of half a kilobyte per property for the other columns.
3. Determine the average size of the tracked objects.

For larger properties:

1. Search for the length of the value in the `ec_clob` table linked to by the `ec_property.clob` column.
2. Add an overhead value of one kilobyte per property for the other columns.
3. Determine the average size of the tracked objects.

- Factor 3: How often new copies of the objects are generated

The following procedure is only for properties:

1. Use one of these methods:
  - Determine ratio of how long ago the `ec_property.created` and `ec_property.modified` datetimes are, which gives an estimate concentrating on only the most recent changes.  
  
*and/or*
  - Determine the value of the `ec_property.version` counter divided how long ago the `ec_property.created` datetime is, which gives a long-term average rate of changes to the property since it was created.
2. Determine the average update frequency.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

```
ectool:ectool modifyProperty <projectName> -- path <propertyPath> -- counter true
```

or

```
ec-perl: $cmdr-> modifyProperty (<projectName>, {path => <propertyPath>, counter => true});
```

When the `counter` flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

CAUTION: Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted,.

## Alternative Estimating Methods

Depending on your usage patterns, one of these methods may result in a more accurate estimate than the previous method of determining the average factor values and multiplying them

Split the set of properties of change tracked objects into different populations

For each object, perform the previous method of determining the average factor values and multiplying them per tracked object.

Add the values for each tracked objects together.

Example:

- If you have one set of properties (such as those in one project, or belonging to one user) containing very large properties that are never changed, and another set containing very small properties that change often, multiplying the average property size by the average rate of property update would result in an overestimate of the total database consumption.
- If you put the properties in separate projects and calculate the database growth rate for each project, the database growth rates are more accurate.

Other columns that may be of interest include `ec_property.owner` (who created the property) and `ec_property.last_modified_by` usernames (who last modified the property).

## Best Practices for Change Tracking

Change Tracking allows you to troubleshoot and debug issues, find information about specific objects, and revert an object to a specific state. However, Change Tracking affects the system performance. In some situations, the performance consequences of Change Tracking can be significant.

This section describes how to improve the system performance.

## When to Enable or Disable Change Tracking for a Project

In some situations, enabling or disabling Change Tracking on a project causes significant performance consequences. The ElectricFlow system performance becomes slower as the server writes to the database the records for all the tracked objects in the project.

To determine when to use Change Tracking on a project, do the following:

1. Export the project using this command:

```
ectool export <project_name> --relocateable 0 --withAcls 1 - withNotifiers 1
```

2. Evaluate the results.

- a. The size of the results file gives you a good estimate of how big the project is:

- If the file size is in the hundreds of MB, the project is large.
- If the file size is in the tens of MB or less, the project is small.

- b. (Optional) Write a script to parse the results and determine these statistics:

- Total number of objects that can be tracked in the project.

Use this value to determine the project size (for example, small, medium, or large), which is used to determine how long it would take to enable, disable, copy, import, or delete a project on which Change Tracking is enabled.

- The total size (in XML format) of the entities in the project that can be tracked by Change Tracking.

This gives a rough estimate of how much the database usage will immediately grow when Change Tracking is enabled for the project.

- The rate at which tracked entities are modified in the project.

Look at the most recent last-modification dates of entities owned by the project for a pattern where certain entities are modified on a regular basis.

If there are objects that appear to be being modified frequently, the script can also parse out their path and the user name they were last modified by.

#### Next Steps:

- If the project is small, and its contents are not frequently changed by an automated process, you can safely enable Change Tracking for it.
- If the project is large, and if you frequently export, import, or copy it, and if the performance of these operations is very important to you, enabling Change Tracking for it may be problematic (see [Estimating Process](#) on page 499 for a possible workaround).
- If significant parts of the contents of the project are frequently updated by an automated process, enabling Change Tracking for the project will consume significantly more database space, and tracking the changes performed by the automated process is unlikely to be of much value, so enabling Change Tracking for the project is inadvisable.

## Splitting Tracked Objects Into Separate Projects

If you export the project, evaluate the results, and determine that enabling or disabling Change Tracking on the project will significantly affect the performance of the ElectricFlow system, one way to improve the system performance is to split the project into separate projects based how the objects are modified.

For example, if you parse the results and find that there are two types of entities in your current project:

- Objects that are manually modified over time by real users.

These objects represent real changes in project and are modified as procedures, jobs, and applications are run.

- Objects that are frequently updated at regular intervals by an automated process using metaprogramming.

These objects are automatically generated and updated on a regular basis. The project file should have a large list of modifications to tracked objects.

Then you should split the objects into separate projects.

- Put the objects that are manually modified by real users in one project and enable Change Tracking on this project.
- Put the objects that are updated by an automated process in a different project and disable Change Tracking on it.

## Configuring Change Tracking

Change Tracking must be enabled when ElectricFlow starts for your system to track changes and record the Change History.

By default, Change Tracking is enabled for projects created in ElectricFlow 5.3 or later. It is disabled for projects created in ElectricFlow versions before ElectricFlow 5.3, but can be enabled manually.

### Enabling Change Tracking Globally

When installing ElectricFlow:

1. Add this line to the `database.properties` file:

```
COMMANDER_DB_AUDITING_ENABLED=true
```

2. Restart the ElectricFlow server.

### Enabling Change Tracking on a Per-Project Basis

**IMPORTANT:** Unless the `allowEnablingDisablingChangeTrackingProjectLevel` setting has been altered, only admin users are allowed to perform this task. The default setting is `adminOnly`. If the setting is changed to `anyoneWithAccess`, any user with access to the project can enable or disable Change Tracking for the project

You can enable Change Tracking one of the following ways:

#### *In the ElectricFlow Platform UI*

Change Tracking is enabled when the **Enable Change Tracking** check box is selected.

The screenshot shows a 'New Project' dialog box with the following fields and controls:

- Name:** A text input field.
- Enable Change Tracking:** A checked checkbox.
- Description:** A large text area.
- Default Resource:** A text input field with a 'Browse' button to its right.
- Default Workspace:** A text input field with a 'Browse' button to its right.

To disable Change Tracking, click the **Enable Change Tracking** check box to clear it, and click **OK**.

### Using ectool

- Enter `ectool modifyProject <projectName> --tracked true` to enable Change Tracking.
- Enter `ectool modifyProject <projectName> --tracked false` to disable Change Tracking.

### Using ec-perl:

- Enter `$cmdr->modifyProject(<projectName>, {tracked => true});` to enable Change Tracking.
- Enter `$cmdr->modifyProject(<projectName>, {tracked => false});` to disable Change Tracking.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

**ectool:** `ectool modifyProperty <projectName> -- path <propertyPath> -- counter true`

or

**ec-perl:** `$cmdr-> modifyProperty (<projectName>, {path => <propertyPath>, counter => true});`

When the `counter` flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

**CAUTION:** Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is

when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted,.

## Upgrading to ElectricFlow 6.x

Change Tracking is enabled when you upgrade to ElectricFlow 6.x. This can significantly increase the time it takes to complete the upgrade.

If you want to upgrade with Change Tracking disabled, add this line to the `database.properties` file before starting the upgrade:

```
COMMANDER_DB_AUDITING_ENABLED=false
```

## Customizing the Change History Page

The performance of the Change Tracking feature is affected by number of records in the Change History as well as the number of entries being tracked. For example, a page showing 5000 entries may be slow to load and update and does not provide much useful information.

This ElectricFlow server uses the lowest of the following limits to determine the maximum amount of records to display in the Change History page:

- Maximum amount of records on the Change History page

To change the maximum number of records in the Change History page:

1. Set the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file to a new value.

The default value is 1000.

2. Restart the ElectricFlow server.

- Maximum number of records retrieved

Set the `TrackingMaxRecords` server setting to a new value not exceeding the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file.

To set `TrackingMaxRecords`, do one of the following:

Change the value in the UI. See the Server Settings page in the automation platform UI.

Use `ectool` to change the value. For example, enter the following command to limit the number of records retrieved to 100:

```
ectool setProperty /server/settings/changeTrackingMaxRecords --value 100
```

## Searching the Change History

Follow these steps to start a search in the Change History.

You can start a Change History search from most pages in the ElectricFlow UI.

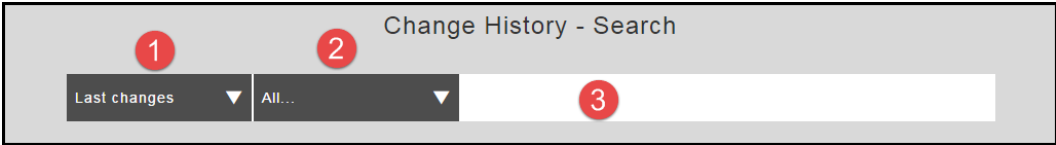
1. Click the **Search** button or click **Change History**.

**Example:**



The **Change History—Search** dialog box opens.

**Example:**

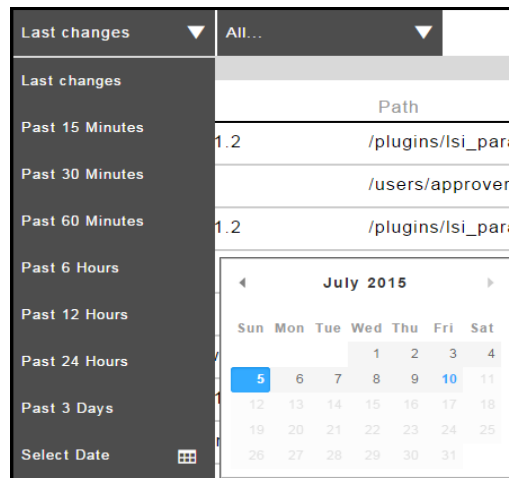


1	<p><b>Time range</b> field.</p> <p>Click the down arrow to open the drop-down list of start times.</p> <p>The end time is the current time.</p>
2	<p><b>Objects</b> field.</p> <p>Click the down arrow to open the drop-down list of objects to include in the search.</p> <p>You can select <b>All</b> or specific objects.</p> <p>By default, seven of the most commonly tracked objects are selected.</p>
3	<p>Search criteria.</p> <p>After you type, the system starts searching for objects based on the time range and objects that you selected.</p> <p>The search results are in the Change History.</p>

2. To select a time range for the search:
  - a. Click the down arrow in the **Time range** field to open the drop-down list.
  - b. Select a time range.
  - c. If you want to use a time increment longer than three days, do the following:
    - a. Click **Select Date**.

The Date Picker opens.

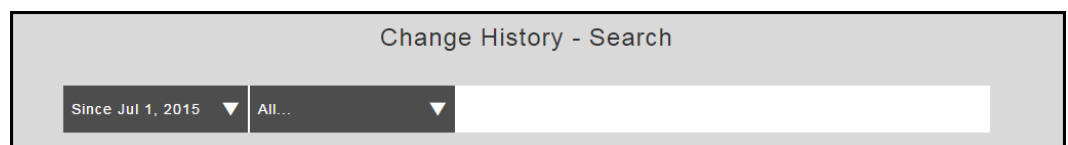
### Example:



- b. Select a date.

The Date Picker closes and the date that you selected appears in the Time Increment field.

### Example:



3. To select an objects for the search:
  - a. Click the down arrow in the **Object** field to open the drop-down list.
  - b. Select the objects for the search.
4. Enter the search criteria.
 

As you type, the system starts to search for objects that match your search criteria.

A list of objects matching your search criteria appears in the results section.



5. Select an object in the list.

### Example:

Since Jul 1, 2015 ▼	All... ▼	property	✕
<b>Access Control En...</b>	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	▲
	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
<b>Access Control List</b>	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	
<b>Plugin</b>	statetemplate_fullprope...	/server/ec_notifiertemplates/statetemplate_fullpropertypaths	
	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
<b>Property</b>	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	
	artifactversionlocationp...	/projects/default/applications/jpetstore-aws-beanstalk/compone...	
	label	/server/ec_notifiertemplates/statetemplate_fullpropertypaths/la...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	series 1 property function	/projects/electric cloud/schedules/report recent job trend/series...	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	

The change history for the object that you selected appears.

### Example:

Change History for propertyviewer-1.0.1 ↗						
<div> <div>▼ Last changes</div> <div> <div>7/10/15 - 1:02 PM</div> <div>Now - 7/10/15 - 6:18 PM</div> <div>Most Recent</div> </div> </div>						
View All Changes	When ▲ ▼	What	Name	By...	Change	Path
Objects						
✓ Acl (1)	1 Jul 10, 2015 1:02 PM Pacific...	acl	propertyviewer-1.0.1	admin	created	↗
✓ Ace (3)	2 Jul 10, 2015 1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created	↗
Changes						
✓ Created (4)	3 Jul 10, 2015 1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created	↗
Changed by...						
✓ Admin (4)	4 Jul 10, 2015 1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created	↗

## Viewing the Change History

You can open and view the change history from the following objects in ElectricFlow:

- Applications List
- Applications Visual Editor
- Application Process Designer
- Artifacts
- Component

- Component Process Designer
- Environments Designer
- Environment Tier
- Jobs
- Process Step (Application or Component)
- Projects
- Resources
- Workflows

## Viewing the Change History from the Applications List

You may want to view the Change History for these objects in an application:

- An application process that did not run successfully

4	JPetStore	1 Component	1 Application Process	4 Tier Map	
5	Test	1 Component	1 Application Process	1 Tier Map	
7_Proc	Proc	Env	Dec 04, 2014 11:08 Pac...	00:06	100%
6_Proc	Proc	Env	Dec 04, 2014 10:45 Pac...	00:07	100%
5_Proc	Proc	Env	Dec 04, 2014 10:12 Pac...	00:05	100%

- Component or component process in an application process that did not run successfully

setup database	Dec 04, 2014 10:11 Pac...	03:4...	50%
Create database	Dec 04, 2014 10:11 Pac...	03:4...	50%

- Resource that was not deployed successfully

Starting from the Home page:

1. Go to the Applications List.
2. Choose an application.
3. Click the **View** button.

### Example:



A list of the application processes for the application appear.

4. To view the Change History of an application process:
  - a. Choose a process.
  - b. Click the **Change History** button.

### Example:



The Change History for the application process opens.

5. To view the change history for an object in the application process,
  - a. Click the **View Details** button.

A list of objects in the application process (components and component processes) appears, and the breadcrumb changes to *Applications/View Run*.
  - b. Choose an object.
  - c. Click the **Change History** button to see the change history for the object.

## Viewing the Change History From an Application or Environment

You may want to view the Change History for these objects:

- Applications
- Application processes
- Component processes
- Environment
- Resources

### Application Visual Editor

1. Go to the Applications List.
2. Select an application.

The Applications Visual Editor opens.
3. Click the **Menu** button.

### Example:

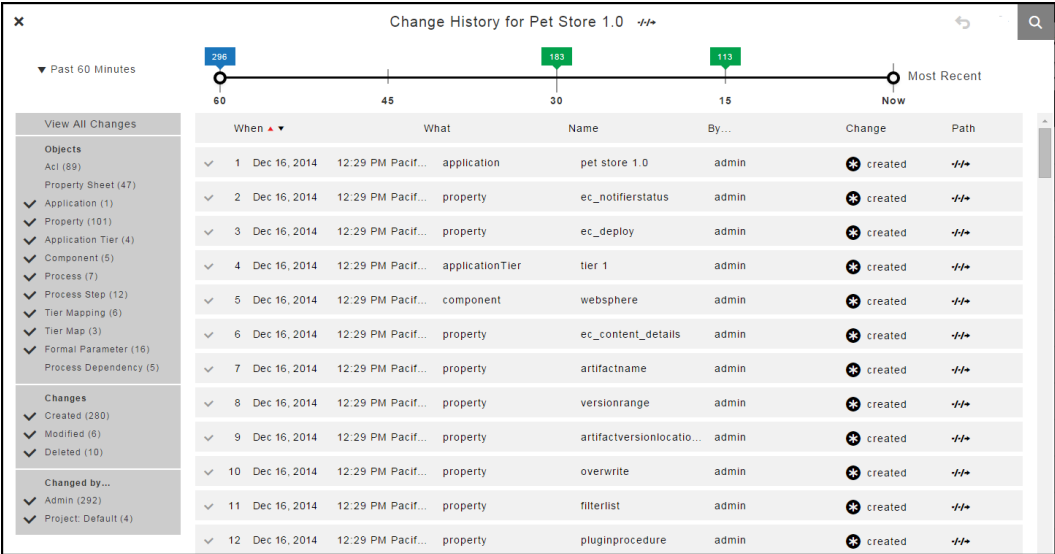


4. Select **Track Changes**.

The Change History for the object opens.

The default time increment is **Past 60 Minutes**.

**Example:**



1. Go to the Applications List.

2. Select an application.

The Applications Visual Editor opens.

3. Select an application process.

The Application Process Visual Editor opens.

4. To view the Change History for the application process:

- a. Click the **Menu** button.

### Example:



- b. Select **Track Changes**.

The Change History for the application process opens.

The default time increment is **Past 60 Minutes**.

### Example:

Change History for Deploy						
▼ Past 60 Minutes						
Most Recent						
When	What	Name	By...	Change	Path	
1 Dec 16, 2014 12:41 PM Pacif...	process	deploy	admin	created	...	
2 Dec 16, 2014 12:41 PM Pacif...	property	ec_notifierstatus	admin	created	...	
3 Dec 16, 2014 12:41 PM Pacif...	property	ec_deploy	admin	created	...	
4 Dec 16, 2014 12:41 PM Pacif...	processStep	s1	admin	created	...	
5 Dec 16, 2014 12:41 PM Pacif...	formalParameter	ec_config-version	admin	created	...	
6 Dec 16, 2014 12:41 PM Pacif...	formalParameter	ec_config-run	admin	created	...	
7 Dec 16, 2014 12:41 PM Pacif...	formalParameter	ec_smartdeployop...	admin	created	...	
8 Dec 16, 2014 12:41 PM Pacif...	property	ec_notifierstatus	admin	created	...	

5. To view the Change History for the application process step:
  - a. Choose a step.
  - b. Click the **Edit** button in the step to open the context menu.

### Example:

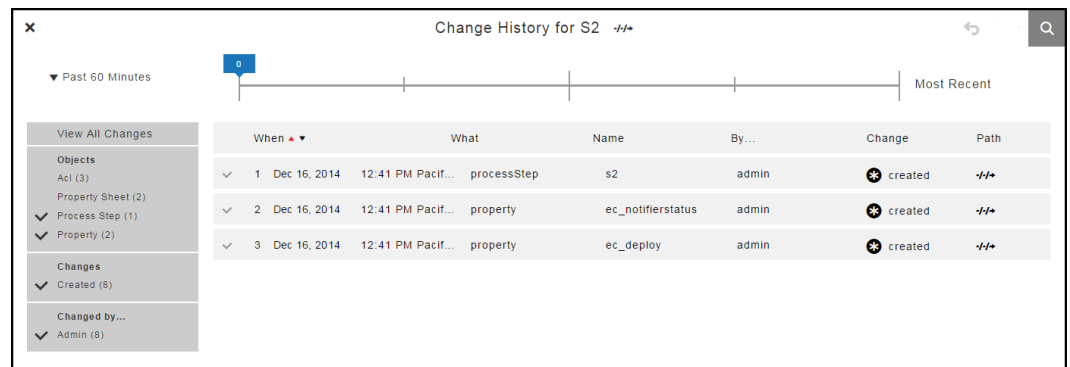


- c. Select **Track Changes**.

The Change History for the application process step opens.

The default time increment is **Past 60 Minutes**.

### Example:



Change History for S2						
▼ Past 60 Minutes						
Most Recent						
When ▲ ▼	What	Name	By...	Change	Path	
✓ 1 Dec 16, 2014 12:41 PM Pacif...	processStep	s2	admin	✱ created	///	
✓ 2 Dec 16, 2014 12:41 PM Pacif...	property	ec_notifierstatus	admin	✱ created	///	
✓ 3 Dec 16, 2014 12:41 PM Pacif...	property	ec_deploy	admin	✱ created	///	

View All Changes

Objects

- Act (3)
- Property Sheet (2)
- Process Step (1)
- Property (2)

Changes

- Created (8)

Changed by...

- Admin (8)

## Component Process Visual Editor

1. Go to the Applications List.
2. Select an application.
 

The Applications Visual Editor opens.
3. Choose a component.
4. Select a component process for the component.
 

The Component Process Visual Editor opens.

5. To view the Change History for the component process:

- a. Click the **Menu** button.

### Example:



- b. Select **Track Changes**.

The Change History for the component process opens.

The default time increment is **Past 60 Minutes**.

### Example:

When	What	Name	By...	Change	Path
1 Dec 16, 2014 12:32 PM Pacif...	process	setproperties	admin	created	...
2 Dec 16, 2014 12:33 PM Pacif...	property	repositoryname	admin	created	...
3 Dec 16, 2014 12:33 PM Pacif...	property	artifactname	admin	created	...
4 Dec 16, 2014 12:33 PM Pacif...	property	artifactversionversion	admin	created	...
5 Dec 16, 2014 12:33 PM Pacif...	property	compress	admin	created	...
6 Dec 16, 2014 12:33 PM Pacif...	property	dependentartifactv...	admin	created	...
7 Dec 16, 2014 12:33 PM Pacif...	property	excludepatterns	admin	created	...

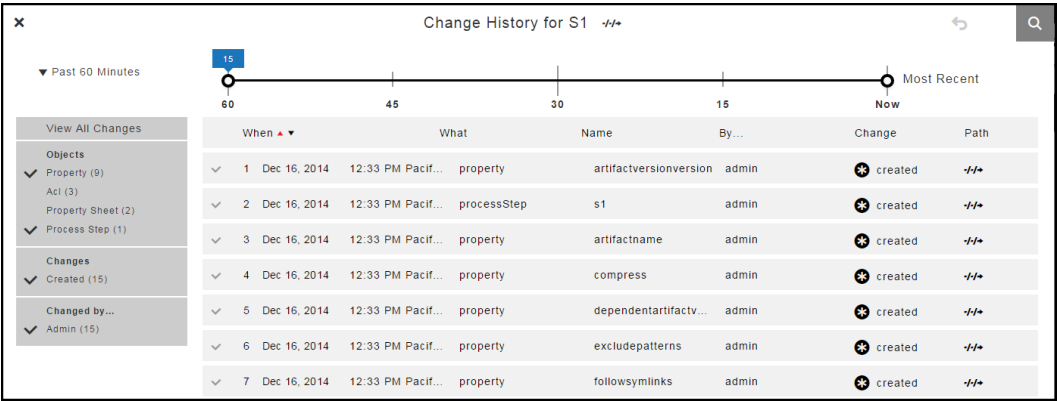
- 6. To view the Change History for the component process step:
  - a. Choose a step.
  - b. Click the **Edit** button in the step to open the context menu.

Example:



- c. Select **Track Changes**.
- The Change History for the component process step opens.

Example:



Environments Visual Editor

- 1. Go to the Environments List.
- 2. Select an environment.

The Environments Visual Editor opens.
- 3. Click the **Menu** button.

Example:

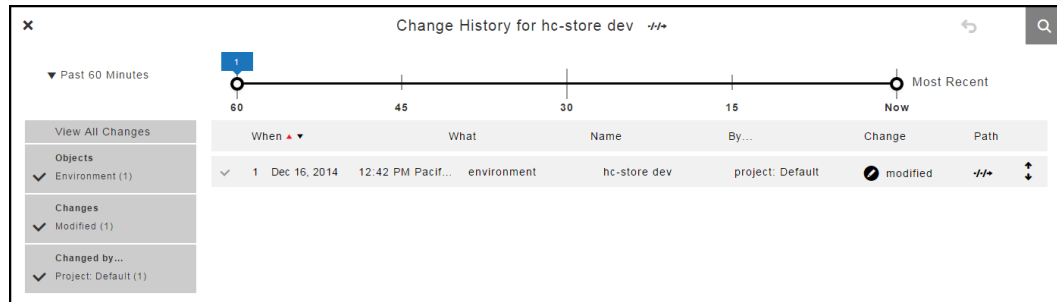




#### 4. Select **Track Changes**.

The Change History for the object opens.

#### Example:



## Environment Tier

1. Go to the Environments Designer.
2. Choose an environment tier.
3. Click the **Menu** button.

#### Example:

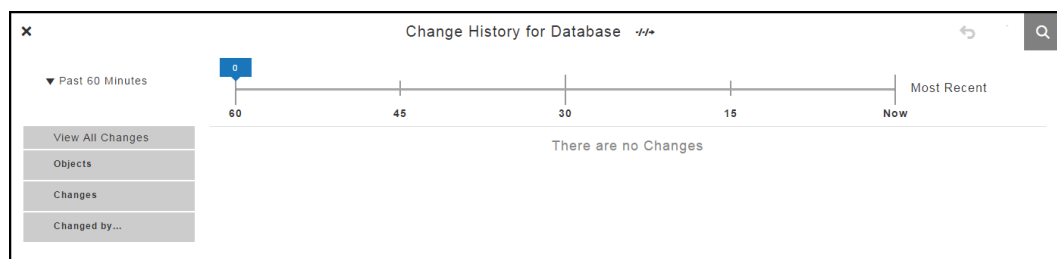


#### 4. Select **Track Changes**.

The Change History for the object opens.

The default time increment is **Past 60 Minutes**.

#### Example:



## Viewing the Change History for Artifacts, Jobs, Projects, and Workflows

When troubleshooting why a job failed, you can view the Change History for artifacts, jobs, projects, and workflows in the automation platform.

- [Artifacts](#) on page 517
- [Jobs](#) on page 518
- [Projects](#) on page 519
- [Workflows](#) on page 519

## Artifacts

Starting from the Home page:

1. Go to the Artifacts tab.
2. Choose an artifact.
3. Click the **Track Changes** button.

### Example:

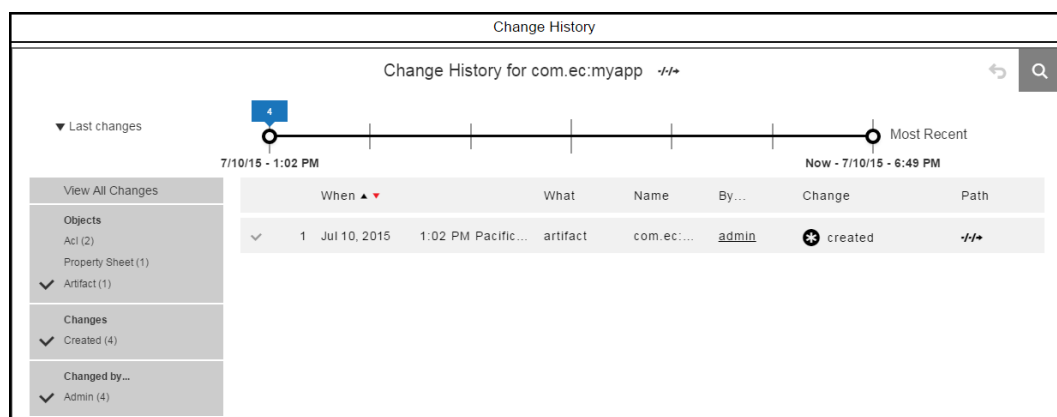


Name	Group Id	Artifact Key	Description	Actions
com.ec:myapp	com.ec	myapp		  
com.myccompany.heatclinic:config	com.myccompany.heatclinic	config		  
com.myccompany.heatclinic:warfile	com.myccompany.heatclinic	warfile		  
com.myccompany.heatclinic:warfileWildfire	com.myccompany.heatclinic	warfileWildfire		  

The Change History for the selected artifact opens.

The default time increment is **Past 60 Minutes**.

### Example:



Change History for com.ec:myapp						
▼ Last changes						
View All Changes						
Objects						
Act (2)						
Property Sheet (1)						
✓ Artifact (1)						
Changes						
✓ Created (4)						
Changed by...						
✓ Admin (4)						

When	What	Name	By...	Change	Path
1 Jul 10, 2015 1:02 PM Pacific...	artifact	com.ec:...	admin	created	-/-

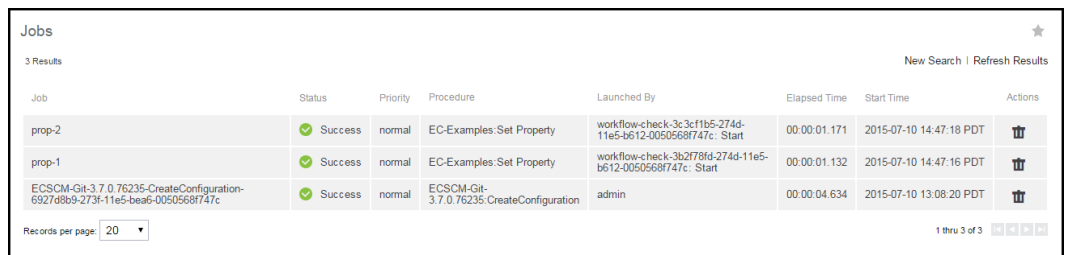
## Jobs

Starting from the Home page:

1. To go to the Job Details page, do one of the following:
  - Use the Jobs tab.
  - Use the Jobs Quick View list.
2. If you use the Jobs tab, follow these steps:
  - a. Click the Jobs tab.

The Jobs page opens.

### Example:



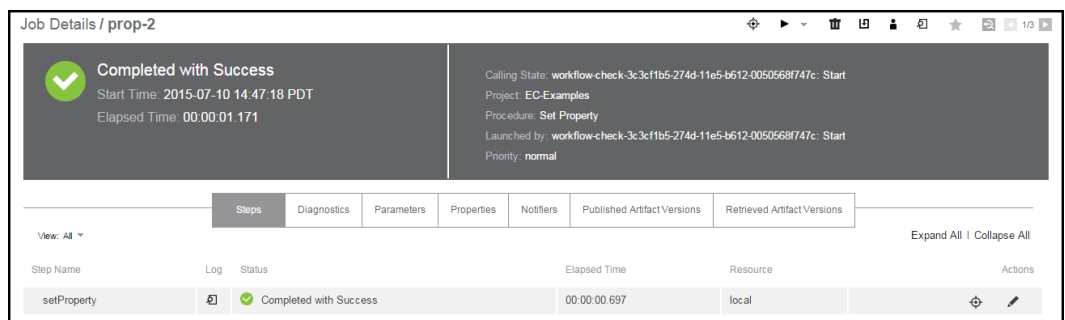
The screenshot shows the 'Jobs' page with 3 results. The table has columns: Job, Status, Priority, Procedure, Launched By, Elapsed Time, Start Time, and Actions. The jobs listed are 'prop-2', 'prop-1', and 'ECSCM-Git-3.7.0.76235-CreateConfiguration-6927d0b9-273f-11e5-bea6-0050568f747c'. All jobs have a status of 'Success' and a priority of 'normal'. The 'prop-2' job was launched by 'workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start' and completed in 00:00:01.171. The 'prop-1' job was launched by 'workflow-check-3b278fd-274d-11e5-b612-0050568f747c: Start' and completed in 00:00:01.132. The 'ECSCM-Git' job was launched by 'admin' and completed in 00:00:04.634. The page also shows a 'Records per page' dropdown set to 20 and a '1 thru 3 of 3' indicator.

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
prop-2	Success	normal	EC-Examples:Set Property	workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start	00:00:01.171	2015-07-10 14:47:18 PDT	
prop-1	Success	normal	EC-Examples:Set Property	workflow-check-3b278fd-274d-11e5-b612-0050568f747c: Start	00:00:01.132	2015-07-10 14:47:16 PDT	
ECSCM-Git-3.7.0.76235-CreateConfiguration-6927d0b9-273f-11e5-bea6-0050568f747c	Success	normal	ECSCM-Git-3.7.0.76235:CreateConfiguration	admin	00:00:04.634	2015-07-10 13:08:20 PDT	

- b. Click a job name to select a job.

The Job Details page opens.

### Example:



The screenshot shows the 'Job Details / prop-2' page. It features a large green checkmark icon and the text 'Completed with Success'. Below this, it shows the 'Start Time: 2015-07-10 14:47:18 PDT' and 'Elapsed Time: 00:00:01.171'. To the right, there is a summary of the job: 'Calling State: workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start', 'Project: EC-Examples', 'Procedure: Set Property', 'Launched by: workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start', and 'Priority: normal'. Below the summary, there are tabs for 'Steps', 'Diagnostics', 'Parameters', 'Properties', 'Notifiers', 'Published Artifact Versions', and 'Retrieved Artifact Versions'. The 'Steps' tab is selected, showing a table with columns: Step Name, Log, Status, Elapsed Time, Resource, and Actions. The table contains one row: 'setProperty' with a status of 'Completed with Success' and an elapsed time of '00:00:00.697'. The resource is 'local'. The page also has a 'View: All' dropdown and 'Expand All | Collapse All' links.

Step Name	Log	Status	Elapsed Time	Resource	Actions
setProperty		Completed with Success	00:00:00.697	local	

3. If you use the Jobs Quick View list, click a job name to select a job.

The Job Details page opens.

4. Choose a job or job step.
  5. Click **Track Changes** for the job or job step.
- The Change History for the job or job step opens.
- The default time increment is **Past 60 Minutes**.

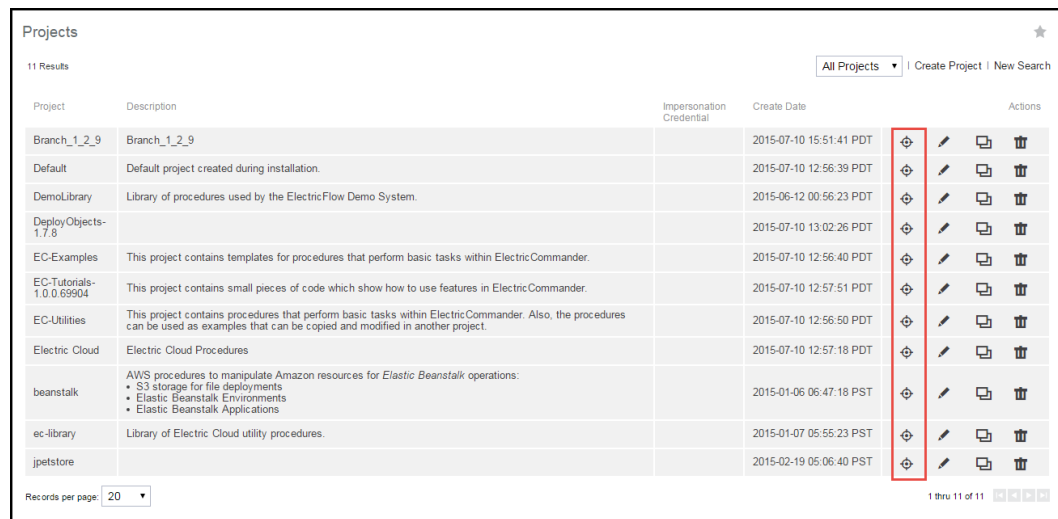
## Projects

Starting from the Home page:

1. Go to the Projects tab.
2. Choose a project.
3. Click the **Track Changes** button.

The Change History for the project opens.

### Example:



Project	Description	Impersonation Credential	Create Date	Actions
Branch_1_2_9	Branch_1_2_9		2015-07-10 15:51:41 PDT	[Icons]
Default	Default project created during installation.		2015-07-10 12:56:39 PDT	[Icons]
DemoLibrary	Library of procedures used by the ElectricFlow Demo System.		2015-06-12 00:56:23 PDT	[Icons]
DeployObjects-1.7.6			2015-07-10 13:02:26 PDT	[Icons]
EC-Examples	This project contains templates for procedures that perform basic tasks within ElectricCommander.		2015-07-10 12:56:40 PDT	[Icons]
EC-Tutorials-1.0.0.69504	This project contains small pieces of code which show how to use features in ElectricCommander.		2015-07-10 12:57:51 PDT	[Icons]
EC-Utilities	This project contains procedures that perform basic tasks within ElectricCommander. Also, the procedures can be used as examples that can be copied and modified in another project.		2015-07-10 12:56:50 PDT	[Icons]
Electric Cloud	Electric Cloud Procedures		2015-07-10 12:57:18 PDT	[Icons]
beanstalk	AWS procedures to manipulate Amazon resources for Elastic Beanstalk operations: • S3 storage for file deployments • Elastic Beanstalk Environments • Elastic Beanstalk Applications		2015-01-06 06:47:18 PST	[Icons]
ec-library	Library of Electric Cloud utility procedures.		2015-01-07 05:55:23 PST	[Icons]
jpetstore			2015-02-19 05:06:40 PST	[Icons]

## Workflows

Starting from the Home page:

1. Go to the Workflows tab.
2. Choose a workflow.
3. Click **Track Changes**.

The Change History for the workflow opens.

## Change History Page

**How to get here:** Click the **Search** button to open the "Change History—Search" form, and enter the search criteria.

The search results appear in the Change History page and include the following information:

The screenshot shows the 'Change History for JPetStore' window. It includes a timeline at the top, a left sidebar with filters, and a main table of changes. Red callouts are placed as follows:

- 1: Close button (X) in the top left corner.
- 2: Title bar 'Change History for JPetStore'.
- 3: Refresh button (circular arrow) in the top right.
- 4: Filter icon (list with checkmarks) in the top right.
- 5: Search icon (magnifying glass) in the top right.
- 6: Timeline slider with a blue marker at '1' and a range from 'Past 60 Minutes' to 'Most Recent'.
- 7: 'View All Changes' button in the left sidebar.
- 8: Filter section in the left sidebar, including 'Objects', 'Changes', and 'Changed by...'.
- 9: Vertical scrollbar on the right side of the change history table.

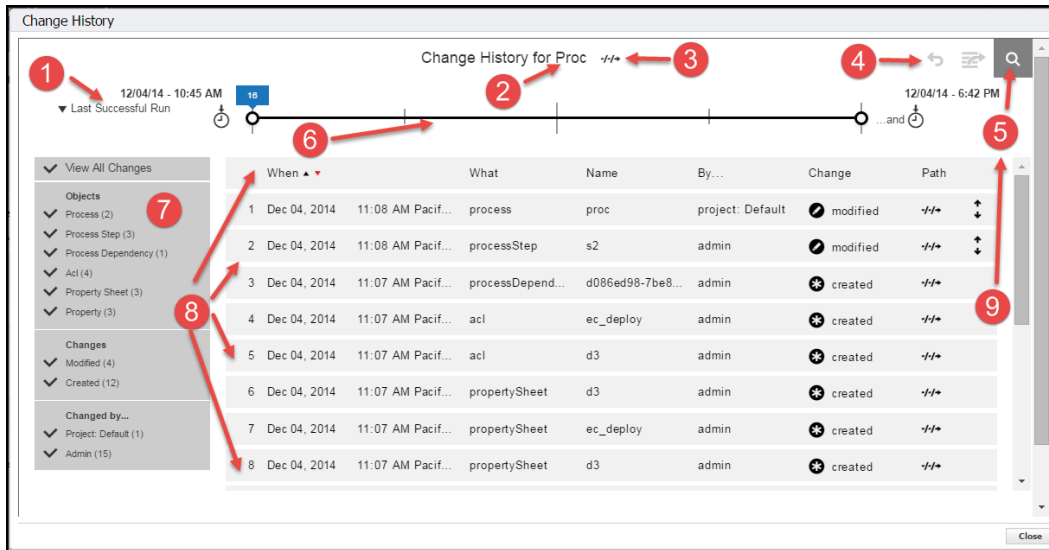
	When ▲ ▼	What	Name	By...	Change	Path
1	Dec 03, 2014 4:34 PM Pacif...	property	jobcounter	project: ...	modified	-/-/
2	Dec 03, 2014 4:34 PM Pacif...	process	deploy	project: ...	modified	-/-/
3	Dec 03, 2014 12:38 PM Pacif...	property	pluginpr...	admin	created	-/-/
4	Dec 03, 2014 12:38 PM Pacif...	property	pluginpr...	admin	created	-/-/
5	Dec 03, 2014 12:38 PM Pacif...	property	overwrite	admin	created	-/-/
6	Dec 03, 2014 12:38 PM Pacif...	property	directory	admin	created	-/-/
7	Dec 03, 2014 12:38 PM Pacif...	property	type	admin	created	-/-/
8	Dec 03, 2014 12:38 PM Pacif...	property	version	admin	created	-/-/
9	Dec 03, 2014 12:38 PM Pacif...	property	artifact	admin	created	-/-/
10	Dec 03, 2014 12:38 PM Pacif...	property	repository	admin	created	-/-/
11	Dec 03, 2014 12:38 PM Pacif...	property	server	admin	created	-/-/
12	Dec 03, 2014 12:38 PM Pacif...	property...	ec_conte...	admin	created	-/-/
13	Dec 03, 2014 12:38 PM Pacif...	acl	ec_conte...	admin	created	-/-/

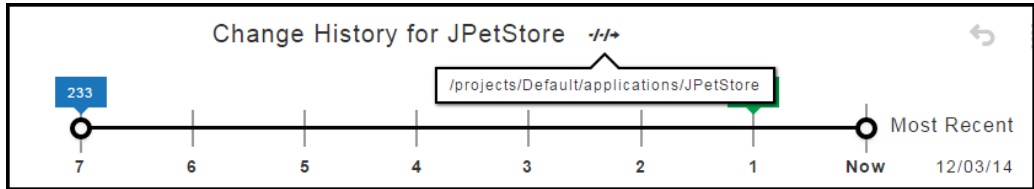
#### How to get here:

From the Home page in the automation platform, use one of the following methods to open and view the change history for jobs, projects, workflows, and artifacts:

- Select a job that failed > Click the job name to go to the Job Details page > Click **Track Changes** in the upper right of the page.
- Click the Jobs tab > Select a job that failed to the Job Details page > Click **Track Changes** in the upper right of the page.

The search results appear in the Change History page for the job and include the following information:



1	<p>Time range.</p> <p>The end time is the current time. You can change the end time after you run the search and get the search results.</p>
2	Name of the tracked object.
3	<p>Path to the tracked object.</p> <p>Example:</p> 
4	After making a change, you can revert or export the object. Click this to go to the undo or redo the last action on the page.
5	Click this to run a new change history search.

6	<p>Time line.</p> <p>The start time is based on the time range that you selected.</p> <p>The end time is the current time.</p> <p>You can manually change the start and end times after you run the search and get the search results.</p>																																
7	<p>Filters for the change history.</p> <p>You can view all changes or view only selected changes.</p> <p>The objects in the list are the objects in the change history search results.</p>																																
8	<p>Change history for the selected object.</p> <ul style="list-style-type: none"><li>• When—the date and time that the object changed.</li><li>• What—The type of object.</li><li>• Name—The name of the object.</li><li>• By—The "user" that changed the object, which can be a project or a user.</li><li>• Change—The type of change.</li><li>• Path—Click the <b>View Path</b> button to see the path to the object.</li></ul> <table><thead><tr><th></th><th>When ▲ ▼</th><th></th><th>What</th><th>Name</th><th>By...</th><th>Change</th><th>Path</th></tr></thead><tbody><tr><td>1</td><td>Dec 03, 2014 4:34 PM Pacific...</td><td>property</td><td>jobcounter</td><td>project: ...</td><td> modified</td><td></td><td></td></tr><tr><td>2</td><td>Dec 03, 2014 4:34 PM Pacific...</td><td>process</td><td colspan="2"><div>Before path: /projects/Default/applications/JPetStore/jobcounter After path: /projects/Default/applications/JPetStore/jobcounter</div></td><td></td><td></td><td></td></tr><tr><td>3</td><td>Dec 03, 2014 12:38 PM Pacific...</td><td>property</td><td>pluginpr...</td><td>admin</td><td> created</td><td></td><td></td></tr></tbody></table>		When ▲ ▼		What	Name	By...	Change	Path	1	Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified			2	Dec 03, 2014 4:34 PM Pacific...	process	<div>Before path: /projects/Default/applications/JPetStore/jobcounter After path: /projects/Default/applications/JPetStore/jobcounter</div>					3	Dec 03, 2014 12:38 PM Pacific...	property	pluginpr...	admin	created		
	When ▲ ▼		What	Name	By...	Change	Path																										
1	Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified																												
2	Dec 03, 2014 4:34 PM Pacific...	process	<div>Before path: /projects/Default/applications/JPetStore/jobcounter After path: /projects/Default/applications/JPetStore/jobcounter</div>																														
3	Dec 03, 2014 12:38 PM Pacific...	property	pluginpr...	admin	created																												
9	<p>Click the <b>View</b> button to see more details about the object.</p>																																

## Time Line

The time line for the change history is at the top of the Change History page.

The time line is automatically separated into divisions based on the number of minutes, hours, or days between the end time and the start time.

## Default Settings

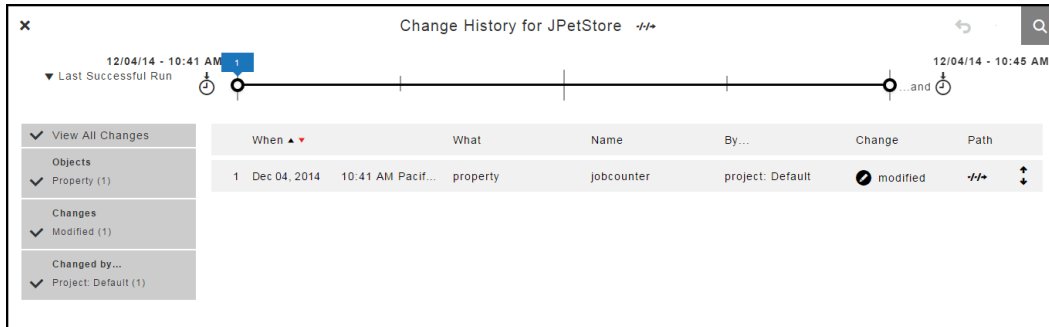
These are the default settings for the time line:

- The start time is the selected time range in the upper left of the page.
- The end time is **Most Recent** when the latest change to the object occurred.

- The default range is from the **Last Successful Run** to the **Most Recent**.
- The entire time line is displayed, and all the changes are in the list below the time line.

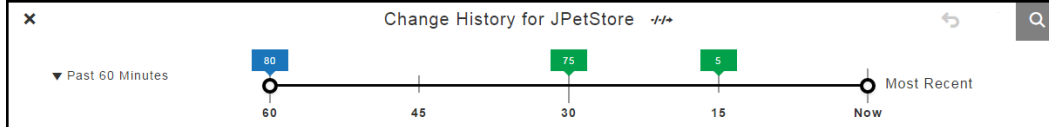
The time line on this page has the default range.

**Note:** The **Last Successful Run** range is available only after the first time that you run an application.

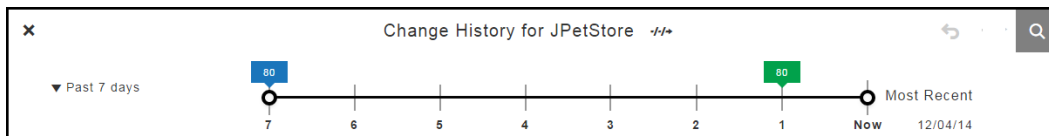


When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.



If the increment is **Past 7 Days**, the time line has seven one-day divisions.



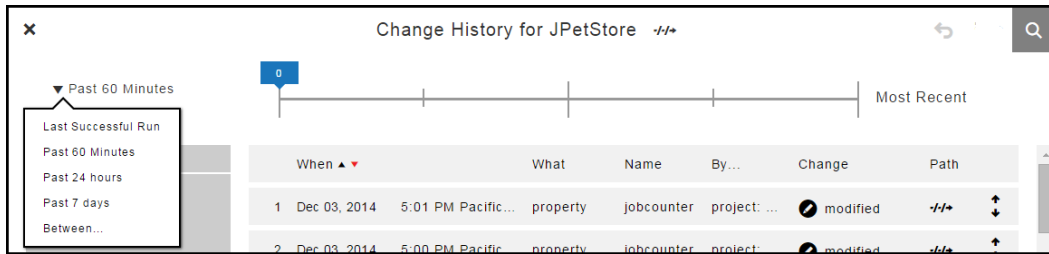
You can view the change history in different ways depending on the time range for the time line.

### Selecting the Time Range

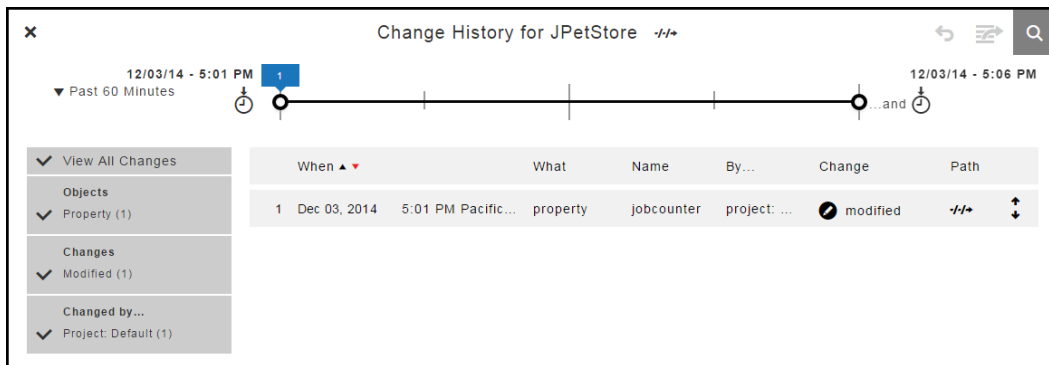
You can view the change history in different ways depending on the time range for the time line.

Click the down arrow next to the time range to select a different range for the change history.





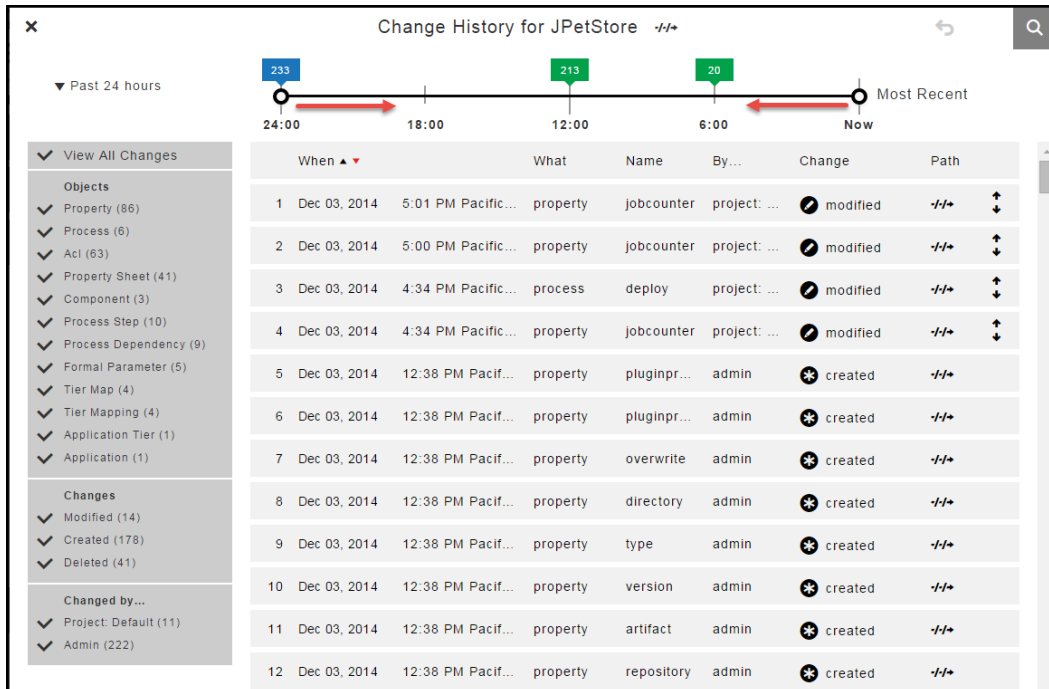
You can see the change history since the last successful run. Notice that the information on the left side shows a summary of the changes, which is a subset of the results that you got.



### Moving the Start and End Times

You can manually move the start and end times on the time line.

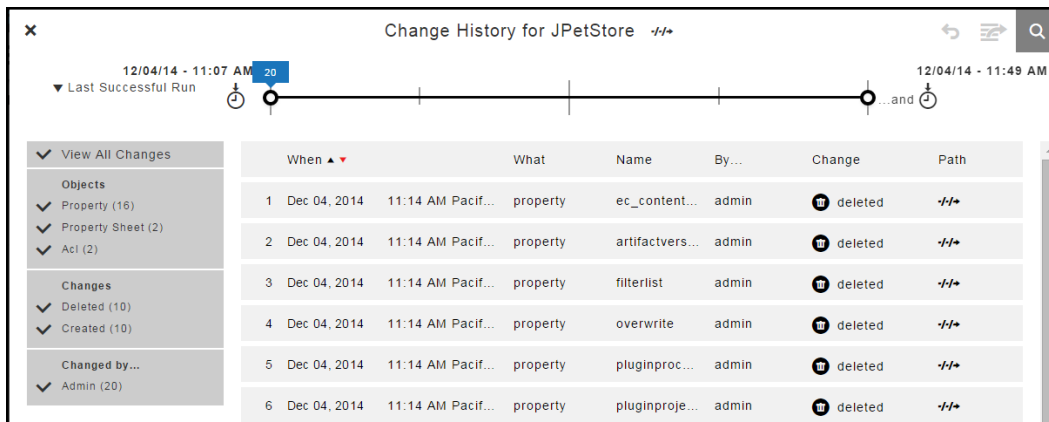
When you move the start time to 18:00 and the end time to 6:00, notice that the list of objects in the change history changes.



When you move the start time to 18:00 and the end time to 6:00, notice that the list of objects in the change history changes.

### Specifying the Time Range

#### Example:



To manually set the times and dates for the start and end times:

1. Select **Between**.

A drop down dialog box opens.

#### Example:

The screenshot shows a software interface with a sidebar on the left containing the following items: a dropdown menu labeled "Between...", a checked item "View All Char", and three items labeled "Objects", "Changes", and "Changed by...". The main area displays a date and time "11/26/14 - 3:30 PM" next to a blue button with the number "0". A clock icon is positioned above a dialog box. The dialog box has a "Time" section with input fields for "3", "30", and "PM", and a "Date" section with input fields for "11", "26", and "14". An "OK" button is at the bottom of the dialog.

2. Select the time and date for the start of the time line.

The default settings are 3:30 pm and eight days before the current date.

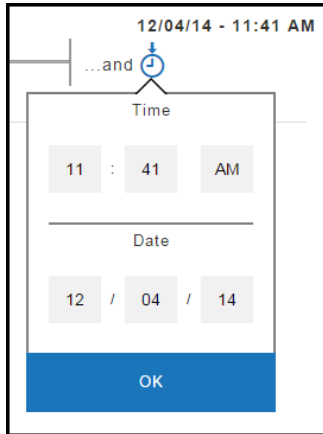
### Example:

This screenshot is similar to the first one but shows example values. The main area displays the date and time "11/24/14 - 8:30 AM" next to a blue button with the number "0". The dialog box's "Time" section shows "8", "30", and "AM", while the "Date" section shows "11", "24", and "14". The "OK" button remains at the bottom.

3. Click **OK**.

A drop down dialog box opens at the other end of the time line.

**Example:**

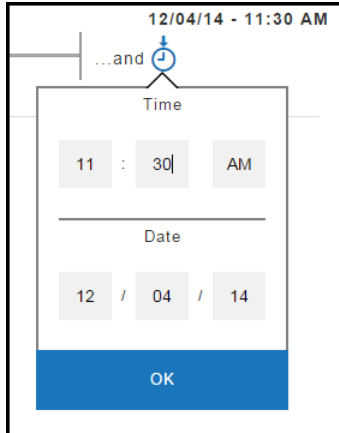


The screenshot shows a dialog box titled "Time" with a date and time selection interface. At the top, it displays "12/04/14 - 11:41 AM". Below this, there is a section labeled "Time" with input fields for "11", ":", "41", and "AM". Below the time section, there is a section labeled "Date" with input fields for "12", "/", "04", "/", and "14". At the bottom of the dialog box is a blue button labeled "OK".

4. Select the time and date for the end of the time line.

The defaults are 3:30 pm and the current date.

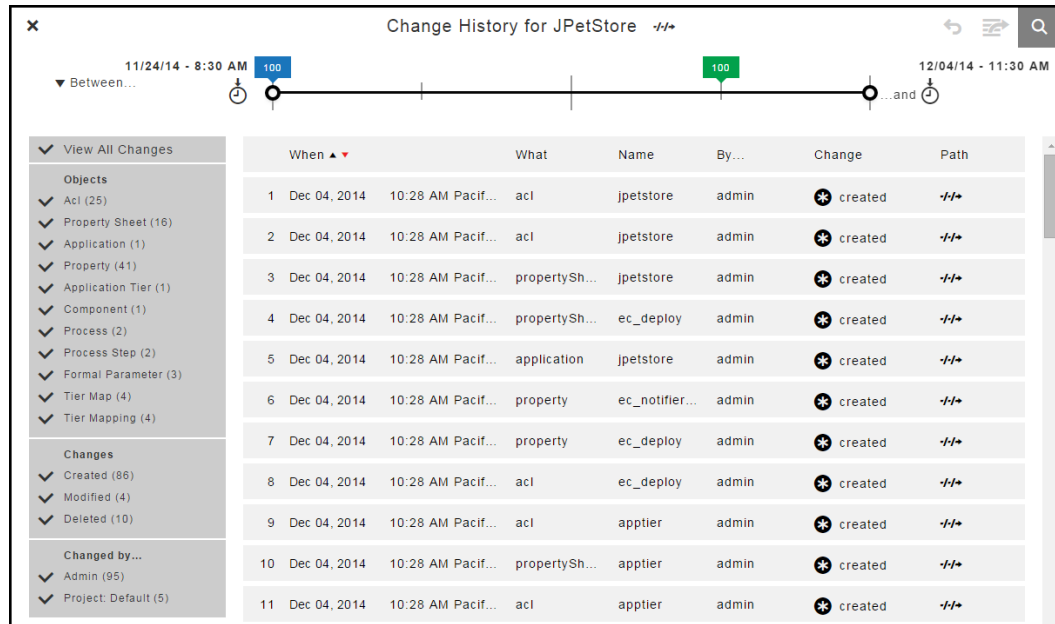
**Example:**



The screenshot shows a dialog box titled "Time" with a date and time selection interface. At the top, it displays "12/04/14 - 11:30 AM". Below this, there is a section labeled "Time" with input fields for "11", ":", "30", and "AM". Below the time section, there is a section labeled "Date" with input fields for "12", "/", "04", "/", and "14". At the bottom of the dialog box is a blue button labeled "OK".

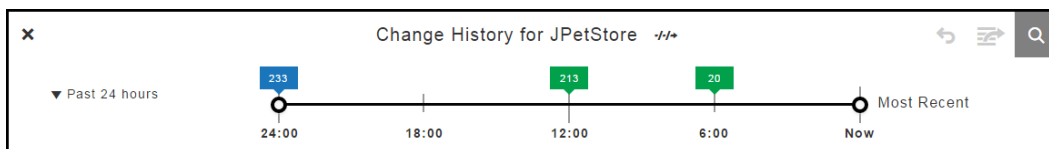
5. Click **OK**.

The time line changes to show only the changes from the start and end times and dates that you selected.

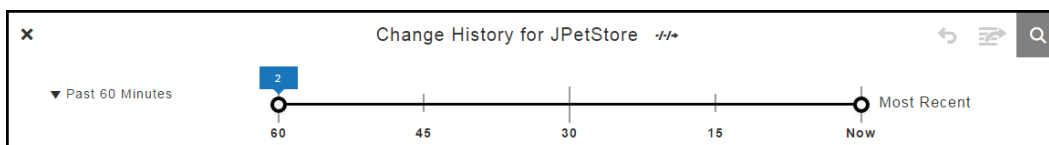
**Example:****Number of Changes**

The time range at the top of the change history shows the number of changes.

- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.

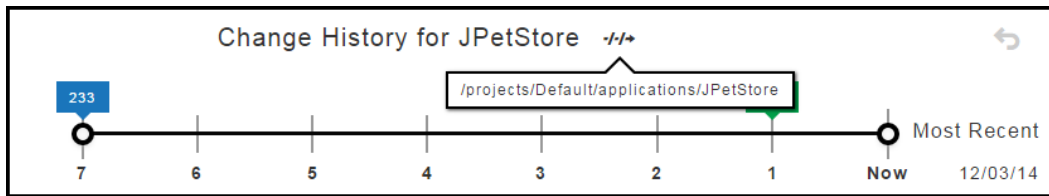


When you change the time range, the number of changes also changes. In the last 60 minutes, there have been only two changes.



## Paths to Objects

Click the **View Path** button next to the "Change History for JPetStore" title to see the path to the application.




Click the **View Path** button to see the change in the path to the object before and after the change.

	When ▲ ▼	What	Name	By...	Change	Path
1	Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified	View Path
2	Dec 03, 2014 4:34 PM Pacific...	process	Before path: /projects/Default/applications/JPetStore/jobcounter After path: /projects/Default/applications/JPetStore/jobcounter			
3	Dec 03, 2014 12:38 PM Pacific...	property	pluginpr...	admin	created	View Path

## Detailed Object Changes

Click the **View** button to see the change in the property called jobcounter.

	When ▲ ▼	What	Name	By...	Change	Path								
1	Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	 modified	 								
<table><tr><th>Column Changed</th><th>From...</th><th>To...</th><th>Current state</th></tr><tr><td>1. value</td><td>5</td><td>6</td><td>6</td></tr></table>							Column Changed	From...	To...	Current state	1. value	5	6	6
Column Changed	From...	To...	Current state											
1. value	5	6	6											

## Filters

You can use filters to view changes to specific objects, the types of changes, and the users who made those changes.

Instead of selecting **View All Changes**, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.

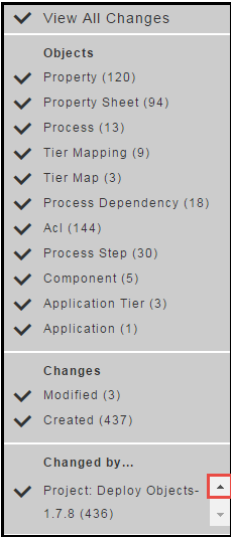
View All Changes		When ▲ ▼	What	Name	By...	Change	Path
<b>Objects</b>							
✓	Property (43)	1 Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified	↕
✓	Process (2)	2 Dec 03, 2014 4:34 PM Pacific...	process	deploy	project: ...	modified	↕
✓	Property Sheet (20)						
	Acl (27)						
	Component (1)						
✓	Process Step (6)						
✓	Process Dependency (8)						
<b>Changes</b>							
✓	Modified (6)						
	Created (60)						
	Deleted (41)						
<b>Changed by...</b>							
✓	Project: Default (2)						
✓	Admin (105)						

When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.

✓	View All Changes	
<b>Objects</b>		
✓	Property (120)	
✓	Property Sheet (94)	
✓	Process (13)	
✓	Tier Mapping (9)	
✓	Tier Map (3)	
✓	Process Dependency (18)	
✓	Acl (144)	
✓	Process Step (30)	
✓	Component (5)	
✓	Application Tier (3)	
✓	Application (1)	
<b>Changes</b>		
✓	Modified (3)	
✓	Created (437)	
<b>Changed by...</b>		
✓	Project: Default (4)	▲
✓	Project: Deploy Objects-	▼

Click the down arrow to see the other users.



## Modifying What You See the Change History

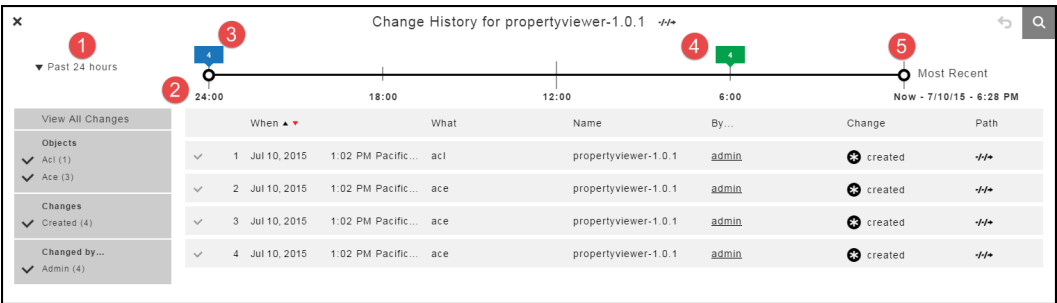
You can modify the information that appears in the Change History with these settings:

- Time line—Go to [Change History Time Line](#) on page 986.
- Filters—Go to [Change History Filters](#) on page 992.

### Change History Time Line

The time line is at the top of the Change History page.

This example shows the Change History for a property called *propertyviewer-1.0.1*.



1	<p>Time increment.</p> <p>The default is <b>Last Changes</b>.</p> <p>Click the down arrow to select another time increment.</p>
---	---



2	The system automatically calculates the minutes, hours, and days since the last successful run.  In the example, the last successful run occurred 24 hours ago. The time line is divided into four 6 hour subdivisions.
3	Total number of changes in the selected time increment.
4	The number of changes that occurred between 6 hours ago and now is 4.  When you click the change number, the Change History is updated and shows only those changes.
5	Drag the start and end time markers to view specific changes.

### Default Settings

The default time increment is **Last Change**.

The entire time line is displayed, and all the changes are in the list below the time line.

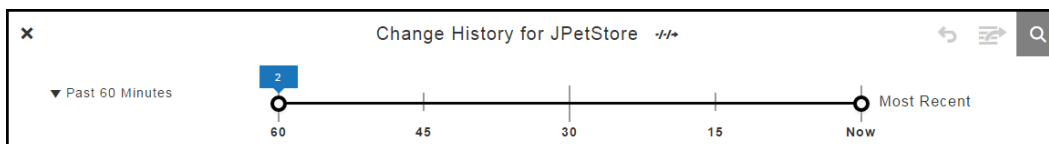
### Number of Changes

The time line shows the number of changes throughout the time increment. In the following example:

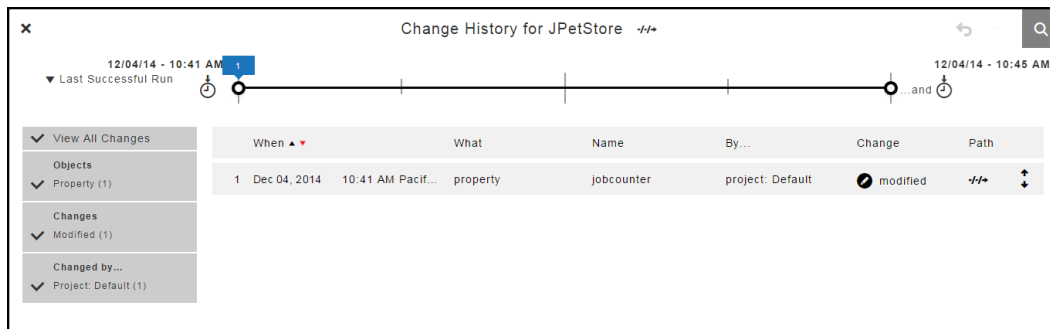
- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.



When you change the time increment, there have been two changes in the previous 60 minutes.



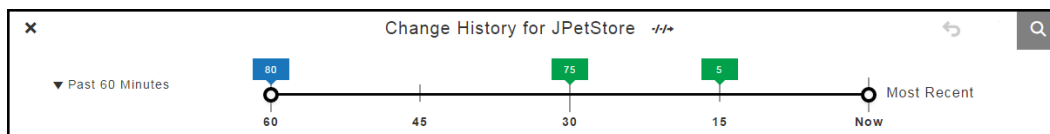
## Time Increment



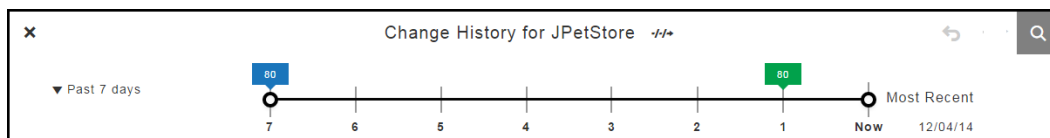
The system automatically determines how the time line is divided for the selected time increment.

When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.



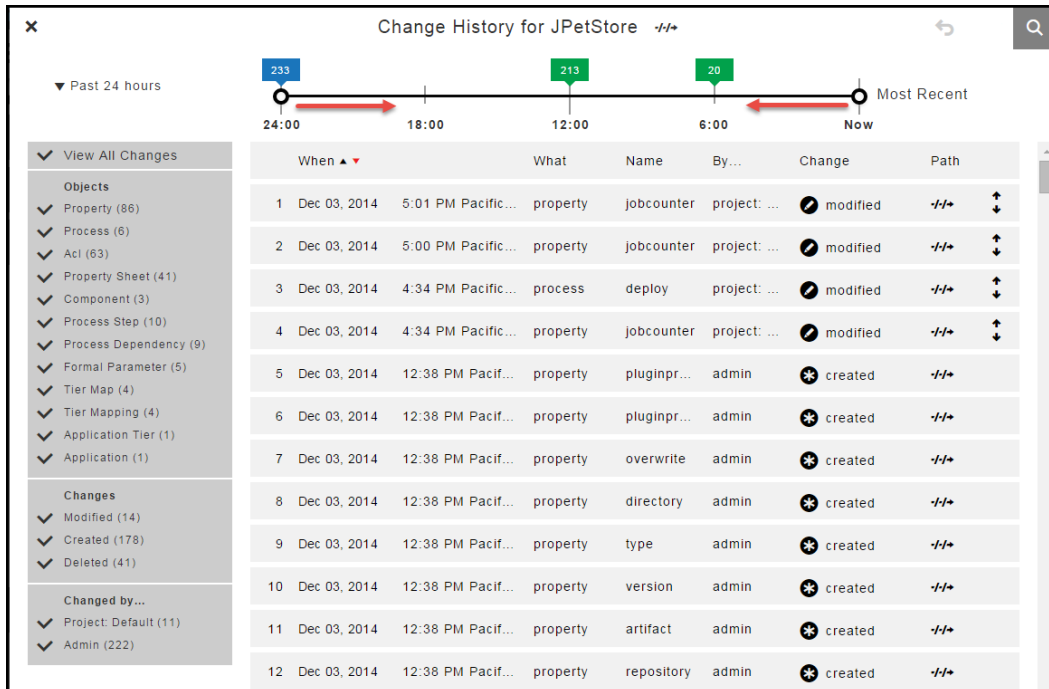
If the increment is **Past 7 Days**, the time line has seven one-day divisions.



## Moving the Start and End Times Manually

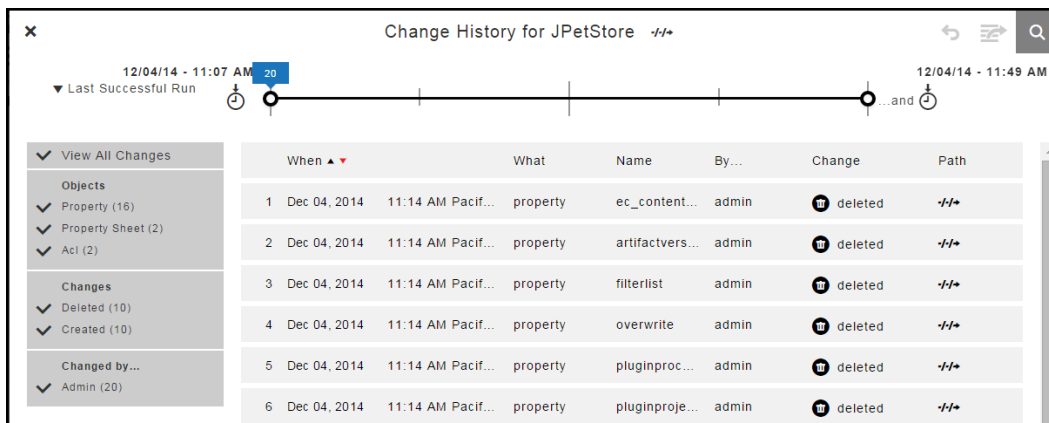
You can manually move the start and end times on the time line.

When you move the start time to 18:00 and the end time to 6:00, the list of objects in the change history changes.



## Setting Custom Time Increments

### Example:



#### 1. Select **Between**.

A drop down dialog box opens.

### Example:

A screenshot of a software interface showing a time and date selection dialog box. The dialog box is titled "Time" and "Date". The time is set to 3:30 PM and the date is set to 11/26/14. The dialog box has an "OK" button at the bottom. In the background, there is a sidebar with a "Between..." dropdown menu and a "View All Char" checkbox. The main area shows a timeline with a clock icon and a blue bar at the top.

2. Select the time and date for the start of the time line.

The default settings are **3:30 PM** and eight days before the current date.

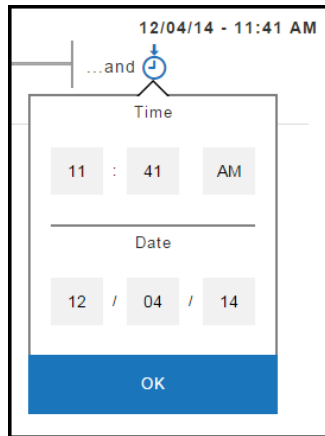
### Example:

A screenshot of a software interface showing a time and date selection dialog box. The dialog box is titled "Time" and "Date". The time is set to 8:30 AM and the date is set to 11/24/14. The dialog box has an "OK" button at the bottom. In the background, there is a sidebar with a "Between..." dropdown menu and a "View All Char" checkbox. The main area shows a timeline with a clock icon and a blue bar at the top.

3. Click **OK**.

A drop down dialog box opens at the other end of the time line.

**Example:**

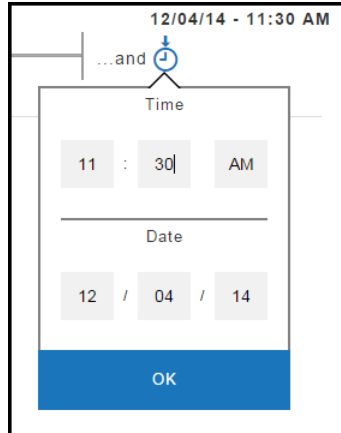


The screenshot shows a dialog box titled "Time" with a date and time selection interface. At the top, it displays "12/04/14 - 11:41 AM". Below this, there is a section labeled "Time" with input fields for "11", ":", "41", and "AM". Below the time section is a section labeled "Date" with input fields for "12", "/", "04", "/", and "14". At the bottom of the dialog is a blue button labeled "OK".

4. Select the time and date for the end of the time line.

The defaults are **3:30 PM** and the current date.

**Example:**



The screenshot shows a dialog box titled "Time" with a date and time selection interface. At the top, it displays "12/04/14 - 11:30 AM". Below this, there is a section labeled "Time" with input fields for "11", ":", "30", and "AM". Below the time section is a section labeled "Date" with input fields for "12", "/", "04", "/", and "14". At the bottom of the dialog is a blue button labeled "OK".

5. Click **OK**.

The time line changes to show only the changes from the start and end times and dates that you selected.

### Example:

The screenshot shows the 'Change History for JPetStore' window. At the top, a timeline is displayed with a date range from 11/24/14 - 8:30 AM to 12/04/14 - 11:30 AM. Below the timeline, a table lists 11 changes. The left sidebar contains filters for 'View All Changes', 'Objects', 'Changes', and 'Changed by...'.

When	What	Name	By...	Change	Path
1 Dec 04, 2014 10:28 AM Pacific...	acl	jpetstore	admin	created	...
2 Dec 04, 2014 10:28 AM Pacific...	acl	jpetstore	admin	created	...
3 Dec 04, 2014 10:28 AM Pacific...	propertySh...	jpetstore	admin	created	...
4 Dec 04, 2014 10:28 AM Pacific...	propertySh...	ec_deploy	admin	created	...
5 Dec 04, 2014 10:28 AM Pacific...	application	jpetstore	admin	created	...
6 Dec 04, 2014 10:28 AM Pacific...	property	ec_notifier...	admin	created	...
7 Dec 04, 2014 10:28 AM Pacific...	property	ec_deploy	admin	created	...
8 Dec 04, 2014 10:28 AM Pacific...	acl	ec_deploy	admin	created	...
9 Dec 04, 2014 10:28 AM Pacific...	acl	apptier	admin	created	...
10 Dec 04, 2014 10:28 AM Pacific...	propertySh...	apptier	admin	created	...
11 Dec 04, 2014 10:28 AM Pacific...	acl	apptier	admin	created	...

## Change History Filters

The Change History has records only for an object and its tracked entities, not all entities belonging to the object. You can use filters to view changes to specific objects, the types of changes, and the users how made those changes if they are are tracked.

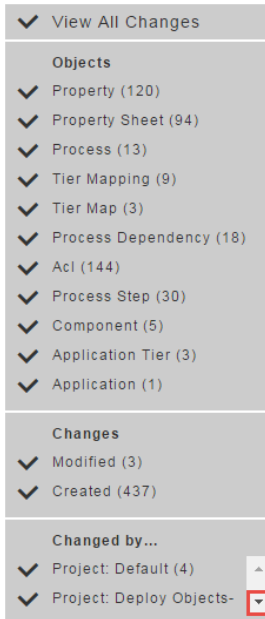
In this example, instead of selecting **View All Changes**, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.

The screenshot shows the 'Change History for JPetStore' window with filters applied. The left sidebar shows 'View All Changes' selected, and the table displays 3 modified records. The filters for 'Objects' and 'Changes' are visible.

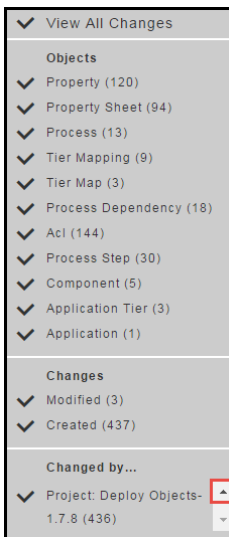
When	What	Name	By...	Change	Path
1 Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified	...
2 Dec 03, 2014 4:34 PM Pacific...	process	deploy	project: ...	modified	...
3 Dec 03, 2014 11:35 AM Pacific...	process	deploy	admin	modified	...

When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.



Click the down arrow to see the other users.



## Reverting Changes to a Tracked Object and Its Tracked Contents

The Change History displays a list of changes in reverse chronological order (from latest to oldest) for tracked entities in objects such as applications, procedures, workflows, workspaces, resources, and project-owned components such as library components. Each row in the Change History or a tracked object is a record of a change made either to the tracked object or to a tracked object owned by the object (directly or indirectly). For example, the Change History of a project would show both changes to the project itself and changes to any tracked object in the project, such as its procedures, the ' steps for each procedure, or properties belonging to the procedure steps.

Some types of objects (mostly run-time objects such as jobs, because tracking those would be resource-intensive and seldom useful) are not tracked by the Change Tracking feature. For a few types of tracked objects, some of their attributes are not tracked (for example, agents are tracked, but certain attributes of agents that vary frequently in real-time, such as their current status, are not). Changes to untracked objects, or to untracked attributes of tracked objects, are not shown in the Change History and cannot be reverted. In general, objects that are normally created or changed manually are tracked, and objects that are normally created or modified during automated processing are not. However, depending on your specific usage patterns, this behavior may not be recorded in the Change History, such as when you frequently run jobs that use ectool or API commands to automate the creation of new procedures or steps.

**Note:** You must have the *Read*, *Modify*, and *Execute* permissions to revert changes in the UI or to access to the `revert` API function.


Follow these steps to select a tracked object and its tracked entities that you want to revert:

1. Go to the Change History for the object that you want to revert using one of these methods:



- Click the **Track Changes** button (  ) for the object.



- From the ElectricFlow Home page, click the **Search** button (  ) to go to the "Change History—Search" page and search for the object.

2. Locate the time period in which you are interested.


A list of changes for the tracked object appears.



3. If you decide to revert the changes for an object owned by the tracked object or for an object that owns the tracked object, use one of the methods to view the list of changes for this object:


- Close the current Change History and navigate to the Change History for the object.



- Click the **View Path** button (  ) on the top of the current Change History, copy the path, go to the "Change History—Search" page, and search for a suitable addition to or truncation of that path.
4. Select a row (record) in the Change History corresponding to the earliest of the changes that you want to undo.

You will be reverting the object and all its tracked contents to their state directly before the selected change was made.



- a. If the **Revert** button (  ) becomes enabled, ElectricFlow is capable of reverting the selected changes to the object. is tracking the changes to this object.

Go to Step 5.

- b. If the **Revert** button is still disabled, ElectricFlow is not currently capable of reverting changes to the selected object. This could be due to tracking of this object being disabled and re-enabled, or the Change History feature being disabled and re-enabled. Also, not all types of tracked objects can currently be reverted (and due to mutual consistency requirements in the database format, certain types of objects cannot be reverted).

If you are unable to revert the selected object, you may still be able to achieve what you need to do one of these ways:

- Revert the parent object that owns the object you want to revert.
- Separately revert the individual objects owned by the selected object or even nested partial-reversions-of-reversions, possibly combined with manually reversion (undoing) certain changes.

Go to Step 3 to search for an for an owned or owning tracked object.

5. Before clicking the **Revert** button, make certain that you know all the changes that will be reverted, and have confirmed that this is what you want to do. (While it is possible to re-revert the changes caused by a mistaken reversion operation, doing so leaves a lot of activity in the Change History.)

**IMPORTANT:** All of the changes for tracked entities will be reverted, even the ones that you do not see in the Change History because of the timeline and filter settings.

- a. You may need to modify the timeline and filter settings to display all records in the Change History before you verify that all of the records are changes you want to revert.
- b. Make sure that the end of the timeline is set to **Now** and that the filters are set to **View All Changes**.
- c. Look through the entire list of changes from the most recent to the one you have selected, expanding them to see the details if needed, and confirm that you really want to revert all of them.

**IMPORTANT: Tip on how to further refine what changes will be reverted**

If you want to revert some of the changes shown but not others, you may be able to achieve what you want to do with some combination of the following methods:

- Reverting just certain objects owned by the object that you want to revert.
- Using nested or overlapping sets of reverts of owned objects.
- Undoing individual changes manually using the ElectricFlow UI.
- Using nested partial-reverts-of-reverts.

If you fully understand the XML format used for ElectricFlow exports, you can use the `export` API call to export the past and current states of a part of the object hierarchy, diff and merge them using a suitable tool for diffing and merging XML files, and then re-import the results. Caution is strongly suggested if you are using this approach to revert objects for which ElectricFlow does not currently support reversion, because:

- There are some places in the ElectricFlow XML data hierarchy where peer objects refer to each other in ways that need to be kept consistent (such as by index of current position in a list).
- For some types of objects, re-importing them can change their IDs and break references-by-id.

6. Click the **Revert** button. Depending on the size of the object and every tracked object it owns, this operation could take some time (as long as exporting a past state of them and then re-importing it).

If this operation is successful, the object and its tracked entities are reverted back to the state at the date and time of the record selected in Step 3. A message appears that the Revert operation was successful.

If this operation is not successful, the object and its tracked entities are not reverted, and a message appears about the failed operation.

## Chapter 1: Notifications

ElectricFlow supports email notifications, also referred to as email notifiers, for these ElectricFlow objects:

- Application processes
- Application process steps (type: process)
- Jobs and job steps
- Workflow states
- Procedure results
- Procedure step results
- State definition results

### Application Processes and Process Steps

ElectricFlow sends email notifications to users and groups at the application-process and application-process-step (type: process) levels. The notifications are triggered based on how the job finishes (the onCompletion event) and on the job outcome (success or failure).

When configuring email notifications:

- You specify users, groups, or email addresses as recipients of the notifications.
- You can also target notifications at specific environments.
- You can enable or disable notifications at the application-process and application-process-step levels.

**Note:** The user and group settings are defined and managed at the platform level. See the "Users and Groups" section for more information.

Go to [Configuring Email Notifications in Application Processes](#) about how to set up email notifications. When notifications are enabled and a default template is used, you do not have to perform additional steps to set up an email notification.

ElectricFlow provides default templates for success and failure outcomes. All the templates have a name, subject, body, and type content that are stored as properties in ElectricFlow.

You can edit existing templates or create new email templates in ElectricFlow. Go to [Selecting and Editing Email Messages for Application Processes](#) about how to edit HTML default notifications and to create new email templates.

ElectricFlow also sends notifications for assignees and approvers of manual process steps. Go to [Manual Tasks and Steps](#) on page 124 for more information.

## Jobs, Workflow States, and Procedures

For jobs and job steps, two types of email notifiers:

- On Start Notifier – Sends an email when a job or job step starts.
- On Completion Notifier – Sends an email when a job or job step completes.

For workflow states, three types of email notifiers:

- On Enter Notifier – Sends an email when the state becomes the workflow's active state.
- On Start Notifier – Sends an email after the state's subjob or subworkflow starts. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.
- On Completion Notifier – Sends an email after the state's subjob or subworkflow completes. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.

Using email notifiers:

- Attaching an email notifier to a procedure results in a corresponding email notifier associated with the job that is created when the procedure is executed.
- Attaching an email notifier to a procedure step results in a corresponding email notifier associated with the job step created when the procedure referencing the procedure step is executed.
- Attaching an email notifier to a state definition results in a corresponding email notifier associated with the state that is created when the workflow is executed.

You must create an email configuration before you create and configure email notifiers at the platform level. Then you can send them to individuals and groups.

To create and edit email configurations, go to [Email Configurations](#) on page 698, and [Email Configuration—create new or edit existing email configuration](#) on page 698.

To create or edit email notifiers, go to [Email Notifier—create new or edit existing email notifier](#) on page 699. See the topics starting with "Email Notifier Template" for examples of HTML templates that you can use as-is or copy and rename to create a new template.

## Pipelines

Notifications for pipelines are automatically sent in the following scenarios. You do not have to perform any additional steps to send email notifications.

- For a manual task in a stage, the appropriate notifications are sent to the user or group who performs that task and to the user or group who responds when the task is completed.

- When entry and exit gates have specified approvers, ElectricFlow sends approval notifications to them.
  - You can set the approvals such that approval from only one of the approvers is sufficient for the pipeline to progress. In this case, you can have one approval rule and have all the approvers assigned to that rule.
  - Instead, if you want all the key individuals to approve sequentially, you can specify multiple approval rules, each for a specific user.
  - In addition to specific users, approval rules support groups. Approval or rejection from any user in the group will allow the pipeline to progress or stop.

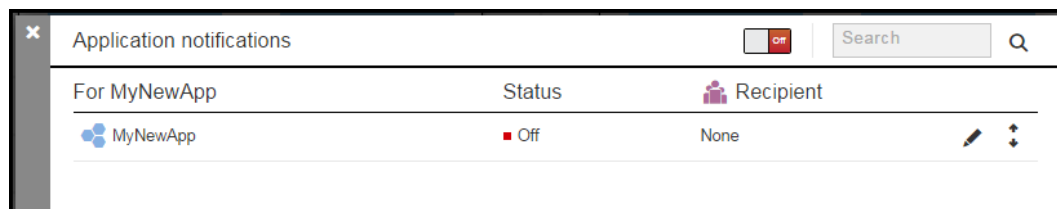
After approvers log into ElectricFlow, they can approve or reject the approval rules. The pipeline's progress will continue if the approval rules are approved. The pipeline will end with the appropriate error if the rules are rejected.

Go to [Pipeline Concepts](#) on page 309 for more information about notifications in pipelines.

## Configuring Email Notifications in Application Processes

**Review these guidelines before configuring email notifications:**

- You can configure notifications for application processes and application process steps (type: process).  
When you open the Applications notifications dialog box and expand the application process details, only the application process steps (type: process) appear in the list.
- New email notifications are disabled in the application, its application processes, and the process steps before you configure them.



- You configure notifications in the "Application notifications / edit" dialog box.

**IMPORTANT:** The first time that you set notifications in this dialog box, the Notifications toggle changes to **On**. After you enter notification settings and click **OK**, email notifications are enabled at that level.

By default, the application expects that the user creates an email configuration called "default." The email configuration defaults to the server property `/server/ec_deploy/ec_defaultEmailConfiguration`, which is set to "default."

If you want to use a different name for the email configuration, change the value of `/server/ec_deploy/ec_defaultEmailConfiguration` to the new email configuration name.

Starting from the Home page, to set email notifications:

- 1. Go to the Applications List.
- 2. Select an application.

The Applications Visual Editor opens.

- 3. Click the **Menu** button.

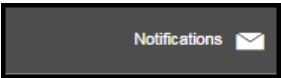
Example:



The Applications menu opens.

- 4. Click **Notifications** to add a new application.

Example:



The **Application notifications** dialog box opens.

Example:

Application notifications			
For MyNewApp		Status	Recipient
MyNewApp		Off	Some
1	New installation	Off	Some
2	existing installation	Off	None

## 5. Configure email notifications as follows:

You can configure one or more notifications in an application process or an application process step (type: process).

### *Configuring recipients*

In the **Who** field, add users, groups, and/or email addresses.

When you start typing a user name, group name, or email address, a list of names or email addresses appear that match what you are typing.

**Note:** The user and group settings are defined and managed at the platform level. See the "Users and Groups" section for more information.

### **Example:**

The screenshot shows the 'Application notifications / edit' interface. At the top, there's a title bar with a close button and a back arrow. Below it, the notification name 'backup' is displayed next to an 'On' toggle switch. The configuration is divided into three main sections: 'Who', 'When', and 'Where'. The 'Who' section has a text input field with the placeholder 'Add users, groups, or email addresses:' and a dropdown menu showing suggestions: 'admin (?)', 'admin-asia (?)', 'admin-aus (?)', 'admin-uk (?)', 'admin-us (?)', 'jadams (?)', and 'sclaus (?)'. The 'When' section has an 'Event:' dropdown menu with the selected option 'Both Failed and Succes...'. The 'Where' section has an 'Environment:' dropdown menu with the selected option 'All'. There are also icons for adding (+) and removing (-) configurations.

If one of the suggestions matches the name or email address, select it or continue typing. You can add more than one name or email address.

### **Example:**

Application notifications / edit

backup On

Who When Where +

Add users, groups, or email addresses: Event: Environment:

admin admin-asia sclaus jadams userX@gmail.com Both Failed and Succes... All

DevT200@gmail.com

### Configuring the event that triggers the notification

In the **When** field, select the event that triggers a notification to be sent to the recipients in the **Who** field. The default is **Both Failed and Successful**. Clicking in the **When** field shows a list of event triggers.

#### Example:

Application notifications / edit

backup On

Who When Where +

Add users, groups, or email addresses: Event: Environment:

admin admin-asia sclaus jadams userX@gmail.com Both Failed and Succes... All

DevT200@gmail.com

Both Failed and Successful

Run Failed

Run Successful

### Configuring the environments where the notification applies

In the **Where** field, you select the environments to which the notifications apply. Clicking in the **Where** field shows the list of available environments to which the application is mapped in the tier map.

#### Example:



Application notifications / edit

backup On

Who	When	Where
Add users, groups, or email addresses:	Event:	Environment:
admin admin-asia sclaus jadam userX@gmail.com	Run Successful	All
DevT200@gmail.com		hc-store dev

6. Select and edit the email notification message.
7. Add another notification for an application process or application process step.

Click the **Add Notifications** button to add a new notification.

### Example:



After you have added your email notifications, click **OK** to save the settings and return to the **Application notifications / edit** dialog box.

### Example:

Application notifications / edit

backup On

Who	When	Where
Add users, groups, or email addresses:	Event:	Environment:
jadam admin-asia sclaus admin userX@gmail.com	Run Successful	hc-store dev
DevT200@gmail.com		
admin-uk admin-aus DevLead@electric-cloud.com UserAZ@gmail.com	Both Failed and Succes...	All

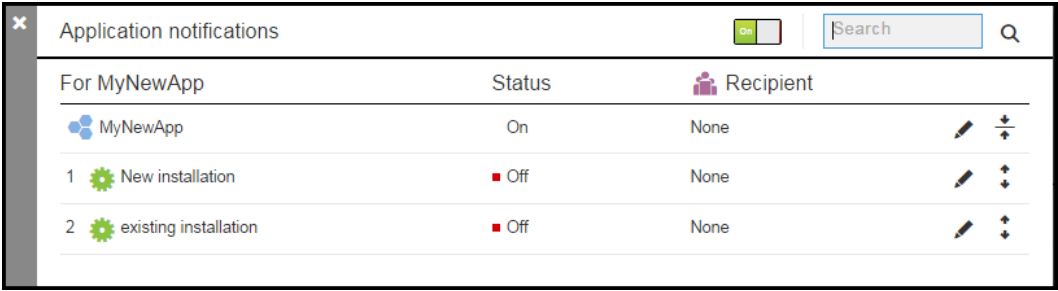
8. (Optional) Enable email notifications for the application processes or application process steps that are not already enabled.

To enable email notifications at the application level:

- Click the Notifications toggle and change it to **On**.

The status of the application changes to **On**.

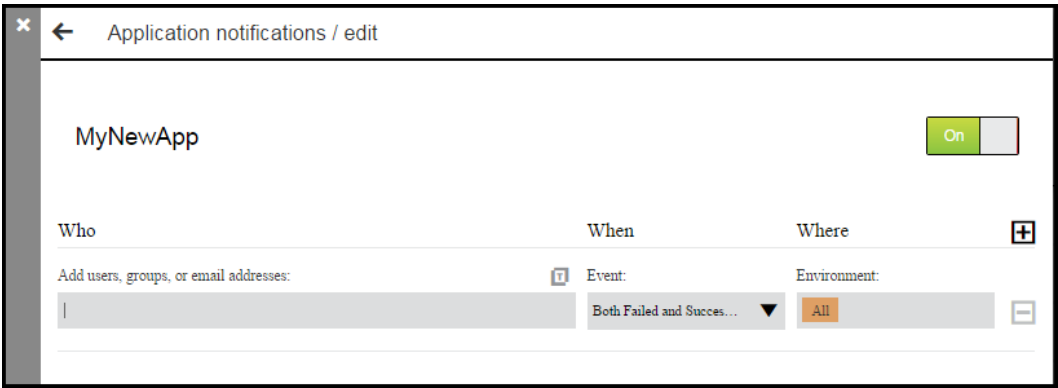
**Example:**



- Click the **Edit** button to open the **Application notifications / edit** dialog box.

The **Application notifications / edit** dialog box appears. The Notification toggle changes to **On**.

**Example:**



To enable notifications at the application process and process step levels, go to the **Application notifications / edit** dialog box for the specific process or process step.

The dialog box opens, and the Notifications toggle is now **On**.

**Example:**

When you enter notification settings in the dialog box and click **OK**, the settings are saved. The **Application notifications** dialog box appears and now shows that the application process status is **On**.

### Example:

For MyNewApp	Status	Recipient
MyNewApp	On	Some
1 New installation	On	Some
2 existing installation	Off	None

## Selecting and Editing Email Messages for Application Processes

You can edit the email messages sent as notifications for application processes and application process steps (type: process).

Starting in the **Application notifications / edit** dialog box:

1. Click the **Template** button.

A drop-down box opens.

**Example:**

The screenshot shows a dialog box titled "Application notifications / edit" with a close button (X) in the top left corner. The notification name "backup" is displayed at the top left, and a toggle switch is set to "On" at the top right. Below the name, there are three columns: "Who", "When", and "Where".

**Who:** A section labeled "Add users, groups, or email addresses:" with a list of tags: "jadmins", "admin-asia", "sclaus", "admin", "userX@gmail.com", and "DevT200@gmail.com".

**When:** A section labeled "Event:" with a dropdown menu currently showing "Run Successful".

**Where:** A section labeled "Environment:" with a dropdown menu currently showing "hc-store dev".

Below these columns, there is another row of settings. The "Who" column has tags "admin-uk" and "admin-aus". The "When" column has a dropdown menu showing "Both Failed and Succes...". The "Where" column has a dropdown menu showing "All".

A modal dialog box is open over the "Who" section, titled "Apply email message template", with a dropdown menu showing "Default Success notific...".

At the bottom of the main dialog, there are three buttons: a grey "Cancel" button and a blue "OK" button.

2. Click the down arrow to open the list of email message templates that can be applied to the application.

3. Select a template.

**Example:**

Application notifications / edit

backup On

Who When Where

Add users, groups, or email addresses: Event: Environment:

jadams admin-asia sclaus admin userX@gmail.com Run Successful hc-store dev

DevT200@gmail.com

admin-uk admin-aus

Both Failed and Succes... All

Apply email message template

Default Success notific... ▼

Arthur

Arthur2

Artyoms Success notification

Default Failure notification

Default Success notification

Cancel OK

If the template is the current template applied to notification, the name of the template appears in the dialog box.

**Example:**

admin-uk admin-aus

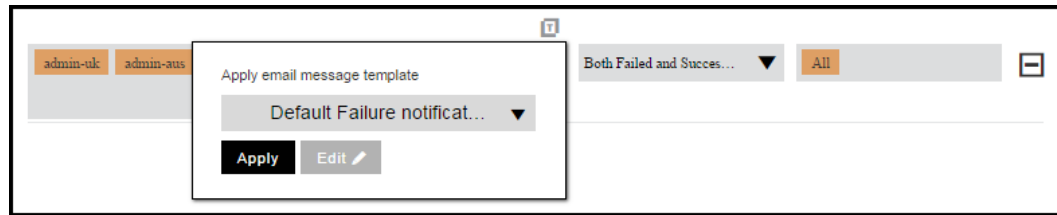
Apply email message template

Default Success notific... ▼

Both Failed and Succes... All

If the template is not the current template, the **Apply** and **Edit** buttons appear in the dialog box.

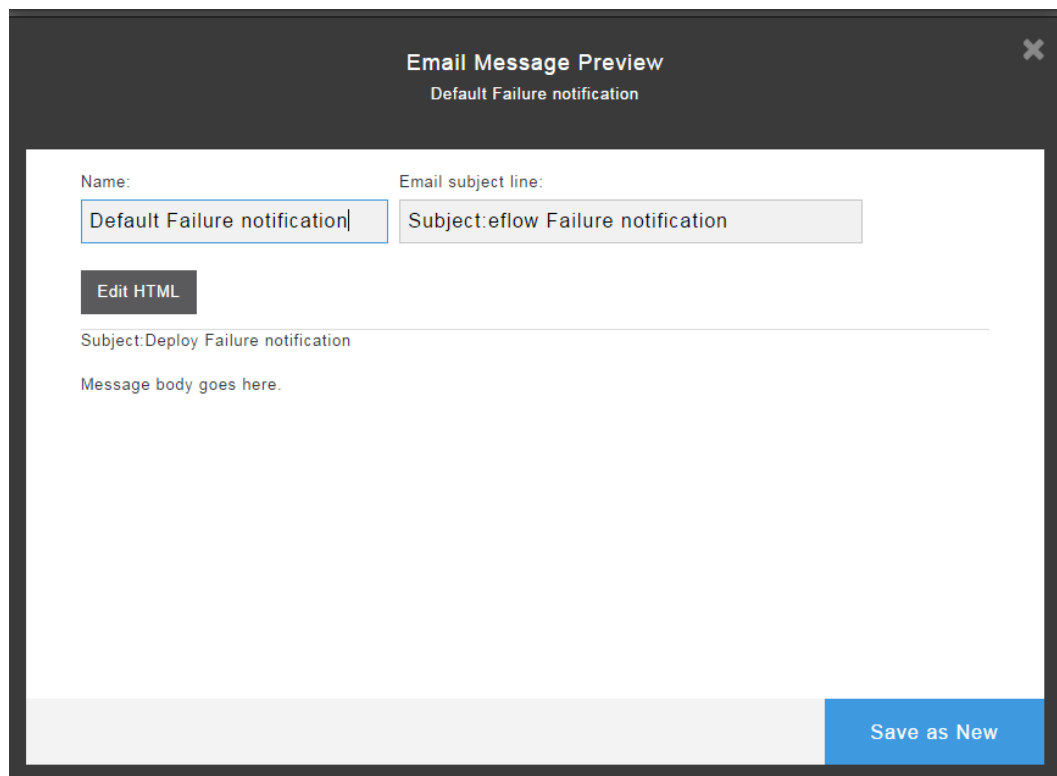
**Example:**



4. If you want to use the template that you selected instead of the current one and do not want to change selected one, skip the remaining steps in this task.
5. If you want to apply a different template or edit the template that you selected, do the remaining steps in this task.
  - If you click **Apply** to use the template as-is, skip the remaining steps.
  - If you click **Edit** to modify the template, go to the next step.

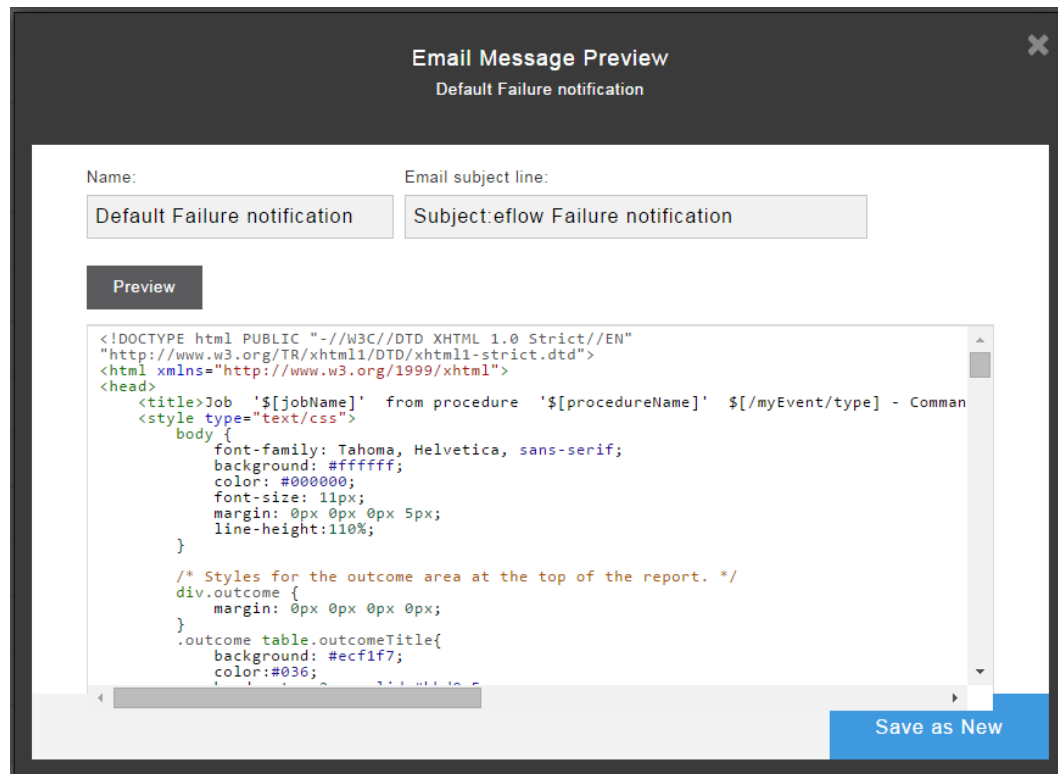
The **Email Message Preview** dialog box appears.

### Example:



6. To edit the template:
  - a. Change the name of the template in the **Name** field.
  - b. Change the subject of the email in the **Email subject line**.
  - c. To modify the body of the email message, click **Edit HTML** and edit the HTML code.

### Example:



7. Click **Preview**.
8. To save your changes:
  - Click **Save Changes** to save the changes in the existing template
  - Click **Save as New** to save the template as a new template.

The **Application notifications / edit** dialog box re-appears.

- Click the down arrow to open the list of email message templates that be can applied to the application.

The new email message template is in the list.

### Example:

Application notifications / edit

backup On

Who When Where

Add users, groups, or email addresses:

jadams admin-asia sclaus admin userX@gmail.com

DevT200@gmail.com

admin-uk admin-aus

Event: Run Successful

Environment: hc-store dev

Both Failed and Succes... All

Apply email message template

- Default Success notific...
- adsdDefault Failure notification
- Arthur
- Arthur2
- Default Failure or Success notification
- Artyoms Success notification
- Default Failure notification
- Default Success notification

Cancel OK

- Click **OK** to save the settings.



# Chapter 1: Automation Platform

ElectricFlow is built on a powerful proven automation platform that natively integrates domain-specific capabilities for Enterprise-level continuous delivery. The automation platform gives distributed DevOps teams shared control and visibility into infrastructure, tool chains, and processes. It accelerates and automates the software delivery process and enables agility, availability, predictability, and security across many build-test, deployment, and release pipelines.

This section describes how to create, configure, and manage objects in the automation platform that make the automation of build-test processes, application deployments, and pipelines possible in ElectricFlow. Examples include:

- For build-test automation: Configuring resources and creating procedures to build and test your software.
- For deployment automation: Creating components based on artifacts, defining process steps with plugins, and assigning resources to environments.
- For pipelines: Defining tasks based on procedures, workflows, or plugins.
- For release management: Defining releases based on pipelines.

You use only the automation platform UI to configure ElectricFlow to perform these tasks. The objects and operations for build-test automation are the same as those for the automation platform.

You can also use Perl API commands through `ec-perl` and `ectool`, RESTful API commands, and DSL scripts. For information about using API commands and DSL scripts, see the [ElectricFlow API Guide](#).

## Build-Test Automation

Before you use ElectricFlow for build-test automation, deployment automation, pipelines, or release management, you must create, configure, and manage these objects in the automation platform:

For build-test automation, you must create, configure, and manage these objects in the automation platform:

- Projects

A *project* is an object used in ElectricFlow to organize information. A project is a container object for procedures, steps, schedules, workflows, and properties. If you use ElectricFlow for different purposes, you can use a separate project for each purpose so different projects do not interfere with each other. When you work in one project, you do not normally see information in other projects. At the same time, a project can use information defined in other projects, which allows you to create shared library projects.

- Resources

A *resource* is defined as an agent machine where steps can execute. A resource has a logical name and a host name. In some situations, it is convenient to have multiple logical resources associated with the same host. A resource can also be associated with one or more pools. Each resource has a *step limit* that determines the maximum number of steps that can execute simultaneously on the resource. Resources can be grouped into *resource pools*. Multiple resources can be defined on the same machine.

- Procedures

*Procedures* and *steps* define tasks that you want ElectricFlow to execute. A procedure consists of one or more steps. A step includes a command or script executed on a single resource and is the smallest unit of work that ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *resource pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit, and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

You can define *parameters* for procedures. Parameter values are assigned when procedures are scheduled. Parameters can be required, optional, or have default values. Parameters are used for a variety of purposes such as specifying the branch to build or the set of platforms on which to run tests. Parameter values can be used in step commands and many other places.

Procedures can be nested. A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure, also referred to as a subprocedure.

- Schedules

A schedule is used to execute procedures and determine when specific procedures run. A schedule can trigger at defined times, for example, every 2 hours from 10:00 pm to 6:00 am on Mondays, Wednesdays, and Fridays, or when modifications are checked into a particular branch of your source code control system. It is also possible to create a schedule that runs immediately and disappears after the job runs. When you create a schedule, you must provide the parameters required by the procedure that you want to invoke.

The Continuous Integration Dashboard works with your source code management (SCM) system and provides visibility into running builds, the ability to add a project to continuous integration quickly, and easily accessed configuration pages to setup or modify a continuous integration schedule.

- Workflows

Managing a build-test-deploy product life cycle spanning multiple procedures and projects requires a significant amount of "meta-programming" and a heavy use of properties, and the *workflow* feature simplifies this process. Using the workflow object, you can create build-test-deploy life cycles by defining a set of states and transitions. Any ElectricFlow project can contain a workflow.

- When a procedure is executed or run, a *job* is created. A job is an object that is created each time a procedure begins to execute or run. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

After setting resources, procedures, and schedules, ElectricFlow automatically runs the procedures that you created using these objects and facilities:

- **Zones and Gateways**—A zone (or top-level network) that you create is a way to partition a collection of agents to secure them from use by other groups. A gateway is a secured connection between two zones when you want to share or transfer information between the zones. For example, you might want a developers zone and a test zone. The ElectricFlow server is a member of the *default* zone, created during ElectricFlow installation.
- **Continuous Integration Builds** and other schedules—Run jobs according to *schedules* that you define. Scheduled jobs can run at specific times or when source code changes are checked in to your source control system. ElectricFlow integrates with major source control systems. The Continuous Integration Dashboard allows you to add more projects easily and create build configurations quickly so you can visually see running builds, build status, and so on.
- **Artifact Management** functionality—Using artifacts can improve performance across builds, provide better reusability of components, and improve cross-team collaboration with greater tractability. For example, instead of developers repeatedly downloading third-party packages from external sources, these components can be published and versioned as an artifact. Developers then simply retrieve a specific artifact version from a local repository, guaranteeing a consistent package from build to build.
- **Preflight build functionality**—Used by developers to build and test code changes in isolation on their local machines before those changes are committed to a production build.
- **Plugin** capability—ElectricFlow is built with an extensible UI, enabling easy development of plugins that include integrations with other tools, custom dashboards, and unique user experiences based on roles. "Bundled" plugins, installed during ElectricFlow installation, provide easy integration with your SCM systems, defect tracking applications, and so on.
- **Workflow** functionality—Use a workflow to design and manage processes at a higher level than individual jobs. You can use workflows to combine procedures into processes to create build-test-deploy life cycles (for example). A workflow contains states and transitions that you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small life cycle combinations to meet your needs.
- **Resource** management—If a resource is overcommitted, ElectricFlow delays some jobs until others are finished with the resource. You can define pools of equivalent resources, and ElectricFlow spreads usage across the pool.
- Recording a variety of information about each job, such as the running time and the success or failure of each step. A set of reports is available to provide even more information.
- Powerful and flexible *reporting* facilities—Various statistics such as number of compiles or test errors are collected after each step and recorded in the ElectricFlow database. A variety of reports can be generated from this information.
- Allowing you to observe jobs as they run and to cancel jobs.
- **Credentials**—Use a credential, consisting of an user name and password, can be attached directly to a step or schedule at the platform level. You can also attach impersonation credentials to procedure steps, procedures, and projects before executing the job step. It allows ElectricFlow to use a specific account with special privileges on a per-job or per-step basis.
- **Workspace** for each job, which is a disk area a job uses for storage—ElectricFlow also provides a facility for reclaiming space occupied by workspaces.

- Powerful data model based on *properties*—Properties are used to store job input data such as the source code branch to use for the build, to collect data during a job (such as number of errors or warnings), and to annotate the job after it completes (for example, a build has passed QA).
- *Access control* for users logged into the system—ElectricFlow uses this information to control their activities and integrates with Active Directory and LDAP repositories.
- *Search, sort, and filter* functions to minimize viewing or "wading" through information that is of no interest to you, allowing you to access to the information you need quickly.
- *Email notifications* to get important information or data to individuals or groups immediately and on a regular basis for a particular job or a specific job aspect.
- All ElectricFlow operations and features are available from a command-line application tool (Perl API), *ectool*, the RESTful API, DSL methods, and a user interface (UI).

For more information, go to [Automation Platform Objects and Functionality](#) on page 911.

## Getting Started

[Overview](#)

[Automation Platform Terminology](#)

[Getting Started Scenarios Help Topic Series](#)

[Navigating the ElectricFlow User Interface](#)

### Overview

ElectricFlow is an application for automating and managing your development life cycle, the software build, test, and deployment process. It helps development teams make these tasks repeatable, visible, and efficient.

ElectricFlow creates an environment where IT and Development organizations can work together to connect physical and virtual environments, processes, and tools already in use to create a private development cloud, also known as a *smart development cloud*. ElectricFlow is a scalable solution, solving some of the biggest challenges of managing "back-end" software development tasks.

### Automation Platform Terminology

To get an overview of how the automation platform works and understand the ElectricFlow concepts and processes, review the following basic terms:

- [Project](#)
- [Procedure](#)
- [Step](#)
- [Plugins](#)
- [Parameter](#)
- [Schedule](#)
- [Continuous Integration](#)

- [Resource](#)
- [Job](#)
- [Reports](#)
- [Workspace](#)
- [Zones](#)
- [Gateways](#)

See the [glossary](#) for a list of ElectricFlow terminology.

## Getting Started Scenarios Help Topic Series

The series of scenario Help topics are designed to help you learn to use the ElectricFlow automation platform quickly. Follow the step-by-step scenario format to learn the automation platform basics:

- Creating a simple procedure—[Scenario 1](#)
- Creating a procedure that uses a Source Code Management (SCM) system— [Scenario 2](#)
- Setting up email notifications, reporting, and scheduling—[Scenario 3](#)
- Creating a multi-agent build procedure—[Scenario 4](#)

*Each scenario builds on what you learned in the previous scenario, and each scenario ends with one or more scenario extensions to introduce you to other related ElectricFlow functionality.*

## Navigating the Automation Platform User Interface

To quickly link to task pages, view running or completed jobs, configure resources and so on, the automation platform web interface displays tabs across the top of the page. These tabs remain available at the top of all ElectricFlow automation-platform web pages.

When you select some of the main tabs, subtabs are provided. For example (see the next screen example), when the **Home** tab is selected, notice that the Overview tab is in bold font, which means you are looking at the Overview page. This page can be customized to show the information that you want to see quickly. You can use this page for shortcuts, quick links to jobs, "thumbnail" report views, and so on.

Selecting the Continuous Integration subtab takes you to the Continuous Integration Dashboard, which is place to configure your projects for continuous integration builds.

**In addition to the main set of tabs, the top bar includes:**

- **Logged in as** clearly shows the name of the logged-in user.
- **Logout**—Use this link to log out between ElectricFlow sessions if necessary.
- **Help**—This link provides a Help topic for the current page you are viewing, but if you select the down-arrow adjacent to the Help link, you have access to the following:
  - **Tutorials**—Use this link to display the Table of Contents for all currently available tutorial examples you may find useful as you become familiar with ElectricFlow .
  - **Documentation**—Use this link to access the entire ElectricFlow online Help system, which is fully searchable in the event you do not quickly see what you are looking for in the left-pane Table of Contents.

The Help Table of Contents contains feature overview/concept user-guide style Help topics, which are not linked to a particular web page. These topics are listed in the Table of Contents *above* the "Web Interface Help" section. The Web Interface Help section contains all of the page-specific Help topics.

**Note:** *To print a Help topic*—Right-click your mouse in the Help topic pane or go to your browser File menu.

- **Visit the Community Site**—This link takes you to the Electric Cloud Knowledge Base, all product documentation, and so on.
- **Contact Support**—Use this link to access the Electric Cloud Technical support phone number and email address. At a later time, you may choose to reconfigure this link to redirect it to your internal support time. See the "Reconfigure Contact Support" section in the "[Customizing the ElectricFlow UI](#)" Help topic.
- **About**—Use this link to display the current version of ElectricFlow you are using.

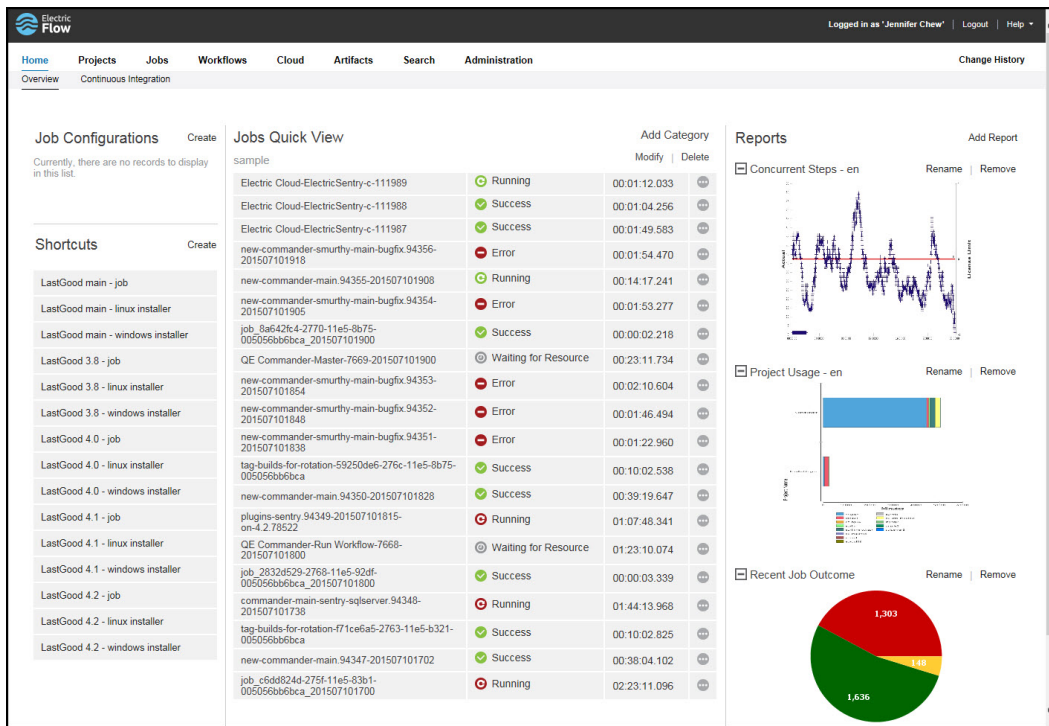
## Home Tab

You can customize the Home page to see the information you need at-a-glance or add Shortcuts to quickly return to the ElectricFlow pages you visit frequently. The Home page provides four categories:

- **Job Configurations**  
ElectricFlow procedures can contain complex sets of parameters, making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem.
- **Shortcuts**  
Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can also create a shortcut to any page on the web.
- **Jobs Quick View**  
The Jobs Quick View allows you to define job categories that are interesting to you. You may be interested in a few jobs on this server. For example, you want only information about jobs that you launch manually and official builds for the products you work on. You do not want information about production builds for other products or personal jobs for other users.
- **Reports**  
You can configure reports you would like to see on a regular basis and display a thumbnail report graphic in this section.

In the following Home page example, there are additional links. This page allows you to create, edit, and delete objects you see so that you can easily keep the page updated and current.

For more information about Home page functionality, see the [Home Page](#) Help topic.



## Continuous Integration Subtab

The Continuous Integration Manager (CI Manager) provides a front-end user interface (the Continuous Integration Dashboard) for creating, managing, and monitoring continuous integration builds.

The Continuous Integration Dashboard provides:

- Visually seeing your running builds, build progress, build status, and accumulated build status.
- Easily accessed "Actions" to configure a continuous integration build.
- Quick configuration of your preferred SCM system.
- A project that contains any number of continuous integration builds, depending on the work you have already setup for your procedures and steps to perform.

The following is an example of the dashboard. Your initial view will be blank until you add configurations (using your preferred SCM) to run your build procedures continuously. When this tab is opened to view the dashboard, click the **Help** link in the upper-right corner of the page for instructions to begin using the dashboard.

Continuous Integration Dashboard

Filter by: ☐ Broken ☐ Running Update Filter Settings + Add Project

Projects/Configurations	Recent Success Ratio	Jobs (Oldest -> Newest)	Current Job Progress	Actions
BundledPlugins				
nightly-full application123Main	0%			
nightly-full-4.2	0%			
nightly-full-5.0	0%			

## Projects, Jobs, and Workflow Tabs

Selecting the Projects, Jobs, or Workflows tab displays a table listing all previously configured projects, all completed jobs, or all previously configured workflows, respectively. Each table contains links in the table and links in the section above the table.

For example, selecting the Projects tab displays a table (see the next screen example), which has the projects you created and ElectricFlow default projects, which were added during ElectricFlow installation.

- Links at the top of the table include:
  - A "star" icon—Click this icon to add this page to your Home page.
  - A drop-down menu to choose which projects you want to see.
  - Create Project link to go to the New Project page to define and add a new project.
  - New Search link to find a project whose name you may not remember or projects of the same type.
- Links within the table include:
  - Click on a Project name (first column) to go to the Projects Details page for that project.
  - Actions column—This column usually contains links to Track Changes, Edit, Copy, or Delete the object, which is a project in this example.

Each table, Projects, Jobs, or Workflows, has similar links to help you get more information, modify existing information, or create a new object. For more information on any of these ElectricFlow pages, see these Help topics: [Projects](#), [Jobs](#), or [Workflows](#).

Projects

(129 Results)

▼ Filters Hide | Save | New \* Saved Filter

Add Criteria + Add Custom Criteria +

Find  OK

Project	Description	Impersonation Credential	Create Date	Actions
AM_Test			2015-07-10 17:54:12 PDT	
AWS-EC2	Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. We have a plugin, EC-EC2, that connects to it. This is the friendly front end, complete with a Workflow.		2012-11-14 13:23:29 PST	



## Cloud Tab

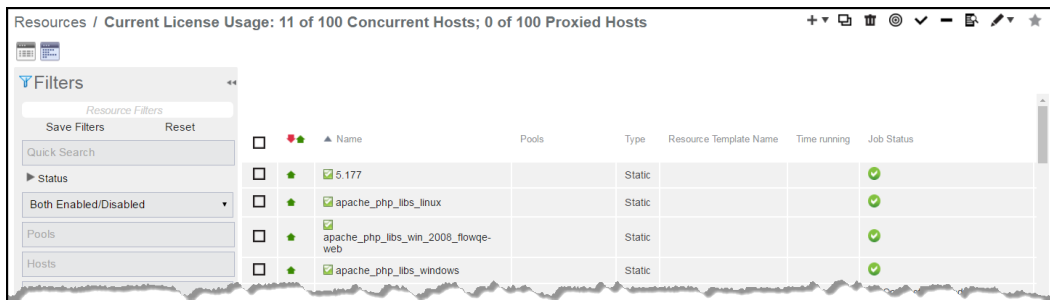
This tab opens to the Resources page and provides several other subtabs—Pools, Workspaces, Zones, Gateways, and the Cloud Manager plugin if it is installed.

### Resources Page

The following example displays all resources that you configured ElectricFlow to use.

- In the information immediately after the **Resources** title at the top of the table, you can see how many licensed resources are in use.
- Use the row of buttons at the top of the page to perform resource management tasks.
- A resource name, in the **Name** column in the table, is a link to open the **Resource Details** panel for more information about the resource, and to access the **Edit Resource** panel to change or add access control privileges.

See the [Resources](#) Help topic for more information.



Resources / Current License Usage: 11 of 100 Concurrent Hosts; 0 of 100 Proxied Hosts

	Name	Pools	Type	Resource Template Name	Time running	Job Status
<input type="checkbox"/>	5.177		Static			Success
<input type="checkbox"/>	apache_php_libs_linux		Static			Success
<input type="checkbox"/>	apache_php_libs_win_2008_flowge-web		Static			Success
<input type="checkbox"/>	apache_php_libs_windows		Static			Success

### Pools Subtab

Click this subtab to display a list of all resource pools available to ElectricFlow. You may find it useful to group resources, creating one or more resource pools. For example, you can have resource pools for specific purposes, development teams, or other groups in your organization.

Similar to the Resources page, this page provides:

- A link to create a new resource pool.
- A Search link to find an existing resource pool.
- Summary information for each resource pool in the list.
- Clicking the resource Pool Name takes you to the Resource Pool Details page for more information about that pool.
- And the Action column contains Copy and Delete links.

For more information about pools, see the [Resource Pools](#) or [Resource Pool—create new or edit existing pool](#) Help topics.

## Workspaces Subtab

Similar to the Resources and Pools pages, the Workspaces page displays a table all available workspaces and summary information for each workspace.

Available links are:

- **Create Workspace** for adding another workspace.
- **New Search** to find an existing workspace.
- Clicking the Workspace Name takes you to the Edit Workspace page to make modifications.
- And the Action column contains **Copy** and **Delete** links.

For more information, see the [Workspaces and Disk Space Management](#), [Workspaces](#), or [Workspaces—create new or edit existing workspace](#) Help topics.

## Zones and Gateways Subtabs

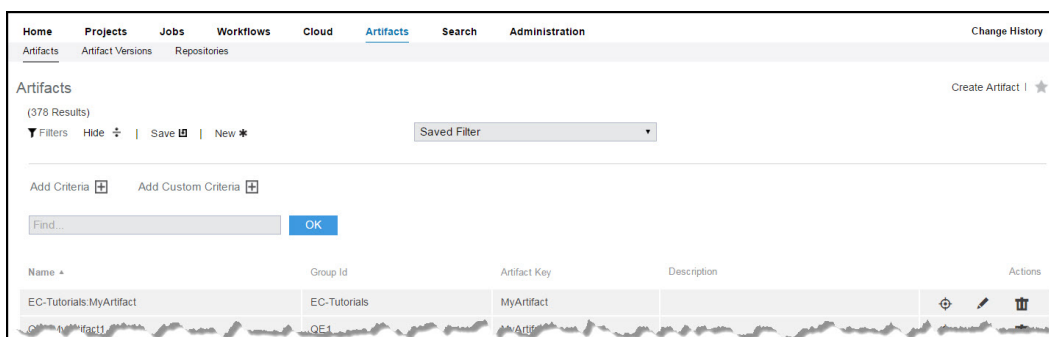
Similar to the other subtabs under the Cloud tab, the Zones and Gateways subtabs each have a table, listing all available zone or gateways, respectively.

- Selecting an object in the Name column takes you to the "Detail" page for more information.
- These pages are your management centers for zones or gateways, respectively.

For more information, see the [Zones](#) and [Gateways](#) Help topics.

## Artifacts Tabs

This page displays all artifacts available on this ElectricFlow server. Clicking on an artifact Name (first column) takes you to the Artifact Details page. For more information, see the [Artifact Management](#) Help topic.



## Artifact Versions Subtab

The Artifact Versions page displays all artifact versions available on the ElectricFlow server. Links in the table are the similar to other ElectricFlow pages. For more information, see the [Artifact Versions](#) Help topic.

## Repositories Subtab

The Repositories page displays all artifact repositories available to the ElectricFlow server. For more information about repositories, see the [Artifact Management](#) and [Repositories](#) Help topics.

## Search Tab

While many ElectricFlow web pages have a Search link, some do not. The Search page is always available. You can search any ElectricFlow supported object type on this page. For more information, see the [Searching and Filtering](#) Help topic.

## Administration Tab

The next screen example shows all the current subtabs available when you select the Administration tab. Less-frequently used tasks are grouped for you as subtabs under the Administration tab. For example, after users and groups are set up, you do not need these pages unless a user or group configuration changes.

Home	Projects	Jobs	Workflows	Cloud	Artifacts	Search	Administration									Change History
Event Log	Groups	Users	Licenses	Directory Providers	Email Configurations	Database Configuration	Plugins	Server	Defect Tracking	Source Control						

Administration subtab descriptions:

- **Event Log**—This page displays a log of events generated anywhere in the system, including jobs and workflows.
- **Groups**—Use this page to view a filtered list of ElectricFlow *local* users or groups.
- **Users**—Use this page to view a filtered list of ElectricFlow *local* users or groups.
- **Licenses**—This page displays all license information known to the ElectricFlow server. Typically, a single license is displayed, which describes the usage to which you are entitled. The license on the server may be based on concurrent resources, concurrent users, concurrent steps, registered hosts, or any combination of these licenses.
- **Directory Providers**—ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. *Local* users and groups are defined in ElectricFlow.
- **Email Configurations**—This page displays all previously configured email configurations. You must create an email configuration so ElectricFlow can communicate with your mail server to send email notifications
- **Database Configuration**—If you do not use the ElectricFlow-supplied default database, use this page to configure another database to communicate with ElectricFlow. See the *ElectricFlow Installation Guide* for a list of approved databases for use with ElectricFlow.
- **Plugins**—This subtab displays the Plugin Manager page. A *plugin* is a collection of one or more features that can be added to ElectricFlow. Numerous plugins are bundled and installed with ElectricFlow, integrating third-party products seamlessly with ElectricFlow. For example, Source Code Management plugins are installed and so that you can configure your preferred SCM to communicate with ElectricFlow.

- **Server**—This page displays overall information about the ElectricFlow server. Use the Settings or Access Control links to make changes.
- **Source Control**—This page displays all SCM (source code management) configurations you have created to communicate with ElectricFlow.
- **Defect Tracking**—This page displays previously configured Defect Tracking systems known to the ElectricFlow server. Use plugins to integrate ElectricFlow with numerous defect tracking systems.

Go to [Scenario 1](#).

## Getting Started—Scenario 1—Creating a Simple Procedure

To begin, select the Projects tab, then the **Create Project** link at the top of the table. You need to create a project to contain the procedures you create.

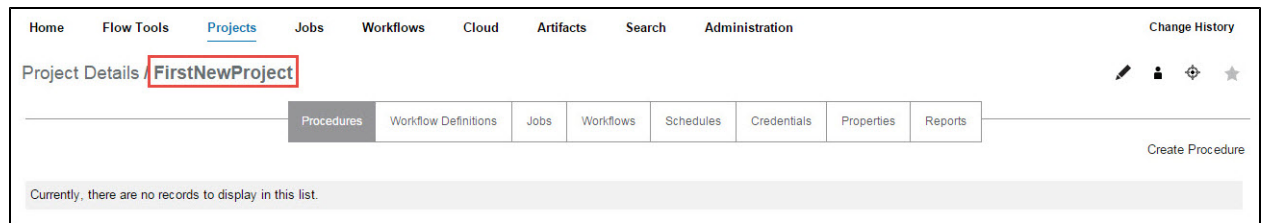
On the New Project page, enter information in the fields as follows:

Field Name	Description
Name	Type a unique project name. You may want your project names to reflect the work groups or teams that will be using them. For example, you might set project names based on the products they support.  For our scenario examples, we will use "FirstNewProject" for our project name.
Description	Enter a text description for your reference if you choose. ElectricFlow does not use or interpret this information.
Default Resource	(optional) For the purpose of "getting started", leave this field blank to use the Default resource already created during the ElectricFlow installation.
Default Workspace	(optional) For the purpose of "getting started", leave this field blank to use the Default workspace already created during the ElectricFlow installation.

Click **OK** to save the information you entered.

After clicking **OK**, you see the Project Details page and the name of the new project adjacent to the page title.

- For our scenarios, the project name is FirstNewProject.
- Your new project name will appear on the Projects page also.



**Scenario requirement:** No additional requirements for this scenario. This scenario uses the *local* agent (resource) that was included on your local machine when ElectricFlow was installed.

## Overview

This scenario establishes that ElectricFlow and its components were installed successfully and guides you through creating a simple procedure with a parameter that will echo Hello World. After you create this procedure, you will run the procedure and review the results.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

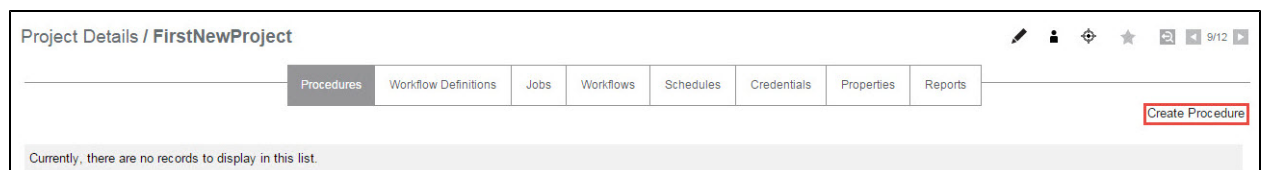
- Projects
- Procedures
- Steps
- Parameters
- Jobs
- Navigating the Job Details web page

## Begin Scenario 1

### Step1. Select the Projects tab

On the Projects page, you can see the default projects installed during the ElectricFlow installation and the new project you just created.

Select your new project name to go to its Project Details page, then click the **Create Procedure** link.



## Step 2. Create a procedure

On the New Procedure page, you need to be concerned with the section of the page illustrated below only.

Enter the following information:

Field Name	Description
Name	For this scenario, <code>Hello World</code> is the procedure name. At a later time when you are creating your own procedures, you can choose any unique name that is most meaningful for procedures in your project.
Description	(optional) Enter a text description for your procedure if you choose to do so.
Default Resource	Use the Browse link and choose <code>local</code> . Using <code>local</code> accesses the agent installed during the ElectricFlow installation. At a later time after you have configured other resources, your Browse list could contain many choices.

Your New Procedure page will look similar to the following:

Project: FirstNewProject
New Procedure
★

Name: Hello World

Description: my first procedure

Job Name Template:

Default Resource: local Browse

Before leaving this page, notice the "breadcrumb" in the top-left corner. Most ElectricFlow web pages contain a breadcrumb for easy return to the previous page.

Click **OK** to continue.

After clicking **OK**, ElectricFlow takes you to the Procedure Details page—this is the page you use to add important information to your procedure. When your procedure contains steps, parameters, or email notifiers, and so on, those objects will be displayed here for your reference.

### Step 3. Create a parameter

An ElectricFlow procedure can define one or more parameters. These parameters are similar to the parameters of a subroutine in a programming language. Parameters allow you to define a "reusable" procedure by using symbolic variable names in place of a single, fixed value. When you run the procedure, you can type in a value to use for that particular job. You can refer to the parameter in a step for a procedure, using the standard ElectricFlow "property reference syntax"—`$(...)`.

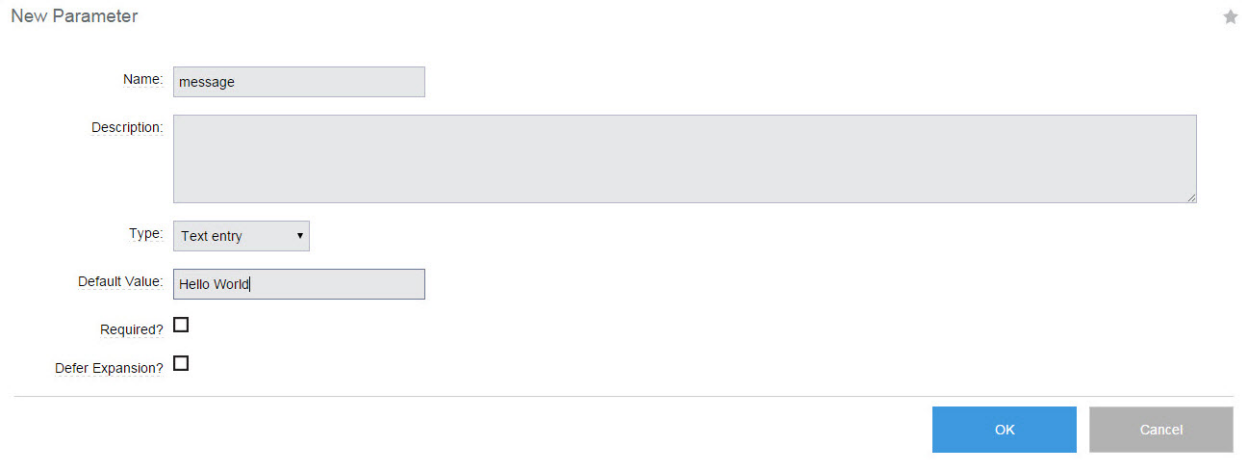
For example, see **Step 4**, specifically the text in the Command(s) text box.

On the Procedure Details page, click the **Create Parameter** link to go to the New Parameter page.

Enter the following information:

Field Name	Description
Name	Enter the parameter name <code>message</code> for this scenario.
Type	Use the default <code>Text entry</code> for the parameter type.
Default Value	Type-in <code>Hello World</code> for the default parameter value.

Your New Parameter entries will look like the following:



Click **OK** after filling in the fields and ElectricFlow returns you to the Procedure Details page.

#### On the Procedure Details page:

Notice the Parameters table is populated with your parameter entry.

Procedure Details / **Hello World**

Procedure Steps

New Step: Command | Subprocedure | Plugin | Custom

Currently, there are no records to display in this list.

Parameters

Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
message	Hello World	entry			

Email Notifiers

Create On Start Email Notifier | Create On Completion Email Notifier

Currently, there are no records to display in this list.

Custom Procedure Properties

Create Property | Create Nested Sheet | Access Control

Property Name	Value	Description	Actions
ec_customEditorData			

Also notice the name of the procedure we created (Hello World) is shown adjacent to the page title for your reference.



You can use the DSL Export ( ) button to download the objects as a DSL file.

Step 4. Create a step

Now we can create a step on this procedure. On the Procedure Details page, to create a New Step for our current purpose, click the **Command** link to go to the New Step page.

On the New Step page:

The following screen displays the portion of the New Step page you need for this scenario.

Notice this version of the New Step page contains a Command text box to enter the information you need. At a later time, when you choose to create a different step type, the New Step page will be populated with the appropriate fields required for that step type.

Enter the following information:

Field Name	Description
Step Name	Use <code>Print message</code> for the step name. For work outside this scenario, you can enter any unique name of your choice for the step name.
Description	(optional) Add a text description about this step if you need one.



Field Name	Description
Command(s) box	<p>Type <code>echo \${message}</code></p> <p>In this command, <code>message</code> refers to the parameter we created.</p> <p><b>Note:</b> The ElectricFlow Server does not actually interpret (or even understand) the contents of this field. ElectricFlow simply expands all property references and then passes the resulting text block to the ElectricFlow Agent. The Agent copies the text block to a temporary file and then invokes the Agent's native shell command, passing the name of the temporary file as a parameter to the shell command. The overall result is the same as if you had created this block of text as a BAT file (on Windows) or a shell script (on Linux). The operating system of the Agent machine takes over from that point to actually run your commands.</p>
Resource(s)	<p>For this scenario, leave this field blank to use the default resource you set on the procedure. If multiple resources are configured, you have the option to change the resource for each step if you prefer.</p>

Your New Step page will look like the following example:

New Step

General

Name:

Print message

Description:

Command

Command(s):

echo \${message}

Resource:

Postprocessor:

Click **OK** to create the step and ElectricFlow returns you to the Procedure Details page to see its entry as displayed in the next screen example.

Procedure Details / Hello World

Procedure Steps

New Step: Command | Subprocedure | Plugin | Custom

Step Name	Resource	Action	Parallel	Time Limit	Actions
Print message		echo \${message}			

Parameters

Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
message	Hello World	entry			

## Step 5. Run the procedure

Notice the Run-arrow icon among the links at the top of the tables. If you click the **Run** link, the procedure will run as-is immediately.

For this scenario, hover your mouse over the adjacent down-arrow and select the **Run...** option.

Selecting this option provides the Run Procedure page where you can add or modify the parameter values as necessary.

Run Procedure / Hello World

Parameters

message: Hello World

Advanced

Priority: normal

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

Run Cancel

The Run Procedure page has the information we want for this scenario, so click the **Run** button.

When a procedure runs, it creates a "job".

After clicking **Run**, ElectricFlow takes you to the Job Details page to see the status of the "job" and watch its running progress.

This web page supplies a wealth of other information.

Job Details / job\_6\_20150711160208

**Completed with Success**  
 Start Time: 2015-07-11 16:02:08 PDT  
 Elapsed Time: 00:00:00.693

Project: FirstNewProject  
 Procedure: Hello World  
 Launched by: admin  
 Priority: normal

View: All ▾

Steps | Diagnostics | Parameters | Properties | Notifiers | Published Artifact Versions | Retrieved Artifact Versions

Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
Print message			Completed with Success	00:00:00.157	local

The Job Details page contains two sections. The section at the top of the page is the job's summary, displaying the job's status and other general information:

- The "green check" icon is displayed to show the job completed successfully.
- The "Completed with Success" section displays the result of the procedure that ran.
- The General Information section displays the project and procedure names and who launched the job.

The section below the summary area displays detailed job information, including tabs to expand information and links to access various other ElectricFlow web pages.

- Notice the "Success" entry in the Status column—this is your step result.
- In the Log column, click the icon in the Print message row to see the outcome/result of your Hello World Print message step. Your file will look similar to the following:

```
Job: job_6_20150711160208

Workspace File / Print message.db7dd766-2820-11e5-8679-0050568f747c.log

Hello World
```

- Select the Parameters tab to see the parameter you created and its value.

For complete information about the Job Details page functions and available information, click the **Help** link in the top-right corner of this ElectricFlow web page.

## Scenario Extension—Adding Another Step

Each procedure you create can contain as many steps as you need. We created only one step in this scenario. This example shows how to modify a procedure by adding additional steps. You can always add more steps or edit an existing step before you run a procedure again.

To add a step to an existing procedure:

1. On the Job Details page, select your procedure name (at the top of the page) to go to the Procedure Details page.
2. On the Procedure Details page, click the **Command New Step** link again.
3. On the New Step page, enter information in the fields as follows:

- **Name**—Print Step Info
- **Command(s)**—Enter the following text:  

```
print "This step was launched by ${launchedByUser} on the resource
${/myResource/resourceName}.\n";
```
- **Shell**—ec-perl
- Click **OK** to save the step and return to the Procedure Details page.

**Note:** You can move this new step to the top of the procedure by hovering your mouse over the icon next to the step name, then drag-and-drop the step to the top of the list. This is a useful function particularly if you find you have created steps in a different order in which you need them.

Click **Run** (from the Procedure Details page).

## Finding an ElectricFlow Automation Platform Web Page

If you "lose" the Job Details page or any other ElectricFlow web page, several navigation methods are available:

- Use your browser's Back button if you were recently on a page you want to revisit.
- Use ElectricFlow "breadcrumbs." On some pages you see breadcrumbs on the left-side of the page that note your current position/level within the project.
- Use the tabs at the top of the page to drill-down to the page you need.

For example:

- **To find the Job Details page:**  
 Select the Jobs tab and notice that your procedure name is now listed in the Job column, accompanied by a date, job number, and other related job information on the same row. When you run a procedure, it becomes a job. Select the job you want to see and you will go to the Job Details page for that job.
- **To find the Procedure Details page:**  
 Select the Projects tab, then select your project to go to the Project Details page to see a list of procedures in that project. Click on a procedure to go to the Procedure Details page for that procedure.

**Note:** A "project" is a container for all related procedures you create. You can create as many projects as you need, using the **Create Projects** link on the Projects page.

As you use ElectricFlow, you will quickly learn other navigation paths for your particular interests. In addition, most ElectricFlow web pages contain a "star" icon in the upper-right corner. Click this icon to add that page to your Home page for quick "one-click" access in the future.

## Summary

This simple `Hello World` procedure demonstrated how to quickly create a procedure and how any command can be wrapped and parameterized using an ElectricFlow procedure. If you have an existing script you want to automate, you can call that script within a step command block. This scenario also introduced you to running a job, entering parameters for the job, and viewing results for the job you ran.

Go to [Scenario 2](#)

## Getting Started—Scenario 2—Creating a Procedure That Uses an SCM

**Scenario requirements:** Before you begin this scenario, ElectricFlow needs to be able to access your Source Control Management (SCM) system.

### To set up a Source Control system (SCM) to use with ElectricFlow, you need:

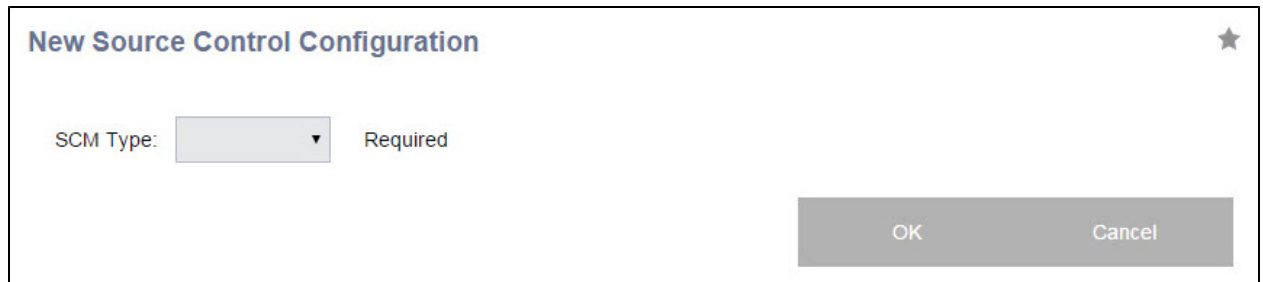
- a running SCM system
- an active source depot in your SCM system
- an ElectricFlow agent that can communicate with your SCM server

**Note:** If the machine where you installed ElectricFlow can communicate with your Source Control (SCM) server, this requirement is met. *If not*, return to the installation executable file and run the ElectricFlow Agent install program on a machine that has access to your SCM system.

**To install ElectricFlow agent software on another machine**, copy the installation executable file to that machine, then double-click on the file to run the installation program. Select Express Agent when the install window opens.

When installation is complete, configure this new agent as an ElectricFlow Resource. See the beginning of [Scenario 4](#) for more information.

- Configure ElectricFlow to communicate with your SCM system.
- Select the Administration tab, then the Source Control subtab.
- The Source Control Configurations page displays a table listing Source Control configurations after you create them. Click the **Create Configuration** link and the following web page is displayed.



New Source Control Configuration

SCM Type:  Required

OK Cancel

- On the New Source Control Configuration web page, use the drop-down menu to choose your SCM type.  
For our example, we chose **Perforce**.
- Depending on which SCM you choose, the page expands to display appropriate fields for entering values to configure your SCM.

See the next screen example.

Enter information in the fields as follows:

- Configuration Name—For our example, we use the name, "p4". You can choose any name for your SCM Configuration.

**Note:** You will need this name later, so remember the name you choose for your SCM configuration. A configuration name is important because you may want to create more than one source control configuration.

- P4PORT—For our example, we use p4:3710 to designate the P4PORT. Your specification will be different.

**Important:** Other fields remain blank to use the defaults, but you may need to specify some or all information in the remaining fields depending on how your internal systems and access are set up for access to your SCM system.

**New Source Control Configuration** ★

SCM Type:  Required

Configuration Name:  Required

Description:

Login As:

User Name:

Password:

Retype Password:

P4PORT (host:port):

P4TICKETS:

P4CHARSET:

P4COMMANDCHARSET:

P4HOST (override):

Debug:

OK Cancel

Click **OK** after filling in the fields.

For additional help with this ElectricFlow web page, click the **Help** link in the top-right corner of the web page.

## Overview

This scenario guides you through creating a common build process integrated with your SCM system and build utility. And you will learn how to navigate and modify the procedure definition using the ElectricFlow Procedure Details web page.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

- Source control configuration
- Creating more complex steps
- Creating a build process
- Navigating the Procedure Details web page

## Begin Scenario 2

### Step 1. Select the Projects tab

On the Projects page, select the project name you created in Scenario 1 (in the first column) to go to the Project Details page, then select the **Create Procedure** link to begin.

### Step 2. Create a procedure

On the New Procedure page, enter a Procedure Name (required).

You can use any unique name you choose. Do not use the same procedure name you chose for Scenario 1.

Procedure names within the same project must be unique.

- Name—For this scenario, we use `Basic Build` for the procedure name.
- Default Resource—Use `local` for the resource name.

Click **OK** to go to the Procedure Details page.





You can use the DSL Export ( ) button to download the objects as a DSL file.

### Step 3. Create a parameter

On the Procedure Details page (illustrated above), click the **Create Parameter** link to go to the New Parameter page.

- **Name**—For our example, the parameter name is `target`. You can choose any unique name of your choice for your parameter name—parameter names must be unique within a procedure.
- **Default Value**—We chose `jar` for this value.

Click **OK** to continue and to return to the Procedure Details page to see the parameter you just created.

### Step 4. Create a step to “checkout” source files from your SCM system

From the same Procedure Details page, click the Plugin link to create a New Step.

- In the Choose Step dialog, select Source Code Management from the left pane.
- Next, select ECSCM-Perforce from the list, then select "Perforce—Checkout" from the right pane.
- Click **Close** to go to the New Step page, which will be populated with the fields you need to enter for the Perforce SCM.

Both the Subprocedure and the Parameters sections are populated with fields to enter information so ElectricFlow can communicate with your Perforce SCM system, using the ElectricFlow Perforce plugin.

**Note:** Depending on the SCM you chose to work with, including Perforce, the New Step screen you see may be different than the following example. If you need additional help configuring your SCM, see the corresponding SCM plugin on the Plugin Manager page. Each plugin has its own Help topic.



New Step

General

Name:

checkout

Description:

Command

Subprocedure

Subprocedure:

ECSCM-Perforce : CheckoutCode

Change

Resource:

Parameters

Configuration:

default

Required

Source Type:

Client Template

Required

Sync Type:

Standard Sync

Required

Client Template:

default

Required

Workspace Name Postfix:

Destination Directory:

project

Changelist (or Label):

Generate changelog report:

☒

Last Snapshot:

Updates File:

Parallel Sync:

☐ threads=10

Forced Sync:

☐

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique name for your subprocedure step. For this scenario, the step name we supplied is checkout.







Field Name	Description
Description	(Optional) Enter a text description for this step.
<p><b>In the Subprocedure section:</b></p> <p>This section displays the subprocedure name or a plugin name because the plugin is being called as subprocedure.</p> <p><b>Note:</b> The plugin name defined: "EC" is for Electric Cloud, "SCM" identifies the plugin as belonging to the Source Control Management category, and "Perforce" identifies the name of the source control system.</p> <p>Our example illustrates the fields for the Perforce SCM plugin. Your fields will be different if you are using a different SCM. These parameter fields request some of the same values you already specified when you created the Source Control Configuration.</p>	
ECSCM-Perforce	Clicking this link takes you to the Project Details page for the plugin. Generally, and for this scenario, you do not need to access this page to make changes—it is for your reference only.
CheckoutCode	Clicking this link takes you to the Procedure Details page for this procedure. Generally, and for this scenario, you do not need to access this page to make changes—it is for your reference only.
Change	<p>Clicking this link displays a dialog that allows you to change the project, plugin, or subprocedure. If you make a change in the Change Subprocedure dialog, the Subprocedure and Parameters sections on the New Step page will update automatically with corresponding fields for your new choice.</p> <p><b>Note:</b> All SCM plugins that can checkout code contain the <code>checkoutCode</code> procedure.</p>
Resource	The <code>local</code> resource was specified earlier. If this field remains blank, the <code>local</code> resource is used.
<p><b>Note:</b> The following two parameter fields are common among all SCM plugins:</p>	
Configuration	The name of your Source Control Configuration.
dest	The destination where you want to put your checked-out code—it is the directory within your job workspace. Each job adds a new directory to the workspace. At this point, you have not defined multiple workspaces, so the ElectricFlow default workspace is used.

For more information about workspaces, see the "[Workspaces and Disk Space Management](#)" Help topic.

Click **OK** after entering values and to continue to the Procedure Details page, which should now look similar to the following example:








Procedure Details / Create Running Instance on EC2 - Te

New Step: Command | Subprocedure | Plugin | Custom

Step Name	Resource	Action	Parallel	Time Limit	Actions
determine platform		use ElectricCommander; my \$ec = new ElectricCommander(); ...			  
Run Instance on EC2		EC-EC2.API_RunInstances			  

Parameters

Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
config	realMoneyAmazon	entry			
group	chef	entry			
instanceType	m1.medium	entry			
keyname	chronic3useast	entry			
platform	linux	select	✓		
resultsLocation	/myWorkflow/EC2info	entry			
zone	us-east-1a	entry			



Email Notifiers

Create On Start Email Notifier | Create On Completion Email Notifier

Currently, there are no records to display in this list.

Custom Procedure Properties

Create Property | Create Nested Sheet | Access Control

Property Name	Value	Description	Actions
ec_customEditorData			 

The Procedure Details page now displays the name of our new procedure, Basic Build, and its new `checkout` step using the Perforce SCM, and the `target` parameter with the `jar` value.

## Step 5. Create a step to run the build

This step can be another subprocedure step, a command step, or a custom step. Any procedure can contain multiple types of steps, any of which may be either simple or complex.

Steps can contain or use:

- parameters and/or properties
- many of your existing scripts, including shell scripts

For this step example (to run the build), we will create an `Ant` step. To invoke Ant, you could write a script that calls Ant directly, or you could call the ElectricFlow Ant plugin to invoke the `runAnt` procedure. For this example, we will use the ElectricFlow Ant plugin.

- From the Procedure Details page, click the **Plugin** link to see the Choose Step dialog and select the Build category.
- Select the EC-Ant plugin to see and select the "Ant—Run Ant" step.
- When the New Step page is displayed, notice the Subprocedure section is populated with the chosen EC-Ant plugin, and the Parameters section provides the appropriate fields for this Ant step.

New Step

General

Name: AntBuild

Description:

Command

Subprocedure

Subprocedure: EC-Ant : runAnt Change

Resource:

Enter information in the fields as follows:

Field Name	Description
Name	For this example, we specified <code>AntBuild</code> for the step name. You can use any unique name you choose for this step.
<b>Subprocedure section:</b> Note the EC-Ant plugin project name and the <code>runAnt</code> procedure name.	
Resource	Leave this field blank to continue using the local resource.
<b>Parameters section:</b>	
Build File	Use <code>build.xml</code> .
Target	For this example, we used <code>\${target}</code> .
Working Directory	For this example, we used <code>project</code> .

For this scenario, we leave the remaining fields blank, but you may need to enter additional information depending on your Ant invocation.

Click **OK** to continue and return to the Procedure Details page.

The following screen example illustrates the two steps we created for this scenario.

Procedure Details / <b>Basic Build</b>						
Procedure Steps			New Step: Command   Subprocedure   Plugin   Custom			
Step Name	Resource	Action	Parallel	Time Limit	Actions	
checkout		ECSCM-Perforce:CheckoutCode				
AntBuild		EC-Ant:runAnt				

## Step 6. Running the procedure

On the Procedure Details page, hover your mouse over the small down-arrow on the right-side of the **Run** link, choosing **Run...**

- **Run Immediately**—This option runs the procedure immediately as set.
- **Run...**—This option displays the Run Procedure web page where you may alter any existing parameters for this procedure, or set an existing credential.

**Note:** This scenario does not introduce you to the Advanced section of the Run Procedure page. For more information on these topics, click the **Help** link in the top-right corner of the Run Procedure page.

Run Procedure / **Basic Build**
★

**Parameters**

target:

---

**Advanced**

Priority:

Impersonation:
☒ Use pre-defined credential
☐ Use specific credential
☐ Use a specific user

Click **Run** to run the procedure and continue to the Job Details page to see the status of your running job.

## Step 7. On the Job Details page

The Job Details page now displays the status and results of running the Basic Build procedure.

Your Job Details page will look somewhat different if you supplied other values in this scenario.

Job Details / Job\_7\_20150711170511

**Completed with Success**  
Start Time: 2015-07-11 16:02:08 PDT  
Elapsed Time: 00:00:00.693

Project: FirstNewProject  
Procedure: Basic Build  
Launched by: admin  
Priority: normal

Steps

Diagnostics
Parameters
Properties
Notifiers
Published Artifact Versions
Retrieved Artifact Versions

View: All
Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
checkout		Completed with Success	00:00:01.293		
checkoutMethod		Completed with Success	00:00:01.293		
runMethod		Completed with Success	00:00:01.397	local	
AntBuild		Completed with Success	00:00:01.482		
createCommandLine		Completed with Success	00:00:01.210	local	
runCommandLine		Completed with Success	00:00:00.060	local	

Records per page: 100
1 thru 6 of 6

## More about the Job Details page

- The General Information section at the top of the table provides links back to the **Project > Procedure** that was launched to create this job.
- Click on a Step Name to go to the Job Step Details page.
- Click the Parameters tab to see parameters in this job.
- If there are errors, the Diagnostics tab has specific information.

## More about the Procedure Details page

To go to the Procedure Details page at any time:

- Select the Projects tab.
- Select the Project name (that contains the procedures you want to see) to go to the Project Details page.
- Select a Procedure name to go to the Procedure Details page.

You may want to review to the Procedure Details page frequently because it displays the steps that make up your procedure, the parameters contained in the procedure, email notifiers, and so on. Full edit capabilities are available by selecting any object (step, parameter, and so on).

Also, you can run this procedure again “on demand” by clicking the **Run** link at the top of the page.

For more information about the Procedure Details page functions, click the **Help** link in the top-right corner of the Procedure Details page.

### Scenario extension—Add a step to show workspace contents

If you are curious about what your current default workspace contains at this point, you can create a step to see the workspace.

- Select the Projects tab, select FirstNewProject (or your project name if you used something different), select the Basic Build procedure name.
- Click the **Command** link to create a New Step—a new *command* step.
- The New Step page is displayed with a Command text box.
  - For Name, use `seeWorkspace`.
  - In the Command(s) text box:
    - for Windows—type `dir /s`
    - for Linux—type `ls -r`
- Click **OK** to create the step and go to the Procedure Details page.
- Click **Run** to create the job and to go to the Job Details page.

When the job is completed, click the log icon in the Log column to see the contents of the current workspace for this procedure. Your Workspace File will be similar to the following example:

Job: job\_7\_20150711170511

### Workspace File – seeWorkspace.1375.log

Volume in drive N has no label.  
Volume Serial Number is EAB8-74CE

Directory of N:\job\_7\_20150711170511

07/11/15	09:43 AM	<DIR>	.
07/11/15	09:43 AM	<DIR>	..
07/11/15	09:43 AM	<DIR>	project
07/11/15	09:43 AM		2,770 runMethod-checkoutCode-1377.log
07/11/15	09:43 AM		0 seeWorkspace.1375.log
		2 File(s)	2,770 bytes

Directory of N:\job\_7\_20150711170511\project

07/11/15	09:43 AM	<DIR>	.
07/11/15	09:43 AM	<DIR>	..
07/11/15	09:43 AM		1,141 build.xml
07/11/15	09:43 AM		338 Makefile
07/11/15	09:43 AM		338 Makefile2
07/11/15	09:43 AM	<DIR>	src
		3 File(s)	1,817 bytes

Directory of N:\job\_7\_20150711170511\project\src

07/11/15	09:43 AM	<DIR>	.
07/11/15	09:43 AM	<DIR>	..
07/11/15	09:43 AM		144 HelloWorld.java
		1 File(s)	144 bytes

Total Files Listed:  
6 File(s) 4,731 bytes  
8 Dir(s) 244,679,413,760 bytes free

## Summary

This scenario demonstrated how easily ElectricFlow can integrate with your SCM system and build utilities.

Go to [Scenario 3](#)

## Getting Started—Scenario 3—Notification, Scheduling, and Reporting

**Scenario requirements:** For this scenario, you need to set up an Email Configuration to use the email notification feature.



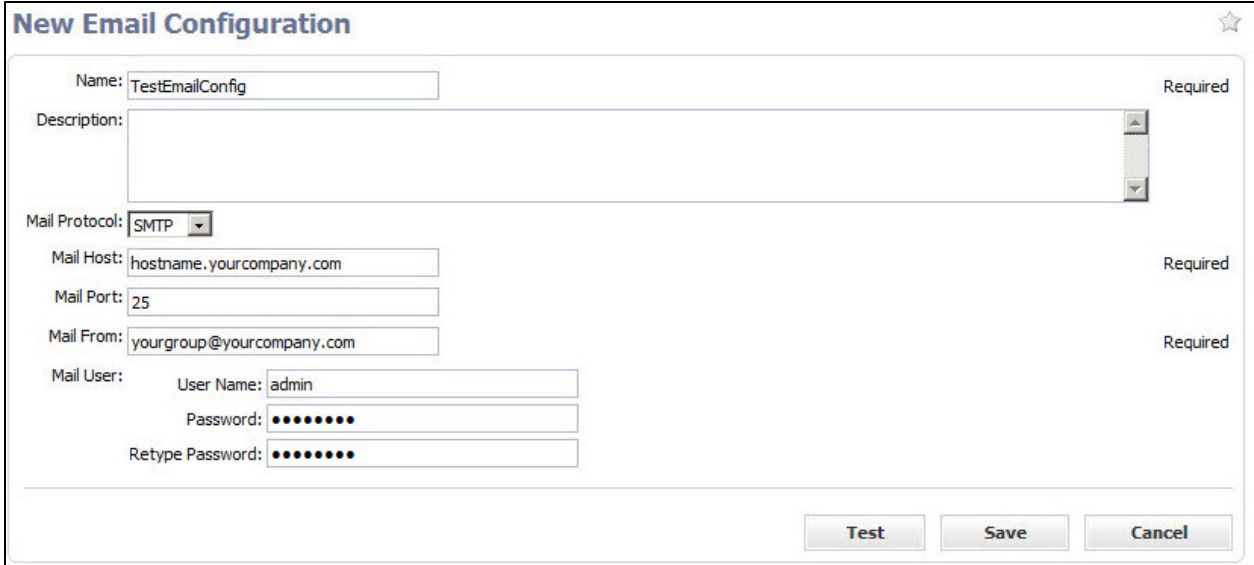
**To set up an Email Configuration:**

- Select the Administration tab, then select the Email Configurations subtab.  
You will see a blank Email Configurations page. As you create one or more email configurations, they will be listed in table format on this page.
- Click the **Add Configuration** link.

On the New Email Configuration page, enter information in the fields to define your mail system.

Name	New Version	Status
Name	Enter a unique name for your email configuration.	
Description	Optional) Enter a text description for your reference.	
Mail Protocol	Use the drop-down arrow to make a selection.	
Mail Host	Enter the name of your mail host.	

Enter information in the remaining fields according to the specifications you need. Your New Email Configuration page should look similar to the following example:



**New Email Configuration** ☆

Name:  Required

Description:

Mail Protocol:

Mail Host:  Required

Mail Port:

Mail From:  Required

Mail User:

User Name:

Password:

Retype Password:

Click **Save** after filling in the fields or click the **Test** button first if you want to make sure your email configuration works.

Enter an email address in the pop-up box and click **Send**.

**Note:** For additional help with this ElectricFlow page, click the **Help** link in the top-right corner of the page.

## Overview

This scenario guides you through creating an email notification, invoking your build process with a timed (standard) schedule, invoking your build process using a continuous build integration trigger, and introduces ElectricFlow reporting features.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

- Creating an email configuration
- Creating an email notifier
- Creating schedules
- Creating reports

## Begin Scenario 3

### Step 1. Creating an email notifier

On the Procedure Details page for the Basic Build procedure, click the **Create On Completion Email Notifier** link to begin. This link takes you to the New On Completion Email Notifier page.

**Procedure Details – Basic Build** Run Edit Access Control 1/2

**Procedure Steps** New Step: Command | Subprocedure | Plugin

Step Name	Resource	Action	Parallel	Time Limit	Actions
checkout		ECSCM-Perforce-1.1.11.40415:CheckoutCode			Copy   Delete
AntBuild		EC-Ant-1.0.3.40250:runAnt			Copy   Delete
seeWorkspace		dir /s			Copy   Delete

**Parameters** Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
target	jar	entry			Delete

**Email Notifiers** Create On Start Email Notifier **Create On Completion Email Notifier**

Currently, there are no records to display in this list.

Two email notifier types for jobs or job steps:

- On Start Notifier–Sends an email when a job or job step starts.
- On Completion Notifier–Sends an email when a job or job step completes.

The fields for each of these notifiers are similar, but we chose the On Completion notifier because you may find you use this one more frequently.


#### On the New On Completion Email Notifier page:

Enter information in the fields as follows:

Field Name	Description
Name	For this example, we use <code>BuildTeam</code> . This name can be an arbitrary text string.
Description	(Optional) Enter a text description for your reference. ElectricFlow does not use or interpret this information.
Condition	Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty, non-zero, or "true", the message is sent. If the result is "0" or "false", the message is not sent.

Field Name	Description
Formatting Template	<p>For this example, choose the "Job summary HTML" notification template, or you can use the drop-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different.</p> <p>To customize your template, edit the auto-supplied text in the Formatting Template text box, or you can add a completely new template for your purpose. <b>Note:</b> Any edits made in this text box will not be saved to the global template, and the template will appear as a Custom template when you return to this notifier definition. Additionally, make sure the content is formatted correctly, i.e., no illegal characters or spacing.</p>
Email Configuration	Use <code>TestEmailConfig</code> , the email configuration we created.
Destinations	This is a space-separated list of valid email addresses, email aliases, or ElectricFlow user names, or a property reference that expands into such a list.

After filling in the fields, your page may look similar to the following example:

**New On Completion Email Notifier** 

Name:  Required

Description:

Condition:

`$/javascript if(getProperty("outcome") == 'error')`  
`true;`  
`else`  
`false;`

Formatting Template:

Subject: Job '\$[jobName]' from procedure '\$[procedureName]' \$[/myEvent/type] - Commander notification Required

`$/server/ec_notifierTemplates/Html_JobTempl/body]`

Email Configuration:

Destinations:  Required

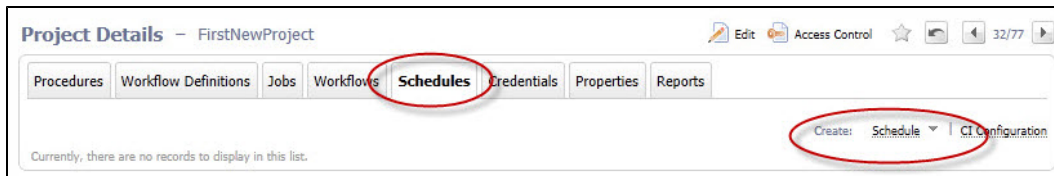
Click **OK** to create your email notifier and to return to the Procedure Details page, where you can now see the Email Notifier you created.

**Note:** For more information, see the [Email Notifiers](#) Help topic.

## Step 2. Creating a standard schedule

To create a standard "timed" schedule:

- Select the Projects tab.
- Select your project name to go to the Project Details page.
- Select the Schedules subtab, then select the down-arrow to the right of the "Schedule" link, and choose "Standard Schedule" to go to the New Schedule page.



### On the New Schedule page:

The following is an example of the New Schedule page.

- Notice the "breadcrumb" above the New Schedule page title—this entry displays the name of the project that will contain this schedule.
- After entering a name (unique within your project) for your schedule (we chose "Sentry-MainBuild"), choose the procedure your schedule will run.
  - Click the **Change** link adjacent to the Procedure field.
  - In the pop-up menu, leave the Current project selected.
  - Place your cursor in the Procedure field to see a list of procedures in your project.
  - Select the procedure you want this schedule to run. We chose "Basic Build".

Project: FirstNewProject

New Schedule

General

Name:

Sentry-MainBuild

Procedure:

FirstNewProject : Basic Build

Change

Description:

Parameter

target:

jar

Frequency

Run at 00:00.

Days:

☒ Every Day

☐ Once

☐ Days of Week

☐ Days of Month

☐ Custom

Repetition:

Run Once

at

(hh:mm)

Advanced

Enabled:

☒

Misfire Policy:

Ignore the missed triggers and wait for the next scheduled time

Time Zone:

[- Default -]

Priority:

normal

Impersonation Credential

Credential Project:

☒ Current

☐

Browse

Credential Name:

Browse

OK

Cancel

Enter information in the remaining fields as follows:

Field Name	Description
Description	(optional) A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
<b>Parameters</b> section  If the procedure has parameters, enter their values in this section. The procedure cannot execute unless all required parameters are provided.	

Field Name	Description
<b>Frequency section</b>  "Run at" is a summary section: As you make selections for the following Days and Repetition sections, a summary of what you selected appears here.	
Days	Select weekdays, month days, or create a custom frequency when you want the schedule to run.  <b>Note:</b> The "day" applies to the start time if the time range spans two days, that is, if the time range crosses the midnight boundary.
Repetition	If Run Once—the schedule will run once per selected day, at the time you specify.  If Run Every—the procedure will execute repeatedly during the specified time range. For example, if you select a time range from 11:00-14:00 and an interval of 40 minutes, the procedure will execute 5 times on each of the selected days: at 11:00 am, 11:40 am, 12:20 pm, 1:00 pm, and 1:40 pm.  If Run Continuously—as soon as one job ends, the scheduler will trigger immediately to run the job again.
<b>Advanced section</b>	
Enabled	If this box is "checked," the schedule will run. You can disable this schedule whenever necessary.

**Note:** For this scenario, you do not need to enter information for any remaining fields. Later, when creating an actual timed schedule for one of your procedures, refer to the Help topic for this page for more information.

Click **OK** to save your information and create this schedule.

At any time, you can return to the Project Details page for this project, select the Schedules subtab, and then select the Schedule Name from the table to go to the Edit Schedule page to modify this schedule.

## Step 2a. Creating a continuous integration build trigger

At a later time when you have procedures and steps created to do the work you need, you may prefer implementing continuous integration build configurations for your software builds. Unlike a standard schedule that runs on days and times you specify, a continuous integration build can be triggered to run each time code is checked into your source code management (SCM) system.

Adding a project to the Continuous Integration Dashboard is quick and easy. Each project can have one or more CI configurations, depending on the number of source branches you want to monitor. After the simple

configuration process, you can visually see status and other information about your continuous integration jobs as builds are triggered to run.

To find the Continuous Integration Dashboard, select the Home tab, then select the Continuous Integration subtab. The dashboard will be empty until you start adding projects. For help using the Continuous Integration Manager and Dashboard, click the **Help** link in the upper-right corner of the dashboard web page.

### Step 3. Creating a report

ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.

Summary of available report types:

- Real-time reports—filtered view of your ElectricFlow data in real-time
- Build reports—summary reports produced at the end of a build and attached to the job
- Batch reports—summaries of your build environment with trends over time, two types:
  - Default Batch reports—automatically installed during ElectricFlow installation and scheduled to run daily (Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)
  - Optional Batch reports—you can configure and schedule these reports to fit your requirements (Category, Procedure Usage, Count Over Time, or Multiple Series reports)
- Custom reports—your choice to create and add at any time

**Note:** Batch and Custom reports must be run on the ElectricFlow server agent (local agent) only. These reports use the BIRT report engine, which is installed only on the ElectricFlow server.

#### Defining a “saved” search

Before you create a report, you need to define a “search” to focus the report on the information you want to see.

- Select the Search tab to go to the [Searching and Filtering page](#).

Enter information in the fields as follows:

Field Name	Description
Object Type	Use the drop-down menu to select the object you wish to search.
Criteria	<p>Click <b>Add Criteria</b> one or more times to further define the sort criteria for your search.</p> <ul style="list-style-type: none"> <li>• Use the drop-down arrow to select a criteria argument. These arguments are properties. For a description of any of these properties, see the <a href="#">Properties</a> Help topic.</li> <li>• Use the drop-down arrow to select an operator for the search.</li> <li>• To narrow your search, enter an actual object name. For example, if you selected Project Name to begin your search, you might want to enter the actual project name in this field or the first few letters if you have multiple projects named in a similar pattern.</li> </ul>



Field Name	Description
Custom Criteria	Not needed for this scenario.

Your Searching and Filtering page will look similar to the following example:

Search

Object Type: Job

Project Name

equals

FirstNewProject

Procedure Name

equals

Basic Build

Add Criteria 
Add Custom Criteria

OK

Cancel

Click **OK** after filling in the fields and to go to the Search Results page.


Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
job_98523338-57e5-11e6-8033-005056bb6bca_201608010543	Success	normal	FirstNewProject Basic Build	admin	00:01:07.369	2016-08-01 14:16:03 PDT	
job_7ef14362-54f5-11e6-b8a2-005056bb1fd4_201607281200	Success	normal	FirstNewProject Basic Build	admin	00:00:48.153	2016-08-01 14:16:01 PDT	
job_b94f57af-54e4-11e6-97e1-005056bb1fd4_201607281000	Success	normal	FirstNewProject Basic Build	admin	00:01:26.913	2016-08-01 14:16:00 PDT	
job_ea09cb91-582a-11e6-9e76-005056bb1fd4_201608011400	Success	normal	FirstNewProject Basic Build	admin	00:00:50.952	2016-07-21 08:00:06 PDT	
job_8b05e351-5822-11e6-9e76-005056bb1fd4_201608011300	Success	normal	FirstNewProject Basic Build	admin	00:00:33.412	2016-07-21 08:00:02 PDT	

Click **Save Report Filter** to see the Save Filter dialog box.

New Search | Save Report Filter | Edit Search | Refresh Search

In this dialog box, use the drop-down arrow to select the project name for your report, then enter a name of your choice for the filter. We used `BasicBuildFilter` for the filter name to tie the filter name to the Basic Build procedure for which we are creating a filter.

Save Report Filter

 **ATTENTION!**

Project Name: FirstNewProject ▼

Report Filter Name: BasicBuildFilter

OK
Cancel








Click **OK** to return to the Job Search Results page—now we are ready to define the report we want to see.

## Define the report

For this scenario, we will create an Optional Batch report. Select the Projects tab, select *your* project name to go to the Project Details page, then select the Reports subtab.

Click **Create Report**.

Project Details / FirstNewProject






 2/129 

Procedures
Workflow Definitions
Jobs
Workflows
Schedules
Credentials
Properties
Reports

Create Report

### On the Optional Batch Reports page:

For this scenario, select the Multiple Series report tab.

Enter information in the fields or select the appropriate values as follows:

Field Name	Description
Report Title	This is your report title. Type over the default report name, choosing any unique name for your report. We supplied <code>Basic Build Report</code> for our report name.
Saved Filter	Project—Click your mouse inside this field to see a list of projects from which to make a selection. We select our <code>FirstNewProject</code> project name.  Filter—Use the <code>BasicBuildFilter</code> we created earlier.

Field Name	Description
Time Period	Use the drop-down menu to select the time period.
Create thumbnail?	Check this box so you can view this report on your Home page. (We will create a "thumbnail" report view on your Home page at the end of this scenario.)
Object Type	Use the drop-down menu to select Job for this example.
<b>Table column choices</b>	
Chart Type	Use the drop-down menu to choose the chart type.
Function	Use the drop-down menu to choose the function you need.
Property Name	Use the default property value or delete the text and click your mouse in the blank field to see a list of possible properties. We chose "outcome" for this example.
Display Name	You can choose a different unique Display Name if you prefer to do so.
Stacked	Select this check box to see your report results "stacked" versus overlaid.
The "X" icon	Click this icon to delete any row you no longer need.
Add Series button	Select this button if you would like to create additional table entries for additional report information.
Chart Options	Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.

Your Multiple Series report page will be similar to the following example:

The screenshot shows a configuration window for a 'Multiple Series' report. At the top, there are four tabs: 'Multiple Series' (selected), 'Category', 'Count Over Time', and 'Procedure Usage'. Below the tabs, the following fields are visible:

- Report Title:** Multiple Series Report
- Project:** ==Select Project==
- Saved Filter:** Filter: [-None-]
- Time Period:** Yesterday
- Create thumbnail?** ☐
- Object Type:** Job

Below these fields is a table for configuring the data series:

Chart Type	Function	Property Name	Display Name	Stacked
Line	Average	elapsedTime	Elapsed Time	<input type="checkbox"/>

Below the table is an 'Add Series' button. At the bottom of the window are three buttons: 'Run Report' (blue), 'Create Schedule' (grey), and 'Cancel' (grey). On the left side, there are expandable sections for 'Chart Options', 'Table Options', and 'Advanced'.

- **Run Report button**—(information only for this scenario) this button takes you to the Job Details page to run the report immediately—one time only.
- Click the **Create Schedule** button—this button displays a box with a default schedule name you can change.

The screenshot shows a dialog box titled 'Enter Schedule Name'. It contains a text input field with the value 'RunReport\_MultiSeries\_Sched'. At the bottom of the dialog are two buttons: 'OK' (blue) and 'Cancel' (grey).

- Enter a name for the schedule—again, we tied the schedule name to the procedure name for which we want the report.
- Click **OK** to go to the Project Details page.

**Project Details – FirstNewProject** [Edit](#) [Access Control](#) [☆](#)

Procedures Workflow Definitions Jobs Workflows **Schedules** Credentials Properties Reports

Create: [Schedule](#) | [CI Configuration](#)

Schedule	Enabled	Procedure	Priority	Description	When to run	Time Zone	Actions
<a href="#">Basic Build Report Schedule</a>	<input checked="" type="checkbox"/>	<a href="#">EC-Reports:RunReport_MultiSeries</a>	normal		Run at 02:00.	America/Los_Angeles	<a href="#">Run</a>   <a href="#">Copy</a>   <a href="#">Delete</a>
<a href="#">Sentry-MainBuild</a>	<input type="checkbox"/>	<a href="#">Basic Build</a>	highest		Run at 00:00.	America/Los_Angeles	<a href="#">Run</a>   <a href="#">Copy</a>   <a href="#">Delete</a>

Now you can see the report you just created listed in the Schedules table.

Click the **Run** link in the Actions column to run this report and then go to the Job Details page.


**On the Job Details page**, you will see your report running.

When the report is generated, you will see a Links section in the summary section at the top of the Job Details page.

This section contains a link to the report you generated.

Click this link to see your report.

**Job Details – EC-Reports-1.1.3.36678-RunReport\_MultiSeries-1281** [Run Again](#) [Delete](#) [☆](#) [»](#)



**Completed with Success**  
 Start Time: 2011-04-12 15:46:08 PDT  
 Elapsed Time: 00:00:48.979

**General Information**  
 Project: [FirstNewProject](#)  
 Procedure: [EC-Reports-1.1.3.36678:RunReport\\_MultiSeries](#)  
 Schedule: [Basic Build Report Schedule](#)  
 Launched by: [admin](#)  
 Priority: normal

**Links**  
[Basic Build Report](#)

Steps Diagnostics Parameters Properties Notifiers

View: All [Expand All](#) | [Collapse All](#)

Step Name	Log	Status	Elapsed Time	Resource	Actions
<a href="#">RunCustomReport</a>	<a href="#">Log</a>	Success	00:00:47.387	local	<a href="#">Edit</a>

For more information about the Job Details page, click [here](#). For more information about ElectricFlow reports, see the [Reports](#), [Creating Custom Reports](#), and other report Help topics.

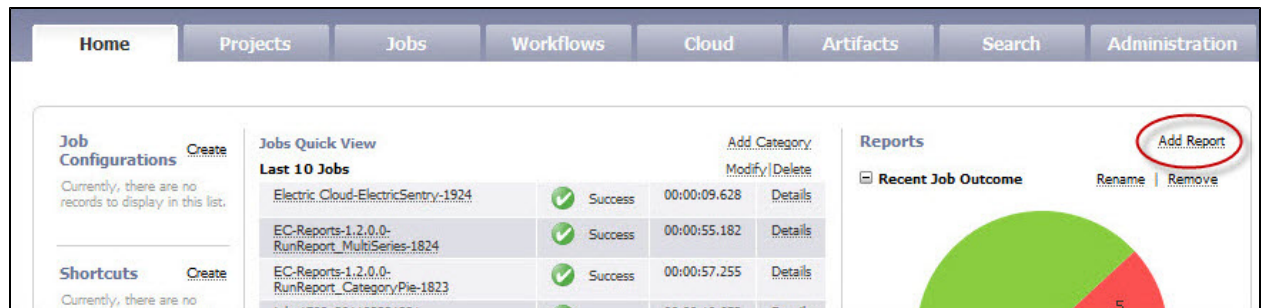
## Scenario extension—Add a thumbnail report to your Home page

When we created a report, we "checked" the Create thumbnail? checkbox, so we are ready to activate the thumbnail report view on the Home page.

**Note:** Viewing an interesting report assumes there is ample data to report. While you can see a report after running one job, it is not very interesting unless you can see trends or comparisons after running numerous jobs.

**To see a thumbnail report on the Home page:**

- Select the Home tab.
- Click the **Add Report** link and a New Report page is displayed.



**On the New Reports page:**

## New Report

Project: FirstNewProject

Report: Basic Build Report

Title: Basic Build Report

Required

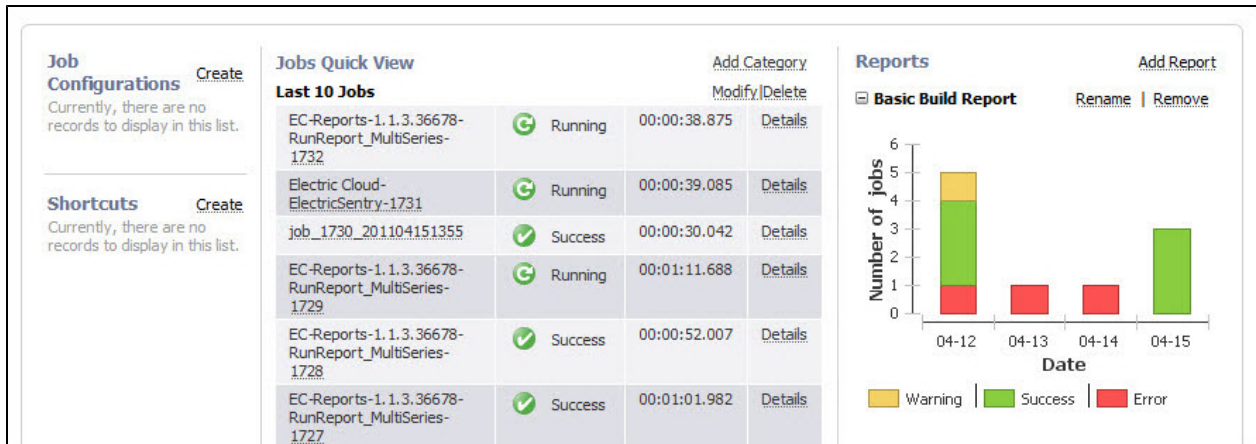
Required

Required

- Project—Use the down-arrow to select the project containing the report you want to view—FirstNewProject.
- Report—This is the report name you entered in the Report Title field when you configured this report—Basic Build Report.
- Title—This is the report title you want to see on your Home page to identify this report. We used the same Basic Build Report name.

Click **OK** to generate the thumbnail report view and to go to the Home page.

The following screen example illustrates how your Home page may look with the thumbnail report.



For more information about how to use the Home page, see [The Home Page](#) Help topic.

## Summary

This scenario demonstrated how to create an Email Configuration so you could use an email notifier, how to create a continuous integration schedule, and how to set up a basic report with a "thumbnail" report view on your Home page.

Go to [Scenario 4](#)

## Getting Started—Scenario 4—Multi-agent Build and Test

**Scenario requirements:** For this scenario, you can use the configurations you created for Scenario 2 and 3. However, before you begin this scenario, you need to configure an additional agent machine. If you have a firewall running on the ElectricFlow server machine, disable it now or allow access to ports 8000, 8443, 61613, 80, and 443.

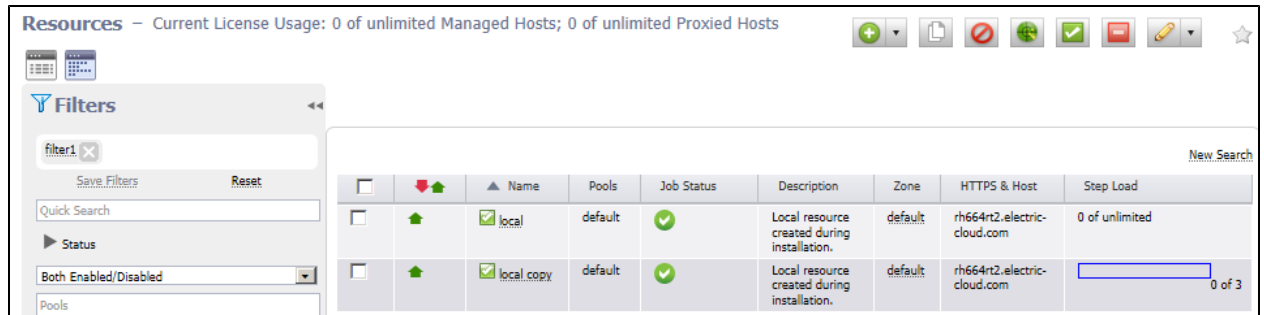
### Installing ElectricFlow Agent software:

Install ElectricFlow Agent software on the machine you intend to use as an agent to run builds. For the simple purpose of getting started, install this agent on a different machine with the same operating system as the ElectricFlow server.

1. Copy the ElectricFlow installation executable file to the machine you intend to use as an ElectricFlow agent.
2. Double-click the executable file to begin the installation program.
3. When the installation program opens, select the Express Agent installation.

**Note:** During the agent installation, you will have the opportunity to create a resource and provide a resource name. Enter any name you choose for your new resource. For this scenario, we will name our new resource, `Resource2`.

4. After agent installation, verify that your new resource information is included in the ElectricFlow resource table. Select the Cloud tab to go to the Resources page.



At a later time when you are more familiar with ElectricFlow, you can use the Resources page to install additional agents. See the Resources page Help topic, then specifically review the "Install or Upgrade Remotes Agents" section.

## To configure a shared workspace:

### For Linux

If your agents are installed on Linux, change the default workspace to point to a network location accessible to both machines:

1. Select the Cloud tab, then select the Workspaces subtab, to see a list of workspaces.
2. Select the workspace named "default" to edit the default workspace.
3. Change the value of the UNIX Path to a network location accessible to the ElectricFlow server and agent machines.
4. Make sure this location is readable and writable by the users chosen during the server and agent installations.

After fulfilling these scenario prerequisites, you are ready to proceed.

### For Windows

If using a Windows environment, the shared workspace is created for you already.

## Overview

This scenario guides you through creating a multi-agent build and test process integrated with your SCM system, build utility, and unit/system tests. You can invoke this build using a schedule, Continuous Integration (CI), or "on demand". At the end of this scenario you will be familiar with the following ElectricFlow concepts and features:

- Agent-only installation
- Copying a procedure to create a new procedure
- Running steps in parallel
- Pools
- Post processor
- Search



## Begin Scenario 4

### Step 1. Create a new procedure

This time, we are going to *copy* an existing procedure, rename it, and add another step.

1. Select the Projects tab, then select the FirstNewProject project name.
2. On the Project Details page, click the **Copy** link to copy the Basic Build procedure.

**Project Details** – FirstNewProject

Edit Access Control 5/5

Procedures Workflow Definitions Jobs Workflows Schedules Credentials Properties Reports

Create Procedure

Procedure	Description	Resource	Create Date	Actions
Basic Build		local	2011-03-25 14:32:14 PDT	Run   Edit   <b>Copy</b>   Delete
Hello World	my first procedure	local	2011-03-25 10:36:38 PDT	Run   Edit   Copy   Delete

Records per page: 20 1 thru 2 of 2

3. When the Basic Build copy procedure is displayed, you can click its name to go to the Procedure Details page to verify it contains the same contents of the Basic Build procedure.
4. Return to the Project Details page.

**Project Details** – FirstNewProject

Edit Access Control 5/5

Procedures Workflow Definitions Jobs Workflows Schedules Credentials Properties Reports

Create Procedure

Procedure	Description	Resource	Create Date	Actions
Basic Build		local	2011-03-25 14:32:14 PDT	Run   Edit   Copy   Delete
Basic Build copy		local	2011-03-25 14:32:14 PDT	Run   <b>Edit</b>   Copy   Delete
Hello World	my first procedure	local	2011-03-25 10:36:38 PDT	Run   Edit   Copy   Delete

Records per page: 20 1 thru 3 of 3

5. Select the **Edit** link for the Basic Build copy procedure.
6. On the Edit Procedure page:
  - Name—Enter a new procedure name, MultiAgentBuild.
  - Description—Add a description noting this procedure was copied from the Basic Build procedure.
  - Default Resource—Select your new resource, Resource2, for this procedure.

- Click **OK** after entering your information and ElectricFlow will take you back to the Project Details page.

Your Project Details page should now look similar to the following example:

Project Details – FirstNewProject				
<a href="#">Edit</a> <a href="#">Access Control</a> <a href="#">Star</a> <a href="#">Refresh</a> <a href="#">5/5</a>				
<b>Procedures</b>	<a href="#">Workflow Definitions</a>	<a href="#">Jobs</a>	<a href="#">Workflows</a>	<a href="#">Schedules</a>
	<a href="#">Credentials</a>	<a href="#">Properties</a>	<a href="#">Reports</a>	
<a href="#">Create Procedure</a>				
Procedure	Description	Resource	Create Date	Actions
Basic Build		local	2011-03-25 14:32:14 PDT	<a href="#">Run</a>   <a href="#">Edit</a>   <a href="#">Copy</a>   <a href="#">Delete</a>
Hello World	my first procedure	local	2011-03-25 10:36:38 PDT	<a href="#">Run</a>   <a href="#">Edit</a>   <a href="#">Copy</a>   <a href="#">Delete</a>
MultiAgentBuild	copied from the Basic Build procedure	Resource2	2011-03-25 14:32:14 PDT	<a href="#">Run</a>   <a href="#">Edit</a>   <a href="#">Copy</a>   <a href="#">Delete</a>
Records per page: <a href="#">20</a> <span style="float: right;">1 thru 3 of 3</span>				

This page now displays the new MultiAgentBuild procedure with a description, and a new resource is designated for this procedure to use.

## Step 2. Create two new Ant steps

- Beginning on the Project Details page, click the MultiAgentBuild procedure name to go to the Procedure Details page.
- Click the AntBuild step **Copy** link, twice.

Procedure Details – MultiAgentBuild						
<a href="#">Run</a> <a href="#">Edit</a> <a href="#">Access Control</a> <a href="#">Star</a> <a href="#">Refresh</a> <a href="#">3/3</a>						
<a href="#">New Step: Command</a>   <a href="#">Subprocedure</a>   <a href="#">Plugin</a>						
	Step Name	Resource	Action	Parallel	Time Limit	Actions
≡	checkout		ECSCM-Perforce-1.1.11.40415:CheckoutCode			<a href="#">Copy</a>   <a href="#">Delete</a>
≡	AntBuild		EC-Ant-1.0.3.40250:runAnt			<a href="#">Copy</a>   <a href="#">Delete</a>
≡	AntBuild copy 2		EC-Ant-1.0.3.40250:runAnt			<a href="#">Copy</a>   <a href="#">Delete</a>
≡	AntBuild copy		EC-Ant-1.0.3.40250:runAnt			<a href="#">Copy</a>   <a href="#">Delete</a>
≡	seeWorkspace		dir /s			<a href="#">Copy</a>   <a href="#">Delete</a>

Now you see two additional steps names: AntBuild copy and AntBuild copy 2.

- Click the AntBuild copy step name to go to the Edit Step page.

Notice the AntBuild copy step name is adjacent to the page title because this is the step we are going to edit.

#### 4. Modifications for creating the new Ant steps:

Because this is an "Edit" page, some of the fields already contain the information we originally supplied to create the first Ant step. The following list contains the fields we need to edit or add new information:

- Name—For this example, we chose `unittest` for the step name. Type over the existing text to edit the text.
- Resource—Enter the name, `TestPool`, because we will be creating a resource pool for testing. At this point, you need to enter a pool name only (no spaces in the name).
- Target—Edit this field to: `unittest`. In the Advanced section:
- Run in Parallel—Click the check box to select this option. You are designating that you want this step to run in parallel with one or more other steps.

5. Click **OK** to create the first of two new Ant steps and ElectricFlow returns you to the Procedure Details page.

**Edit Step** – AntBuild copy Access Control

**General**  
Name:   
Description:

**Subprocedure**  
Subprocedure: EC-Ant : runAnt [Change](#)  
Resource:

**Parameters** ?  
  
Ant Location:   
Build File:   
Libraries:   
Properties:   
Property File:   
Debug: ☐  
Diagnostics: ☐  
Output Level: ☐ Normal  
☐ Quiet  
☐ Verbose  
☒ normal  
Log File:   
Target:   
Additional Commands:   
Postp Line:   
Working Directory:   
Environment Variables:

**Advanced**  
Precondition:   
Run Condition:   
Error Handling:   
Time Limit:  minutes  
Run in Parallel: ☒

- From the Procedure Details page, click the AntBuild copy two step name to go to the Edit Step page again.

To create the next Ant step, make the same edits (above) as you did to create the `unittest` step, except:

- Name—Change the step name to `systemtest`.
  - target—Change this field to: `systemtest`
- Beginning on the Project Details page, click the MultiAgentBuild procedure name to go to the Procedure Details page.
  - Click **OK** to create the second of two new Ant steps and to return to the Procedure Details page. You now have three Ant steps, including two new Ant steps, `unittest` and `systemtest`, with `TestPool` as the designated resource.

Step Name	Resource	Action	Parallel	Time Limit	Actions
checkout		ECSCM-Perforce-1.1.11.40415:CheckoutCode			Copy   Delete
AntBuild		EC-Ant-1.0.3.40250:runAnt			Copy   Delete
unittest	TestPool	EC-Ant-1.0.3.40250:runAnt	✓		Copy   Delete
systemtest	TestPool	EC-Ant-1.0.3.40250:runAnt	✓		Copy   Delete
seeWorkspace		dir /s			Copy   Delete

Also notice, the Parallel column now contains "checkmarks" for the 2 steps we want to run in parallel.

### Step 3. Create a resource pool

- Select the Cloud tab to see the following Resources page with a table listing the currently available resources.

Name	Pools	Job Status	Description	Zone	HTTPS & Host	Step Load
local	default	✓	Local resource created during installation.	default	rh664rt2.electric-cloud.com	0 of unlimited
Resource2	default	✓	Local resource created during installation.	default	rh664rt2.electric-cloud.com	0 of 3

To put these two resources in a resource pool that we previously "named" when we created the new Ant steps, we need to edit each resource.

2. On the **Edit Resource** panel, the only change we need to make is to add the `TestPool` pool name to the `Pool(s)` field.

**Edit Resource**

Name:

Description:

Agent Host Name:

Agent Port Number:

Default Workspace:

Pool(s):

Default Shell:

Step Limit:

Artifact Cache Directory:

Zone:

Repository Names:

Connection Type:

Enabled: ☒

3. Click **OK** to save your change and return to the Resources page.

Notice the `Pool(s)` column now has `TestPool` specified as a resource pool where the `local` resource is a member.

- Repeat this process to put `Resource2` in the `TestPool` resource pool.

A resource can belong to one or more pools. If any resource belongs to multiple pools, all pools would be listed in this column. For more information about the Resources page, click [here](#) or click the **Help** link in the top-right corner of the web page.

The following screen example should be similar to your Resources page.

**Resources** – Current License Usage: 0 of unlimited Managed Hosts; 0 of unlimited Proxied Hosts

**Filters**

filter1 X

Save Filters Reset

Quick Search

► Status

Both Enabled/Disabled

Pools

		Name	Pools	Job Status	Description	Zone	HTTPS & Host	Step Load
<input type="checkbox"/>	↑	local	TestPool	✓	Local resource created during installation.	default	rh664rt2.electric-cloud.com	0 of unlimited
<input type="checkbox"/>	↑	Resource2	TestPool	✓	Local resource created during installation.	default	rh664rt2.electric-cloud.com	0 of

New Search

## Step 4. Run the procedure

To run the new MultiAgentBuild procedure, select the Projects tab > FirstNewProject project name > MultiAgentBuild procedure.

On the Procedure Details page:



1. Click the **Run** link at the top of the page.
2. Click **Run** on the Run Procedure page.

Your Job Details page should be similar to the following example.

**Job Details** – job\_352\_201106151426

[Abort](#)
[Run Again](#)
[Delete](#)
[Save Configuration](#)
[Access Control](#)

**Running with Success**  
 Start Time: 2011-06-15 14:26:56 PDT  
 Elapsed Time: 00:00:48.956

**General Information**  
 Project: [FirstNewProject](#)  
 Procedure: [MultiAgentBuild](#)  
 Launched by: [admin](#)  
 Priority: normal

[Steps](#)
[Diagnostics](#)
[Parameters](#)
[Properties](#)
[Notifiers](#)

View: All [Expand All](#) | [Collapse All](#)

Step Name	Log	Status	Elapsed Time	Resource	Actions
<a href="#">checkout</a>		Running	00:00:47.869		<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">checkoutMethod</a>		Running	00:00:47.875		<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">runMethod</a>		Running	00:00:47.882	<a href="#">Resource2</a>	<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">AntBuild</a>			00:00:00.000	<a href="#">Resource2</a>	<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">unittest</a>			00:00:00.000	<a href="#">TestPool</a>	<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">systemtest</a>			00:00:00.000	<a href="#">TestPool</a>	<a href="#">Abort</a>   <a href="#">Edit</a>
<a href="#">seeWorkspace</a>			00:00:00.000	<a href="#">Resource2</a>	<a href="#">Abort</a>   <a href="#">Edit</a>

Records per page:  1 thru 7 of 7

**Note:** The screen example above illustrates a job that is still running—notice the green circular-arrow icon at the top of the page. This icon changes to a "checkmark" if this job completes successfully.

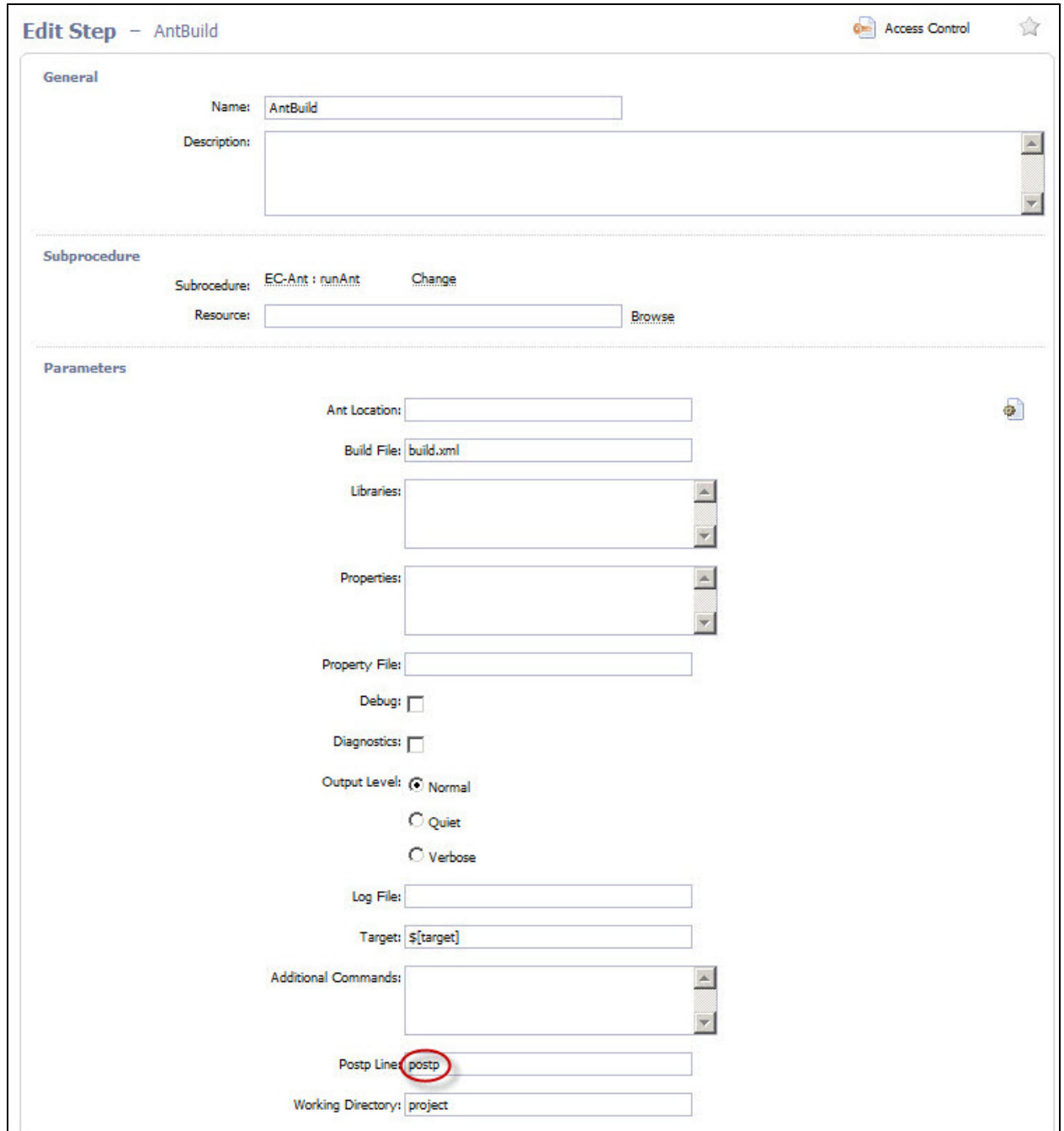
## Scenario extension—Using postsp

ElectricFlow implements data collection with a postprocessor. The postprocessor is a command associated with a particular procedure step. If the postprocessor is specified for a step, it executes concurrently with the main step command. The postprocessor runs on the same machine as the main command and in the same working directory, and it retrieves the log file from the step as its standard input.

The standard ElectricFlow postprocessor is called **postsp**. **postsp** scans the step's log file looking for interesting output such as error messages and then sets properties on the job step to describe what it found. For example, postsp might create a property named "errors" whose value is the number of error messages in the log file, or a property named "tests" that counts the number of tests the step executes. Also, postsp can extract portions of the step log that contain useful diagnostic information and save this information for reporting.

When you create a step, you can specify **postsp**. If you already have a step and want to add postsp reporting, you just have to edit the step to include postsp.

1. From the previous Job Details page screen example, click the **Edit** link for the AntBuild step.
2. On the Edit Step—AntBuild page, in the Parameters section, add `postp` to Postp Line field.



**Edit Step - AntBuild** Access Control ☆

**General**

Name:

Description:

**Subprocedure**

Subprocedure:  [Change](#)

Resource:  [Browse](#)

**Parameters**

Ant Location:

Build File:

Libraries:

Properties:

Property File:

Debug: ☐

Diagnostics: ☐

Output Level: ☒ Normal  
☐ Quiet  
☐ Verbose

Log File:

Target:

Additional Commands:

Postp Line:

Working Directory:

3. Click **OK** to save your edit and return to the Job Details page.

- Run this job again to see the postp result—click the **Run/Run Again** link.

On the next screen example, notice the AntBuild step now shows "3 compiles" in the Status column. Using postp supplies additional information.

**Job Details** – job\_1934\_201104181440
 Run Again Delete Save Configuration ☆ >>

**Completed with Success**  
 Start Time: 2011-04-18 14:40:08 PDT  
 Elapsed Time: 00:00:40.900

**General Information**  
 Project: [FirstNewProject](#)  
 Procedure: [MultiAgentBuild](#)  
 Launched by: [admin](#)  
 Priority: [normal](#)

**Steps** | Diagnostics | Parameters | Properties | Notifiers

View: All Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
[-] checkout		✓ Success	00:00:13.069		<a href="#">Edit</a>
[-] checkoutMethod		✓ Success	00:00:13.066		<a href="#">Edit</a>
runMethod		✓ Success	00:00:13.158	local	<a href="#">Edit</a>
[-] AntBuild		✓ Success	00:00:14.186		<a href="#">Edit</a>
createCommandLine		✓ Success	00:00:05.284	local	<a href="#">Edit</a>
runCommandLine		✓ 3 compiles	00:00:08.237	local	<a href="#">Edit</a>
[-] unittest		✓ Success	00:00:06.999		<a href="#">Edit</a>
createCommandLine		✓ Success	00:00:06.100	local	<a href="#">Edit</a>
runCommandLine		✓ Success	00:00:00.447	local	<a href="#">Edit</a>
[-] systemtest		✓ Success	00:00:05.311		<a href="#">Edit</a>
createCommandLine		✓ Success	00:00:04.319	local	<a href="#">Edit</a>
runCommandLine		✓ Success	00:00:00.419	local	<a href="#">Edit</a>
seeWorkspace		✓ Success	00:00:00.356	local	<a href="#">Edit</a>

Records per page: 100
1 thru 13 of 13
◀ ▶ ⏪ ⏩

For more information about using postp, see the "[Postprocessors](#)" Help topic.

## Summary

This scenario demonstrated how ElectricFlow can drive a complete build and test process—including building steps to run in parallel and creating a resource pool. This scenario also provided a brief look at how you can use ElectricFlow to execute rapid root cause analysis by reviewing postp diagnostics.

## Automation Platform Setup

The topics in this section describe how to set up the automation platform UI.

After completing the tasks, you can create, configure and manage the objects needed to automate your build-test processes, application deployment, and pipelines.

## Automation Platform Home Page

[Job Configurations](#)

[Shortcuts](#)

[Jobs Quick View](#)

[Reports](#)

### Overview

This page provides a convenient console for running jobs and viewing results.

- This web page is your ElectricFlow Dashboard for tracking project health.
- You can customize the page to display only the jobs that interest you and to provide one-click access to the jobs you run frequently. Each of the Home page sections can be customized.
- The Reports section allows you to see thumbnail report images that are updated each time the report is generated.
- This page provides shortcuts for quick access to pages you use most frequently in the automation platform or anywhere on the web.

**IMPORTANT:** If you are using or plan to use the EC-Homepage plugin to share your Home page sections, you will not see some links normally available to you. For example, if a particular Jobs Quick View category is shared, you **cannot** Delete or Modify that category. You can perform these functions only if the category belongs to you alone.

For information on sharing your Home page configuration, see the "[Home page configurations](#)" section in the "[Customizing the ElectricFlow Platform UI](#) on page 617" Help topic.

### Job Configurations

Procedures in ElectricFlow can contain complex sets of parameters— making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem. When you create a job configuration, you enter all the information needed to run a procedure, including parameters and/or a credential. All job configurations are displayed here on the Home page. Invoke a particular configuration by clicking its name in the Job Configurations section.

#### Create Job Configurations three ways

- On the Home page, create a job configuration from "scratch" by clicking the **Create** link in the Job Configurations section.
  - In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.

- From the Job Details page for a previously invoked job, click the **Save Configuration** link at the top of the page.  
Your saved job configuration is displayed on your Home page.
- From the Edit Schedule page, click the **Save Configuration** link at the top of the page.  
Your saved configuration is displayed on your Home page.

## Shortcuts

Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can create a shortcut to any page on the web also.

### Create Shortcuts two ways

- Mouse-over the "star" icon at the top of any automation platform page and click "Add current page" to add that page to the shortcut list. Mouse-over the star icon again and click "Remove current page" to remove the shortcut for that page. The star icon is yellow for pages saved as a shortcut and gray for those pages not saved as a shortcut.
- Click the **Create** link in the Shortcut section and provide a name and URL to create a shortcut.

To modify or update a shortcut, click the **Edit** link adjacent to the shortcut you want to change.

Shortcuts can be accessed conveniently from any automation platform web page. Mousing-over the star icon displays a list of shortcuts saved by the current user. Click on a shortcut name to view the page.

**Note:** The Shortcut section may contain static entries that cannot be deleted. And if you "share" your Home page, the Edit link will not be available for shared items.

## Jobs Quick View

Perhaps only a few jobs on this server are of interest to you. For example, you may care about jobs you launch manually and official builds for the products you work on, but you may not care about production builds for other products or personal jobs for other users.

The Jobs Quick View allows you to define job categories that are interesting to you.

The Home page displays the most recent jobs in each category, and you can easily click-through to get more details about any of those jobs. For example, clicking on a job name takes you to that job's Job Details page.

### Create a job category

- Click the **Add Category** link in the Jobs Quick View section.  
After creating a category, results are displayed on the Home page. Clicking the **Details** link displays a summary to the right of the category. In addition to job status and other diagnostic information, the summary displays running steps and failed steps (containing errors and warnings).
- Click the **Modify** link to edit the Jobs Quick View category or the **Delete** link to remove that job from the Jobs Quick View category.
- Click on the **Details** link to see job summary information—the summary remains visible, regardless of mouse location, until you click somewhere else on the page.

**Note:** If you "share" your Home page, the Modify and Delete links will **not** be available for shared items.

## Reports

You can configure reports you would like to see on a regular basis and display a "thumbnail" report graphic in this section.

- Click the **Add Report** link to go to the New Reports page.  
After filling in the information on the New Reports page, you will see a thumbnail view of your report (after it runs) on your Home page.  
**Note:** If the drop-down menu on this page is empty, click the **Help** link on the New Report page for more information.
- Click the Collapse/Expand (+/-) box to see the full thumbnail report or just the report title.
- Click the **Rename** link if you need to rename your report.
- Click the **Remove** link if you need to remove this report from your Home page.

**Note:** If you "share" your Home page, the Rename and Remove links will not be available for shared items.

## Customizing the ElectricFlow Platform UI

You can customize the ElectricFlow platform UI to get a more intuitive, task-specific user interface.

- [Customizing parameters](#)
- [Customizing tab layouts](#)
- [Home page configurations](#)

### Customizing parameters

Two types of objects contain formal parameters – procedures and state definitions. For these objects, you can customize the way their formal parameters are presented. You can reorder the parameters and set the labels, form element types, default values, tooltip Help text, and whether or not the parameter is required. When defined, this customization shows up whenever the parameters are displayed—running a procedure, creating a step to call a procedure, creating a transition definition to a specific target state, and so on.

#### How do you customize parameters?

Create a property named `ec_parameterForm` on the object containing formal parameters (the procedure or state definition). The value of this property is an XML-style specification of form elements that map to the parameters. This property must be in sync with the formal parameters, which means all formal parameters must have a corresponding XML element, with no "extra" XML elements.

#### Custom parameter form contents

The value of the property in XML: Under a top-level element called `<editor>`, you need an element called `<formElement>` for each parameter. Under a `<formElement>`, you can specify the following tags:

- `property*`—the name of the formal parameter
- `type*`—`entry`|`textarea`|`select`|`radio`|`checkbox`|`project`|`savedSearch`|`credential`

- **label\***—displayed next to the element
- **value**—the initial value of the element (does not apply to credentials, which must be specified at runtime)
- **required**—if true, the user must enter a value for the element
- **documentation**—text displayed in the tooltip when the form element is "moused" over
- **numRows**—valid for `textarea` elements; represents the height of the element
- **option**—a single option for `select|radio` elements; at least one is required
  - **name\***—the text displayed in the option
  - **value**—the value of the option
- **checkedValue**—valid for `checkbox` elements; the value of the element when it is checked
- **uncheckedValue**—valid for `checkbox` elements; the value of the element when it is unchecked
- **initiallyChecked**—valid for `checkbox` elements; whether or not the element is "checked" by default

**Note:** An asterisk (\*) in the list above indicates a *required* tag.

### Example

The following example is a parameter form that rearranges parameters and sets the labels, descriptions, default values, and form elements for each parameter.

```
<editor>
  <formElement>
    <label>One:</label>
    <property>one</property>
    <documentation>The first parameter.</documentation>
    <type>entry</type>
    <value>Test value</value>
  </formElement>
  <formElement>
    <label>Two:</label>
    <property>two</property>
    <documentation>The second parameter.</documentation>
    <type>textarea</type>
    <required>1</required>
  </formElement>
  <formElement>
    <label>Three:</label>
    <property>three</property>
    <documentation>The third parameter.</documentation>
    <type>select</type>
    <option>
      <name>ABC</name>
      <value>abc</value>
    </option>
    <option>
      <name>XYZ</name>
      <value>xyz</value>
    </option>
    <value>xyz</value>
  </formElement>
</formElement>
```

```

    <label>Four:</label>
    <property>four</property>
    <documentation>The fourth parameter.</documentation>
    <type>radio</type>
    <option>
      <name>First Option</name>
      <value>123</value>
    </option>
    <option>
      <name>Second Option</name>
      <value>456</value>
    </option>
    <value>123</value>
  </formElement>
  <formElement>
    <label>Five:</label>
    <property>five</property>
    <documentation>The fifth parameter.</documentation>
    <type>checkbox</type>
    <checkedValue>true</checkedValue>
    <uncheckedValue>false</uncheckedValue>
    <initiallyChecked>1</initiallyChecked>
    <value>true</value>
  </formElement>
  <formElement>
    <label>Six:</label>
    <property>six</property>
    <documentation>The sixth parameter.</documentation>
    <type>project</type>
    <value>myProject</value>
  </formElement>
  <formElement>
    <label>Seven:</label>
    <property>seven</property>
    <documentation>The seventh parameter.</documentation>
    <type>savedSearch</type>
    <value>/projects/myProject/ec_savedSearches/mySavedSearch</value>
  </formElement>
  <formElement>
    <label>Eight:</label>
    <property>eight</property>
    <documentation>The eighth parameter.</documentation>
    <type>credential</type>
  </formElement>
</editor>

```

### Preserving spaces in parameter values containing only spaces

You can restore the behavior in ElectricFlow versions 4.2.x in which spaces are not stripped from parameter values that contain *only* spaces. To do so, add the `COMMANDER_XML_READER_STRIP_WHITESPACE_TEXT` variable to the `wrapper.conf` file on the server and set it to `false`:

```
set.default.COMMANDER_XML_READER_STRIP_WHITESPACE_TEXT=false
```



When set to `true` (the default), these spaces are stripped. This variable does *not* strip spaces in parameter values that contain leading or trailing spaces in conjunction with other characters.

## Customizing the tab layout

### Overview

A "view" defines the layout of tabs in the ElectricFlow web UI. One or more tab views may be defined at the server, group, and user level. The default view the user sees when they first log in can be set at the server, group, and user level. The default defined on the user takes precedence over its groups and the groups take precedence over the server. Electric Cloud provides a system default view that will always show up in the user's list. Views can inherit from each other and add/modify/remove/reposition tabs and subtabs as needed.

If you define a custom view, you have to manually add tabs such as Continuous Integration so that they will appear in your custom view.

### View definition syntax

A view is an XML property. The following is a list of elements that can be defined in a view:

- **tab**—a top level tab
  - **label**—the text to display for the tab
  - **url**—the target URL of the tab
  - **accesskey**—the keyboard shortcut to access this tab (a single letter)
  - **position**—the position of this tab relative to the other tabs (first tab is 1, second tab is 2, and so on)
  - **show**—when inheriting from another base view, if 0, the tab is not visible, if 1 it is visible (default 1)
  - **tab**—a subtab displayed within this tab
    - **label**—the text to display for the subtab
    - **url**—the target URL of the subtab (relative to ElectricFlow base)
    - **position**—the position of this subtab relative to the other subtabs (integer greater than 1)
    - **show**—when inheriting from another base view, if "0", the tab is not visible, if "1" it is visible (default 1)
- **base**—the name of a view from which to inherit tab and subtab definitions

The following is a basic definition of a two-tab view where one of the tabs has three subtabs.

```
<?xml version="1.0" encoding="utf-8"?>
<view>
  <tab>
    <label>Home</label>
    <url>home.php</url>
    <accesskey>h</accesskey>
  </tab>
  <tab>
```

```

    <label>Administration</label>
    <url>workspaces.php</url>
    <accesskey>a</accesskey>
    <tab>
        <label>Workspaces</label>
        <url>workspaces.php</url>
    </tab>
    <tab>
        <label>Directory Providers</label>
        <url>directoryProviders.php</url>
    </tab>
    <tab>
        <label>Licenses</label>
        <url>licenses.php</url>
    </tab>
</tab>
</view>

```

The following is a view that inherits from the above view and:

1. Changes the URL of the Home tab
2. Adds a new tab called Projects and places it at the beginning of the list
3. Changes the accesskey of the Administration tab
4. Moves the Workspaces subtab to the end of the list
5. Hides the Licenses subtab

```

<?xml version="1.0" encoding="utf-8"?>
<view>
    <base>firstView</base>
    <tab>
        <label>Home</label>
        <url>customizedHome.php</url>
    </tab>
    <tab>
        <label>Projects</label>
        <url>projects.php</url>
        <accesskey>p</accesskey>
        <position>1</position>
    </tab>
    <tab>
        <label>Administration</label>
        <url>workspaces.php</url>
        <accesskey>a</accesskey>
    </tab>
    <tab>
        <label>Workspaces</label>
        <url>workspaces.php</url>
    </tab>
    <tab>
        <label>Directory Providers</label>
        <url>directoryProviders.php</url>
    </tab>
    <tab>
        <label>Licenses</label>
        <url>licenses.php</url>
    </tab>
</view>

```

```
</tab>
<tab>
  <label>Administration</label>
  <accesskey>z</accesskey>
  <tab>
    <label>Workspaces</label>
    <position>3</position>
  </tab>
  <tab>
    <label>Licenses</label>
    <show>0</show>
  </tab>
</tab>
</view>
```

### Storing views

Tab views are stored in the server, group, and user property sheets. The view definitions are stored in a property sheet called `ec_ui/availableViews`. The name of the view is set to the property's description if defined, otherwise it is set to the property's name. The value of the view property is the XML definition document described above.

### Default views

The property `ec_ui/defaultView`, if set, determines the default view for users inheriting from that object.

- If this property is set on the server, it is the default for all users.
- If this property is set on a group, all users belonging to that group will see that view, overriding the server's default if it is set also.
- Finally, a user can explicitly set their view by defining the property on their own property sheet. If the user belongs to multiple groups that define defaults, then ElectricFlow chooses the first group alphabetically.

The user can set their view by clicking on their name in the navigation bar, then clicking on the **Edit Settings** link. The list of views shown here comprise all views defined in the `ec_ui/availableViews` property sheets for the server, groups to which the user belongs, and the user itself.

If views have the same name at different levels, then the user overrides the group which overrides the server. If a user selects a view and chooses to Save, then the `ec_ui/defaultView` property on their sheet is set accordingly.

Two special values are always available in this list: "EC Default" and "Inherit". The former is the default tab layout defined in the ElectricFlow web UI. The latter means to use the first view in the list. By default, all users inherit their tab view.

**For more information** on user settings, see the [Edit User Settings](#) Help topic.

## Developing and troubleshooting

If you create an invalid view definition on a group or server property sheet, you will break the UI for all users who inherit that view. The best practice for developing tab views is to use a "test user". Store the view definition in the `ec_ui/availableViews` property sheet for that user, and set the `ec_ui/defaultView` for that user to the name of the new view. When the view is working properly and ready for other users, you can migrate the new view to a group or to the server.

If you continue to have difficulty and tab definitions are not working correctly and can no longer get to the user settings page, revert to the ElectricFlow default by running the following command:

```
ectool setProperty /users/$USERNAME/ec_ui/defaultView ec_default
```

When you log out and then log back in, you will have the default view again.

Note that changes to views are not visible until the next time a user logs in.

## Home page configuration

The automation platform Home page is your configurable Dashboard. This page allows you to manage shared configurations and you can customize this page for your work preferences also. Refer to [The Home page](#) Help topic for details on creating Job Configurations, Shortcuts, Jobs Quick View, and Reports.

Shared Home page configurations can be set globally or for specific groups of users only. The general model for creating shared configurations is:

1. Set up your personal configuration the way you want it to appear to others.  
To get to the configuration page, select the Administration tab > Plugins > and click the **Configure** link for EC-Homepage.
2. Click **Save** to make the configuration available to a specific group or globally to everyone on the server.

If you published the configuration to a specific group, no further action is needed. If you published the configuration globally, continue to the next step.

3. Copy and paste the Tab XML string into a specific user's or group's view.

This adds the public configuration to that user's or group's own home page and no further action is required for the user or group. If this step is not completed, additional action is required as described in [Installing the Home page](#) on page 624.

You can alter an existing shared configuration by loading from a previously saved location, make changes, then save the changes back to the original or an alternate location.

## User settings

Use the Backup Settings action to save and restore your personal Home page configuration.

Select **Create** to back up and temporarily set aside your personal settings while you create or update shared settings.

Select **Restore** to retrieve your personal settings after updating shared settings.

## Location

Select Global to share the new Home page with everyone on the server, or select Group to share with specific users only.

## Installing the Home page

If a globally available Tab XML string (from the Configure EC-Homepage page) has **not** been pasted to the user's or group's view, it must be added to an existing view definition to replace the standard Home page with the one provided by this plugin. To do this, click **Load**. This replaces the current home page with the one that's publicly available.

## Reconfigure Contact Support link

In the event you want to redirect the Electric Cloud Support URL (available from the Help link on each ElectricFlow web page) to your own support center, you can create a file to add to the ElectricFlow installed directory at `<ElectricFlow Install Dir>/apache/htdocs/commander`. Create a file named `config_user.php` with the following contents:

```
<?php
$config["contactSupportUrl"] = "your URL";
?>
```

### Notes:

1. You must enter the value (URL) for your customer support site, replacing "your URL" in the example above. If no value is supplied, a blank window is displayed.
2. You must restart the Web Server for your change to take effect.

## Configuring ElectricFlow

Use this page for quick access to configuring resources, workspaces, email configurations, your source control system, and defect tracking to communicate with ElectricFlow.

**Note:** If you are viewing this Help topic from the "Configuring ElectricFlow" web page, use these instructions:

Click the **Add** link for any object you want to configure and that object's configuration page is displayed.

- Each item you configure will be listed in this table for your easy reference.
- Configure objects listed in this table are linked to their respective **"Edit..."** page in the event you need to modify any values previously supplied. Select a configured object to edit its values.

The table below provides a brief description of ElectricFlow configuration tasks

Click on one of the **"Setting Up..."** links to see more information about that topic.

Setting Up Resources	Before resources can be set up, you need to know which agent machines are available to allocate to jobs. The ElectricFlow Resource web page displays all resources currently available to the ElectricFlow server. This section also describes how to run the resource scheduler in multiple threads to parallelize scheduling, which potentially increases scheduler throughput (and thus overall ElectricFlow server throughput).
Setting Up Workspaces	<p>ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a job <i>workspace</i>.</p> <p>A job step can create whatever files it needs within its workspace and ElectricFlow automatically places files, such as step logs, in the workspace. The location of the job step workspace is displayed on the Job Details web page.</p>
Setting Up Email Configurations	<p>If you do not create an Email Configuration, you will be unable to send email notifications to individuals or groups.</p> <p>If you have multiple users or groups in remote locations who use a different mail server, you will want to create additional email configurations to accommodate those locations if they need to receive notifications.</p>
Setting Up a Source Control Configuration	ElectricFlow needs to communicate with your Source Control system (SCM) if you intend to use the CI Dashboard for continuous integration schedules to start a new build based on new/modified source control checkins, or if you plan to configure Preflight builds (to build and test code changes before those changes are "committed").
Setting Up Directory Providers	ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups can be defined within ElectricFlow.
Setting Up Defect Tracking	ElectricFlow uses plugins to integrate with numerous defect tracking systems. If the plugin you need for your defect tracking system is not automatically installed with ElectricFlow, see the Plugin Catalog to find the integration you need.

## Web Interface Online Help System

Use the automation platform online Help system for more information. Click the **Help** link in the top-right corner of any product web page to see a specific Help topic for that page.

When the Help system opens, we recommend reviewing the Help table of contents. All Help folders above the Web Interface Help folder are user-guide style Help topics that provide more detailed information on each of their topics. If you generally prefer to use a command line rather than the ElectricFlow web interface, you will find complete ectool (the ElectricFlow command-line tool) commands and arguments here too.

## Setting Up Resources

Select **Cloud > Resources** to view the Resources page. Before resources can be configured, you need to know which agent machines are available to allocate to jobs. The Resources page displays all resources available to the ElectricFlow server. This page is your Resources management center where you create, modify, or delete resources and see the resource status.

To view the Resource Pools page where you can manage the resource pools in ElectricFlow, go to **Cloud > Pools**. To view the Zones page where you can manage the zones in ElectricFlow, go to **Cloud > Zones**.

### What is a Resource?

A *resource* is an agent machine where steps can execute. In addition:

- Each resource has a logical name.
- Each resource refers to an agent machine by its host name.
- Multiple resources can be defined on the same physical host.
- Each resource can be assigned to one or more pools, or one zone.
- Each resource has a step limit that determines the maximum number of steps that can execute simultaneously on the resource.

In Create/Edit Resource panels, you define the number of steps that can run on a resource. Remember that setting Step Limit to "0" or leaving the field blank defaults to no step limit.

When ElectricFlow allocates resources for a job and steps are executed on the resource, it considers the step limit, not the CPU load from the steps. The step limit for a resource in your system depends on the agent machine performance. For example, using *unlimited* as the step limit for a heavy load can slow the agent and cause less consistent agent performance if this is not managed properly.

### What is a Resource Pool?

A resource pool is a group of interchangeable resources. For example, a pool of Windows servers. Naming a pool in a procedure step lets ElectricFlow assign any resource from that pool to do the work for that step. By default, ElectricFlow tries to balance the requests against the set of resources in the pool, but you can also define rules for how resources are selected.

To define a resource for a procedure step, you can:

- Specify a resource or a pool name in a procedure step to execute that step on that resource/pool.
- Define custom properties for your resources or pools.

- Mark a resource as "exclusive" (the step acquires and retains its resource exclusively).

For example, if configuration information varies from resource to resource, you can use custom properties to hold this information and then reference it from procedure steps where it is needed. Suppose you have a pool of test machines where the test hardware is in a different location on each machine. You could define a property named "testLocation" on each resource, then pass this property to procedure steps using a reference such as `$/myResource/testLocation`. This approach lets you define procedure steps to run on any resource and automatically handle configuration differences.

**Note:** When the ElectricFlow server and agents are installed on different hosts, make sure that the configuration for each agent specifies the Domain Name System (DNS) server.

## Resource Categories

- Standard
- Proxy

### Standard Resources

This resource category specifies a machine running an installed ElectricFlow agent on one of the supported agent platforms, as specified in the *ElectricFlow Installation Guide*, Chapter 2, "System Requirements and Supported Platforms."

### Proxy Resources

This resource category requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment. A proxy agent is an ElectricFlow agent, channeling to a proxy target.

- **Proxy agent**—This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform. A proxy agent is an ElectricFlow agent, channeling to a proxy target.
- **Proxy target**—This is a machine on an unsupported platform that can run commands via an SSH server. Proxy targets have limitations, such as the inability to work with plugins or communicate with ectool commands.

For a step that will run on a proxy target, specify the **Working Directory** as the directory to which the step's `commandFile` is uploaded from the proxy agent to the proxy target via SSH.

When a step runs on a proxy resource, the proxy agent performs the following tasks:

- Uploads the `commandFile` to the Working Directory on the proxy target via SSH.
  - Working Directory—the step runs in this directory on the proxy target, which defaults to the UNIX path to the workspace
- Creates a wrapper `sh` shell script to:
  - CD to the Working Directory
  - Set `COMMANDER_environment` variables that exist in the proxy agent's environment
  - Run the `commandFile` that was uploaded earlier
- Uploads the wrapper script to the Working Directory on the proxy target



- Runs the wrapper script on the proxy target
- Cleans up script files on the agent and proxy target

### Setting Up SSH Keys

For details about setting up SSH keys, see the [KBEC-00049—Setting up SSH Keys in preparation to use a Proxy Agent](#) KB article.

On UNIX, the ElectricFlow agent looks in the `~/ .ssh` directory for the private and public key files to set up the SSH connection to the proxy target. Therefore, you should generate your key files in that directory.

On Windows, the ElectricFlow agent does not presume a default location. Therefore, in the proxy resource definition you must specify the key file location. To do so, enter the following line in the resource “Proxy Customizations” field:

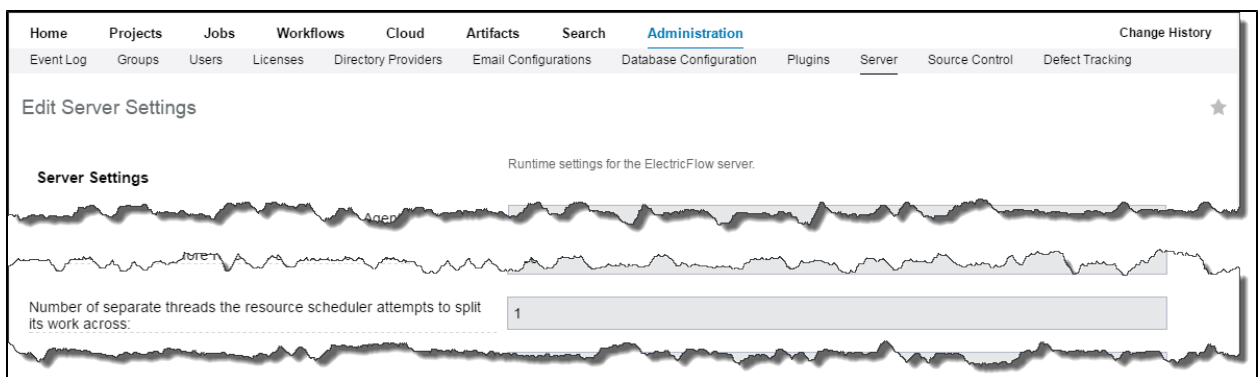
```
setSSHKeyFiles('c:\ foo\priv.key');
```

### Optimizing Resource Scheduler Performance

**IMPORTANT:** Using this feature is recommended only if:

- You have peak periods where large volumes of steps (1000+) are scheduled in a short time window..
- You are running ElectricFlow in a cluster mode with traffic high enough to have required installation using the *performance approach* as described in the installation guide.

The resource scheduler is the part of the ElectricFlow server that schedules runnable job, process, and workflow steps to run on resources. The resource scheduler runs as an ElectricFlow *singleton service*, so in a cluster, it runs on only one node. If your resource scheduler schedules thousands of steps per minute, you can optimize its performance by using the **Number of separate threads the resource scheduler attempts to split its work across** server setting. This setting lets you run the scheduler in multiple threads to parallelize resource scheduling; the multiple threads still run as a singleton service and thus are all on the same node in a cluster. The setting is in the **Administration > Server > Settings** screen in the Automation Platform:



The setting specifies the number of “buckets” of work that the resource scheduler attempts to divide resources into, and thus the number of threads that it runs to handle these buckets of work. The range is 1 through 8. The

default is 1 (one bucket). Depending on server workload and other details, setting it to more than 1 might increase resource scheduler throughput and thus might also increase overall ElectricFlow server throughput.

For a value exceeding 1, the ElectricFlow server tries to divide the lists of enabled resources and pools into that number of buckets so that each resource is in the same bucket as all of its pools, and each bucket size (measured by the number of resources and pools in it) is about equal. The division reoccurs (as part of the same database transaction) whenever:

- A resource or pool is created, enabled, deleted, disabled, or renamed
- The list of resources in a pool is modified
- The server or a server node starts

Depending on system speed and the numbers of resources and pools, redivision could slightly delay these operations. During redivision, all the resource schedulers are paused, which delays the scheduling of steps.

**Note:** After changing the value, you must restart the ElectricFlow server or cluster nodes so that the new value takes effect. You should restart all nodes as soon as possible after a value change to avoid issues as a result of this change.

#### Situations Where Resource Scheduler Parallelization Might Not Be Advantageous

Parallelization might not be advantageous in the following situations.

##### *If There Are Numerous Resources or Pools that Change Frequently*

Parallelization might not be effective if you:

- Both frequently create, enable, delete, disable, or rename resources or pools or modify the list of resources in any pool (which likely means that you have automated one or more of these operations)
- And have more than 1000 resources or pools, which causes the redivision to require about several seconds

You should not use parallelization if the resulting decrease in performance of these operations because of redivision is unacceptable. Also, any of the resource or resource pool changes as described above that cause a redivision will briefly pause parallelized resource schedulers (typically for around ten seconds). This briefly delays all jobs running on the server. Thus, if you modify resources so frequently that the resulting jobs delay decreases performance that exceeds the potential gain from parallelization, then you should not use parallelization.

##### *If a Resource Pool or a Set of Overlapping Pools Contains More Than Its Share of All Resources*

If you have one (enabled) pool or a set of overlapping (enabled) pools that contains more than  $1/N$ th (in other words, more than its share) of all resources, then using a parallelization value greater than  $N$  will not divide resources into perfectly equal buckets of work. If the largest bucket exceeds about twice the size of the smallest, a warning appears in the ElectricFlow log at each redivision (such as at server startup).

The warning indicates the pool most responsible for the problem. If the warning appears, then disabling or subdividing the pool (if the pool's purpose allows it) might fix the problem. If not, you should avoid parallelization (or at least keep the value sufficiently low).

### ***If Steps are Run Mostly on Resources in the Same Pool or Overlapping Set of Pools During Peak Workload***

If during peak workload, the list of all runnable steps that can be scheduled usually contains mostly steps being run on resources in the same pool or an overlapping set of pools (most likely because they are usually broadcast steps in the same job), then parallelization is unlikely to increase performance significantly. This is because at any point time, most of the workload would still be on a single thread.

#### **Determining the Best Resource Scheduler Setting**

If ElectricFlow server performance is a concern, then unless an issue discussed above keeps you from using parallelization, you should experiment with using it. You should monitor performance (particularly the amount of time that steps spend in the “Runnable” state) and try various values to find the best one for your setup and usage pattern. Whether enabling this feature helps, and what the optimum setting is, depend greatly on your usage pattern and how your resources and resource pools are arranged. It can even decrease performance.

For one ElectricFlow server, you should use a value of 1 or 2. For an ElectricFlow cluster, the best value is probably between 1 and a few over the number of cluster nodes. You should first try a value of 2 for one server or a value equal to the number of nodes in the cluster and then experiment from there. Any resulting performance increase depends on your usage pattern such as volume of jobs and the volume of resources. In general, the potential performance increase is small for a single-server ElectricFlow installation and large for a cluster.

#### **Optimizing Oracle Database Performance When Using Parallelization**

If changing the value speeds up your ElectricFlow server, it increases the load on your database server and can make the database server the performance bottleneck (particularly for a cluster). If you experiment with using a value greater than 1, you should also work with your database administrator (DBA) to optimize database performance (for example, to ensure that table/index fragmentation is under control).

Oracle database performance optimization is complex because of Oracle's numerous performance tuning tools and mechanisms. Their proper use is outside the scope of this manual. However, your Oracle DBA should know that:

- The resource scheduler interacts heavily with tables with names of the form EC\_SM\_.\*.
- The contents of these tables are short-term data that is deleted typically within a few minutes after the relevant job ends.

This means that the contents of these tables and their indexes turn over fast and are also normally empty if the ElectricFlow server is idle. Unless your ElectricFlow workload is stable and always consistent, they can thus interact poorly with the default table/index statistics-gathering mechanism used by the Oracle performance optimizer unless you “lock” the statistics while the ElectricFlow server is under typical high and extended job load. (In which case the performance optimizer will still rapidly claim that the “locked” statistics have become stale.) So on Oracle, unless your ElectricFlow workload is stable and always consistent, you should use a “locked” snapshot of the statistics for these tables and their indexes. Depending on workload and usage patterns (and especially your deletion pattern), this might also be true for several other tables in the Electric Cloud schema. Your Oracle DBA should work with you to identify those tables.

## Creating a Resource

Click the Cloud tab in the ElectricFlow web interface to go to the Resources page.

At the top right-side of the table, click the down arrow next to the plus sign and select **Create Resource** or **Create Proxy Resource** link to see the New Resource or New Proxy Resource panel.

## Setting Up Workspaces

ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a job workspace.

A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files in the workspace, such as step logs. Normally, a single workspace is shared by all steps in a job, but it is possible for different steps within a job to use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.

### To create a new workspace

ElectricFlow can handle any number of workspaces.

- To define a workspace from the web interface, click the Cloud > Workspaces tabs.
- On the Workspaces page, click the **Create Workspace** link at the top right-side of the table and the New Workspace web page is displayed.

Click the **Help** link in the top-right corner of the web page for assistance with filling in the fields to create a workspace.

To see the Workspaces Help topic now, click [Workspace—create new or edit existing workspace](#).

After you create a workspace specification, you will see it listed on the Workspaces page.

## Setting Up Email Configurations

This topic describes how to set up an email configuration. It must be created and configured before you set up email notifications, also referred to as *email notifiers* at the platform level. Then you can send them to individuals or groups.

If you have multiple users or groups in remote locations who use a different mail server, you need to create additional email configurations to accommodate those locations if they receive ElectricFlow notifications.

### Creating an Email Configuration

To create an email configuration in the platform GUI:

1. Click **Administration > Email Configurations** to go to the Email Configurations page.
2. Click **Add Configuration** to go to the New Email Configuration page.

3. Enter information in the fields on the page.

There are two ways to get help in entering information in the fields:

- Click [Email Configuration—create new or edit existing email configuration](#) to go to the Email Configuration help topic.
- If you are in the platform GUI, click the **Help** link in the upper-right corner of the page to see descriptions and other information.

After the email configuration is created, you will see it listed in the table on the Email Configurations page.

## Setting Up a Source Control Configuration

You must configure your source control system to communicate with the ElectricFlow server if you plan to take advantage of the ElectricFlow Continuous Integration Dashboard and associated functionality and Preflight functionality—both of these features are designed to work with a number of source control (SCM) systems.

- Continuous Integration Dashboard—use this feature to create continuous integration schedules for your build environment. The Continuous Integration Manager is the front-end user interface for the ElectricSentry Continuous Integration engine.
- Preflight—use this feature to build and test developer code before it is *committed* to the code base for your product.

ElectricFlow installs (bundles) and supports numerous source control types. After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page—to see this web page, select the Administration > Source Control tabs.

**Note:** If the SCM you prefer is not listed here, see the Plugin Manager page (Administration > Plugins) for a list of all currently available SCM plugin integrations available for ElectricFlow. To configure a different SCM, see the Help topic associated with that plugin.

Select one of the following links to go to the source control configuration page to configure your SCM system:

[AccuRev](#)

[ClearCase](#)

[File](#)

[Git](#)

[Perforce](#)

[Property](#)

[Subversion](#)

The Continuous Integration Dashboard has its own Help topic. For more information on ElectricSentry or Preflight builds, see their respective Help topics: [ElectricSentry](#) , [Preflight Builds](#).

## Setting Up Directory Providers

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups can be defined within ElectricFlow.

### To specify a directory provider

ElectricFlow includes a web page to facilitate adding your existing LDAP or Active Directory users and groups to ElectricFlow.

- To access the Directory Providers web page, select the Administration > Directory Providers tabs.
- Click the **Add Active Directory Provider** or the **Add LDAP Provider** link to add a new provider.

Depending on which **Add... Provider** link you choose, you will see either the New Active Directory Provider or the New LDAP Provider web page. From either page, click the **Help** link in the upper-right corner of the page. The Help topic describes each field on either web page so you can easily enter information in the forms to have ElectricFlow use your existing user or group account information.

To see the Directory Provider Help topic now, click [Directory Providers—create new or edit existing directory providers](#).

After adding a provider, you will see it listed in the table on the Directory Providers web page.

### Enable/Disable Local ElectricFlow Users

Two server settings properties are supplied for local ElectricFlow users (both are "on" by default):

- `enableAdminUser`—if set to '0', attempts to log in as the 'admin' user are denied as if the user did not exist
- `enableLocalUsers`—if set to '0', attempts by a non-admin local user to log in are denied as if the user did not exist

These settings are stored in properties in the `/server/settings` property sheet and can be set from ectool by calling:

```
ectool setProperty /server/settings/enableAdminUser 0
```

Or, these settings can be set from the automation platform web interface:

- Select the Administration > Server tabs.
- At the top of the page, select the **Settings** link.

**Note:** Disabling these properties takes effect only for new sessions. Existing sessions continue to function "as-is" until the user logs out and attempts to log in again.

## wrapper.conf Properties

If you need to edit the wrapper.conf file, see <http://wrapper.tanukisoftware.com/doc/english/properties.html> for complete information about property formats.

## Using ElectricFlow in Your Environment

This topic addresses some common issues you may encounter as you start using ElectricFlow and offers some tips about managing your ElectricFlow projects.

[What's in a step?](#)

[Where's the script for the step?](#)

[Environment variables](#)

[When do you use subprocedures?](#)

[How do you evolve procedures?](#)

[Porting existing scripts](#)

[ElectricFlow project version control](#)

### What's in a step?

One of the first questions you may ask when you start to implement your build and test processes on ElectricFlow is how to divide processes into individual steps: "Should I use only a few steps, each of which does a lot, or a large number of fine-grain steps?" Here are some factors to help you decide how many steps to use:

- **Reporting**—If you would like a separate report of success/failure for two activities, put those activities in separate steps. If you are happy to have a single report for both activities, a single step may make sense. For example, compilation and test phases should probably be in different steps because errors in the two phases will probably be handled differently. Unit tests for product components managed by different groups may make sense in separate steps; each group can watch for errors in its step.
- **Parallelism**—If you want to use ElectricFlow to run two activities in parallel, put them in separate steps. If these activities are in the same step, ElectricFlow cannot run them in parallel.

ElectricFlow parallelism works best at a coarse grain, such as running different sets of unit tests in parallel or compiling for different platforms. Electric Cloud does not recommend trying to do fine-grain parallelism with ElectricFlow, such as compiling every individual source file in a separate step—this is likely to be complicated and brittle, resulting in an enormous number of job steps, which will make it difficult to view results. If you would like to use fine-grain parallelism for compilation, we recommend using our ElectricAccelerator product. In this case, you would make your compilation steps large, with as much work in each makefile as possible because ElectricAccelerator automatically subdivides the work and runs as many sub-steps as possible in parallel. The more work in a makefile, the more efficient the process becomes.

- **Resources**—If two different activities need to run on different resources, they need to be in different steps. A single step runs entirely on a single resource.

- **Conditional steps**—If you want to skip portions of your process during some jobs, but execute them during others, it probably makes sense to put those activities in separate steps and use the ElectricFlow "Run condition" mechanism to decide whether they run during each particular job. However, if you are invoking programs like *make* that already allow you to choose which actions to perform, it may make more sense to have a single large step and handle conditional behavior with those programs, rather than with ElectricFlow. For example, when running *make*, you can specify the targets to be built.
- **Setup**—You might want to have a single step at the beginning of a procedure that processes the procedure's parameters and sets up the environment for the rest of the procedure. The setup step will create a snapshot of your source code or set up a ClearCase view also. After setup, the remaining steps should be easier to write because they just use information created during the setup step.

## Where's the script for a step?

Typically, each step executes a script of some type, which is processed by a command language such as *cmd* on Windows, a *shell* on UNIX, or Perl.

### Two ways to handle script execution

- The first approach—Enter the script directly into the command field for the step. You can specify the language interpreter as the shell for the step.
- The second approach—Store the script in a file that is part of the source code for your project, then specify a simple command for the step that invokes the command language to process the script file.

We recommend using the second approach in most cases. The main advantage of this approach is that it makes your ElectricFlow procedures more robust. For example, suppose the script needs to change as your product evolves. If you have kept the script outside ElectricFlow with the source code for the product, each product version can have its own copy of the script. When you extract the source code for the product at the beginning of a job, you also extract the scripts for its steps. You can change a step's script without worrying about its impact on other versions of the product.

However, if the script for a step is stored in the step, it is more difficult to evolve the script with new product versions. You probably still need to build older product versions, so you will worry whether the new script for the step will work with older product versions. If the script does not work, perhaps you can modify the step's script to test the version being built and take different actions for each version—this process becomes increasingly more complex as the number of versions increases. Or, you can make a separate copy of the build procedure for each product version (more on this below), but this process also gets complicated as you acquire more and more procedure versions. We find it is easier to store scripts for steps with the product code, so script changes are handled in the same way as changes to the product.

### Two cases where it makes sense to store the script for a step in the ElectricFlow step

- The first case is for the first step of a job.  
At this point you have not extracted the source code for the product, so you do not yet have access to any scripts stored with the source code.



- The second case is for steps with one or two commands only, or steps already specified primarily by information stored with your source code.  
For example, if a step is running a *make* or *ant* command, step behavior is already specified almost entirely by a makefile or a `build.xml` file for Ant. In this case, the step's script invokes a single, relatively simple command; no need to store this in a file. If you subsequently find that the script for a step is changing frequently, consider moving it out of ElectricFlow and into a file stored with your source code.

The object is to make your ElectricFlow procedures as reusable as possible, so no change is needed with every small change to your product. Even better, organize your ElectricFlow procedures so a single procedure can be used for multiple products. To do this, store product-or version-specific information with the product, not with ElectricFlow.

## Environment variables

Your build and test scripts probably depend on certain environment variables having certain values. In your existing system, you probably set those values at the beginning of your script. However, in ElectricFlow you need to set those values in each step that depends on them. The easiest way to set values is to create a short command file during the first step of the job and save it in the top-level directory of the job workspace. The command file should contain a sequence of commands to set all environment variables required by the job. Then, in each subsequent step, invoke that command file at the beginning of the step to set environment variables for that step. This approach simplifies management of your environment variables: if you need to change a variable, you change only the setup step at the beginning of the job, and the value is reflected in all of the following steps automatically.

## When do you use subprocedures?

In ElectricFlow, the action for a step can invoke another procedure, passing parameters. This is a powerful tool for structuring your processes. Subprocedures tend to be used in two ways: for *encapsulating reusable processes* and for *managing concurrency*.

- *encapsulating reusable processes*, is the preferred use. If you need to perform certain activities repeatedly in different places, you can use a subprocedure for them. For example, when we build and test the ElectricFlow product, we do it on multiple platforms, but the mechanism is virtually the same on all platforms. We implement the basic build and test mechanism for one platform in a subprocedure named `BuildAndTest`. In our main procedure for production builds, we invoke `BuildAndTest` multiple times, once for each of the platforms. If the mechanism changes, we only need to change it once in `BuildAndTest` to fix all six platforms.
- *managing concurrency*—suppose you have three steps A1, A2, and A3, that must run sequentially, and two other steps B1 and B2 that must also run sequentially, but the two groups can run in parallel. The way to implement this is to put A1, A2, and A3 in one subprocedure named "A", and B1 and B2 in another subprocedure named "B". Now you can create a top-level procedure with two steps: one invoking A and the other invoking B, and mark those steps for parallel execution. As a result, A and B will run in parallel but the steps inside each subprocedure will run serially.  
If you placed all five steps inside the top-level procedure, there would be no way to achieve this effect.

## How do you evolve procedures?

After you start using ElectricFlow for managing your build and test processes, it will not be long before you encounter the following situation:

You have a set of ElectricFlow procedures that work fine on all existing versions of the product, but you are about to change the product in a way that affects ElectricFlow procedures. For example, you might be adding a new component, or perhaps you are going to change the way the product is installed for testing, or perhaps you have restructured the product to allow more steps to run concurrently. As a result, you need to change ElectricFlow procedures for the current version. At the same time, you need older product versions to continue building as well.

In most cases, the easiest way to handle these situations is to leave the current ElectricFlow procedures alone and keep using them for your older product version. This ensures you will not "break" older versions. Make copies of the procedures that need to change, then modify the copies and use them for your new software version.

You will have one version of procedures for each significant version of the product. For example, at Electric Cloud, we incorporate the version number into the procedure names: "Master-1.0" is the version of the Master procedure used with the 1.0 release, "Master-1.1" is used for 1.1, and "Master" with no version number is used for our current development.

Another approach would be to make a copy of the entire project for each release. This method may be easier if other information in the project, such as property values, needs to evolve also.

The "copying" approach gets more and more complicated as you add more and more versions of the procedure. To minimize this complexity, try to structure your procedures so they do not have to change frequently. Some techniques you can use:

- Use parameters for things that do change frequently, such as the branch of software to build.
- Where possible, store scripts and other information [used by the procedure] as part of the source code for the project as described above, so this information is versioned automatically, along with your source code.

## Porting existing scripts

You probably already have scripts you have been using to build and test software, before switching to ElectricFlow.

Over time, you will probably want to do quite a bit of restructuring to take full advantage of ElectricFlow. However, you probably do not need to do major restructuring to get started with ElectricFlow. Here are some steps you might take to "get up and running" with ElectricFlow as quickly as possible and gradually convert to make the best use of the system.

**To begin**, see if you can take your existing script and run it monolithically as a single step in a procedure under ElectricFlow. This will get you running and start providing some ElectricFlow benefits for resource management, error analysis, and reporting.

**Next**, start dividing your previous script into separate steps for ElectricFlow. Begin with the steps easiest to separate from the rest of the script, such as the commands to compile your software. One of the challenges you face is how to pass data from one step to another. In a monolithic script, you can keep the data in variables that persist throughout the job. As you divide the script into steps, you need to figure out which variables are used only in a single step and which variables pass from step to step. For variables that pass between steps, use ElectricFlow properties to store their values. In many cases you can compute shared

data values in a single step at the beginning of the job, store their values in properties on the job, then access those values read-only in later job steps.

**After dividing the steps**, you can do finer-grain reporting. Start using the *postp* postprocessor to scan your log files and generate statistics and diagnostics. Over time you will probably discover you have a few error and warning messages peculiar to your site, and are not captured by *postp*'s patterns. Learn how to extend *postp* with additional patterns to capture all the information that matters to you.

**Now that reporting statistics are being recorded**, you may wish to develop your own reports to summarize those statistics. You can easily use *ectool* to read statistics from the properties where they are stored.

**Something else you can do** after steps are divided: start tuning the performance of your procedures. For example, you can start marking steps to run in parallel, and you can choose resources on a step-by-step basis to finish your jobs faster and share resources more effectively.

## ElectricFlow project version control

We recommend exporting your ElectricFlow project data at regular intervals and saving it in the same configuration management system you use for your source code (use the "export" *ectool* command to generate an XML file representing the contents of a project or procedure). This process allows you to track project changes and also allows you to "look back" at older versions if that should become desirable. Also, you should snapshot a version of ElectricFlow project data at the time of each major software release, so you can revert to the exact ElectricFlow configuration used to generate that release if necessary.

### ElectricFlow Installed Tools

This reference topic can acquaint you with some tools you may not know about or provide quick access to information for tools you use already. Select from the links in the table below to go directly to information for that tool.

Tool Name	Description
<a href="#">eccert</a>	A command-line tool used to manage the ElectricFlow Certificate Authority (CA) and the certificates configured in ElectricFlow Server and ElectricFlow Agent installations.
<a href="#">ecconfigure</a>	<p>A command-line tool that can change configuration values for any locally installed ElectricFlow server, web, agent, or repository service. <i>ecconfigure</i> is a more user-friendly mechanism for configuring aspects of ElectricFlow that would otherwise require manual configuration file updates. <i>ecconfigure</i> actually manipulates relevant service configuration files on your behalf.</p> <div><b>IMPORTANT:</b> You must have root privileges to use the <code>--webPluginsDirectory=path</code> option.</div>

Tool Name	Description
<code>ecdaemon</code>	A "wrapper" program that can be used to start another program from an ElectricFlow job step—the "started" program will run as a daemon process. The ElectricFlow agent uses the facilities of the underlying operating system to make sure the process runs in a separate process group on a UNIX-based system, or outside of the normal "Windows Job" grouping in a Windows system. In either case, the ElectricFlow agent does not treat the process as one it should wait for or one it should try to "kill" if ElectricFlow needs to abort the step.
<code>ecproxy</code>	A driver script with built-in support for SSH. Every major operation can be overridden by defining a Perl function in the Proxy Customization field on the New Proxy Resource panel, available from the Resources page,
<code>ecremotefilecopy</code>	<b>Remote file copy:</b> When ElectricFlow agents (on platforms other than Linux or Windows) run steps that create log files in a workspace the ElectricFlow web server cannot access (through Linux or Windows agents), use <i>ecremotefilecopy</i> to recreate job logs so they are visible on those ElectricFlow agents, which then enables the web server to retrieve and render those log files.
<code>ZKConfigTool</code>	A command-line tool that imports your ElectricFlow database configuration information into your ZooKeeper server.
<code>ClusterInfoTool</code>	A command-line tool that displays information on the running ElectricFlow server cluster from ZooKeeper.

## eccert

A command-line tool used to manage the ElectricFlow Certificate Authority (CA) and the certificates configured in ElectricFlow Server and ElectricFlow Agent installations.

### Usage

```
eccert [ options ] command [ arg ... ]
```

### Commands

<code>addTrustedServer crt</code>	Add a server CA certificate to the agent's keystore.
-----------------------------------	--

getCRL	Retrieve the contents of the current certificate revocation list.
--------	---

```
initAgent [ --local |  
--remote ] [ options ]
```

Initialize the agent keystore with a new public/private key pair.

Generates the agent certificate signing request.

If run on the server host, the certificate will automatically be signed by the server CA, and the CA certificate and the signed agent certificate are installed in the agent's keystore.

If run on a non-server host, the signing request is left in the agent directory.

If CA Cert is provided, the CA certificate is installed in the agent's keystore.

	<code>--local</code> Use the local server CA to sign the agent certificate.
--	--



	<code>--remote</code> Connect to a remote ElectricFlow server to sign the agent certificate.
--	---

	<code>--force</code> Replace any existing keystore.
--	--

	<pre>--cname name</pre> <p>Use the specified name as the common name (CN) in the agent certificate subject. This is normally the fully qualified domain name used by clients to connect to the agent.</p>
--	---

	<p><code>--altNames entries</code></p> <p>Use the specified list of entries (comma or space separated) as the <code>subjectAlternateNames</code> list in the agent certificate. Simple names are interpreted as <code>dns</code> entries. Entries may begin with <code>"dns:"</code> or <code>"ip:"</code> to indicate the type (for example, <code>"ip:192.168.0.1"</code> or <code>"dns:myHost"</code>). If no entries are specified, then reverse DNS is used to look up the registered names of the host's IP addresses.</p>
--	--

<code>initCA</code>	Initialize the server CA. Creates a new CA key and certificate.
---------------------	---

<code>initServer [ options ]</code>	Initialize the server keystore. Creates and signs the server certificate. Installs the CA certificate and the signed server certificate into the server's keystore.
-------------------------------------	--

	<pre>--force</pre> <p>Replace any existing keystore.</p>
	<pre>--cname name</pre> <p>Use the specified name as the common name (CN) in the server certificate subject. This is normally the fully qualified domain name used by clients to connect to the server.</p>
	<pre>--altNames entries</pre> <p>Use the specified list of entries (comma or space separated) as the <code>subjectAlternateNames</code> list in the server certificate. Simple names are interpreted as <code>dns</code> entries. Entries may begin with "dns:" or "ip:" to indicate the type (for example, "ip:192.168.0.1" or "dns:myHost"). If no entries are specified, then reverse DNS is used to look up the registered names of the host's IP addresses.</p>
<pre>list [ --agent   --server   --index [ --verbose ]</pre>	<p>Display certificate information for agent and/or server keystores or the CA certificate index. If no options are specified, both the agent and server keystores are listed.</p>
	<pre>--agent</pre> <p>List the contents of the agent keystore.</p>
	<pre>--server</pre> <p>List the contents of the server keystore.</p>
	<pre>--index</pre> <p>List the contents of the CA issued certificates index.</p>
	<pre>--verbose</pre> <p>Display additional details.</p>
<pre>refreshCRL</pre>	<p>Refresh the certificate revocation list from the ElectricFlow server.</p>
<pre>revoke index</pre>	<p>Revoke a previously issued certificate by index.</p>
<pre>signCertificate csr crt</pre>	<p>Sign the certificate signing request provided in file <code>csr</code> and write the signed result to the file <code>crt</code>. The request is rejected by the CA if there is a matching certificate already in the CA database.</p>
<pre>updateAgentCertificate crt</pre>	<p>Install a previously signed certificate <code>crt</code> into the agent's keystore.</p>

## Server Communication Options

<code>--server host</code>	Address of the ElectricFlow server. Defaults to the value of the <code>COMMANDER_SERVER</code> environment variable. If that does not exist, it defaults to <code>localhost</code> .
<code>--securePort port</code>	HTTPS listener port on the server. Defaults to 8443.

## Global Options

<code>--help</code>	Print the Help message.
<code>--version</code>	Print the version message.

## Examples

### Example 1: Configure an agent to talk to any server (untrusted mode)

This example generates a new self-signed certificate for the agent and recreates the keystore with no trusted authorities.

```
$ eccert initAgent -force
```

Generating keys

Generating certificate request

```
cname=myAgent.company.com
```

```
san=dns:myAgent.company.com
```

### Example 2: Configure an agent to accept connections only from a single remote ElectricFlow server

This example generates a new certificate for the agent that is signed by the remote server's certificate authority and installs the signed certificate and its associated trust chain in the agent's keystore. After this point, the agent will only accept requests from the specified server and will be used as a trusted resource by the server.

```
$ ectool --server myserver login admin pw
```

```
$ eccert --server myserver initAgent -remote
```

Generating certificate request

```
cname=myAgent.company.com
```

```
san=dns:myAgent.company.com
```

Asking server 'myserver' to sign certificate

Importing 'CA:myserver.company.com' certificate

Importing 'jetty' certificate



**Example 3: Configure an ElectricFlow server with additional host names in the certificate**

This example regenerates the ElectricFlow Server Certificate, the specified common name, and alternate subject names to allow trusted connections with multiple external `dns` names.

```
$ eccert initServer --force --cname "myServer.company.com" --altNames "myServer,server2.company.com"
```

```
Generating keys
Generating certificate request
  cname=myserver.company.com
  san=dns:myserver,dns:server2.company.com
Signing server certificate
Importing 'CA:myserver.company.com' certificate
Importing 'jetty' certificate
```

## ecconfigure

A command-line tool for changing values in configuration files for any locally-installed ElectricFlow server, web server, repository server, or agent. `ecconfigure` is an easier way to configure ElectricFlow settings than manually editing configuration files.

**Usage**

```
ecconfigure [options]
```

Agent Options	
<code>--agentAcceptQueueSize=max</code>	The maximum number of pending connections the agent will queue up.
<code>--agentArtifactCache=path</code>	The directory containing cached artifactVersions.
<code>--agentCrlFile=relativepath</code>	Relative path of the file containing the agent's certificate revocation list for SSL.
<code>--agentDomainName=domain</code>	The domain name that the agent uses for fully-qualified names.
<code>--agentDuplicateDetectionListSize=size</code>	The size of the list of recently seen requests used in duplicate request detection.

<code>--agentEnableProxySettings=&lt;1 0&gt;</code>	Enable (1) or disable (0) the proxy server configuration. If enabling for the first time, <code>--agentProxyHost</code> and <code>--agentProxyPort</code> must be specified.
<code>--agentIdleConnectionTimeout=milliseconds</code>	Idle connection timeout, in milliseconds.
<code>--agentIdleOutboundConnectionTimeout=seconds</code>	Idle time after which an outbound connection is closed, in seconds.
<code>--agentIdlePostRunnerTimeout=seconds</code>	Idle time after which a PostRunner thread is terminated, in seconds.
<code>--agentIdleServerRequestWorkerTimeout=seconds</code>	Idle time after which a ServerRequestWorker thread is terminated, in seconds
<code>--agentIdleWorkerTimeout=seconds</code>	Idle time after which a Worker thread is terminated, in seconds.
<code>--agentInitMemory=percent</code>	Initial java heap size as a percentage of the total system memory.
<code>--agentInitMemoryMB=size</code>	Initial java heap size in MB.
<code>--agentKeystore=path</code>	Location of the keystore file used by the agent to support SSL connections from the server.
<code>--agentKeystorePassword=password</code>	Password used to access the agent's keystore.
<code>--agentLoadProfile=&lt;true yes 1 false no 0&gt;</code>	Enable (1) or disable (0) loading the impersonated user's profile for impersonation steps if on Windows.
<code>--agentLocalPort=port</code>	Port used by the Commander agent for http communication on the localhost network interface.
<code>--agentLogFile=path</code>	Path where the C++ agent log file should be written.
<code>--agentLogLevel=&lt;TRACE DEBUG INFO WARN ERROR&gt;</code>	Logging level used by the C++ portion of the agent.
<code>--agentLogMaxFiles=max</code>	Maximum number of log files the C++ agent will accrue.

<code>--agentLogMaxSize=max</code>	Maximum size of each log file from the C++ agent. The value may be suffixed with a unit (MB, KB, B). Without a unit, the value is interpreted as bytes.
<code>--agentMaxConnections=max</code>	Maximum number of network connections for the agent.
<code>--agentMaxConnectionsPerRoute=max</code>	Maximum number of network connections per route for the agent.
<code>--agentMaxHttpThreads=max</code>	Maximum number of threads for handling inbound requests.
<code>--agentMaxLoggedMessageLength=max</code>	Maximum message length, used when logging requests/ responses to/from the Commander server.
<code>--agentMaxMemory=percent</code>	Maximum java heap size as a percentage of the total system memory.
<code>--agentMaxMemoryMB=size</code>	Maximum java heap size in MB.
<code>--agentNoProxyHosts=hosts</code>	Comma delimited list of hosts that should be reached directly, bypassing the proxy server.
<code>--agentOutboundConnectTimeout=milliseconds</code>	Timeout for the agent establishing outbound connections, in milliseconds.
<code>--agentOutboundRequestInitialRetryInterval=seconds</code>	Initial delay between retries for sending outbound requests to a server, in seconds.
<code>--agentOutboundRequestMaxRetryInterval=seconds</code>	Maximum delay between retries for sending outbound requests to a server, in seconds.
<code>--agentOutboundRequestTimeout=hours</code>	Timeout after which the agent gives up trying to send a request to a server, in hours.
<code>--agentPluginsDirectory=path</code>	The path used by the agent to get to the plugins directory of the Commander server where its resource definition lies.
<code>--agentPort=port</code>	Port used by the Commander agent for https communication on any network interface.

<code>--agentProtocol=&lt;http https&gt;</code>	Protocol used by the agent.
<code>--agentProxyHost=host</code>	The IP address of the proxy server.
<code>--agentProxyPort=port</code>	The port of the proxy server.
<code>--agentServerSessionsFile=relativepath</code>	Relative path to the persisted server sessions file.
<code>--agentUnixShellPattern=pattern</code>	Windows-only: ordinarily, the agent creates script-files with CRLF line termination. But some shells on Windows require script files to be LF line-terminated, like Unix. This option sets a regular expression pattern for such shells. Defaults to a pattern that matches sh and bash, which in modern versions of Cygwin require LF-terminated script files.
<code>--agentWrapperConsoleFormat=format</code>	Format of output for the agent wrapper console.
<code>--agentWrapperEcwrapperWriteMaxAttempts=max</code>	Workspace write maximum attempts count
<code>--agentWrapperEcwrapperWriteRetryInterval=milliseconds</code>	Workspace write interval between two attempts, in milliseconds.
<code>--agentWrapperJavaAdditional=nnnnn=value</code>	Set a custom line of the form <code>wrapper.java.additional.nnnnn=value</code> in the agent's <code>wrapper.conf</code> file. <code>nnnnn</code> must be an integer $\geq 10000$ .
<code>--agentWrapperJavaClasspath=n=path</code>	The Java classpath. <code>n</code> must be an integer $\geq 1$ .
<code>--agentWrapperJavaLibraryPath=n=path</code>	The Java Library Path (location of <code>Wrapper.DLL</code> or <code>libwrapper.so</code> ). <code>n</code> must be an integer $\geq 1$ .
<code>--agentWrapperLogfile=path</code>	Log file to use for agent wrapper output logging.
<code>--agentWrapperLogfileFormat=format</code>	Format of output for the agent wrapper log file.
<code>--agentWrapperLogfileLogLevel=loglevel</code>	Log Level for agent wrapper log file output.

<code>--agentWrapperLogfileMaxsize=size</code>	Maximum size that the log file will be allowed to grow to before the log is rolled. Size is specified in bytes, kilobytes with a 'k' suffix, or megabytes with an 'm' suffix.
<code>--agentWrapperLogfileMaxfiles=max</code>	Maximum number of rolled log files which will be allowed before old files are deleted.
<code>--agentWrapperNtserviceDependency=n=service</code>	NT service dependencies. Add dependencies as needed starting from 1. n must be an integer >= 1.
<code>--agentWrapperNtserviceStarttype=&lt;AUTO_START DEMAND_START&gt;</code>	Mode in which the NT service is installed.
<code>--agentWrapperNtserviceInteractive=&lt;true false&gt;</code>	Whether to allow the NT service to interact with the desktop.
<code>--agentWrapperPingInterval=seconds</code>	Java virtual machine-wrapper heartbeat interval, in seconds.
<code>--agentWrapperPingTimeout=seconds</code>	Java virtual machine-wrapper heartbeat timeout, in seconds.
<code>--agentWrapperRequestThreadDumpOnFailedJvmExit=&lt;true false&gt;</code>	Whether to try to get a thread dump if the Java virtual machine doesn't exit cleanly.
<code>--agentWrapperShutdownTimeout=seconds</code>	The wrapper's shutdown timeout, in seconds.
<code>--agentWrapperStartupTimeout=seconds</code>	The wrapper's startup timeout, in seconds.
<code>--agentWrapperSuccessfulInvocationTime=seconds</code>	The amount of time the agent has to be up before the wrapper considers it a 'successful' invocation. If there are 5 or more consecutive failed invocations, the wrapper will no longer start up the agent.
<code>--agentWrapperSyslogLogLevel=loglevel</code>	Log Level for sys/event agent wrapper log output.
<b>Apache Web Server Configuration Options</b>	
<code>--webHostName=host</code>	The host name of the current machine in the form that users will typically use in their browser to access the web server.

<code>--webHttpPort=port</code>	The HTTP port of the web server.
<code>--webHttpsPort=port</code>	The HTTPS port of the web server.
<code>--webTargetHostName=host</code>	The host name of the Commander server to which the web server points.
<code>--webTargetHttpPort=port</code>	The HTTP port of the Commander server to which the web server points.
<code>--webTargetHttpsPort=port</code>	The HTTPS port of the Commander server to which the web server points.
<code>--webTimeZone=timezone</code>	The Olson TimeZone format (example: America/Los Angeles) for the php web server.
<code>--webPluginsDirectory=path</code>	The path used by the web server to get to the plugins directory of the Commander server to which it points.
<code>--webProxyUrl=url</code>	The IP address and port of the proxy server in the following format. <code>http://&lt;IP_ADDRESS_PROXY&gt;:&lt;PROXY_PORT&gt;</code>
<code>--webNoProxyHosts=hosts</code>	Comma delimited list of hosts that should be reached directly, bypassing the proxy server.
<code>--webEnableProxySettings=&lt;1 0&gt;</code>	(1) or disable (0) the proxy server configuration. If enabling for the first time, <code>--webProxyUrl</code> must be specified.
<code>--webDLC=url</code>	The URL to use for downloadable content requests.
<code>--webDisableHttpsRedirection=&lt;1 0&gt;</code>	Disable (1) or enable (0) HTTP -> HTTPS web redirection by the web server.
<code>--webCsrfProtection=&lt;true false&gt;</code>	Enable (true) or disable (false) Cross-Site Request Forgery protection on the web server.
<b>Commander Server Configuration Options</b>	
<code>--serverFileTransferPort=port</code>	The file transfer port of the server.
<code>--serverCommanderPort=port</code>	The HTTP port of the server.

<code>--serverCommanderHttpsPort=port</code>	The HTTPS port of the server.
<code>--serverDatabaseName=name</code>	The name of the database the Commander server uses for its operation.
<code>--serverDatabaseUsername=name</code>	The user name for the database the Commander server uses for its operation.
<code>--serverName=host</code>	The name the Commander server, usually its fully-qualified domain name, or for a cluster the fully-qualified domain name of the load balancer.
<code>--serverHttpPort=port</code>	The HTTP port of the server, default value 8000.
<code>--serverHttpsPort=port</code>	The HTTPS port of the server, default value 8443.
<code>--serverInitMemory=percent</code>	Initial java heap size as a percentage of the total system memory.
<code>--serverMaxMemory=percent</code>	Maximum java heap size as a percentage of the total system memory.
<code>--serverInitMemoryMB=size</code>	Initial java heap size in MB.
<code>--serverMaxMemoryMB=size</code>	Maximum java heap size in MB.
<code>--serverPasskeyFile=path</code>	Path to the server's passkey file.
<code>--serverProxyHost=host</code>	The IP address of the proxy server.
<code>--serverProxyPort=port</code>	The port of the proxy server.
<code>--serverNoProxyHosts=hosts</code>	Comma delimited list of hosts that should be reached directly, bypassing the proxy server.
<code>--serverEnableProxySettings=&lt;1 0&gt;</code>	(1) or disable (0) the proxy server configuration. If enabling for the first time, <code>--serverProxyHost</code> and <code>--serverProxyPort</code> must be specified.
<code>--serverZooKeeperConnection=host:port [,host:port,host:port [,host:port,host:port]]</code>	Comma-separated list of host IP/FQDN and ports for the ZooKeeper servers for a clustered configuration.

<code>--serverExhibitorConnection=host[:port][,host,host[,host,host]]</code>	Comma-separated list of host IP/FQDN for the Exhibitor servers for a clustered configuration, if you are using Exhibitor. To use a port number other than 80, add the port number after the first host IP/FQDN: the same port number will be used for all hosts.
<code>--serverEnableClusteredMode=&lt;1 0&gt;</code>	(1) or disable (0) the clustered configuration. If enabling for the first time, <code>--serverZooKeeperConnection</code> must be specified.
<code>--wrapperJavaAdditional=nnnnn=value</code>	Set a line <code>wrapper.java.additional=value</code> in the server's <code>wrapper.conf</code> file. <code>nnnnn</code> must be an integer $\geq 10000$ .
<b>MySQL Database Configuration Options</b>	
<code>--databaseMemoryBufferSize=size</code>	Size of the database memory buffer. The value may be suffixed with a unit (K, M, G). Without a unit, the value is interpreted as bytes.
<code>--databasePort</code>	The database port.
<b>Repository Server Configuration Options</b>	
<code>--repositoryPort</code>	The repository server port.
<code>--repositoryInitMemory=percent</code>	Initial java heap size as a percentage of the total system memory.
<code>--repositoryMaxMemory=percent</code>	Maximum java heap size as a percentage of the total system memory.
<code>--repositoryInitMemoryMB=size</code>	Initial java heap size in MB.
<code>--repositoryMaxMemoryMB=size</code>	Maximum java heap size in MB.
<code>--repositoryStorageDirectory=path</code>	Path to the repository backing store. The artifact repository will use this directory to store artifacts.
<code>--repositoryTargetHostName=host</code>	The host name of the Commander server to which the repository server points.
<code>--repositoryTargetHttpPort=port</code>	The HTTP port of the Commander server to which the repository server points.



<code>--repositoryTargetHttpsPort=port</code>	The HTTPS port of the Commander server to which the repository server points.
<code>--repositoryTargetProtocol=&lt;http https&gt;</code>	The protocol that the repository server uses to talk to the Commander server.
<code>--repositoryProtocol</code>	The protocol that the repository server uses to talk to client applications.
<code>--repositoryProxyHost=host</code>	The IP address of the proxy server.
<code>--repositoryProxyPort=port</code>	The port of the proxy server.
<code>--repositoryNoProxyHosts=hosts</code>	Comma delimited list of hosts that should be reached directly, bypassing the proxy server.
<code>--repositoryEnableProxySettings=&lt;1 0&gt;</code>	Enable (1) or disable (0) the proxy server configuration. If enabling for the first time, <code>--repositoryProxyHost</code> and <code>--repositoryProxyPort</code> must be specified.
<code>--repositoryValidateFromDisk=&lt;1 0&gt;</code>	Enable (1) or disable (0) disk validation.

## Examples

### Setting initial and maximum memory settings

For example, to set the ElectricFlow Server initial memory percentage to 21% and the maximum memory percentage to 31%, specify:

```
ecconfigure --serverInitMemory 21 --serverMaxMemory 31
```

---

**If your ElectricFlow server, web server, or repository server is deployed behind a proxy server that inhibits certain Internet access**, you can use `ecconfigure` to set proxy settings for each server in your installation.

To use the following perl scripts, remove the brackets ("`<`" "`>`"), and replace the bracketed example text with the values you need.

- To set ElectricFlow Server proxy settings:

```
ecconfigure --serverProxyHost <IP_ADDRESS_PROXY> --serverProxyPort <PORT>
--serverNoProxyHosts "<HOST1,HOST2>"
```

- To set Repository Server proxy settings:

```
ecconfigure --repositoryProxyHost <IP_ADDRESS_PROXY> --repositoryProxyPort
<PORT>
--repositoryNoProxyHosts "<HOST1,HOST2>"
```

- To set Web Server proxy settings:

```
ecconfigure --webProxyUrl <http://IP_ADDRESS:PORT> --webNoProxyHosts
<HOST1,HOST2,HOST3>
```

---

### Changing the Apache web server port

Run `ecconfigure` with `--webHttpPort` and `--webHttpsPort`.

Your web server port setting will be changed appropriately in `httpd.conf`, `ssl.conf`, and `config.php`.

---

### Configuring the backing store location for the Artifact Repository

```
ecconfigure --repositoryStorageDirectory <new-path>
```

## ecdaemon

`ecdaemon` is a "wrapper" program that can be used to start another program from an ElectricFlow job step—the "started" program will run as a daemon process. The ElectricFlow agent uses the facilities of the underlying operating system to make sure the process runs in a separate process group on a UNIX-based system, or outside of the normal "Windows Job" grouping in a Windows system. In either case, the ElectricFlow agent does not treat the process as one it should wait for or one it should try to "kill" if ElectricFlow needs to abort the step.

### Use Cases

- `ecdaemon` is useful in the case where you are trying to deploy a "server-style" program in an ElectricFlow step. You do not want ElectricFlow to wait for that step to complete because it may run continuously, but you do want ElectricFlow to start the server program and then continue on to the next step.
- `ecdaemon` is useful if you want to "pre-load" some type of background process

`ecdaemon` launches the command and exits. Optionally, it sets a property in ElectricFlow with the `pid` of the program it spawned to make it possible for a later step to "kill" the daemonized program if desired.

For example:

```
ecdaemon c:/install.exe a b c
```

## Using ecdaemon

```
$ ecdaemon
Usage: ecdaemon [options] cmd cmdArg1 cmdArg2 ...
       ecdaemon --version

Required:
  command                The command to daemonize, followed by its args, if any.

Options:
  --pidProperty=prop-path  A property to set with the pid of the daemonized process.
  --version                Print the version of this program and exit.
```

## Command-line parsing

`ecdaemon` supports the standard UNIX-style `--` flag to indicate there are no more `ecdaemon` options and all subsequent options should be treated as simple arguments to the command.

This is particularly important for commands that themselves take `--` arguments.

For example:

```
ecdaemon /usr/bin/myserver --config /etc/myserver.conf
```

will not run properly because `ecdaemon` will attempt to parse the `--config` option instead of passing it to the `myserver` program.

The correct way to invoke `ecdaemon` in this case is:

```
ecdaemon -- /usr/bin/myserver --config /etc/myserver.conf
```

If you want to store the daemonized process's pid in a property, do so as follows:

```
ecdaemon --pidProperty /myJob/serverPid -- /usr/bin/myserver --config
/etc/myserver.conf
```

As a daemon process, any output goes to `/dev/null`, therefore no output file is generated.

## ec-perl considerations

Use the perl `system()` call to start `ecdaemon`.

`System()` returns an exit status, "backticks" capture and return output that waits for the daemonized command to complete on Windows, and `exec` never returns at all if it is successful.

# ecproxy

A driver script with built-in support for SSH. Every major operation can be overridden by defining a Perl function in the Proxy Customization field on the New Proxy Resource panel, available from the Resources page (by

specifying which operation this function re-implements. These operations must have certain "signatures" for the driver to invoke them properly—the operations are listed and described below. For more detail, see the SSH implementation in `ecproxy.pl`.

## **ecproxy Algorithm**

`ecproxy` invokes the operations detailed below to perform the following actions:

1. Uploads the command-file to a `workingDirectory` on the proxy target, using the protocol specified in the proxy config. Currently, only SSH is supported.
2. Creates a wrapper `sh` shell script that CD's to `workingDirectory`, sets `"COMMANDER_ environment variables"` that exist in the proxy agent's environment, and runs the command-file previously uploaded.
3. Uploads the wrapper script to `workingDirectory` on the proxy target.
4. Runs the wrapper script on the proxy target and streams its output to the proxy agent's `stdout`.
5. Deletes the local wrapper `shell` script, the remote wrapper, and remote command-file.
6. Exits using the exit code of running the wrapper script.

## ecproxy Operations

### getDefaultWorkingDirectory

Description	Computes the default working directory where a command needs to run on the proxy target, if the step is not defined with a working directory.
Arguments	None
Returns	The path to a directory as it would be accessed on the proxy target.
SSH implementation function	Not SSH-specific, so the function is 'getDefaultWorkingDirectory'
Existing implementation	Return <code>\$ENV{COMMANDER_WORKSPACE_UNIX};</code>
Reason to override	<p>If the "Working Directory" field is empty on a step that is going to run on a proxy target, the working directory for the step should be the workspace, just as it would be if the step were running on a non-proxy ElectricFlow agent.</p> <p><code>ecproxy</code> is guaranteed to run in the workspace directory on the proxy agent, but it is not guaranteed that the proxy target has the same path to the workspace.</p> <p>For example, the workspace on a Windows proxy agent is not the same as the path a Unix proxy target uses to access the workspace—so the existing implementation of this operation simply returns the UNIX path to the workspace. However, if the proxy target has a different path for accessing the workspace, the existing implementation will give the wrong answer. Thus, a user can provide a different implementation that gives the right answer.</p>
<b>Note:</b> This operation is applicable only if "Working Directory" is empty, and is used as the working directory on the proxy target in that case for running the command.	

### getDefaultTargetPort

Description	Computes the default port where the proxy target is listening for this protocol.
Arguments	None
Returns	The default port.
SSH implementation function	<code>ssh_getDefaultTargetPort</code>
<b>Note:</b> This operation is applicable only if the resource definition specifies no port value.	

**connect**

Description	Opens a connection to the proxy target using the desired protocol.
Arguments	<code>host, port</code> (optional)
Returns	"connection-context hash-ref" on successful connection. This context can contain anything other functions can use to perform their tasks (for example, a connection handle).
Example 1	<code>my \$context = connect('myhost', 22)</code>
Example 2	<code>my \$context = connect('myhost')</code>
SSH implementation function	<code>ssh_connect</code>
<p><b>Note:</b> Because the port is optional, the implementation of <code>connect</code> can default to whatever is reasonable for the protocol. This means the 'Proxy Target Port' need not be specified in the ElectricFlow web UI for proxied agents reachable on the default port.</p>	

**uploadFile**

Description	Uploads the given <code>srcFile</code> to the proxy target as <code>tgtFile</code> .
Arguments	<code>context, srcFile</code> (typically simple file-name), <code>tgtFile</code> (typically workingDirectory/file-name)
Returns	Nothing; on failure it does a 'die' with an appropriate error message.
Example	<code>uploadFile(\$context, 'agent123.tmp', '/opt/work/joe/agent123.tmp')</code>
SSH implementation function	<code>ssh_uploadFile</code>

**generateWrapperScript**

Description	Generates the script body that will run the command-file on the proxy-target in the <code>workingDirectory</code> .
Arguments	<code>workingDirectory</code> , <code>cmd</code> , <code>cmdArg1</code> , ..., <code>cmdFileName</code> (just the base-name, no directory)
Returns	A string containing the script to execute on the proxy target.
Example	<code>generateWrapperScript('/opt/work/joe', 'perl', 'agent123.tmp'</code>
SSH implementation function	Not SSH-specific, so the function is <code>'generateWrapperScript'</code>
Existing implementation	<code>cd workingDirectory</code> ; set <code>COMMANDER_</code> environment variables; run command-file, properly quoting the command and args.
Reason to override	If the proxy target does not have <code>sh</code> , the wrapper script needs to be written in a language available on the target.

**uploadWrapperScript**

Description	Uploads the wrapper-script code to the proxy target.
Arguments	<code>context</code> <code>workingDirectory.wrapperScriptBody</code>
Returns	The path to the wrapper-script on the proxy target.
Example	<pre>my \$wrapperFile = uploadWrapperScript (\$context, '/opt/work/joe', 'cd /opt/work/joe; perl agent123.tmp')</pre>
SSH implementation function	3.1, 3.1.1: <code>ssh_uploadWrapperScript</code>
3.1.2 and later	Not SSH-specific anymore, so the function is <code>'uploadWrapperScript'</code>
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. This function must generate a uniquely named file that will not conflict with other <code>ecproxy</code> invocations that might be occurring in parallel steps. The recommended approach is to generate a file name containing the <code>job-step-id</code>.</li> <li>2. Depending on the protocol and facilities available in the Perl implementation, you may or may not need to create a local <code>tmp</code> file to upload to the proxy target. If you do, record that fact in the <code>context</code> and clean up the local file in the <code>cleanup</code> operation. Setting the local wrapper file path in <code>\$context-&gt;{wrapperFile}</code> is recommended because the default <code>cleanup</code> operation implementation looks for that string.</li> </ol>	



**generateWrapperInvocationCommand**

Description	Generates the command-line for running the wrapper script on the proxy target.
Arguments	<code>remoteWrapperFile</code> (path on proxy target)
Returns	A string containing the command-line for running the wrapper script file on the proxy target.
Example	<pre>my \$wrapperCmdLine = generateWrapperInvocationCommand(\$wrapperFile)</pre>
SSH implementation function	Not SSH-specific, so the function is 'generateWrapperInvocationCommand'
Existing implementation	<code>Return "sh \$remoteWrapperFile";</code>
Reason to override	The default implementation of this function returns something like 'sh \$wrapperFile'. If the wrapper script is not an <code>sh</code> script, or if you want to pass different arguments to the shell, you must override this function.

**runCommand**

Description	Runs the given command-line on the proxy target.
Arguments:	<code>context</code> , <code>cmdLine</code>
Returns	exit-code from running the command on the proxy target, <code>undef</code> if the command could not be run for some reason.
Example	<pre>runCommand(\$context, \$wrapperCmdLine)</pre>
SSH implementation function	<code>ssh_runCommand</code>

**cleanup**

Description	Performs any cleanup task after the command has completed on the proxy target. Typically, it deletes any locally created temp files and uploaded files on the proxy target.
Arguments	<code>context</code> , <code>cmdFile</code> , <code>wrapperFile</code> (both are of the form <code>workingDirectory/file-name</code> )
Returns	1 on success, <code>undef</code> on failure.
Example	<pre>cleanupTarget(\$context, '/opt/work/joe/agent123.tmp', '/opt/work/joe/cmdwrapper.123.tmp')</pre>
SSH implementation function	3.1, 3.1.1: <code>ssh_cleanup</code>
3.1.2 and later	Not SSH-specific anymore, so the function is <code>cleanup</code>
<b>Note:</b> The default implementation deletes the locally created wrapper script file whose path is stored in <code>\$context-&gt;{wrapperFile}</code> , if it exists. Thus, if the <code>uploadWrapperScript</code> operation is overridden, it is recommended the overriding function set this attribute—that way, <code>cleanup</code> need not be overridden.	

**ping**

Description	A test to see if the proxy target is usable.
Arguments	<code>host</code> , <code>port</code> (optional)
Returns	1 on success, <code>undef</code> on failure.
Example	<pre>ping('myhost', 22)</pre>
SSH implementation function	Not SSH-specific, so the function is <code>ping</code> .
Existing implementation	Opens a socket connection to the proxy target on the desired port.
Reason to override	The existing implementation may be deemed too simple for doing a ping; overriding ping to open a connection and do some protocol-specific handshaking might be more appropriate for some protocols / use cases.

## Available Helper Functions

To make proxy customization easier, `ecproxy` provides the following helper functions.

### **mesg**

Description	Debug logging function. Writes to the file referenced in the <code>ECPROXY_DEBUGFILE</code> environment variable (if it exists). No-op otherwise.
Arguments	<code>message</code>
Example	<pre>mesg("myCleanup: about to delete \$cmdFile on proxy target");</pre>
<b>Note:</b> This function automatically adds a newline to whatever it emits, so the caller does not have to incorporate a newline in message.	

### **readFile**

Description	Reads a file.
Arguments	<code>fileName</code>
Returns	Contents of the file. If there is an error, it returns an empty string.
Example	<pre>my \$data = readFile("foo.txt");</pre>

### **writeFile**

Description	Creates a local file containing data.
Arguments	<code>fileName, data</code>
Returns	<code>1</code> on success, <code>undef</code> on failure.
Example	<pre>writeFile("myWrapper.\$ENV{COMMANDER_JOBSTEPID}.cmd", "perl foo.pl")</pre>

**initDispatcher**

Description	Initialize the operation dispatcher map to point to functions for the given protocol. For each operation, <code>initDispatcher</code> checks if a function named <code>protocol_operation</code> exists, and if so, assigns that function as the implementation for that operation.
Arguments	<code>protocol</code>
Example	<code>initDispatcher("ssh")</code> sets the "connect" operation to run <code>"ssh_connect"</code> , <code>"uploadFile" =&gt; "ssh_uploadFile"</code> , etc.

**setOperation**

Description	Sets the implementation of an operation to be a particular function.
Arguments	<code>operation, function</code> . The 'function' argument may be the name of a function or a reference to a function.
Example	<code>setOperation("ping", "my_ping");</code> sets the "ping" operation to run the "my_ping" function
Example	<code>setOperation("ping", \&amp;my_ping);</code> same as above, but using a function ref
<b>Note:</b> This function manipulates the <code>gDispatcher</code> hash, but provides a safe interface to it.	

**loadFile**

Description	Load proxy customizations from a file.
Arguments	<code>fileName</code>
Example	<code>loadFile("custom.pl")</code>

**setSSHKeyFiles**

Description	Set the paths to the public and private key files that ssh will use to authenticate with the proxy target.
Arguments	publicKeyFile,privateKeyFile
Example	<code>setSSHKeyFiles('c:\foo\pub.key', 'c:\foo\priv.key')</code>
<b>Note:</b> This is very useful on Windows proxies, where there is no reasonable default for ssh to use.	

**setSSHUser**

Description	Set the name of the user to authenticate with the proxy target.
Arguments	userName
Example	<code>setSSHUser('user1')</code>
<b>Note:</b> By default, the user name the agent is "running as" is used to log into the proxy target. If key-based authentication is configured on the target system such that 'agentUser' can log into the 'user1' account on the proxy target, this function leverages that configuration.	

## useMultipleSSHSessions

Description	Normally, ecproxy uses one ssh session with a number of "channels" to perform tasks like uploading files, running the command, and running a cleanup command on the proxy target. Some SSH servers don't allow this. This method configures ecproxy to use a separate SSH session for each operation; this requires authenticating with the SSH daemon on the proxy target several times, and thus it may perform worse than the single-session-multi-channel mode.
Arguments	None
Example	<code>useMultipleSSHSessions()</code>

## Examples

### Specify public/private key files for SSH

1. Set the `proxyCustomization` property on the resource like this: `?setSSHKeyFiles ('c:\foo\pub.key', 'c:\foo\priv.key');`
2. Set the `ECPROXY_SSH_PRIVKEYFILE` and `ECPROXY_SSH_PUBKEYFILE` environment variables on the proxy agent as system environment variables.

### Override one of the operations (for example, to enable SSH connection with username/password)

Set the `proxyCustomization` property on the resource like this: `?sub myConnect($$) {...}`  
`setOperation("connect", \&myConnect);`

### Load proxy customizations from a file rather than having all the logic in the `proxyCustomization` property on the resource

Set the `proxyCustomization` property on the resource like this: `?loadFile('c:\foo\custom.pl');`

### Implement a whole new protocol

Specify protocol as `'myproto'` and have a proxy customization block like this:

```
sub myproto_getDefaultTargetPort() {
  ...
}
sub myproto_connect($;$) {
  ...
}
sub myproto_uploadFile($$$) {
```

```
...
}
sub myproto_uploadWrapperScript($$$) {
# Note: As of 3.1.2, the default implementation is likely good enough, so
it may not be necessary to define this override
....
} sub myproto_runCommand($$) {
...
} sub myproto_cleanup($$$) {
# Note: As of 3.1.2, the default implementation is likely good enough, so
it may not be necessary to define this override
....
}
# Initialize the dispatcher to run these functionsinitDispatcher("myproto");
```

**Override ping to do a connect operation** (which does a full protocol handshake, authentication, and so on)

Write a specialized ping function for the proxy customization like this:

```
sub heavy_ping($$) {
  my ($host, $port) = @_;
  return ssh_connect($host, $port);
}
setOperation("ping", \&heavy_ping);
```

## "Real World" Examples

### ClusterExec

A basic integration for using `clusterupload` and `clusterexec` to reach a proxy target is here. It has been tested on a Windows target with a Cygwin installation. It will not work "out-of-the-box" because it makes the following assumptions:

- The proxy target has `sh` and other UNIX tools (for example, `rm`).
- The locations of the `clusterexec` and `clusterupload` binaries are hard-coded at the top of the proxy customization.

To make this proxy customization work on a Windows machine that does not have Cygwin, the `generateWrapperScript` operation would need to be overridden with a function that generates a `cmd` batch script, and the `generateWrapperInvocationCommand` operation would have to be overridden to generate a `"cmd /c ..."` command rather than `"sh ..."`.

### MySQL

The idea here is that the proxy target need not be a host for running arbitrary commands. It could be a special entity like a `db`. This integration uses the `mysql clt` to run the `step` command (which should be SQL) on the `db` referenced by the proxy target host and port.

A bare-bones integration with MySQL:

```
# Set the path to the mysql binary; if the directory is in the proxy agent's
# PATH, this variable can simply contain the name of the executable.
```

```

my $gMySQL = "c:/cygwin/usr/local/tools/i686_win32/bin/mysql.exe";

sub mysql_getDefaultTargetPort() {
    return 3306;
}

sub mysql_connect($;$) {
    # This "protocol" implementation is just going to use the mysql
    # command-line tool, so just save off host/port.

    my $host = $_[0];
    my $port = $_[1] || mysql_getDefaultTargetPort();

    return {host => $host,
            port => $port};
}

sub mysql_uploadFile($$$) {
    my ($context, $cmdFile, $rmtCmdFile) = @_;

    # We do not need to upload the command-file to the proxy target.
    # We are going to run the mysql clt on the proxy agent to run
    # the query (contained in the local command-file),
    # so just save off the name of the command-file.

    $context->{cmdFile} = $cmdFile;
}

sub mysql_uploadWrapperScript($$$) {
    my ($context, $workingDir, $wrapperScript) = @_;

    # This has no meaning for this integration. No-op.
}

sub mysql_runCommand($$) {
    my ($context, $cmdLine) = @_;

    # cmdLine is a command-line for running the wrapper script, which
    # has no meaning for this integration. We just want to run
    # 'mysql' for the desired host/port with the command-file.

    system("$gMySQL -D commander -h $context->{host} -P $context->{port} " .
           "-u commander -pcommander -e \"source $context->{cmdFile}\"");
}

sub mysql_cleanup($$$) {
    # We didn't create any temp files. No-op.
}

# Initialize the dispatcher to run these functions
initDispatcher("mysql");

```

## Android

This example uses the `adb` tool to upload files to the device and run commands on it. Initial testing has been only against the android emulator, but it is implemented in such a way that it should work against a real android device attached using USB to the proxy agent, or a device on the network.

A first attempt at proxying to android devices:



```
# Set the path to the adb binary; if the directory is in the proxy agent's
# PATH, this variable can simply contain the name of the executable.

my $gADB = "c:/android-sdk-windows-1.6_r1/tools/adb.exe";

sub android_getDefaultTargetPort() {
    # Not sure what a good meaningful value is here.
    return 0;
}

sub android_connect($;$) {
    # This "protocol" implementation uses the adb
    # command-line tool. Depending on the value of
    # host, construct the appropriate adb command-line
    # argument.

    my $host = $_[0];
    my $context = {};
    # if ($host eq "emulator") {
    if ($host eq "localhost") {
        # We want to talk to the emulator running on this host.
        $context->{targetArg} = "-e";
    } elsif ($host eq "usb") {
        # We want to talk to the single android device connected
        # to the computer via a USB.
        $context->{targetArg} = "-d";
    } else {
        # This must be the serial number of some device somewhere.
        $context->{targetArg} = "-s $host";
    }
    return $context;
}

sub android_uploadFile($$$) {
    my ($context, $srcFile, $tgtFile) = @_;
    my($filename, $directories) = fileparse($tgtFile);

    my $result = `$gADB $context->{targetArg} push $srcFile
"/data/tmp/$filename" 2>&1`;
    if ($? != 0) {
        die ("android_uploadFile: Error uploading file $srcFile to
/data/tmp/$filename: $result\n");
    }
}

sub android_runCommand($$) {
    my ($context, $cmdLine) = @_;

    # cmdLine is a command-line for running the wrapper script, which
    # has no meaning for this integration. We just want to run
    # 'adb' for the desired device with the command-file.

    system("$gADB $context->{targetArg} shell $cmdLine");
}

sub android_cleanup($$$) {
    my ($context, $remoteCmdFile, $remoteWrapperFile) = @_;

    # This was copied from ssh_cleanup except that we do "rm",
    # not "rf -f".
}
```

```

    msg("cleaning up");

    # Delete the locally generate wrapper file.
    unlink($context->{"wrapperFile"});

    # Delete the cmd-file and wrapper script file on the proxy target.
    $gDispatcher{"runCommand"}($context,
        "rm $remoteWrapperFile $remoteCmdFile");
}
sub android_ping($;$) {
    my ($host, $port) = @_ ;
    $port = $gDispatcher{"getDefaultTargetPort"}() unless isPortValid($port);

    my $socket = IO::Socket::INET->new(PeerAddr => $host,
                                       PeerPort => $port,
                                       Proto    => "tcp",
                                       Type      => SOCK_STREAM)
        or die "Couldn't connect to $host:$port : $@\n";
}

# Initialize the dispatcher to run these functions
initDispatcher("android");
1;

```

## ecremotefilecopy

When ElectricFlow agents (on platforms other than Linux or Windows) run steps that create log files in a workspace the ElectricFlow web server cannot access (through Linux or Windows agents), use *ecremotefilecopy* to recreate job logs so they are visible on those ElectricFlow agents, which then enables the web server to retrieve and render those log files.

Using `postp` and *ecremotefilecopy*, the log file is populated and recreated in a workspace accessible to the ElectricFlow web server, allowing the Job Details page to display the log file. Although this functionality is supported, it is not a recommended method of operation. This method should be used only as a last resort when a shared file system (between alternate agents and primary platform agents [Linux and Windows]) is not possible.

The reasons *ecremotefilecopy* is not recommended are:

- You will not see logs in real time. Logs are not visible until the "recreate step" has completed running.
- There is a performance penalty, especially when running with large files.

### Setting up the process

- Create a "Setup" step in your procedure
- Update the Postprocessor field for each step whose results you want to see on the server.
- Add a step (one or more times) to the procedure to recreate the ElectricFlow server log files.

## Creating a Setup Step

In your procedure, create a step called "Setup". This step needs to be in your procedure **before** any step running on a remote workspace.

**Note:** This is your top-level procedure, not a subprocedure.

- Navigate to your procedure.
- To create a new step, click the Command step link.
- Set the fields as follows:

Step Name: `Setup`

Command(s): `ecremotefilecopy setup`

Resource: `local`

Workspace: you have two choices:

- `use default`
- `use: alternateWorkspaceForDisplay`

There is a property on the Workspace called `alternateWorkspaceForDisplay`, which is a secondary location to look for workspace files. This secondary location is used when the workspace files are not accessible to the web server. If the Apache server cannot locate the file in the original workspace, it looks in the alternate one.

## Update the Postprocessor field for steps in your procedure

This step defines a postprocessor that will run at the end of the steps you specify. Add the following information to every step running on a remote agent if you want to see its results in the web interface.

- Navigate to a procedure and a step.
- In the Postprocessor field, enter:  
`postp --check none --loadProperty /myJob/jobSteps[Setup]/postpExtensions`
- If you are using `postp` in this step to scan your step log for errors, warnings, and so on also, omit "`--check none`" from the invocation line.

## Add a Final Step to your procedure

This step adds a new step at the end of your existing procedure. This step finds all properties created by the postprocessor, then reads the properties and creates local log files based on the properties, then deletes the properties.

- Navigate to your procedure.
- To create a new step, click the Command step link.
- Set the fields as follows:

Step Name: `Recreate the Log Files`

Always run step: (Check the box)

Command(s): `ecremotefilecopy recreateFiles`

Resource: local

Workspace: default

After the final step runs, you should see links (icons) displayed in the Log column on the Jobs Details page.

Click the icon to display the log file.

## Copying Other Files from the Workspace

By default, `ecremotefilecopy` copies only `postp` log and `diag` files, and step logs. You can also copy other files from the workspace using a function named `postpEndHook2`.

You must do the following in your step:

1. Make sure that the file you want to copy is in the step workspace. (It can be copied there, created there, etc.)
2. For your procedure, create a property (named `postpEndHook2`, for example).
3. Define a function named `postpEndHook2` inside the property. For example:

```
sub postpEndHook2() {

    # Missing param does not cause an error
    $::gCommander->abortOnError(0);

    # Add filename to a "special" property such that it will be picked up by ecr
    emotefilecopy
    my $fileName = 'paul.txt';
    copyFileToProperty ($fileName);

    # Restore default error handling
    $::gCommander->abortOnError(1);
}
```

4. Add the following line in the Postprocessor field of this step:

```
postp --check none --loadProperty /myJob/jobSteps[Setup]/postpExtensions --loadP
roperty /myProcedure/postpEndHook2
```

## ZKConfigTool

You can ZooKeeper server with configuration information that all ElectricFlow server nodes will use in a clustered configuration. This command-line tool that imports your ElectricFlow database configuration information into your ZooKeeper server. The following minimum set of files is imported:

- `database.properties`
- `keystore`
- `passkey`
- `commander.properties`

**Prerequisites**

- The ElectricFlow Tools package must be installed on the system.
- The system must be running a version of Java supported by ElectricFlow. Java is automatically installed on a system with the ElectricFlow software as part of the Tools install.
- The ZooKeeper software must be installed on the network.

**Command**

```
$ java -jar zk-config-tool-jar-with-dependencies.jar -<options>
```

**Usage: ZKConfigTool**

Option	Description
-commanderPropertiesFile <path_to_file>	Import the ElectricFlow commander.properties file.
-databasePropertiesFile <path_to_file>	Import the ElectricFlow database.properties file.
-help	Show the command Help.
-keystoreFile <path_to_file>	Import the ElectricFlow keystore file.
-passkeyFile <path_to_file>	Import the ElectricFlow passkey file.
-wrapperConfFile <path_to_file>	Import the wrapper.conf file.
-writeFile <path_on_zookeeper> <path_to_file>	Write the specified file to the ZooKeeper server.

**Import Files**

Run the `ClusterTool` command to completely populate the ZooKeeper server with configuration information. The system must have the Tools install and can be able to communicate with ZooKeeper.

- If you run the command with defined file options, the tool immediately attempts to contact the specified ZooKeeper system and import the specified files.

Example command:

```
COMMANDER_ZK_CONNECTION=10.168.33.10:2181 java -jar zk-config-tool-jar-with-
dependencies.jar --databasePropertiesFile database.properties --keystoreFile
keystore --passkeyFile passkey --wrapperConfFile wrapper.conf --
commanderPropertiesFile commander.properties
```

- If you run the command without defined file options, the tool displays a series of prompts for the required ElectricFlow information. Once the correct information is entered, the tool contacts the specified ZooKeeper system to import the specified files.

Example command:

```
$ COMMANDER_ZK_CONNECTION=10.168.33.10:2181 java -jar zk-config-tool-jar-with-
dependencies.jar
```

## ClusterInfoTool

Use `ClusterInfoTool` to get information on the running ElectricFlow server cluster from ZooKeeper.

### Prerequisites

- The ElectricFlow server cluster must be installed and running on the network.
- Configuration files that all ElectricFlow server nodes will use in a clustered configuration must be uploaded to Apache ZooKeeper server using the `ZKConfigTool`.
- The ZooKeeper cluster must be running an odd number of Zookeeper nodes and there must be a leader node.
- The system must be running a version of Java supported by ElectricFlow. Java is automatically installed on a system with the ElectricFlow software as part of the Tools installation.

### Locations

The ElectricFlow installer adds the `ClusterInfoTool` to the following default locations:

- **Windows:** `C:\Program Files\Electric Cloud\ElectricCommander\server\bin\cluster-info-tool-jar-with-dependencies.jar`
- **Linux:** `/opt/electriccloud/electriccommander/server/bin/cluster-info-tool-jar-with-dependencies.jar`

### Command

```
$ java -DCOMMANDER_ZK_CONNECTION=<ZooKeeper_Server1_IP>:2181,<ZooKeeper_Server2_IP>:21
81,<ZooKeeper_Server3_IP>:2181 -jar cluster-info-tool-jar-with-dependencies.jar
```

where `DCOMMANDER_ZK_CONNECTION` must point to the ZooKeeper system to which the ElectricFlow server cluster is connected.

### Output

This is sample output generated by `ClusterInfoTool`:

```
Checking /commander/jgroups/hornetq:
```

```
582d3642-9736-e87f-4e19-c22d7776ccab ->
```

```
WIN-M3Q09A2PNFP-21066    6c80e9a9-2fed-6352-e437-fe76b65aa80d    10.0
.175.78:5446             F
```

```
WIN-M3Q09A2PNFP-28728  0afa39df-d072-b05a-034a-aed74b7a39ee  10.0
.238.179:5446          F
WIN-M3Q09A2PNFP-28295  c69f0430-df04-bf24-1294-b471a4a3f151  10.0
.2.207:5446           F
WIN-M3Q09A2PNFP-15869  582d3642-9736-e87f-4e19-c22d7776ccab  10.0
.2.206:5446           T
```

Checking /commander/jgroups/commander:

```
0c32103a-d4e7-da91-f8c4-1fd8e125c156 ->
```

```
WIN-M3Q09A2PNFP-19713  0c32103a-d4e7-da91-f8c4-1fd8e125c156  10.0
.2.206:5447            T
WIN-M3Q09A2PNFP-14432  75afe3eb-7a04-d160-c8d0-d64f8ac3c796  10.0
.175.78:5447           F
WIN-M3Q09A2PNFP-33530  1cf1795f-e658-3cae-c515-546082bfffec9  10.0
.238.179:5447          F
WIN-M3Q09A2PNFP-60743  cf8b4201-3fac-71c4-18da-0a885b3e1e61  10.0
.2.207:5447            F
```

How to interpret ClusterInfoTool output:

- The nodes /commander/jgroups/hornetq and /commander/jgroups/commander contain information on these JGroups clusters:
  - commander for the ElectricFlow server cluster
  - hornetq for the HornetQ cluster
- The children nodes under each of the JGroups nodes represent the participating ElectricFlow servers in the cluster. Each child node entry is in this form:

```
<Logical Name>    <UUID>    <IP address>:<port>    T|F
```
- The number of entries in both JGroups nodes should be the same, with matching IP addresses but with different port numbers and distinct logical names and UUIDs. The coordinator node in each JGroups cluster is identified with a 'T' against its entry.

## Security Issues

This topic describes how to resolve security issues.

### Cross-Site Request Forgery Protection

Cross-Site Request Forgery (CSRF) is an attack that forces end users to execute unwanted actions on a web application in which they are currently authenticated. CSRF attacks specifically target state-changing requests, not data theft, because the attacker cannot see the response to the forged request. Using social engineering (such as sending a link via email or chat), an attacker may trick the users of a web application into executing actions of the attacker's choosing. If the victim is a normal user, a successful CSRF attack can force the user to perform state changing requests like transferring funds, changing their email address, and so on. If the victim is an administrative account, CSRF can compromise the entire web application. For more information about CSRF, go [here](#).

CSRF protection is disabled by default. You can enable or disable CSRF protection as follows:

- To enable CSRF protection, enter `ecconfigure --webCsrfProtection=true`.

Examples using the default directory:

- For Linux, enter

```
/opt/electriccloud/electriccommander/bin/ecconfigure --webCsrfProtection=true
```

- For Windows, enter

```
C:\Program Files\Electric Cloud\ElectricCommander\bin>ecconfigure --webCsrfProtection=true
```

- To disable CSRF protection, enter `ecconfigure --webCsrfProtection=false`.

Examples using the default directory:

- For Linux, enter

```
/opt/electriccloud/electriccommander/bin/ecconfigure --webCsrfProtection=false
```

- For Windows, enter

```
C:\Program Files\Electric Cloud\ElectricCommander\bin>ecconfigure --webCsrfProtection=false
```

## Automation Platform Tasks

All the topics in this section are about a particular feature or function in the ElectricFlow automation platform. They are the same as the topics in the "Web Interface Help" section of the Help system on the automation platform UI.

From the automation platform UI, you can access the topics as follows:

- All ElectricFlow Help topics above this directory are expanded, user-guide style Help topics about a particular ElectricFlow feature or function. Direct access to these Help topics is from the Help system Table of Contents. Although these topics are not directly linked within the ElectricFlow product, many "page-specific Help topics contain links to one or more of these topics to provide more detailed information quickly.
- The Help topics listed below this directory are "page-specific" Help topics, which means each of these topics contains specific information for the automation platform web page you are viewing. To access these Help topics while using ElectricFlow, click the **Help** link at the top-right corner on any automation platform web page. (The topics in this section of the AllHelp directory are listed singularly or in groups as is appropriate.)

## Access Control

Use this GUI page to view and modify access privileges for a particular ElectricFlow object. Depending on the object where you want to set permissions, you will see that object's name as part of the page title (above the tables).



For example, if you clicked the Access Control link from a Project Details page, you will see the project name as part of the Access Control page title.

### Reading and Using This Page

- This page displays one or more access control lists. The top list contains entries for the object itself (specified in the page title) and also identifies the object.  
For example, if the heading for the top list reads "Privileges for Procedure: buildAndTestAll," you are viewing access privileges for a procedure named "buildAndTestAll". Click the object name to view the main page for that object.
- Typically, you will see more than one list on the page. Each list below the first one contains privileges for an object that "contains" the objects above it.  
For example, a project contains all of its procedures and a procedure contains all of its steps. Privileges for the top-level object are determined by all the privileges in all of the displayed lists. The lists form an "inheritance chain" where each object "inherits" permissions from the objects below it on the page.
- When a user attempts a particular operation on the object, ElectricFlow examines the lists on this page from top to bottom. If there is an entry specifying "deny" for the user (or a group containing the user) in the top list, access is denied. Otherwise, if an entry specifies "allow" for the user (or a group containing the user) in the top list, access is allowed. If access is neither allowed nor denied by the top list, ElectricFlow proceeds to the next list and processes it in the same way.  
**Note:** If access is neither allowed nor denied by any list, ElectricFlow denies access.
- The inheritance mechanism makes it easy to control access for a large number of objects in a single place.  
For example, project access control entries automatically apply to new objects created within the project. Each new object in the project has an empty access control list, but will inherit from the project.

### Using the Links...

Use these links to add or increase Access Control for an object.

- **Add User**—Use this link to add permissions for a specific user.
- **Add Group**—Use this link to add permissions for a specific group, which means all users in that group would have the permissions allowed to the group.
- **Add Project**—Use this link to set or redefine permissions for a project.
- **Break Inheritance**—**Caution: Be very careful if you break inheritance!** If you use the "Break Inheritance" action for any list, no additional inheritance occurs *below* that list and you no longer see other lists on this page. This action is useful if you want privileges for an object to be totally different than its containing object. If an object has no entries in its access control list and you break inheritance for that object, you make the object *completely inaccessible*—you will not even have the "Change Permissions" privilege, so you cannot restore inheritance. If this occurs, see your system administrator to restore inheritance.
- **Actions:**
  - **Edit**—Use this link to modify current permissions, but be careful if you modify permissions in an *inherited* access control list. Modifying inherited access control affects all other objects that inherit from the same list.
  - **Delete**—Deletes the current privileges granted for that user, group, or project.

## Privilege Definitions

The following four privilege types (for each ElectricFlow object) can be assigned *allow*, *deny*, or *inherit* permission.

**Read**—Allows object contents to be viewed.

**Modify**—Allows object contents (but not its permissions) to be changed.

**Execute**—If an object is a procedure or it contains procedures (for example, a project), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.

**Change Permissions**—Allows object permissions to be modified.

**For more information**, see the main [Access Control](#) Help topic. This Help topic also contains two examples that illustrate how you might use Access Control to increase ElectricFlow security.

## Access Control—defining entries

Use this page to define access control entries selected from a filtered list of ElectricFlow users, groups, or projects, or by providing an explicit name.

Enter information in the fields as follows:

**Note:** The following instructions are generic. For example, if you chose Add User, the Filter field will be labeled "User Filter".

Field Name	Description
Radio selector	Choose between selecting "Search for existing..." or select "Provide explicit ... name". Providing an explicit name bypasses the search and allows you to enter an arbitrary name.
Filter	Enter a partial name to retrieve a list of all users/groups/projects that include the partial name you supplied.
Include Inactive	<p>[User/Group only]—Use this checkbox only if requesting external LDAP or Active Directory providers.</p> <p>If "checked," all available users or groups are returned.</p> <p>If not checked, only those users or groups known to the ElectricFlow server are returned, for example, users who have logged in or groups containing users who have logged in.</p>

Click **OK** to retrieve your information.

If you entered filter criteria, the page will refresh with a list of matches. Select any row in this table to create an access control entry for that principal.

### Column descriptions

Name—The name of the user/group/project.

Location—Only viewable for users or groups from non-local directory providers. The name combined with the location is the unique identifier for this user or group, local to the ElectricFlow server.

### Privileges—create new or edit existing privileges

Use this page to create or modify an access control list entry. Each entry names a *principal*, which can be either an individual user or a group, and defines four privileges for the principal.

For each of the four privileges, **Read**, **Modify**, **Execute**, or **Change** Permissions:

- Creating a new entry or modifying an existing entry allows you to select either Inherit, Allow, or Deny access entries.
- On the server access control table, "Don't Care" replaces the "Inherit" option.

For more information about access control, see the [Access Control](#) Help topic.

### Artifacts

This page displays all artifacts available on this ElectricFlow server.

You can search for artifacts and save the artifact search filters for later use. See [Context Searching and Filtering on page 843](#) for details on using the search capabilities on this page.

### Links and actions at the top of the table

- **Create Artifact**—Use this link to go to the New Artifact page to create a new artifact.
- The "star" icon allows you to save this page to your Home page for quick access.

### Column descriptions

Column Name	Description / Actions
Name	The name of the artifact—a system-generated name created by combining the Group Id and Artifact Key components. <b>Note:</b> Selecting an artifact name takes you to the Artifact Details page for that artifact.
Group Id	The user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.

Column Name	Description / Actions
Artifact Key	The "key" component of the artifact name.
Description	The plain text or HTML description previously supplied for this artifact.
Actions	<b>Edit</b> —Use this link to go to the Edit Artifact page to modify the artifact on this row. <b>Delete</b> —Use this link to delete the artifact on this row.

## Artifact Details

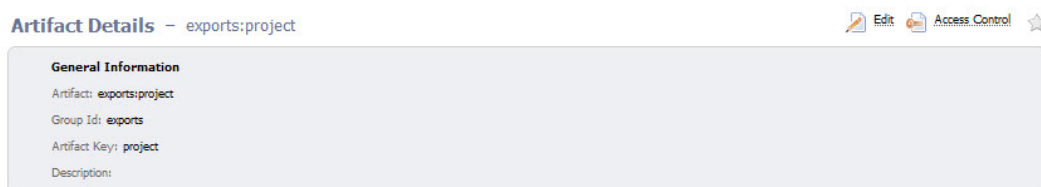
This page displays detailed information about an artifact.

### *Links and actions at the top of the table*

- **Edit**—Use this link to go to the Edit Artifact page to make any necessary changes for this artifact's description or artifact version name template.
- **Access Control**—Use this link to set privileges for this artifact. *For more information*, see the [Access Control](#) Help topic.
- The "star" icon allows you to save this job information to your Home page.

### General Information section

This section displays the artifact name (Artifact), Group Id, Artifact Key, and any Description previously supplied for this artifact.





### The "tabbed" sections

The next section of tabs allows you to select the type of information you want to see.

### Artifact Versions table

This table displays all artifact versions included in this artifact.

Artifact Versions			Properties
Artifact Version	Description	Actions	
com.ec.myapp:1.0		 	

Column descriptions

Artifact Version—Click on an artifact version name to go to the Artifact Version Details page for that artifact version.

Description—The previously supplied description, if any, for this artifact version.


Actions

- Click the **Edit** link to go to the Edit Artifact Version page.
- Click the **Delete** link to delete this artifact version from the artifact.

Properties table

This table contains custom properties for this artifact.

- Click on a Property Name to edit that property.
- If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.
- This section also provides **Create Property**, **Create Nested Sheet**, and **Access Control** links to add more custom properties or change or set privileges on this artifact.

Artifact Versions			Properties
Property Name	Value	Description	Create Property   Create Nested Sheet   Access Control
Status	New		

Artifact—create new or edit existing artifact

To create a new artifact

Enter information in the fields as follows:

Field Name	Description
Group Id	Enter a group name of your choice for this artifact. A Group Id (groupId) acts as a namespace for grouping related artifacts. The idea is that artifact "sdk" for group "platform" can co-exist with artifact "sdk" in group "ui" without there being any name collisions. This field is limited to alphanumeric characters, spaces, underscores, hyphens, and periods.

Field Name	Description
Artifact Key	Enter an identifier of your choice for this artifact. This field is limited to alphanumeric characters, spaces, underscores, hyphens, and periods.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code> .
Artifact Version Name Template	<p>A template for the names of artifact versions published to this artifact.</p> <p>For example:</p> <pre>\$/myArtifactVersion/groupId]:\$/myArtifactVersion/artifactKey]:\$ [/myArtifactVersion/version]</pre> <p>Produces a name like: <code>platform:sdk:1.0.0-36</code></p> <p>Only absolute property paths and <code>/myArtifactVersion</code>-based paths are supported. If not specified, the "Artifact Version name template" server setting is used.</p>

Click **OK** after filling in the fields and to go to the Artifacts page to see your new artifact listed in the first column.

#### To edit an artifact

- Click the **Access Control** link at the top of the page to add permissions to this artifact.
- You can add a Description or modify your existing description.
- You can add an Artifact Version Name Template or modify your existing template.
- Click **OK** to save your changes and return to the Artifacts page.

## Artifact Versions

This page displays all artifact versions available on this ElectricFlow server.

You can search for artifact versions and save the search filters for later use. See [Context Searching and Filtering on page 843](#) for details on using the search capabilities on this page.

### *Links and actions at the top of the table*

- The "star" icon allows you to save this page to your Home page for quick access.

### Column descriptions

Column Name	Description / Actions
Name	The name of the artifact version. Select an artifact version name to go to the Artifact Version Details page for that artifact version.
Artifact	The name of the artifact. Select an artifact name to go to the Artifact Details page for that artifact.
Group Id	The name of the group where this artifact version is a member.
Artifact Key	The "key" identifier for this artifact version.
Version	The artifact version represented, by default, as <code>major.minor.patch-qualifier-buildNumber</code> . <b>Note:</b> You will not see all 5 artifact version components specified if only 3 components were defined.
State	The current state of this artifact version. Possible values are: <code>available</code>   <code>publishing</code>   <code>unavailable</code> .
Modify Time	The last time this artifact version was modified.
Actions	<b>Edit</b> —Use this link to go to the Edit Artifact Version page to modify the artifact version on this row.  <b>Delete</b> —Use this link to delete the artifact version on this row.

### Artifact Version Details

This page displays detailed information about an artifact version.

#### Links and actions at the top of the table

- **Edit**—Use this link to go to the Edit Artifact Version page.
- **Access Control**—Use this link to set privileges for this artifact version. *For more information*, see the [Access Control](#) Help topic.
- The "star" icon allows you to save this artifact version information to your Home page.

General Information section

This section lists current information about the artifact version. While most of the information is static, two items link to other pages:

- Artifact—Click the artifact name to go to the Artifact Details page for the "owning" artifact.
- Published By—Click this link to go to the Job Details page for the job that published this artifact version. If this artifact version was published by an end user outside of a job context, this field will display None.



The "tabbed" sections

The next section of tabs allows you to select the type of information you want to see.

Files

This section shows the collection of files included in this artifact version. The left-pane displays the artifact version directory structure and the right-pane displays files and subdirectories for the currently selected folder in the left-pane. This structure is similar to Windows Explorer.



Retrievers table

This table lists the 50 most recent jobs that retrieved this artifact version and includes links to the Job Details page for those jobs.



Dependent Artifact Versions table

This section displays dependent artifact version queries registered with the artifact version during a publish operation. These queries are evaluated during retrieval and the most current artifact version that matches each query is returned along with the primary artifact version.





Properties table

This table contains custom properties for this artifact version.

- Click on a Property Name to edit that property.
- If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.
- This section also provides **Create Property**, **Create Nested Sheet**, and **Access Control** links to allow you to add more custom properties.



Artifact Version—edit an existing artifact version

This page displays an existing artifact version you can modify.

Links and actions at the top of the table

- **Access Control**—Use this link to add or change permissions for this artifact version.
- The "star" icon allows you to save this page to your Home page for quick access.

To edit an artifact version

Field Name	Description / Action
Name	You can type-over the artifact version name in this field to change or modify the existing name.
Description	You can add a description or modify your existing description.
Publisher	This is the job that completed the publish operation. Click this link to go to the Job Details page for this job. If this artifact version was published outside of a job context (for example, from ectool), the value for this field is "None".

Field Name	Description / Action
State	<p>An artifact version can be in one of three states: <code>available</code>, <code>unavailable</code>, and <code>publishing</code>.</p> <p>If the artifact version is:</p> <ul style="list-style-type: none"> <li>in the <code>Publishing</code> state, the artifact version cannot be retrieved, but it will transition to the <code>Available</code> state when the publishing operation is complete. The web interface does not allow you to change the state if it is currently <code>Publishing</code>.</li> <li>in the <code>Available</code> state, the artifact version can be retrieved. To confirm this state, the checkbox is "checked," and unchecking this box makes the artifact version <code>unavailable</code>.</li> <li>in the <code>Unavailable</code> state, the artifact version cannot be retrieved. "Checking" the box changes the artifact version state to <code>Available</code>.</li> </ul>

## Repositories

This page displays all artifact repositories available to this ElectricFlow server.

### *Links and actions at the top of the table*

- **Add Repository**—Use this link to go to the New Repository page to add another artifact repository.
- The "star" icon allows you to save this page to your Home page for quick access.

### *Column descriptions*

Column Name	Description / Actions
Repository Name	<p>The name of the artifact repository.</p> <p>Select a repository name to go to the Edit Repository page if you need to modify that repository.</p> <p><b>Note:</b> If you have multiple repositories and want to change the search order for retrieving artifacts, drag the icon (in the far left column) up or down to reposition an artifact to the order you need.</p>
Zone	The name of the zone where this repository resides.
URL	The server URL is in the form <code>protocol://host:port/</code> . Typically, the repository server is configured to listen on port 8200 for <code>https</code> requests, so a typical URL looks like <code>https://host:8200/</code>

Column Name	Description / Actions
Enabled	Select this checkbox to enable or disable this artifact repository. By disabling this repository, users will not be able to retrieve any artifacts stored in this repository.
Description	A plain text or HTML description previously supplied for this repository.
Actions	<b>Delete</b> —Use this link to delete the artifact repository on this row.

## Repository—create new or edit existing repository

### To create a new repository

Enter information in the fields as follows:

Field Name	Description
Name	Enter any name of your choice for this repository.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code> .
URL	The server URL is in the form <code>protocol://host:port/</code> . Typically, the repository server is configured to listen on port 8200 for <code>https</code> requests, so a typical URL looks like <code>https://host:8200/</code> .
Zone	Use the drop-down menu to select a zone for this repository. If no zone is selected, this repository will reside in the <i>default</i> zone.
Enabled	Select this checkbox to enable this repository. If this repository is disabled ("unchecked"), users will not be able to retrieve any artifacts stored in this repository.

Click **OK** after filling-in the fields and to return to the Repositories page to see your new repository listed in the first column.

### To edit a repository

You can:

- Use the **Access Control** link at the top of the table to set permissions on this repository
- Change the repository name
- Add a description or modify the existing description
- Modify the URL
- Select a different zone.
- Enable or disable the repository

Click **OK** after making any modifications and to return to the Repositories page.

## Database Configuration

If you choose not to use the ElectricFlow built-in database, use this page to configure your MySQL, SQL Server, or Oracle database to communicate with ElectricFlow.

**Note:** The ElectricFlow built-in database is not recommended for production use.

Fill in the fields as follows:

Field Name	Description
Database Type	Select your database type from the drop-down menu. If "Built-in" is selected, no other information is required.
Database Name	Enter your database name.
Host Name	Enter the host name for your database server.
Port	Use the default port or enter a new port number.
Database Credentials	User Name—Accept the default "commander" user name or enter the appropriate user name for your database. Password—Enter the database password.

**IMPORTANT:** When you set the SQL server as the database, you can only use a non-named database.

Click **Save and Restart Server** after entering information in all fields.

**Note:** You may need to consult with your Database Administrator if you do not have all of the information required on this web page.

**For more information,** consult the *ElectricFlow Installation Guide*.

## Defect Tracking Configurations

This page displays Defect Tracking configurations known to the ElectricFlow server—ElectricFlow integrates, using plugins, with numerous defect tracking systems.

### Link at the top of the table

Use the **Create Configuration** link to create a new Defect Tracking configuration.

### Column descriptions

Column Name	Description
Configuration Name	The name you provided to the configuration you created.
Description	This column describes the Defect Tracking configuration type.
Plugin	The name of the plugin where the Defect Tracking integration resides.
Actions	<b>Edit</b> —Click this link to modify an existing configuration. <b>Delete</b> —Click this link to remove the configuration.

## Defect Tracking—create new or edit existing configuration

Use this page to define a new defect tracking configuration or modify an existing defect tracking configuration. A configuration is a collection of properties that define how ElectricFlow communicates with a particular defect tracking system.

After creating a defect tracking configuration, your entry will appear in the table on the Defect Tracking Configurations web page— to see this web page, select the Administration > Defect Tracking tabs.

### To create a defect tracking configuration

From the Defect Tracking Type drop-down menu, select your defect tracking system—ElectricFlow integrates with numerous defect tracking systems. Each integration was created using plugin technology.

Click the **Submit** button and a set of fields is displayed to enter information to create your configuration.

Enter information in the fields as follows:

Field Name	Description
Configuration Name	Enter a unique name for this defect tracking configuration—any name you choose.

Field Name	Description
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Login As	<p>User Name—This is the name ElectricFlow needs to use to communicate with your defect tracking system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.</p> <p>Password—This is the password for the specified User Name.</p> <p>Retype Password—Type the password again.</p> <p>URL—This is the URL to use to connect to a JIRA server. For example, you might use something similar to: <code>http://10.10.10.10:8080</code> or <code>http://yourJIRAserver</code></p>

Click **Submit** to save your information.

### Using the defect tracking integration

Go to Projects > select a project > select a procedure.

- To create a New Step for defect tracking, select the Plugin link.
- In the Choose Step panel, select Defect Tracking from the left pane, then select the defect tracking system you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the defect tracking integration you configured and the step you chose.
- Enter the remaining information to create your defect tracking step.

See the [Defect Tracking](#) Help topic for more information.

### To edit an existing defect tracking configuration

Modify any of your defect tracking configuration information by "typing-over" any previously entered information.

Click **Submit** to save your modified defect tracking information.

## Defect Tracking Reports

This is a report of URLs to JIRA defects associated with the ElectricFlow job.

The report was compiled by searching job properties for JIRA defect IDs then querying the configured JIRA server for the current defect state.

**For more information** about Defect Tracking, see the main [Defect Tracking](#) Help topic.

If you would like to create a defect tracking configuration, go to Administration > Defect Tracking and click the **Create Configuration** link to see the New Defect Tracking Configuration web page. Access the Help link on that page for more information.

## Email Configurations

This GUI page displays all previously configured email configurations.

- Click on a Configuration Name to go to the Edit Email Configuration web page to modify an existing email configuration.
- Click on the Add Configuration link to create new email configuration.
- Action column—This column contains two links to Copy or Remove an Email Configuration.

Notice this page also lists the email server name and who the email notification was from.

## Email Configuration—create new or edit existing email configuration

Use this web page to specify an email server to ElectricFlow. If you do not create an Email Configuration, you will not be to send Email Notifications to individuals or groups.

If you have multiple users or groups in remote locations that use a different mail server, create additional Email Configurations to accommodate those locations if they need to receive ElectricFlow notifications.

### To create a new email configuration

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique name to identify the Email Configuration.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Mail Protocol	Either SSMTP or SMTP

Field Name	Description
Mail Host	The name of the mail server.
Mail Port	The port number for the mail server, but may not need to be specified. Protocol software determines the default value (25 for SMTP and 465 for SSMTP). Specify a value for this argument when a non -default port is used.
Mail From	An individual name or a generic name like "ElectricFlow" or "build."
Mail Username	An individual name or a generic name like "ElectricFlow."
Mail Password	The password for the mail user name account.

Click **Save** after filling-in all fields.

Click the **Test** button to run a test to make sure your email configuration works. Enter an email address in the pop-up box and click **Send**.

#### To edit an existing email configuration

Use the **Access Control** link at the top of the page to add or change existing permissions.

You can modify any of the information already supplied or add new information.

Click **OK** after completing your edits.

#### Email Notifier—create new or edit existing email notifier

Use this page to set up email notifiers.

**Note:** You must have already set up an email configuration so ElectricFlow knows which email server to use when sending any notifications. If you have not configured an email server to communicate with ElectricFlow, click the **Administration > Email Configurations** tabs to do this configuration now.

For jobs and job steps, two types of email notifiers:

- On Start Notifier – Sends an email when a job or job step starts.
- On Completion Notifier – Sends an email when a job or job step completes.

For workflow states, three types of email notifiers:

- On Enter Notifier – Sends an email when the state becomes the workflow's active state.
- On Start Notifier – Sends an email after the state's subjob or subworkflow starts. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.
- On Completion Notifier – Sends an email after the state's subjob or subworkflow completes. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.



Using email notifiers:

- Attaching an email notifier to a procedure results in a corresponding email notifier associated with the job that is created when the procedure is executed.
- Attaching an email notifier to a procedure step results in a corresponding email notifier associated with the job step created when the procedure referencing the procedure step is executed.
- Attaching an email notifier to a state definition results in a corresponding email notifier associated with the state that is created when the workflow is executed.

**To create a new email notifier**

Enter information in the fields as follows:

Field Name	Description
Name	This name can be an arbitrary text string.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Condition	Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty or non-zero, the message is sent. If the result is "0", the message is not sent

Field Name	Description
Formatting Template	<p>Use the pull-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different. Make sure the content is formatted correctly, i.e., no illegal characters or spacing.</p> <p>To customize your template, edit the auto-supplied text in the Formatting Template text box or you can add a completely new script for your purpose. Any edits made in this text box will not be saved to the global template.</p> <p><b>Note:</b> See the "Email notifier templates" section at the end of this Help topic for a list of available templates and instructions for making global modifications to these templates.</p> <p>To create a custom template, the basic structure is:</p> <ul style="list-style-type: none"> <li>• zero or more email header lines</li> <li>• blank line</li> <li>• message body</li> </ul> <p>The template undergoes property expansion in a <code>job</code>, <code>jobStep</code>, or <code>state</code> context. In addition to normal property paths, an additional event object is accessible via <code>/myEvent/</code>.</p> <p>The following example is a sample formatting template for a job:</p> <pre>Subject: Job '\${jobName}' from procedure '\${procedureName}' \${/myEvent/type}-ElectricFlow notification cc: owner@example.org bcc: admin@example.org  ElectricFlow Notification-from email notifier '\${/myEvent/notifier}'  Job    '\${jobName}'    \${/myEvent/type}    at:    \${/myEvent/time}  Project:           \${projectName} Procedure:         \${procedureName} Started:           \${start} Completed:         \${finish} Directory Name:    \${directoryName} Launched by User:  \${launchedByUser} Outcome:           \${outcome} Error Code:        \${errorCode} Error Message:     \${errorMessage}</pre> <p>This example demonstrates how you can send this notification using CC or</p>

Field Name	Description
	BCC fields in addition to specified Destinations. Because headers are interpreted by SMTP, normal email rules apply.
Email Configuration	Click inside this field or start typing to bring up a list of possible email configuration names. An email notifier that does not specify an email configuration will use the configuration named 'default' if it exists.
Destinations	A space-separated list of valid email addresses, email aliases, or ElectricFlow user or group names, or a property reference that expands into such a list, or you can enter an LDAP DL name (group name).

Click **OK** to save your email notifier configuration.

#### To edit an existing email notifier

Modify or add information to any of the fields and click **OK** to save your changes.

#### Email notifier templates

The table below lists global email notifier templates for your use. Each template name is a link to an example of the template output and the script.

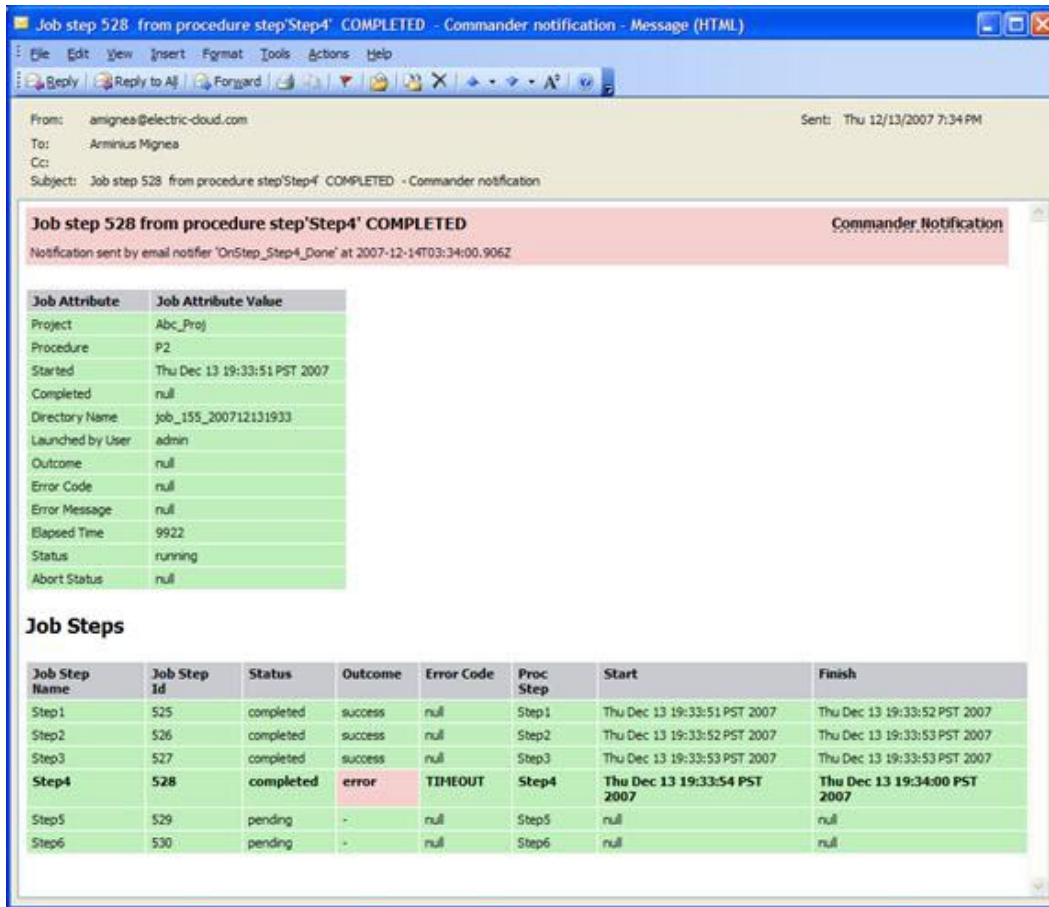
Global templates are stored as property sheets under the `"/server/ec_notifierTemplates"` property sheet. You can modify template properties or add new global templates if you have modify privileges on the server property sheet. An email notifier will be updated if changes are made to its global template.

Template Name	Format	Usage	Description
Job Summary text notification	Plain text	Procedure	Formatting template for Procedure starting/completion notifications using the long form of property names (for example, <code>\$ [/myJob/jobName]</code> )

Template Name	Format	Usage	Description
Step summary text notification	Plain text	Procedure step	Formatting template for Procedure Step starting/completion notifications using the long form of property names (for example, <code>\$/myJobStep/jobStepId</code> )
State summary text notification	Plain text	State	Formatting template for State notifications using the long form of property names (for example, <code>\$/myWorkflow/workflowName</code> )
Job summary HTML notification	HTML	Procedure	HTML formatting template for Procedure starting/completion notifications
Step summary HTML notification	HTML	Procedure step	HTML formatting template for Procedure Step starting/completion notifications displaying information about the Job and the Job Step
All steps HTML notification	HTML	Procedure step	HTML formatting template for Procedure Step starting/completion notifications displaying information about the Job and many Job Steps
Approval request HTML notification	HTML	State	HTML formatting template for State notifications displaying information about the workflow and all of its states
Workflow summary HTML notification	HTML	State	HTML formatting template for State notifications providing the recipient with links to view or take a manual transition

### Email Notifier Template—Html\_JobStepTempl\_AllSteps.txt

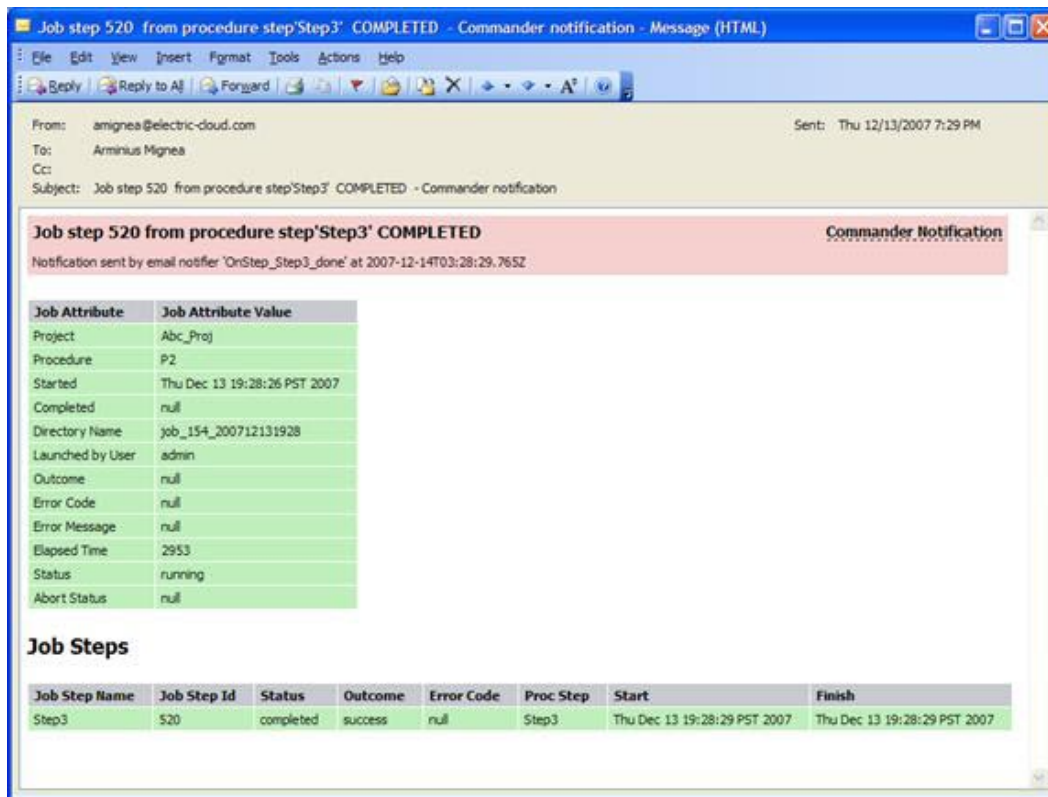
If you use this template, the following screen example is similar to how your email notifier will look.



1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—Html\_JobStepTempl\_SingleStep.txt

If you use this template, the following screen example is similar to how your email notifier will look.

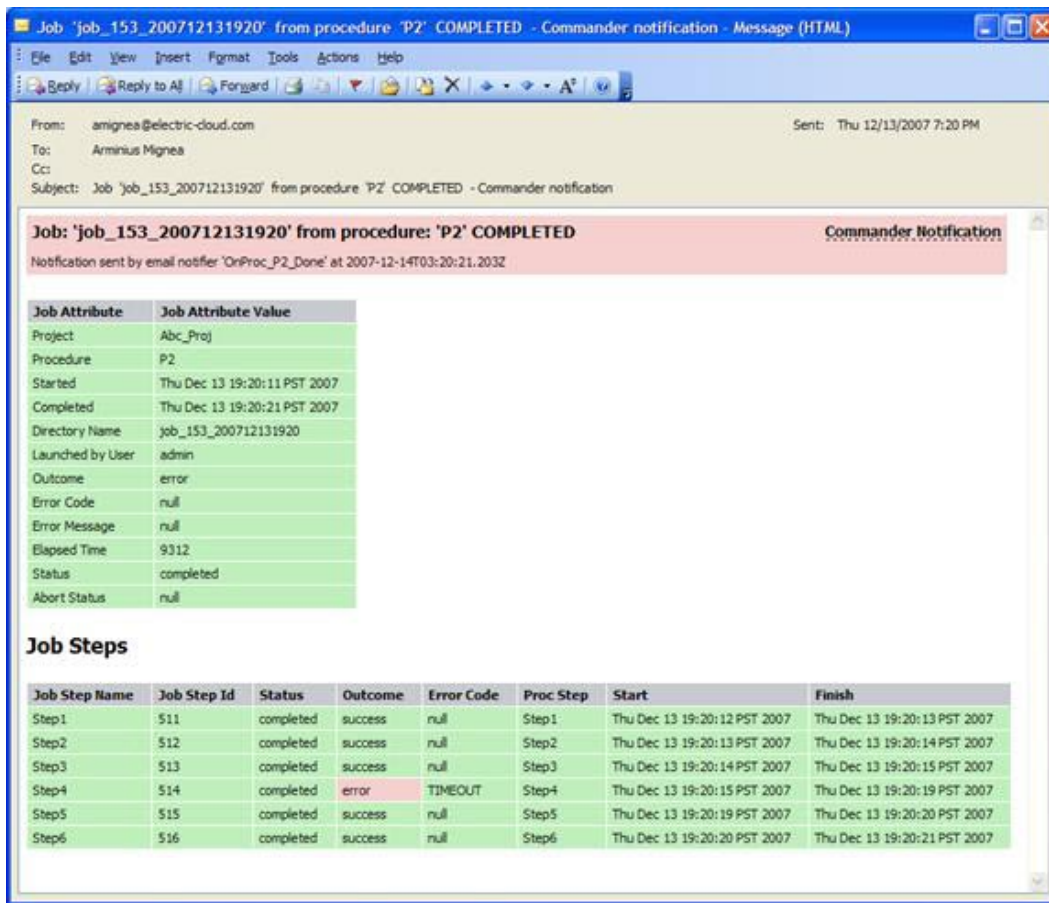


**Note:** In the following script, myJob.steps and myJob.jobSteps return an array of step names.

1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

## Email Notifier Template—Html\_JobTempl.txt

If you use this template, the following screen example is similar to how your email notifier will look.

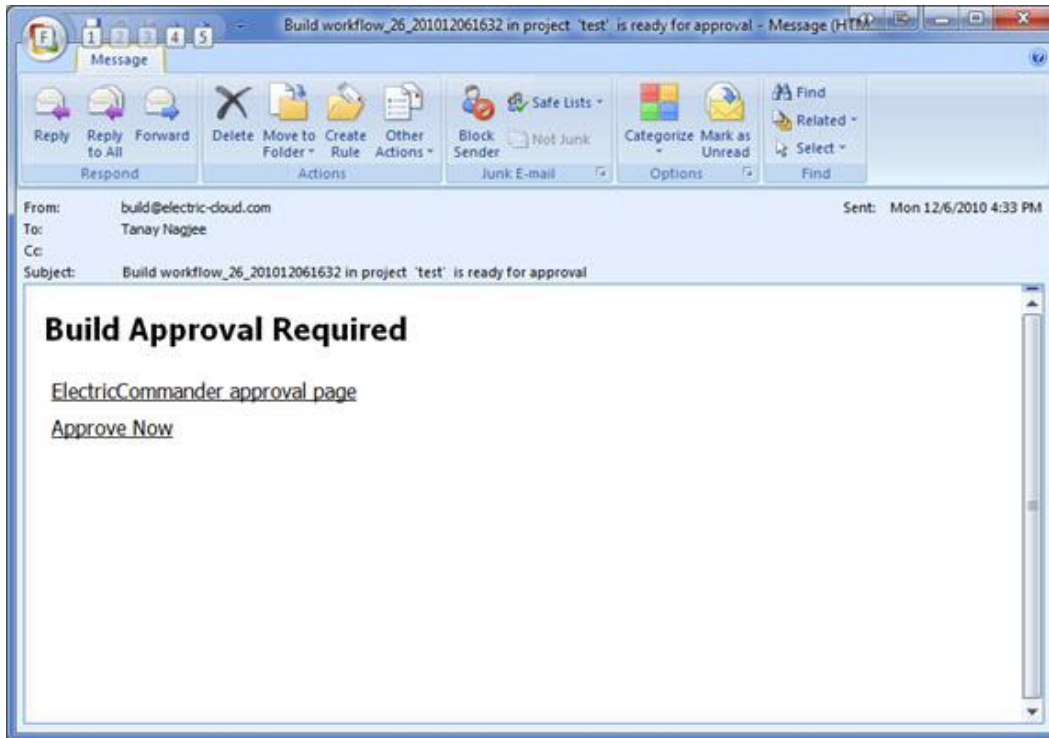


1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—Html\_StateTemplate\_ApproveWorkflow.txt

If you use this template, the following screen example is similar to how your email notifier will look.

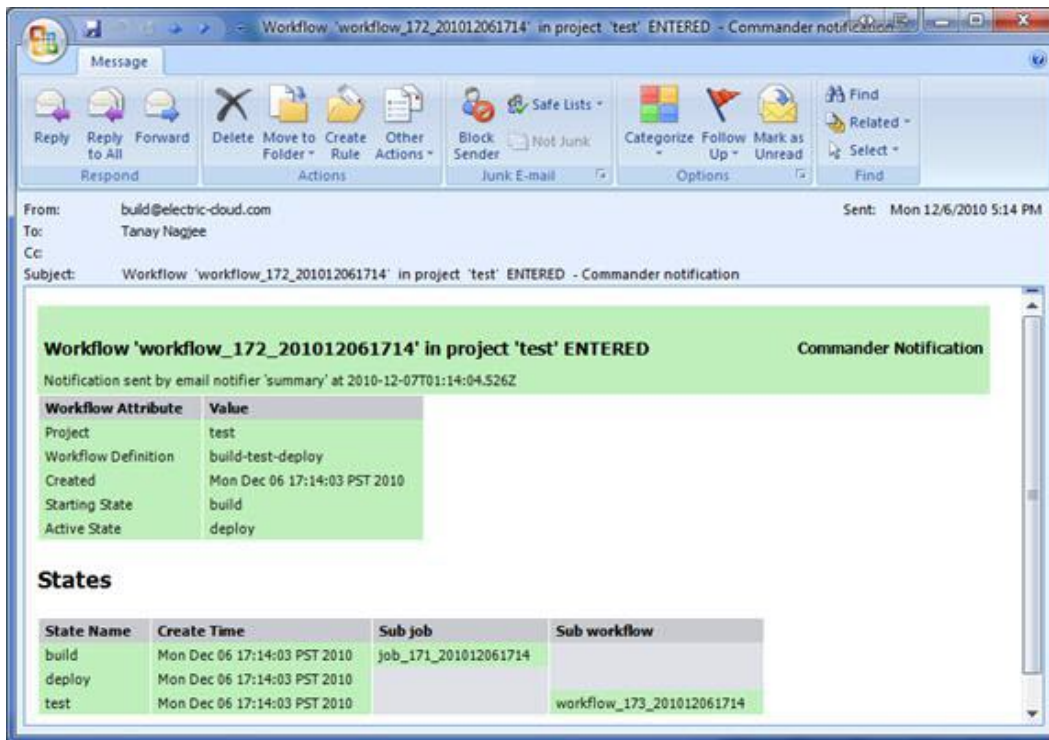




1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—Html\_StateTemplate\_FullWorkflow.txt

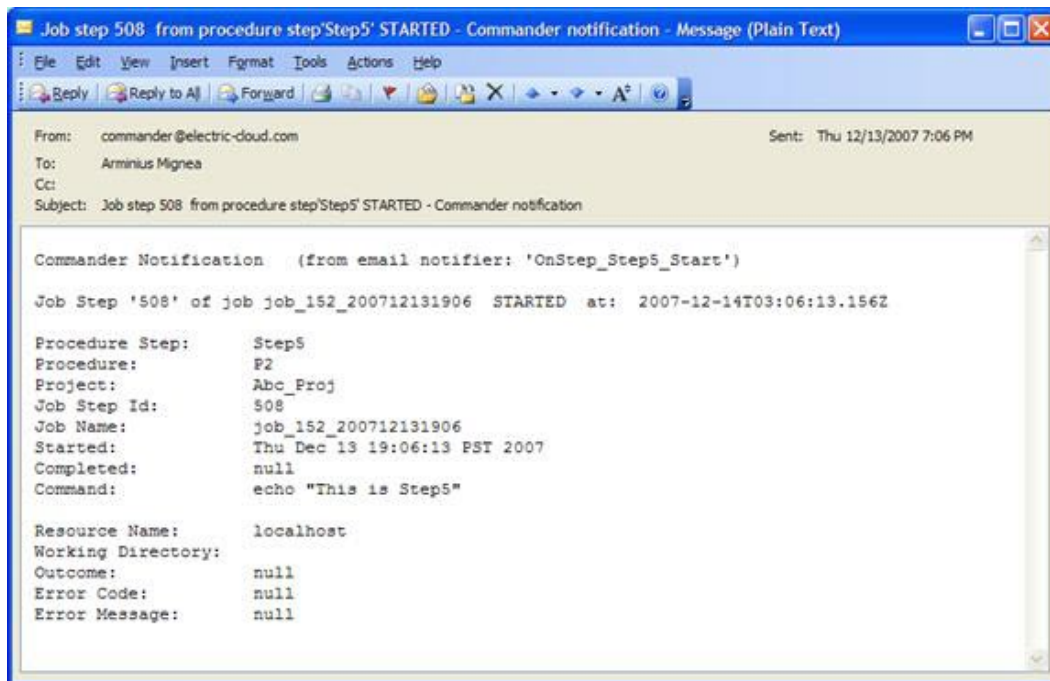
If you use this template, the following screen example is similar to how your email notifier will look.



1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—JobStepTempl\_FullProps.txt

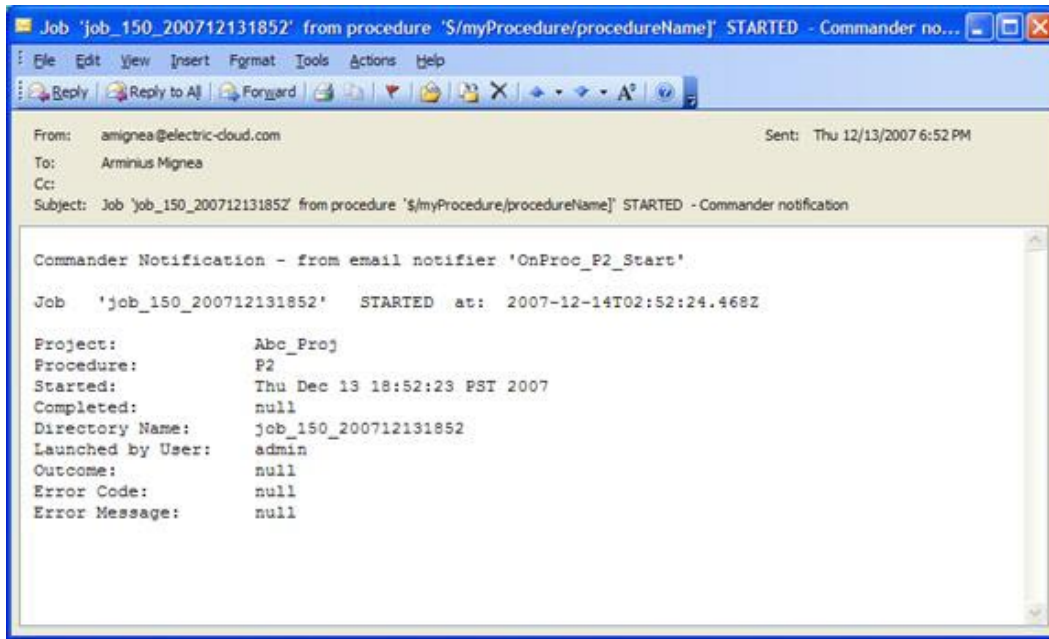
If you use this template, the following screen example is similar to how your email notifier will look.



1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—JobTempl\_FullProps.txt

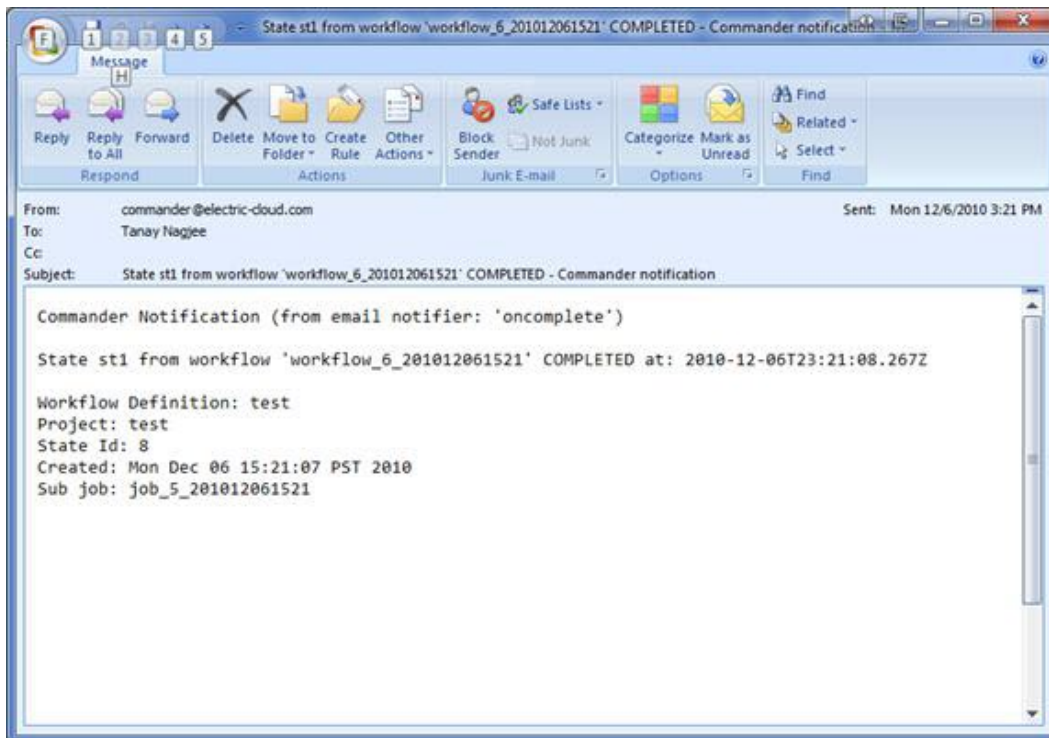
If you use this template, the following screen example is similar to how your email notifier will look.



1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

### Email Notifier Template—StateTemplate\_FullPropertyPaths.txt

If you use this template, the following screen example is similar to how your email notifier will look.



1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

## Event Log

This page displays a log of events generated anywhere in the system, including jobs and workflows.

- To see only events for a single workflow, select the Workflows tab, then a workflow Name to go to the Workflow Details page and click the **View Log** link at the top of the page.
- To see only events for a single job, select the Jobs tab, then the Job name to go to the Job Details page and click the **View Log** link at the top of the page.

**Note:** When running a job in a cluster, the name of the server managing the job is recorded in the job-log. If the management of the job moves to a different node (if the current node crashes for example) the change is logged into the job log as well.

- To see only events for a specific object, select the Search tab to go to the [Searching and Filtering](#) page.

For example:

You might want to select the Object Type, "Log Entry", then click the **Add Intrinsic Filter** link. Select the down-arrow where you see "Container" auto-populated and select "Container Type". Use the "equals" operator, then select the next down-arrow to choose an object. Click **OK** to start the search.

**Note:**

From the Administration tab, the default view for this Event Log page is the warning (WARN) level.

For workflow and job event logs, the default view from their respective pages is the information (INFO) level.

#### Column descriptions

**Time**—This is the time the event was logged.

**Severity**—Severity can be either INFO, WARN, or ERROR. Use the pull-down menu at the top of the table to change between these views.

**User**—The user associated with the event—the user of the session at the time the event was generated. Clicking on a project link in this column takes you to the Project Details page for that project.

**Container**—Typically, this is the type and name of the workflow or job with a corresponding ID. Clicking on a link in this column takes you to the Job Details page for that job or workflow.

**Subject**—The object associated with the message. Clicking on a link in this column takes you to the source for this object.

**Message**—The message text will either be informational or display the warning or error message. The message may contain important information about a resource or workspace issue.

#### Configuring the Event Log

Because log entries can accumulate in large numbers, you can configure the Event Log for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries along with its other tasks.

To change the default settings, go to Administration > Server > Settings.

Modify the following two fields:

**Event log retain time**—Default is 30 days (in "minute" units).

**Note:** Setting the "retain" period to "0" disables the automatic deletion mechanism, allowing you to use an external cleanup script to implement a custom cleanup policy.

**Maximum background delete delay**—Default is 3600 seconds (or one hour).

Click **OK** to save your changes.

## Automation Platform Home Page

[Job Configurations](#)

[Shortcuts](#)

[Jobs Quick View](#)

[Reports](#)

## Overview

This page provides a convenient console for running jobs and viewing results.

- This web page is your ElectricFlow Dashboard for tracking project health.
- You can customize the page to display only the jobs that interest you and to provide one-click access to the jobs you run frequently. Each of the Home page sections can be customized.
- The Reports section allows you to see thumbnail report images that are updated each time the report is generated.
- This page provides shortcuts for quick access to pages you use most frequently in the automation platform or anywhere on the web.

**IMPORTANT:** If you are using or plan to use the EC-Homepage plugin to share your Home page sections, you will not see some links normally available to you. For example, if a particular Jobs Quick View category is shared, you **cannot** Delete or Modify that category. You can perform these functions only if the category belongs to you alone.

For information on sharing your Home page configuration, see the "[Home page configurations](#)" section in the "[Customizing the ElectricFlow Platform UI](#) on page 617" Help topic.

## Job Configurations

Procedures in ElectricFlow can contain complex sets of parameters— making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem. When you create a job configuration, you enter all the information needed to run a procedure, including parameters and/or a credential. All job configurations are displayed here on the Home page. Invoke a particular configuration by clicking its name in the Job Configurations section.

### Create Job Configurations three ways

- On the Home page, create a job configuration from "scratch" by clicking the **Create** link in the Job Configurations section.
  - In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.
- From the Job Details page for a previously invoked job, click the **Save Configuration** link at the top of the page.

Your saved job configuration is displayed on your Home page.
- From the Edit Schedule page, click the **Save Configuration** link at the top of the page.

Your saved configuration is displayed on your Home page.

## Shortcuts

Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can create a shortcut to any page on the web also.

### Create Shortcuts two ways

- Mouse-over the "star" icon at the top of any automation platform page and click "Add current page" to add that page to the shortcut list. Mouse-over the star icon again and click "Remove current page" to remove the shortcut for that page. The star icon is yellow for pages saved as a shortcut and gray for those pages not saved as a shortcut.
- Click the **Create** link in the Shortcut section and provide a name and URL to create a shortcut.

To modify or update a shortcut, click the **Edit** link adjacent to the shortcut you want to change.

Shortcuts can be accessed conveniently from any automation platform web page. Mousing-over the star icon displays a list of shortcuts saved by the current user. Click on a shortcut name to view the page.

**Note:** The Shortcut section may contain static entries that cannot be deleted. And if you "share" your Home page, the Edit link will not be available for shared items.

### Jobs Quick View

Perhaps only a few jobs on this server are of interest to you. For example, you may care about jobs you launch manually and official builds for the products you work on, but you may not care about production builds for other products or personal jobs for other users.

The Jobs Quick View allows you to define job categories that are interesting to you.

The Home page displays the most recent jobs in each category, and you can easily click-through to get more details about any of those jobs. For example, clicking on a job name takes you to that job's Job Details page.

### Create a job category

- Click the **Add Category** link in the Jobs Quick View section.  
After creating a category, results are displayed on the Home page. Clicking the **Details** link displays a summary to the right of the category. In addition to job status and other diagnostic information, the summary displays running steps and failed steps (containing errors and warnings).
- Click the **Modify** link to edit the Jobs Quick View category or the **Delete** link to remove that job from the Jobs Quick View category.
- Click on the **Details** link to see job summary information—the summary remains visible, regardless of mouse location, until you click somewhere else on the page.

**Note:** If you "share" your Home page, the Modify and Delete links will **not** be available for shared items.

### Reports

You can configure reports you would like to see on a regular basis and display a "thumbnail" report graphic in this section.

- Click the **Add Report** link to go to the New Reports page.  
After filling in the information on the New Reports page, you will see a thumbnail view of your report (after it runs) on your Home page.  
**Note:** If the drop-down menu on this page is empty, click the **Help** link on the New Report page for more information.
- Click the Collapse/Expand (+/-) box to see the full thumbnail report or just the report title.



- Click the **Rename** link if you need to rename your report.
- Click the **Remove** link if you need to remove this report from your Home page.

**Note:** If you "share" your Home page, the Rename and Remove links will not be available for shared items.

## Job Configuration

### To create a new job configuration

Enter information in the fields as follows:

Name—Type a name you choose for the job configuration.

Procedure—Displays the current project and procedure. Click **Change** to use the pop-up menu to select a new project/procedure.

### Parameters

Depending on the Project and Procedure you selected, a set of Parameters is displayed.

Enter all parameter values or just the required values if differentiated.

### Advanced

Priority:

Use the drop-down menu to select the priority for this run procedure. Available priorities are: low, normal (default), high, or highest.

- You can select the job's priority here, on Run Procedure web page, or when you schedule the procedure to run at a regular time or interval. When a job is launched, its priority cannot be changed.
- Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority. If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.
- If using ectool, the priority can be set by passing "--priority=<low|normal|high|highest>" to a runProcedure, createSchedule, or modifySchedule operation.

**Note:** To raise the job priority level above "normal," the user who launches the procedure must have execute permission on the system-level access control list for priorities.

Impersonation:

Click one of the three "radio" buttons to determine the default login user to use when the configuration is run.

- Use pre-defined credential—If you select this option, ElectricFlow looks for a credential first in the top-level procedure and then in its project. If it finds a credential, it uses the login from that credential as the default for the job. If there is no credential in either place, by default, the job's

steps run as the user under which the agent for the step is running.

- Use specific credential—If you select this option, you can choose a particular credential from those defined for the project containing the procedure —the login user from that credential is used as the default for the job.
- Use a specific user—If you select this option, you can enter a login name. When the configuration is run, you will be asked to enter the password for that account. The specified login will be used as the default for the job.

For more information on credentials and user impersonation, see the [Credentials and User Impersonation](#) Help topic.

Click **OK** when all selections are complete. Return to the Home page to see your new job configuration displayed.

### To edit an existing job configuration

Change or modify any of your previously specified information.

Click **OK** when all selections are complete.

Return to the Home page to see your edited job configuration displayed.

## Shortcuts

Use this page to create a **New Shortcut** or **Edit** an existing Shortcut.

Shortcuts appear on your Home page and provide quick access to other web pages, either in ElectricFlow or elsewhere.

- To create a new shortcut, type-in a shortcut name and the URL.
- To edit an existing shortcut, re-type the new shortcut name or URL (or both).

The easiest way to create a shortcut to an ElectricFlow automation platform page, such as the page for a particular project or procedure, is to navigate to that page and then click the "star" icon in the upper-right corner. This action automatically creates a shortcut and the star turns yellow to indicate a shortcut is in effect for the page.

If you click on the star icon again, the shortcut for that page is canceled.

Click **OK** to save your new or edited information and see your new/edited shortcut on the Home page.

## Jobs Quick View

A quick view category provides a convenient way to select a group of jobs that interest you, such as "all production builds for product xyz version 3.6" or "all jobs I invoke manually." ElectricFlow displays the most recent jobs for each category on your Home page so you can review them easily.

**To create a new jobs quick view category**

Enter information in the fields as follows:

**Name**—Type a name for your new job category.

**Number of Jobs**—Type the maximum number of jobs you want to see in your quick view summary. The summary displays the most recent applicable jobs.

**Include Last Success**—Select this check box if you want to see the last successful job in this category, even if it was not one of the most recent jobs.

Two Filter categories:

- **Intrinsic filters**—These filters provide a convenient way to access certain well-defined fields for jobs.
- **Custom filters**—These filters allow you to access a much broader range of values, including custom properties. Any values accessible through an intrinsic filter can be checked using a custom filter also (though not as conveniently).

Each filter specifies three values: the name of a particular property to check, a value it should be compared with, and relational operators such as "equals" or "less than." For example, if you select "Outcome" in an intrinsic filter with operator "not equals" and value "Success," the filter selects jobs that did not complete successfully because they had errors or warnings.

For an intrinsic filter, select a property by choosing one of several predefined properties from a list. For a custom filter, enter a property name. This name can be either the name of an intrinsic property for the job (such as "status" or "procedureName"), or the name of a property defined in the global property sheet for that job, or the name of a parameter for that job.

For the relational operator, select one of the values in the list. The behavior of the relational operators is determined by the underlying database. In most cases, comparisons are done using string comparison; operators such as "less than" may not be useful on numbers because "12" is considered less than "9". For some built-in properties, the database treats values according to a specific type such as number or date, so comparisons are implemented in the way appropriate for that type.

The relational operator "like" invokes an SQL wildcard comparison where "%" is the wildcard character. For example %test% matches "first test" and "tests failed" but not "Test 44".

**Note:** Job Quick View filters allow property path references. However, property path references are not allowed in search parameters on the Search page.

Click **OK** after making your selections to save your new job category and see it on the Home page.

**To edit an existing jobs quick view category**

Keep or change any of the previously entered information.

See the Filter information above to add or change existing custom or intrinsic filters.

Click **OK** after making your selections to save your modified job category and see it on the Home page.

**New Report**

Enter information in the following fields to define a new report to display on your Home page.

Field Name	Description
Project	The name of the project that contains the report you want to view.
Report	The report name you entered in the Report Title field when you configured this report. If you did not specify a "thumbnail" view when you defined your report, you will not see it here.
Title	This is the report title you want to see on your Home page to identify this report.

Click **OK** to continue.

After the report runs, the report you specified will be displayed on your Home page and updated whenever the report is generated again.

#### To populate the drop-down menu

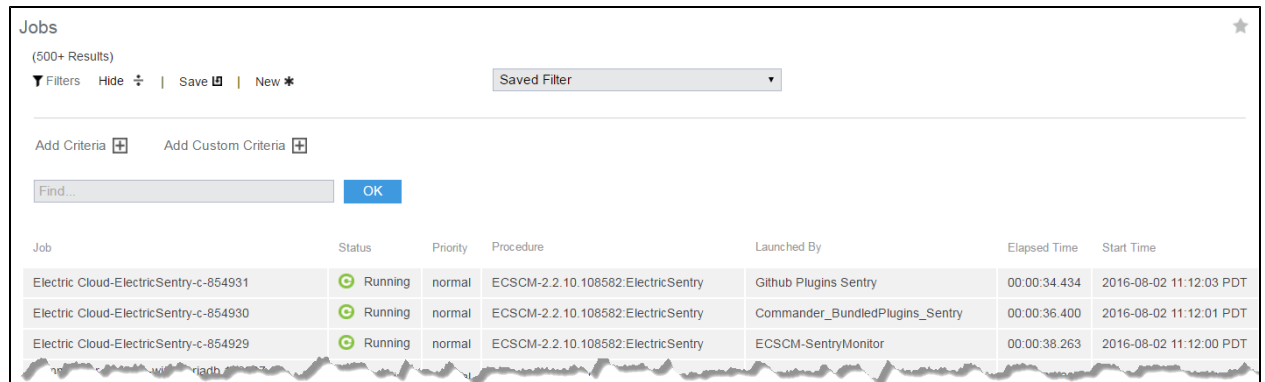
- Go to the Project Details page for the project containing the reports you want to view.
- Select the Report tab.
- Click the **Create Report** link.
- Check the **Create thumbnail?** check box, which enters this report's name in the New Reports drop-down menu.

**Note:** All reports, **except** the Procedure Usage report, are available as "thumbnail" reports on your Home page.

## Jobs

This page displays all jobs in the ElectricFlow system, both running and completed jobs. You can:

- Sort the Job, Status, Elapsed Time, and Start Time columns by clicking on the column name.
- Search for jobs and save the job search filters for later use. See [Context Searching and Filtering on page 843](#) for details about using the search capabilities on the Jobs page.



The screenshot shows the 'Jobs' page in ElectricFlow. At the top, there's a header with 'Jobs' and a star icon. Below it, a sub-header indicates '(500+ Results)'. A filter bar contains 'Filters', 'Hide', 'Save', and 'New' buttons, along with a 'Saved Filter' dropdown. Below the filter bar, there are 'Add Criteria' and 'Add Custom Criteria' buttons, and a search bar with a 'Find...' input and an 'OK' button. The main content is a table with the following columns: Job, Status, Priority, Procedure, Launched By, Elapsed Time, and Start Time. The table contains three rows of data, all with a 'Running' status.

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time
Electric Cloud-ElectricSentry-c-854931	Running	normal	ECSCM-2.2.10.108582:ElectricSentry	Github Plugins Sentry	00:00:34.434	2016-08-02 11:12:03 PDT
Electric Cloud-ElectricSentry-c-854930	Running	normal	ECSCM-2.2.10.108582:ElectricSentry	Commander_BundledPlugins_Sentry	00:00:36.400	2016-08-02 11:12:01 PDT
Electric Cloud-ElectricSentry-c-854929	Running	normal	ECSCM-2.2.10.108582:ElectricSentry	ECSCM-SentryMonitor	00:00:38.263	2016-08-02 11:12:00 PDT

### Column descriptions

**Job**—click on Job to sort the column alphabetically or click on a job name to go to that job's Job Details page.

**Status**—click on Status to sort this column by Running, Success, Warning, Error, or Aborted.

**Priority**—displays the job's priority set by a "run procedure" command or by the job's schedule.

**Procedure**—in this column you can click on a project name to go to the Project Details page or click on the procedure name to go to the Procedure Details page for that procedure.

**Launched By**—click on a name in this column to go to the page for the schedule (Edit Schedule page) or the user that ran the job.

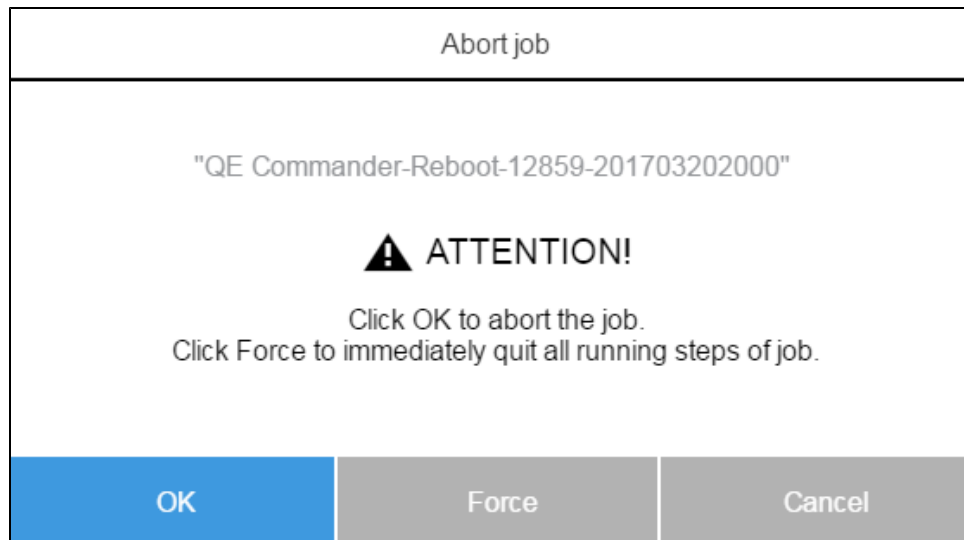
**Elapsed Time**—click Elapsed Time to sort the time values from longest to shortest time, or the reverse.

**Start Time**—click Start Time to sort this column from the start time of the first job to the start time of the most recent job, or the reverse.

**Actions**—use this column to Abort a running job or Delete a completed job.

- Aborting a job requires the execute privilege on the job—not just the modify privilege.

When you click Abort, the following dialog box appears:



Select either **OK** or **Force** to abort the job, or **Cancel** if you change your mind.

- Deleting a job on this page causes removal of job information from the ElectricFlow database, but information in the job's on-disk workspace area is not affected. You must delete workspace information manually.

### Tips

If you use RSS, an active RSS icon is provided in Windows Explorer on this page for your convenience. If you use Firefox, click **Bookmarks** > Subscribe to this page to display the feed. You can then add the feed URL to a viewer of your choice.

## Job Step Details

This page displays detailed information about a job step.

### Links and actions at the top of the table

- **Access Control**—Use this link to set privileges for this job step. For more information, see the Access Control Help topic.
- "star" icon—click this icon to add this page to your Home for quick one-click access in the future.

### Summary section (at the top of the page)

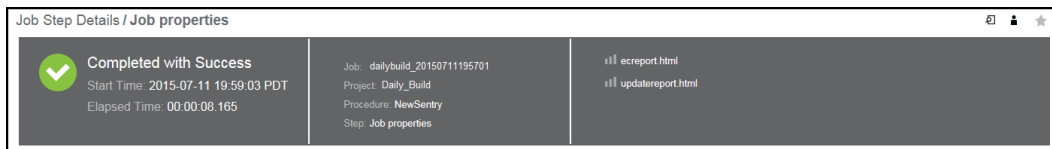
Notice [in the screen example below] that the name of the job step you are viewing is adjacent to the page title, Job Step Details.

The Summary section provides:

- The job's Start, Wait (waiting for a resource), and Elapsed times
- You will see wait times specified if your job steps were restricted by resource, workspace, a precondition, or license availability.  
For example, you will see the license wait time if a job step could not run because your license-allowed maximum concurrent step limit was met or exceeded, meaning no steps will run until the number of concurrent steps is reduced.
- A General Information section with links to get you to the job step's Job Details, Project Details, Procedure Details, or Edit Step pages.
- If the job created any custom reports, they appear in the summary area to the right of General Information. Reports on this page are for command steps only.

## Reports

To create a special-purpose HTML report for a job: In the top-level of any of the job's workspaces, add a file that contains the word "report" or "Report" and ends in the .html file extension. The link is automatically created when the Job Details page is displayed. The job's workspace must be accessible to the web server. The link will be in the Reports section, within the Summary section.



## Links

This page can include a Links section also, which will appear on the far right-side of the Summary section.

To add a link to this section:

- **Create a link to any file:**

To add a link, run a command in any job's job step using this format (this works for both local [disconnected] and non-local workspaces):

```
ectool setProperty "/myJobStep/report-urls/<myReportName>"
"/commander/jobSteps/<jobStepId>/<artifactDirectoryName>/<file-path>"
```

Example command:

```
ectool setProperty "/myJobStep/report-urls/Test Report" "/commander/jobSteps/
$[/myJobStep/jobStepId]/testreport/index.html"
```

**Note:** If you are using this format (from ElectricCommander 4.2 and earlier):

```
ectool setProperty "/myJob/report-urls/<myReportName>" "/commander/jobs/<jobId>/
<workspaceName>/<artifactDirectoryName>]/<file-path>"
```

Example command:

```
ectool setProperty "/myJob/report-urls/Test Report" "/commander/jobs/$[/myJob/jo
bId]/
$[/myJobStep/workspaceName]/testreport/index.html"
```

It will continue to work only for non-local workspaces. We recommend, however, that you change the command to use the newer format.

- **Create a link to any directory:**

To add a link, run the following style command in any job's job step:

```
ectool setProperty "/myJobStep/report-urls/Main Job Workspace"
"file:///WinStor2/scratch/chron55build/${myJob/jobName} "
```

**Note:** Links to a directory automatically work in Internet Explorer, but if using Firefox, local links are disabled unless the default security policy is modified or an extension is used. Refer to [http://kb.mozillazine.org/Links\\_to\\_local\\_pages\\_don%27t\\_work](http://kb.mozillazine.org/Links_to_local_pages_don%27t_work) for more details.

## The "tabbed" Sections

The next section of tabs allows you to select the type of information you want to see. You may see six or fewer tabs, depending on the type of job step you are viewing.

### Child Steps table

**Note:** The Child Steps table is available for subprocedure and broadcast steps only.

- Click on a Step Name to go to that step's Job Step Details page.
- Click the Log "icon" to see that job step's log information.
- Status—This column provides the job's step status.
  - Aborted—The step or job was aborted.
  - Canceled—The step did not run because the job was aborted or a previous step was aborted.
  - Error—The command failed or `postp` detected an error in the output.
  - Running—The step is currently running or a step inside the subprocedure call is running.
  - Skipped—The step did not run because the run condition evaluated to "false".
  - Success—The step completed with no errors or warnings.
  - Waiting for Resource or Workspace—The step is waiting to run as soon as a resource or workspace is available.
  - Warning—`postp` detected a warning message.

**Note:** The Status field can be over-ridden by `postp` to include more specific information. `postp` information may be linked directly to diagnostic information—also available by selecting the Diagnostics tab.

- Click on a Resource name to go to the Edit Resource page.
- Click the **Edit** link in the Action column to go to the Edit Step page.

### General table

This section displays basic information including the step ID, step name, create and end times, and whether the step invoked a subprocedure or ran a command.



GeneralDiagnosticsPropertiesNotifiers

General

Step Id: abbf5a9e-2841-11e5-ab4e-005056bbb6ca

Step Name: Job properties

Create Time: 2015-07-11 19:57:02 PDT

Elapsed Time: 00:00:08.165

End Time: 2015-07-11 19:59:11 PDT

Last Modified: 2015-07-11 19:59:11 PDT

Last Modified By: project: Commander

Run Condition: 1

Exclusive Mode: none

Release Mode: none

Resource Name: default

Diagnostics table

If the job step or child step (for subprocedure and broadcast steps) generated warning or error messages, you will see those messages here. This section contains one or more diagnostics, each of which is a portion of a step's log file that was identified as "interesting" by the step's postprocessor. Typically, each diagnostic relates to an error or warning detected by the postprocessor. All diagnostics for a particular job step appear together.

Diagnostics

Exit Code: 0

Error Handling: Abort Job

Time Limit: 300

Parameters table

This section displays parameter values supplied to the top-level procedure when the job step was invoked and has these columns:

- Name
- Value

**Note:** This table is available for steps with child steps only.

Child StepsGeneralDiagnosticsParametersPropertiesNotifiers	
Name	Value
branch	3.0
cm	lonestar-cm
dbType	oracle
platform	windows
resource	ec-win
skipServerUnitTests	0

Properties table

This section displays information computed and/or used by the job step while it is running. After the job step completes, these properties are normally read-only.

- Click on a Property Name to edit that property.
- If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.

- This section also provides **Create Property**, **Create Nested Property**, and **Access Control** links to update or enter additional information for the next time this job step is run. For more information on properties, see the [Properties](#) Help topic.

### Notifiers table

If you have designated certain persons or groups to be notified of details for specific job steps, this section displays who receives an email notification, the type of notification, any condition, and a description [if supplied]. If a notifier is available, you can click on its name to view details or make modifications.

### Job Step Time and waitTime Properties Explained

- **start**—The time when this job step began executing.

When the ElectricFlow server assigns a resource to run the step, it issues a `<runcommand>` request containing the expanded command body to that resource's agent. The "start" time is when that `<runcommand>` is sent to the agent.

- **finish**—The time when this job step completed.

When a command finishes executing, the ElectricFlow agent issues a `<finishcommand>` request containing the exit code and other metadata back to the ElectricFlow server. The "finish" time is when the `<finishcommand>` is received by the server.

- **elapsedTime**—The number of milliseconds between the start and end times for the job.

This is exactly "finish"—"start".

- **totalWaitTime**—The sum of resource, workspace, and license wait times for this job step.

The sum of `resourceWaitTime`, `licenseWaitTime`, and `workspaceWaitTime`.

- **waitTime**—The number of milliseconds the step spent between runnable and running (for example, waiting for a resource).

Covers known reasons why a step couldn't run as soon as it became runnable (same as `totalWaitTime`), plus any other possible reason (slow transaction commits, system paging, etc).

- **resourceWaitTime**—The length of time this job step stalled because it could not get a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.

For subprocedure steps, this is the sum of all child steps.

- **licenseWaitTime**—The length of time this job step had to wait to process because the license limit was reached or exceeded.

For subprocedure steps, this is the sum of all child steps.

- **workspaceWaitTime**—The time this job step had to wait because no workspace was found or available.

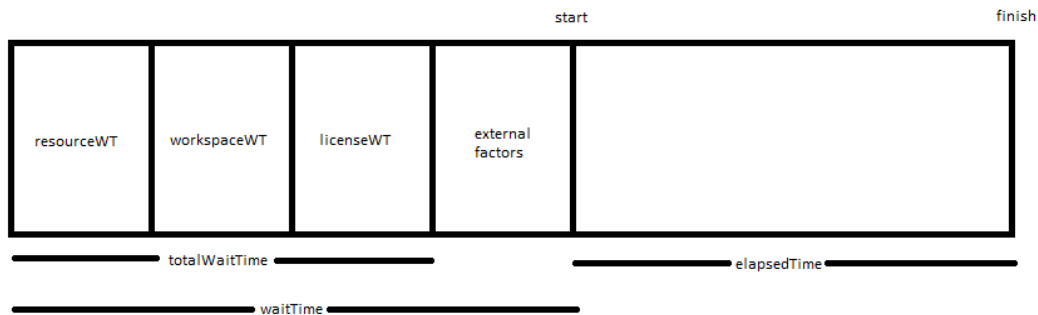
For subprocedure steps, this is the sum of all child steps.

When it is time to schedule the step, ElectricFlow checks the license and starts counting time against `licenseWaitTime` until the license is satisfied (e.g., running this step would not exceed the maximum number of licensed hosts). After the step is scheduled, ElectricFlow sends a `runCommand` message to the agent. If it fails because ElectricFlow cannot talk to the agent, ElectricFlow accrues time against `resourceWaitTime`. If ElectricFlow can talk to the agent, but it has trouble manipulating the workspace (for example, it cannot create the workspace dir, map the drive [on Windows], or create files), ElectricFlow accrues time against `workspaceWaitTime`.

It is possible for the following to occur:

1. A job step becomes stalls due to a license issue.
2. The license limit is no longer exceeded and ElectricFlow tries to run the step but hits a bad resource.
3. When the resource is good, the step stall because of a license again (adding more time to the `licenseWaitTime`),
4. When the license is satisfied, ElectricFlow reaches the resource, and everything runs.

This is why ElectricFlow continues cycling through these states until everything is satisfied.



The first 4 blocks (`resourceWaitTime`, `workspaceWaitTime`, `licenseWaitTime`, and `external factors`) can occur in any order.

External factors could include things such as system paging, slow transaction commits, etc.



## Licenses

This page displays all license information known to the ElectricFlow server. Typically, a single license is displayed, which describes the usage to which you are entitled. The license on the server may be based on concurrent resources, concurrent users, concurrent steps, registered hosts, or any combination of these licenses.

### All Licenses

Click **Import License** to import a new license file.

### Column descriptions

Column Name	Description / Actions
Company	The name of the company or organization to which the license was granted. If this is not your company, please contact Electric Cloud Customer Support.
Feature	The type of license.
Expiration	The last day when this license is no longer valid. After your license expires (and after any grace period), running jobs will complete, but no new jobs can be launched.
Grace Period (days)	If this field is nonzero, you may continue using ElectricFlow for this many days after the expiration date. However, you will be warned frequently during the grace period that your license has expired.
Actions	 <p>Click the <b>View License</b> button to see additional details about this license.</p>  <p>Click the <b>Delete</b> button to delete this license.</p>

### Current Usage

You see some or all of the following fields depending on the type of license or licenses you use for ElectricFlow.

Field Name	Description
Maximum Concurrent Steps	The maximum number of concurrent steps allowed by this license.
Concurrent Steps	The number of concurrent steps running now.

Field Name	Description
Maximum Concurrent Hosts In Use	The maximum number of unique host names defined in concurrent resources (non-proxy resources), where steps can run at any time.
Concurrent Hosts in Use	The number of unique host names defined in concurrent resources where steps are currently running.
Maximum Proxied Hosts In Use	The maximum number of unique host names defined in <i>proxied</i> resources, where steps can run at any time.
Maximum Concurrent Hosts	The maximum number of unique host names allowed to use ElectricFlow concurrently at any given time.
Concurrent Hosts in Use	The number of unique host names defined in concurrent resources where steps are currently running.
Maximum Proxied Host	The maximum number of unique host names define in proxied resources.
Proxied Hosts in Use	The number of unique host names defined in <i>proxied</i> resources where steps are currently running.
<b>The following fields are specific to a concurrent user-based license.</b>	
Maximum Concurrent Users	The number of users allowed to use ElectricFlow concurrently at any given time.
Active Users	The number of users with an active license.
User IP	The "user@IP" combination that holds an active license.
Expiration	The time when the license will be released.
Last Use	The time when the license was last used.
<b>The following fields are specific to a registered host-based license.</b>	
Maximum Registered Hosts	The maximum number of registered hosts allowed by this license.
Registered Hosts in Use	The number of registered hosts where steps are currently running.
Maximum Applications	The maximum number of applications that ElectricFlow can deploy at any given time.
Applications in Use	The number of applications that are currently running.

## License Types

### Concurrent Resource License

This license controls the number of unique host names on which steps can be scheduled at any time. Two properties, `maxHosts` and `maxProxiedHosts`, are defined on a license to control the maximum number of concurrent and proxied hosts that can be in use at the same time. The host named "localhost" and "127.0.0.1" refer to the local agent installed on the ElectricFlow server machine, and these host names are not part of the total count for hosts in use.

If two or more steps are running concurrently on the same host, the host name still counts once only towards the license limit. There is no limit to the number of resources pointing to a single host; from a licensing perspective, they all count as a single host. When the host limit is met, any new job step that attempts to run on a host [not already in use] will stay in the "runnable" state until its host is available. Current license usage statistics are displayed at the top of the Resources page in the web interface. If no license is available, jobs cannot be launched. When a license expires, running jobs are allowed to complete, but no new jobs can be launched.

A concurrent resource license can be a standard or enterprise license.

This is an example of an enterprise license:

Licenses	
All Licenses	
Company	Feature
Electric Cloud	Server (enterprise)
Current Usage	
Maximum Concurrent Steps: unlimited	
Concurrent Steps: 0	
Maximum Concurrent Hosts: 60	
Concurrent Hosts In Use: 0	
Maximum Proxied Hosts: 60	
Proxied Hosts In Use: 0	
Maximum Concurrent Users: unlimited	
Active Users: 0	

This is an example of a standard license:

Licenses	
All Licenses	
Company	Feature
Electric Cloud, Inc.	Server (standard)
Current Usage	
Maximum Concurrent Steps: 2 Concurrent Steps: 0 Maximum Concurrent Hosts: unlimited Concurrent Hosts In Use: 0 Maximum Proxied Hosts: unlimited Proxied Hosts In Use: 0 Maximum Concurrent Users: unlimited Active Users: 0	

### Concurrent User License

If the `maxConcurrentUsers` property is set on the license, its value defines the maximum number of users who can actively use the ElectricFlow server. A unique license is defined by the combination of the user's name and the IP address from which the user is making requests. A user can have multiple active sessions (through the web UI and ectool) from the same machine while only using a single license.

If a user makes a licensed API call without an active license, the server automatically attempts to assign a license. If a license is available (because the maximum has not been met), the user is assigned a license. If no licenses are available, the user will see a `NoAvailableLicenses` error and be redirected to the licenses page. Currently held licenses and their expiration dates can be viewed by calling the `getLicenseUsage` API or by viewing the Active Users table on the Licenses web page. When a license becomes available, the first user to make a licensed API call will be assigned that license. The only API calls not licensed are `login`, `getLicenseUsage`, `getAdminLicense`, `getServerStatus`, and `getServerInfo`.

When a license is first acquired, its expiration is set to 1 hour in the future. After the initial hour has passed, each time the user makes a licensed API call, the license is extended another 10 minutes (a configurable server setting). When a user's license passes the expiration date, it is released. When the user makes another licensed API call, a license is assigned automatically if one is available, otherwise the `NoAvailableLicenses` error is displayed.

A single administrator license can be used in an emergency. All users who have `execute` permission on the system-level licensing access control list can use the administrator license by calling the `getAdminLicense` API. This license has no expiration as long as all regular licenses are in use, but this license abides by the regular license expiration policy if regular licenses are available.

A concurrent user license can be a standard or enterprise license.

This is an example of an enterprise license:

Licenses	
All Licenses	
Company	Feature
Electric Cloud	Server (enterprise)
Current Usage	
Maximum Concurrent Steps: unlimited	
Concurrent Steps: 0	
Maximum Concurrent Hosts: 60	
Concurrent Hosts In Use: 0	
Maximum Proxied Hosts: 60	
Proxied Hosts In Use: 0	
Maximum Concurrent Users: unlimited	
Active Users: 0	

This is an example of a standard license:



Licenses	
All Licenses	
Company	Feature
Electric Cloud, Inc.	Server (standard)
Current Usage	
Maximum Concurrent Steps: 2	
Concurrent Steps: 0	
Maximum Concurrent Hosts: unlimited	
Concurrent Hosts In Use: 0	
Maximum Proxied Hosts: unlimited	
Proxied Hosts In Use: 0	
Maximum Concurrent Users: unlimited	
Active Users: 0	

### Concurrent Step License

This ElectricFlow license controls the number of unique steps you are allowed to run in the system at the same time (in parallel). The `maxConcurrentSteps` property, defined on a license, controls the maximum number of steps that can be running at the same time.

### Registered Host License

Registered hosts are dedicated hosts on which a procedure or step can always run. This license controls the number of unique registered host names. Two properties, `maxHosts` and `maxProxiedHosts`, are defined on a license to control the maximum number of registered and proxied hosts that can be in use at the same time. The host named "localhost" and "127.0.0.1" refer to the local agent installed on the ElectricFlow server machine, and these host names are not part of the total count for hosts in use. Concurrent hosts cannot be used with registered hosts.

If two or more steps are running concurrently on the same host, the host name still counts once only towards the license limit. There is no limit to the number of resources pointing to a single host; from a licensing perspective, they all count as a single host. When the host limit is met, any new job step that attempts to run on a host (not already in use) stays in the "runnable" state until its host is available. Current license usage statistics are displayed at the top of the Resources page in the web interface. If no license is available, jobs cannot be launched. When a license expires, running jobs are allowed to complete, but no new jobs can be launched.

This an example of a registered host license:

## Licenses

### All Licenses

Company	Feature
Electric Cloud	Server (freemium)

### Current Usage

Maximum Concurrent Steps: unlimited

Concurrent Steps: 0

Maximum Registered Hosts: 5

Registered Hosts In Use: 0

Maximum Concurrent Users: unlimited

Active Users: 0

Maximum Applications: 3

Applications In Use: 1

## View License

This page displays all available license details for a single license.

Use the **Delete** link to remove this license.

### Information

Name	Description
Company Name	The name of the company or organization to which the license was granted. If this is not your company, contact Electric Cloud Customer Support.
Product Name	Product to which this license applies (if it is not "ElectricFlow," it will not apply here).

Name	Description
Feature Name	Product feature to which this license applies: must be "Server" for ElectricFlow licenses.
Maximum Concurrent Steps	The maximum number of concurrent steps allowed by the license.
Maximum Concurrent Hosts In Use	The maximum number of unique host names defined in concurrent resources (non-proxy resources), where steps can run at any time.
Maximum Proxied Hosts In Use	This is the maximum number of unique host names defined in proxied resources, where steps can run at any time.
Maximum Registered Hosts	The number of registered hosts on which a procedure or step can always run.  This appears when the license on the ElectricFlow server is based on a combination of concurrent and registered hosts or only registered hosts.
Maximum Concurrent Users	The number of users allowed to use ElectricFlow concurrently at any given time.
Expiration Date	The last day when this license is no longer valid. After your license expires (and after any grace period), running jobs will complete, but no new jobs can be launched.
Grace Period	If this field is non-zero, you may continue using ElectricFlow for this many days after the expiration date. However, you will be warned frequently during the grace period that your license has expired.

## Import License

Use this page to provide a new license for ElectricFlow.

You should have received a license (as a block of text) from Electric Cloud already. If you have not received a license, contact Electric Cloud Customer Support or your sales representative.

- Use a text editor to open the license file.
- Copy the text into the Contents field.
- Click **OK**.

You will see your license information on the Licenses page.

## Plugin Manager

A plugin is a collection of one or more features that can be added to ElectricFlow. A plugin:

- Can provide one or more new pages for the UI and can also provide a configuration page so you can provide additional information needed to implement the plugin.
- Has an associated project that can contain procedures and properties required by the implementation.
- Is delivered as a JAR file containing the features implementation. When a plugin is installed, the ElectricFlow server extracts the JAR contents to disk into a configurable plugins directory.

The ElectricFlow installation includes numerous bundled plugins. These plugins are created and supported by Electric Cloud. You can also create your own plugins as described below.

## Navigating the Plugin Manager User Interface

You can use the Plugin Manager to:

- See a list of installed plugins and whether an installed plugin is promoted.
- Perform a variety of operations on plugins in the list, such as demoting, configuring, and uninstalling them.
- Install plugins from the Plugin Catalog.
- Create plugins, modify those plugins, and export those plugins.

## Descriptions of Tabs and Filtering Options for the Installed Plugins List

Following is the Plugin Manager main page. It provides a list of installed plugins:

The screenshot shows the 'Plugin Manager' interface. At the top right, there is a 'Create Plugin' link and a star icon. Below this, there are three tabs: 'Currently Installed' (selected), 'Install from File/URL', and 'View Catalog'. Under the 'Currently Installed' tab, there is a 'Category' dropdown menu set to 'All' and a 'Show Promoted Plugins Only' checkbox which is unchecked. The main content area is a table with the following columns: 'Plugin Label', 'Author', 'Version', 'Category', 'Description', and 'Actions'.

Plugin Label	Author	Version	Category	Description	Actions
EC-ALM	Electric Cloud	1.0.8.111171 (promoted)	Test	Integrates HP-ALM Test server into ElectricFlow	Demote   Configure   Help   Uninstall
EC-AgentManagement	Electric Cloud	1.3.0.113822 (promoted)	System	Centralized Agent Management procedures	Demote   Help   Uninstall
EC-AmazonECS	Electric Cloud	1.0.0.11 (promoted)	Container Management	Integrates with EC2 Container Service.	Demote   Configure   Help   Uninstall
EC-Ant	Electric Cloud	2.0.9.111171 (promoted)	Build	Java build tool	Demote   Help   Uninstall
EC Artifact	Electric Cloud	1.1.3.113822 (promoted)	System	Provides an interface for artifact version publish and retrieve operations	Demote   Help   Uninstall
EC-CIManager	Electric Cloud	1.4.0.113822 (promoted)	System	Continuous Integration Manager	Demote   Configure   Help   Uninstall
EC-CSH	Electric Cloud	2.0.2.111171 (promoted)	Scripting/Shell	Integrates CSH Scripting Shell Tool into ElectricFlow	Demote   Help   Uninstall
EC-CheckStyle	Electric Cloud	2.0.5.111171 (promoted)	Code Analysis	Integrates CheckStyle code coverage tools into ElectricFlow	Demote   Help   Uninstall

The **Plugin Manager** main page displays the following tabs and the following options for filtering the list of plugins.

Installation or upgrade task	Description
Currently Installed	Displays the installed plugins. Plugins that you create or install from other sources also appear on this page.
Install from File/URL	<p>Displays the screen for plugin installation options:</p> <ul style="list-style-type: none"> <li>• <b>File Install</b>—Upload and install a local JAR file from the machine running your web browser. Click <b>Upload</b> after specifying the path that you need.</li> <li>• <b>URL Install</b>—Install a plugin from a location specified by an URL. This location can either be an external web server (using <code>http://</code>) or a file on the ElectricFlow server host (using <code>file://</code>).</li> </ul> <p>You can also use ectool to install a plugin from the command line. ectool contains a full set of commands to perform plugin tasks. For more information on available ectool plugin commands, see the “API Commands—Plugin Management” topic in the <i>ElectricFlow API Guide</i> at <a href="http://docs.electric-cloud.com/eflow_doc/FlowIndex.html">http://docs.electric-cloud.com/eflow_doc/FlowIndex.html</a>.</p> <p><b>Note:</b> The server has a configurable maximum file upload size that defaults to 50 MB. Use the server <b>Maximum upload size</b> setting to adjust the default.</p>
View Catalog	<p>Displays all plugins available for installation. The <b>View Catalog</b> tab is not present if the ElectricFlow server lacks internet access (such as if it is locked down or has a connectivity issue.) If so, an error message appears in the Plugin Manager (such as on the main page or the <b>New Plugin</b> page): Catalog not found : Catalog URL is <code>http://plugins.electric-cloud.com/catalog/catalog.xml</code>.</p> <p><b>Catalog Install</b>—Click the <b>Install</b> action (next to a plugin listed in the catalog) to download and install the plugin.</p>
Category	A drop-down menu to filter the plugin list by a specific category.

### Descriptions of the Columns in the Installed Plugins List

Columns in the list of installed plugins provide a variety of details about each plugin.

Column name	Description
Plugin Label	Name of the plugin. Click the label of an installed plugin to see the <b>Project Details</b> page for that plugin.
Author	Person or organization who created the plugin.
Version	Plugin version. Promoted plugin versions also appear in this column. The promoted version number is labeled <i>(promoted)</i> immediately after the version number.
Category	Plugin type. Plugins that provide similar types of functionality are grouped into categories.
Description	Short text string that describes the plugin purpose or function.
Actions	<p>List of plugin tasks. Not all plugins have the same list of tasks. For example, some plugins might perform their own setup during installation and thus do not need more configuration information entered here.</p> <ul style="list-style-type: none"> <li>• <b>Configure</b>—Opens the configuration page for the plugin.</li> <li>• <b>Demote</b>—Makes the plugin inactive and removes any tabs associated with it. If you reinstall a previously demoted plugin, previous values from the demoted version are not copied to the new version that you install.</li> <li>• <b>Help</b>—Opens the plugin documentation if it exists.</li> <li>• <b>Install</b>—Downloads and installs a plugin from the plugins catalog site. If this option is not available, you might not have the access control permissions to install a plugin.</li> <li>• <b>Promote</b>—Upgrades the plugin to a new version. Old plugin values are copied to the promoted version.</li> <li>• <b>Re-install</b>—Downloads and re-installs a previously installed plugin.</li> <li>• <b>Uninstall</b>—Removes the plugin from your system.</li> </ul> <p>If the action that you need is not in the <b>Actions</b> column, you might not have sufficient modify permission in the plugins ACL for that action.</p>

## Creating, Modifying, or Exporting Plugins by Using the Plugin Manager

You can use the Plugin Manager to create, modify, or export plugins. Using the Plugin Manager to create or modify plugins is simpler than using the ElectricFlow Plugin Wizard on GitHub and much simpler than using the ElectricFlow SDK.

For details about the ElectricFlow Plugin Wizard, see <https://github.com/electric-cloud/PluginWizard>. For details about the ElectricFlow SDK, see the *ElectricFlow SDK Plugin Developer Guide* at [http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html).

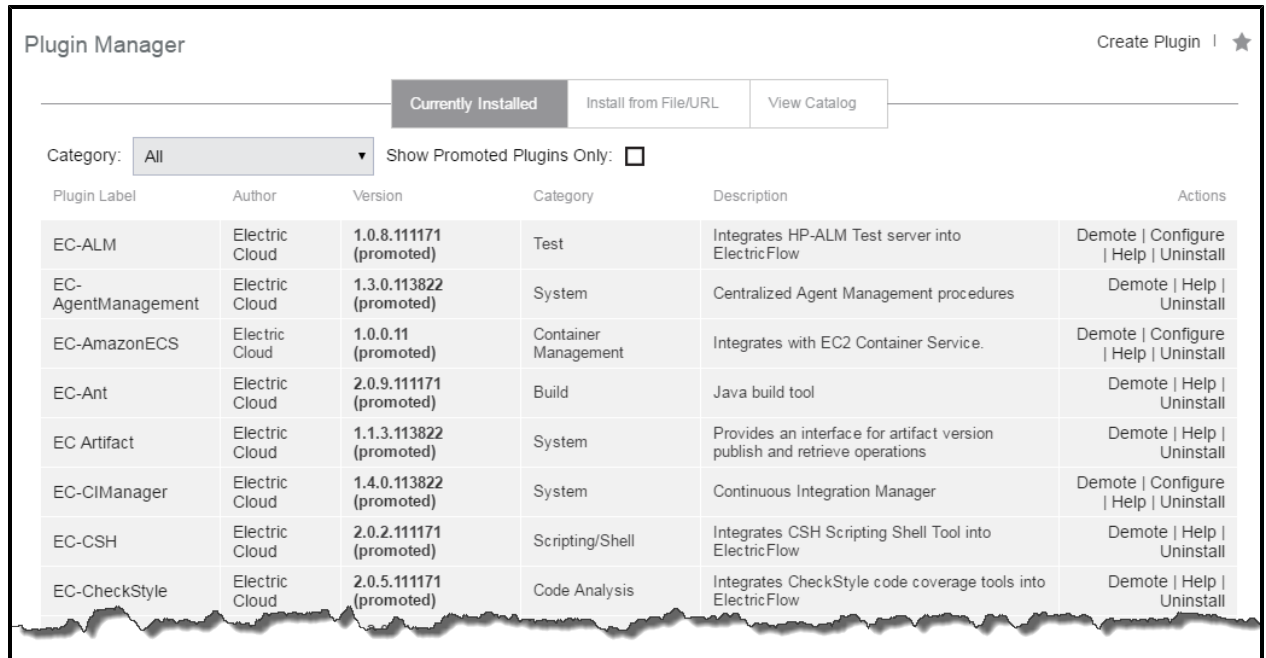
## Creating a Plugin

To create a plugin, you set up the plugin configuration and then add procedures and properties.

### Setting Up the Plugin Configuration

1. In the Automation Platform, choose **Administration > Plugins**.

The **Plugin Manager** page appears. For example:



The screenshot shows the 'Plugin Manager' interface. At the top right, there is a 'Create Plugin' button and a star icon. Below the title, there are three tabs: 'Currently Installed' (selected), 'Install from File/URL', and 'View Catalog'. A 'Category' dropdown menu is set to 'All', and a 'Show Promoted Plugins Only' checkbox is unchecked. The main content is a table with the following columns: Plugin Label, Author, Version, Category, Description, and Actions.

Plugin Label	Author	Version	Category	Description	Actions
EC-ALM	Electric Cloud	1.0.8.111171 (promoted)	Test	Integrates HP-ALM Test server into ElectricFlow	Demote   Configure   Help   Uninstall
EC-AgentManagement	Electric Cloud	1.3.0.113822 (promoted)	System	Centralized Agent Management procedures	Demote   Help   Uninstall
EC-AmazonECS	Electric Cloud	1.0.0.11 (promoted)	Container Management	Integrates with EC2 Container Service.	Demote   Configure   Help   Uninstall
EC-Ant	Electric Cloud	2.0.9.111171 (promoted)	Build	Java build tool	Demote   Help   Uninstall
EC Artifact	Electric Cloud	1.1.3.113822 (promoted)	System	Provides an interface for artifact version publish and retrieve operations	Demote   Help   Uninstall
EC-CIManager	Electric Cloud	1.4.0.113822 (promoted)	System	Continuous Integration Manager	Demote   Configure   Help   Uninstall
EC-CSH	Electric Cloud	2.0.2.111171 (promoted)	Scripting/Shell	Integrates CSH Scripting Shell Tool into ElectricFlow	Demote   Help   Uninstall
EC-CheckStyle	Electric Cloud	2.0.5.111171 (promoted)	Code Analysis	Integrates CheckStyle code coverage tools into ElectricFlow	Demote   Help   Uninstall

2. Click **Create Plugin**.

The **New Plugin** page appears:

New Plugin

Name

Version

1.0.0.0

Description

Category

Utility

Author

System Administrator

Author Url

Enable plugin configuration support

☒

Required

Required

OK

CANCEL



## 3. Complete the page as follows:

Field name	Description
Name	Plugin name. Enter a unique name.
Version	Plugin version. The default is 1.0.0.0.
Description	(Optional) Plain text description of the plugin. ElectricFlow does not interpret this text.
Category	<p>(Optional) Category for the plugin. Categories let you group plugins by functionality or purpose and provide a convenient way to look up a specific plugin if you know its functionality or purpose. For example, when you are configuring a process step and want to deploy an application on WebSphere, you first choose the Application Server category and then the WebSphere plugin.</p> <p>You can select an existing plugin category by using the autofill functionality or enter a new category. The default category is Utility.</p>
Author	(Optional) Plugin author's name. For example, a user or organization name. The default is the current user name (such as System Administrator).
Author Url	(Optional) Plugin author's URL. For example, <a href="http://bigco.com/integrations/docker">http://bigco.com/integrations/docker</a> .
Enable plugin configuration support	<p>(Optional) Determines whether to allow the addition of plugin procedures to support the creation of plugin configurations. Disabling this option displays a confirmation dialog box if the plugin already exists: Any existing plugin configurations for this plugin will be deleted if the 'Enable plugin configuration support' is unchecked.</p> <p>If you enable this feature, the <b>Configuration Setup</b> tab is added to the <b>Project Details</b> page for the plugin, and the CreateConfiguration and DeleteConfiguration procedures are added to the plugin (you can click the <b>Procedures</b> tab to see these procedures). This tab lets you modify information required to support plugin configurations such as the parameters required by the CreateConfiguration procedure.</p> <p>This option is enabled by default (meaning that the check box is checked).</p>

For example:

New Plugin

Name

DockerIntegration

Required

Unique name for the plugin

Version

1.0.0.0

Required

Description

ElectricFlow Docker integration.

Category

Utility

Author

Integrations Administrator

Author Uri

http://bigco.com/integrations/docker

Enable plugin configuration support

☒

OK

CANCEL

4. Click **OK**.

If you selected **Enable plugin configuration support** in the **New Plugin** page above, the **Configuration Setup** tab in the **Project Details** page appears. (A plugin is a type of project.) For example:

Project Details / **DockerIntegration-1.0.0.0**

Procedures Workflow Definitions Jobs Workflows Schedules Credentials Properties Reports **Configuration Setup**

☐ Configuration Parameters Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
config		entry	✓		
credential		credential	✓		
desc		entry			

☐ Procedure Steps that require the plugin configuration credential parameter (if defined) to be attached as credential Add

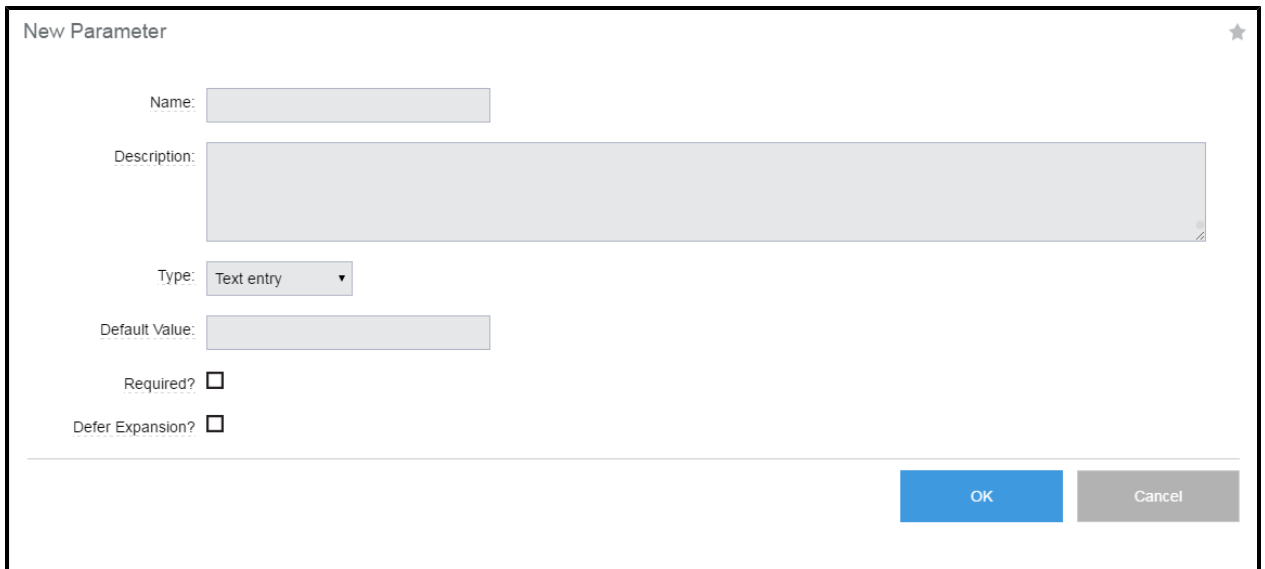
Currently, there are no records to display in this list.

In the **Configuration Setup** tab, the plugin configuration parameters appear under the **Configuration Parameters** section. The CreateConfiguration procedure uses these parameters when creating the plugin configuration. By default, the following configurations parameters are added to a new plugin:

- config—Used to provide a unique name for the configuration
- desc—Description of the plugin configuration
- credential—User name and password used to communicate with the third-party system with which the plugin is integrated

5. In the **Configuration Setup** tab, click **Create Parameter** to add configuration parameters that your plugin requires.

The **New Parameter** page appears. For example:



The screenshot shows a 'New Parameter' dialog box with a title bar containing a star icon. The dialog contains the following fields and controls:

- Name:** A text input field.
- Description:** A large text area with a small icon in the bottom right corner.
- Type:** A dropdown menu currently showing 'Text entry'.
- Default Value:** A text input field.
- Required?** A checkbox.
- Defer Expansion?** A checkbox.

At the bottom right of the dialog are two buttons: a blue 'OK' button and a gray 'Cancel' button.

6. Complete the page as follows:

Field name	Description
Name	Name of the parameter for which values are requested when the CreateConfiguration procedure is invoked. Enter a unique name.
Description	(Optional) Plain text description of the parameter. ElectricFlow does not interpret this text.
Default Value	Default value of the parameter if no value is provided when the procedure is invoked.
Required?	<p>Determines whether a value for the parameter is required. If this is enabled, the CreateConfiguration procedure ignores the default value and does not run unless a value is provided. After the procedure begins execution, the parameter value is available in the job property sheet with the same name as the parameter.</p> <p>The check box is unchecked by default (meaning that the parameter is optional).</p>
Defer Expansion?	<p>Determines whether to expand the parameter value. You can set the parameter value expansion to occur in one of two places:</p> <ul style="list-style-type: none"><li>• When the procedure request is made (the default) (the check box is unchecked)</li><li>• When the step executes (the check box is checked)</li></ul> <p>The check box is unchecked by default (meaning that expansion is not deferred).</p>

For example:

New Parameter

Name: Description

Description: Asks the user to enter a description.

Type: Text entry

Default Value: Enter a description here.

Required? ☒

Defer Expansion? ☐

OK

Cancel

The configuration parameters that you specified are added as parameters to the **Create Configuration** procedure in the **Procedures** tab for the plugin.

7. From the **Type** pull-down menu, choose a form element type and complete the page for that type as follows:

Type	Description
Text entry	Creates a field for users to enter a small amount of text.



Type	Description
Text area	Creates a field that expands for users to enter a large amount of text (such as a script).

Type	Description
Dropdown menu	<p>Creates a drop-down menu for users to select a value when the parameter is presented. Choose one of the following:</p> <ul style="list-style-type: none"><li>• <b>Enter options</b>—Click + <b>Add Option</b> to add one or more new rows. Then enter the text and value for each option. The text is what will appear in the menu, and the value is the parameter value if that option is selected.</li><li>• <b>Load options from list</b>—Enter a pipe-separated list of options (for example, <code>foo bar baz</code>). The text and value for the options will be the same.</li><li>• <b>Load options from property sheet</b>—Enter the path to the property sheet that contains options for the parameter. The property sheet must be created in a specific format:<ul style="list-style-type: none"><li>• An <code>optionCount</code> property must exist whose value is the number of options.</li><li>• For each option, create a nested property sheet named <code>optionN</code>, where <i>N</i> is the option number, starting with 1. For example, if <code>optionCount</code> is set to 3, you must create three nested sheets: <code>option1</code>, <code>option2</code>, and <code>option3</code>.</li><li>• In each nested sheet, create two properties: <code>text</code> and <code>value</code>. The value of the <code>text</code> property will appear in the menu. The value of the <code>value</code> property is the parameter value if that option is selected.</li></ul></li></ul>

Type	Description
Radio selector	<p>Creates radio buttons for users to select a value when the parameter is presented.</p> <ul style="list-style-type: none"> <li>• <b>Enter options</b>—Click <b>+ Add Option</b> to add one or more new rows. Then enter the text and value for each option. The text is what will appear in the menu, and the value is the parameter value if that option is selected.</li> <li>• <b>Load options from list</b>—Enter a pipe-separated list of options (for example, <code>foo bar baz</code>). The text and value for the options will be the same.</li> <li>• <b>Load options from property sheet</b>—Enter the path to the property sheet that contains options for the parameter. The property sheet must be created in a specific format: <ul style="list-style-type: none"> <li>• An <code>optionCount</code> property must exist whose value is the number of options.</li> <li>• For each option, create a nested property sheet named <code>optionN</code>, where <i>N</i> is the option number, starting with 1. For example, if <code>optionCount</code> is set to 3, you must create three nested sheets: <code>option1</code>, <code>option2</code>, and <code>option3</code>.</li> <li>• In each nested sheet, create two properties: <code>text</code> and <code>value</code>. The value of the <code>text</code> property will appear in the menu. The value of the <code>value</code> property is the parameter value if that option is selected.</li> </ul> </li> </ul>
Checkbox	<p>Creates a check box for users to select or deselect a value when the parameter is presented.</p> <ul style="list-style-type: none"> <li>• <b>Value when unchecked</b>—Value of the parameter when the check box is unchecked (<code>false</code> by default)</li> <li>• <b>Value when checked</b>—Value of the check box when the check box is checked (<code>true</code> by default)</li> <li>• <b>Initially checked?</b>—Whether the check box should be checked initially. If <code>true</code>, set <b>Default value</b> to match <b>Value when checked</b>. If <code>false</code> (the default) set <b>Default value</b> to match <b>Value when unchecked</b>.</li> </ul>
Credential	<p>Creates a text box and an input field for users to provide a user name and password respectively to use this parameter at runtime.</p>

8. Click **OK**.

The new parameter appears in the **Project Details** page under the **Configuration Parameters** list. For example:

Project Details / **DockerIntegration-1.0.0.0**

Procedures Workflow Definitions Jobs Workflows Schedules Credentials Properties Reports **Configuration Setup**

**Configuration Parameters** Create Parameter

Parameter Name	Default Value	Type	Req?	Description	Actions
config		entry	✓		
credential		credential	✓		
desc		entry			
Description	Enter a description here.	entry	✓	Asks the user to enter a description.	

**Procedure Steps that require the plugin configuration credential parameter (if defined) to be attached as credential** Add

Currently, there are no records to display in this list.

## 9. Repeat the previous three steps to create more parameters as needed.

The new plugin appears on the **Plugin Manager** page under the **Currently Installed** tab along with the other installed plugins. For example:

Plugin Manager Create Plugin | ★

**Currently Installed** Install from File/URL View Catalog

Category: **All** Show Promoted Plugins Only: ☐

Plugin Label ▼▲	Author ▼▲	Version ▼▲	Category ▼▲	Description ▼▲	Actions
DockerIntegration	Integrations Administrator	1.0.0.0 (promoted)	Utility	ElectricFlow Docker integration.	Export   Demote   Configure   Help   Uninstall
EC-ALM	Electric Cloud	1.0.8.111171 (promoted)	Test	Integrates HP-ALM Test server into ElectricFlow	Demote   Configure   Help   Uninstall
EC-AgentManagement	Electric Cloud	1.3.0.116300 (promoted)	System	Centralized Agent Management procedures	Demote   Help   Uninstall
EC-AmazonECS	Electric Cloud	1.0.2.70 (promoted)	Container Management	Integrates with EC2 Container Service.	Demote   Configure   Help   Uninstall
EC-Ant	Electric Cloud	2.0.9.111171 (promoted)	Build	Java build tool	Demote   Help   Uninstall
EC Artifact	Electric Cloud	1.1.4.116300 (promoted)	System	Provides an interface for artifact version publish and retrieve operations	Demote   Help   Uninstall
EC-AzureContainerService	Electric Cloud	1.0.0.10 (promoted)	Container Management	Integrates with Azure Container Service to run Docker containers on the Azure Cloud Platform.	Demote   Configure   Help   Uninstall
EC-CIManager	Electric Cloud	1.4.0.116300 (promoted)	System	Continuous Integration Manager	Demote   Configure   Help   Uninstall
EC-CSH	Electric Cloud	2.0.2.111171 (promoted)	Scripting/Shell	Integrates CSH Scripting Shell Tool into ElectricFlow	Demote   Help   Uninstall

## Adding Procedures

A procedure defines a process to automate one or more steps. A procedure is run to carry out a process.

1. In the **Plugin Manager** page, click the plugin name.

The **Project Details** page for the plugin appears.

2. Click the **Procedures** tab and then click **Create Procedure**.

The **New Procedure** page appears:

New Procedure

Name:

Description:

Job Name Template:

Default Resource:

Browse

Default Workspace:

Browse

Time Limit:

minutes

Impersonation Credential

Credential Project:

Current

BulkOperations-1.0

Browse

Credential Name:

Browse

OK

Cancel

3. Complete the page as follows:

Field name	Description
Name	Procedure name. This name must be unique within the project.
Description	(Optional) Plain text description of the procedure. ElectricFlow does not interpret this text.
Job Name Template	<p>Template used to determine the default name of a job launched from the procedure. For example:</p> <pre> \$[projectName]_\$/increment /myproject/jobCounter]_\$/timestamp </pre> <p>produces a name such as:</p> <pre> projectFoo_1234_20140102130321 </pre> <p>Enter any combination of elements to create meaningful procedure names. For example, you could include the build number.</p> <p><b>Note:</b> You should not use the ElectricFlow-generated <code>jobId</code>, because it is not a human-readable integer. This means that it does not provide identifiable information and cannot be used as a counter.</p>
Default Resource	Resource name. Enter a name or click <b>Browse</b> and choose a resource. This name must be unique among resource names.
Default Workspace	Name of the default workspace. Enter a name or click <b>Browse</b> and choose a workspace.
Time Limit	<p>Maximum amount of time during which the step can execute. The step is aborted if it exceeds this time. If no time limit was specified on the calling step, time limits are copied to the calling step from the procedure. If the procedure is called from <code>runProcedure</code> (or a schedule), the time limit acts as a global job timeout.</p> <p>The timer for the procedure starts when the calling step or job becomes runnable (when all preconditions are satisfied). Specify a number and then use the pull-down menu to select the units (seconds, minutes, or hours).</p>
<b>Impersonation Credential</b>	
Credential Project	Name of the project that contains this credential. Use the current project or click the other radio button and enter a project name (or click <b>Browse</b> and choose another project). The current project is used by default.
Credential Name	Name of the credential for the project. Enter a name or click <b>Browse</b> and choose another credential.



4. Click **OK**.
5. Repeat the above steps to add more procedures if needed.

### Adding Properties

1. In the **Project Details** page for the plugin, click the **Properties** tab.

The list of properties for the plugin appears. For example:

Project Details / DockerIntegration-1.0.0.0

Procedures

Workflow Definitions

Jobs

Workflows

Schedules

Credentials

Properties

Reports

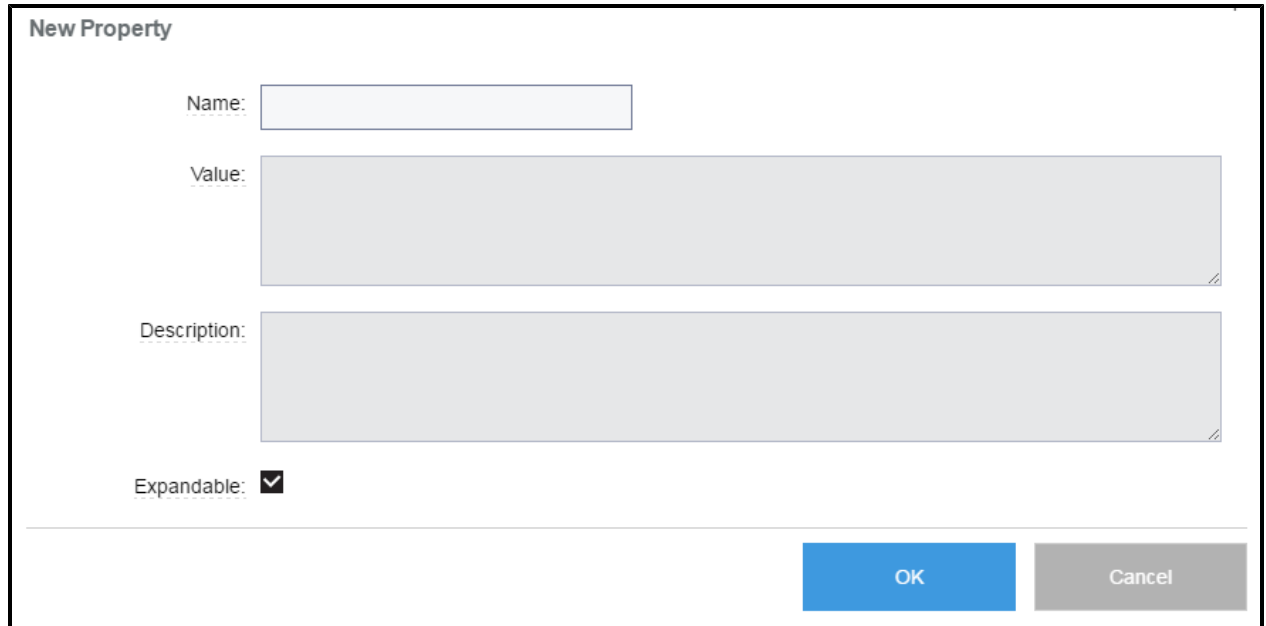
Configuration Setup

Create Property | Create Nested Sheet | Access Control

Property Name	Value	Description	Actions
ec_config			
logs			
scripts			
ec_setup	<pre> use Cwd; use File::Spec; use POSIX; my \$dir = getcwd; my \$logfile = ""; my \$pluginDir;  if ( defined \$ENV{QUERY_STRING} ) { # Promotion through UI     \$pluginDir = \$ENV{COMMANDER_PLUGINS} . "/" . \$pluginName; } </pre> <div>... <a href="#">Show Full Text</a></div>		
ec_visibility	pickListOnly		
pluginDir	/opt/electric cloud/electric commander/plugins/DockerIntegration-1.0.0.0		

2. Click **Create Property**.

The **New Property** popup appears:



3. Complete the popup as follows:

Column Name	Description / Actions
Name	Property name.
Value	Value to assign to the property.
Description	(Optional) Plain text description of this object. ElectricFlow does not interpret this text.
Expandable	Determines whether the property is marked for expansion. Enabled (checked) means that a property value such as <code>\$(MYPROPERTY)</code> will be expanded or resolved to be the actual value of <code>\$(MYPROPERTY)</code> . Disabled (unchecked) means that the value of the property is interpreted literally as <code>\$(MYPROPERTY)</code> .

4. Click **OK**.
5. Repeat the above steps to add more properties if needed.

## Editing a Plugin

You can use the Plugin Manager to edit plugins that you have created in the Plugin Manager. (You cannot use it to edit plugins that are bundled with ElectricFlow or downloaded from the Plugins Catalog.)

1. In the Automation Platform, choose **Administration > Plugins**.

The **Plugin Manager** page appears.

2. Click the name of the plugin that you want to edit.

The **Project Details** page for the plugin appears.

3. Create or update the procedures, properties, and so on as needed for the plugin project.

4. Click the (edit plugin details) button.



The **Edit Plugin Details** page for the plugin appears. For example:

Edit Plugin Details / EC-DockerSwarm-1.0.0

Extension Version:

Description:

Category:

Author:

Author Url:

Enable plugin configuration support:

☒

OK

Cancel

5. Complete the page as follows:

Name	Description
Extension Version	<p>(Optional) Number that ElectricFlow uses to differentiate between the Electric Cloud created plugins that you downloaded but did not modify or extend and Electric Cloud created plugins that you have modified or extended. This prevents an ElectricFlow upgrade that also upgrades the corresponding bundled plugin from overwriting the plugin that you have modified or extended.</p> <p>Use only positive integers with no other characters. For example, 12. The default is 1.</p> <p>For details about version extensions, see <a href="#">How Plugin and Extension Versions Determine Plugin Installation or Autopromotion</a> on page 761.</p>
Description	(Optional) Plain text description of the plugin. ElectricFlow does not interpret this text.
Category	<p>(Optional) Category for the plugin. Categories let you group plugins by functionality or purpose and provide a convenient way to look up a specific plugin if you know its functionality or purpose. For example, when you are configuring a process step and want to deploy an application on WebSphere, you first choose the Application Server category and then the WebSphere plugin.</p> <p>You can select an existing plugin category by using the autofill functionality, or you can enter a new category. The default category is <code>Utility</code>.</p>
Author	(Optional) Plugin author's name. For example, a user or organization name.
Author Url	(Optional) Plugin author's URL. For example, <code>http://bigco.com/integrations/docker</code> .
Enable plugin configuration support	<p>(Optional) Determines whether to allow the addition of plugin procedures to support the creation of plugin configurations. Disabling this option displays a confirmation dialog box: Any existing plugin configurations for this plugin will be deleted if the 'Enable plugin configuration support' is unchecked.</p> <p>If you enable this feature, the <b>Configuration Setup</b> tab is added to the <b>Project Details</b> page for the plugin, and the CreateConfiguration and DeleteConfiguration procedures are added to the plugin (you can click the <b>Procedures</b> tab to see these procedures). This tab lets you modify information required to support plugin configurations such as the parameters required by the CreateConfiguration procedure.</p>

6. Click **OK**.

### Exporting a Plugin

You can export a plugin in order to import it to another ElectricFlow server. Only procedures and properties are exported. Workflows, schedules, credentials and so on are not exported.

1. In the Automation Platform, choose **Administration > Plugins**.

The **Plugin Manager** page appears.

2. Click the **Export** link for the plugin that you want to export.

The plugin .zip file is downloaded to your system as *<plugin-name>-<version>.zip*.

### How Plugin and Extension Versions Determine Plugin Installation or Autopromotion

The Plugin Manager uses a combination of the plugin version and plugin extension version to determine whether to install or autopromote a new plugin version. The following table uses examples to demonstrate the rules for installation and autopromotion of a new plugin version:

Existing version	New version	Result	Rule used
1.2.3.300 (promoted)	1.2.8.1234	1.2.8.1234 (promoted)	For two plugins without extension versions, the newer plugin is installed and promoted regardless of the promotion status of the existing plugin.

Existing version	New version	Result	Rule used
1.2.3.300 (promoted)	1.3.4.1235	1.3.4.1235 installed. 1.2.3.300 remains promoted.	For two plugins without extension versions, the newer plugin is installed (but not promoted, because it is a minor-version upgrade and not just a patch).

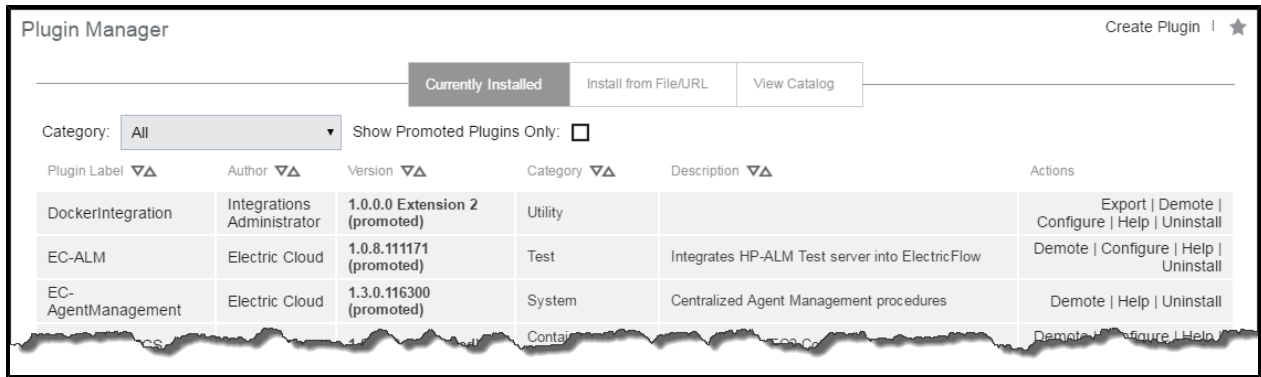


Existing version	New version	Result	Rule used
1.2.3.300 (promoted)	1.2.2.124	1.2.2.124 not installed unless forced (via the <code>--force</code> ) ectool argument or by checking the <b>Disable Plugin Version Check</b> check box in the <b>Install from File/URL</b> tab of the Plugin Manager.	For two plugins without extension versions, the newer plugin is not installed if the existing plugin is a newer version than the plugin being installed.

Existing version	New version	Result	Rule used
1.2.3.300 (promoted)	1.2.3.300 Extension 1	1.2.3.300 extension 1 (promoted)	With two plugins of the same version, a plugin with an extension version takes precedence over a plugin that is promoted and has no extension version (the plugin with the extension version is installed and autopromoted)

Existing version	New version	Result	Rule used
1.2.3.300 Extension 1 (promoted)	1.2.3.300 Extension 2	1.2.3.300 extension 2 (promoted)	With two plugins of the same version, a plugin with a higher extension version takes precedence over a plugin that is promoted and has a lower extension version (the plugin with the newer extension version is installed and autopromoted).
1.2.3.300 extension 2 (promoted)	1.2.3.300	1.2.3.300 is not installed unless forced (by using the <code>--force</code> ) ectool argument or by checking the <b>Disable Plugin Version Check</b> check box in the <b>Install from File/URL</b> tab of the Plugin Manager.	A promoted plugin version with an extension version takes precedence over a plugin of the same version but without an extension version.
1.2.3.300 extension 2 (promoted)	1.2.8.1234	1.2.8.1234 is installed.  1.2.3.300 extension 2 remains promoted.	A newer plugin version is not autopromoted if the existing plugin has an extension version and is currently promoted.

An extension version for a plugin appears as `Extension <version>` on the **Plugin Manager** page in the **Version** column of the **Currently Installed** tab. For example, `Extension 2`:



## Using a Plugin

Multiple methods for adding plugin functionality to ElectricFlow are available.

### Configuring ElectricFlow to Recognize Your SCM Plugin

See [Setting Up a Source Control Configuration](#) on page 632. For additional plugin help, see [Customizing the ElectricFlow UI](#). For help using your SCM plugin with ElectricFlow Preflight, Default Tracking, and ElectricSentry, see [Preflight Builds](#), [Defect Tracking](#), and [ElectricSentry](#).

### Adding a Subprocedure Step Using the Edit Step or New Step Pages

1. Click the **Projects** tab and choose an existing project or click the **Create Project** link to create a new project.
2. On the **Project Details** page, select an existing procedure or click the **Create Procedure** link to create additional procedures.
3. On the **Procedure Details** page, select the **Plugins** link to go to the **Choose Step** pane to create a New Step using a plugin.
  - In the left pane, select a plugin category and then choose a plugin.
  - In the right pane, select a step type. This opens the **New Step** page so you can add a new subprocedure step (using your selected plugin).

On the **New Step** page, note that the plugin that you selected already appears in the **Subprocedure** section.

4. Enter information into the **Parameters** section fields.

These fields are plugin-specific and are frequently different for each plugin.

## Configuring the Plugins Directory

For instructions on configuring the plugins directory for your ElectricFlow server, remote agents, or remote web servers, see the *ElectricFlow Installation Guide* at [http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html).

## Procedure Details

This page displays procedure component tables, including a table for Procedure Steps, Parameters, Email Notifications, and Custom Procedure Properties. A procedure describes a process to execute that consists of one or more step.

***Use this page to create steps.***

### Procedure Steps

This table displays all steps in the procedure [named at the top of the page]. The steps execute in order from top to bottom. Normally only one step executes at a time, but if a group of adjacent steps is marked as "parallel," all of those steps will execute simultaneously.

**Important:** If you want to change the order of the steps, click on the icon to the left of the step name and drag it up or down to the new step position.

**Note:** This table displays only a few of the fields for each step. To view (and modify) the complete details for a step, click on the step's name to go to the Edit Step page.

### *Links at the top of the page*

- Use the **Run** link [hovering your mouse over the small down-arrow on the right-side of the link] to choose Run Immediately or Run...
  - Run Immediately—Selecting this option runs the procedure immediately as set.
  - Run...—Selecting this option displays the Run Procedure web page where you may alter any existing parameters for this procedure, or set an existing credential.
- Click the **Access Control** link to go to the Access Control page to add privileges for this procedure.
- Click the **Edit** link to go to the Edit Procedure page so you can make modifications if necessary.
- Use the **Copy** link in the Actions column to make an exact copy of this step.
- Choose one of the New Step links to create the type of step you need.

### Creating a new step

The following list describes some of the more common steps you can create.

- **Command**—this link takes you directly to the New Step page to write your own step. A Command(s) text box is available to add a script. This step invokes a `bat`, `cmd`, `shell`, `perl` script, or similar.
- **Subprocedure**—the Choose Subprocedure Step dialog is displayed, allowing you to select a project or plugin from which you want to call an existing procedure to create a step. This step invokes another ElectricFlow procedure and will not complete until all subprocedure steps have finished.
- **Plugin**—this link opens the Choose Step panel. The left pane displays plugin categories and the right pane displays available pre-configured steps for your left-pane selection. To quickly find your application/plugin, type your selection name in the Search box. Select the step you want to create and ElectricFlow takes you to the New Steps page.
  - On the New Step page, notice that the plugin step you selected is already displayed in the Subprocedure section.
  - Enter information in the Parameters section fields. These fields are specific to the plugin you chose. (These fields are different for each plugin.)

Enter information in any remaining fields to complete your step. See the New Step Help topic for more information.

### *A note about plugins*

Plugins are the vehicle ElectricFlow uses to integrate source control systems (such as Subversion or Perforce), defect tracking applications (such as JIRA or MKS), reporting functionality, code analysis applications, build applications, and much more. To see the complete list of plugins bundled and installed with ElectricFlow, see the Plugin Manager page (go to **Administration > Plugins**).

**Note:** If you do not see the SCM system or defect tracking system you prefer, a Plugin Catalog is available from the Plugin Manager also. All plugins in the catalog are available for installation into ElectricFlow.

### **Parameters**

Each procedure can define parameters, which are values provided to the procedure when it is invoked. Each parameter value is placed in a property associated with the job and the procedure can use the property to control its execution. For example, a parameter might specify a particular branch of a product to build; another parameter might indicate whether unit tests should be run during this build.

When you define a parameter, indicate whether the parameter is required (meaning the procedure will not run unless a value is provided for the parameter). Also, you can provide a default parameter value and a description to help callers understand how to use the parameter.

- Click the **Create Parameter** link to go to the New Parameter page.
- Click on the Parameter Name to edit its contents.

### **Email Notifiers**

Use the **Create On Start Email Notifier** or **Create On Completion Email Notifier** links to go to one of the respective pages to create an email notifier for this procedure.

After creating an email notifier, click on the "bread crumb" link at the top of the page to return to the Procedure Details page.

### **Custom Procedure Properties**

- To add new properties to this procedure, click the **Create Property**, **Created Nested Sheet**, or **Access Control** links.
- Click on the Property Name to edit its contents.
- Nested Property Sheets appear in this table preceded by a folder icon.

### *Tip*

Want to rename this procedure or change its description? Click the **Edit** link at the top of the page.

## **Procedure—create new or edit existing procedure**

### **Creating a Procedure**

Enter the information as follows:

Field name	Description
Name	Procedure name. This name must be unique within the project.
Description	(Optional) Plain text description of the procedure. ElectricFlow does not interpret this text.
Job Name Template	<p>Template used to determine the default name of a job launched from the procedure. For example:</p> <pre>[projectName]_[/increment /myproject/jobCounter]_[/timestamp]</pre> <p>produces a name such as:</p> <pre>projectFoo_1234_20140102130321</pre> <p>Enter any combination of elements to create meaningful procedure names. For example, you could include the build number.</p> <p><b>Note:</b> You should not use the ElectricFlow-generated <code>jobId</code>, because it is not a human-readable integer. This means that it does not provide identifiable information and cannot be used as a counter.</p>
Default Resource	Resource name. Enter a name or click <b>Browse</b> and choose a resource. This name must be unique among resource names.
Default Workspace	Name of the default workspace. Enter a name or click <b>Browse</b> and choose a workspace.
Time Limit	<p>Maximum amount of time during which the step can execute. The step is aborted if it exceeds this time. If no time limit was specified on the calling step, time limits are copied to the calling step from the procedure. If the procedure is called from <code>runProcedure</code> (or a schedule), the time limit acts as a global job timeout.</p> <p>The timer for the procedure starts when the calling step or job becomes runnable (when all preconditions are satisfied). Specify a number and then use the pull-down menu to select the units (seconds, minutes, or hours).</p>
<b>Impersonation Credential</b>	
Credential Project	Name of the project that contains this credential. Use the current project or click the other radio button and enter a project name (or click <b>Browse</b> and choose another project). The current project is used by default.
Credential Name	Name of the credential for the project. Enter a name or click <b>Browse</b> and choose another credential.



Click **OK** to save the information to create a new procedure.

### Editing an Existing Procedure

Use this page to modify certain overall information about a procedure. Additional information, such as procedure steps and properties, can be viewed and modified on the **Procedure Details** page. To access this page, click the **Project Name** link on the location path (breadcrumb), then select a procedure name. To rename a procedure, enter a new procedure name in the **Name** field and click **OK**.

### Step—create new or edit existing step



Use this page to define a new step or to modify an existing step. The following information describes the common fields you need to enter to create any type of step.

**Note:** If you chose to create a step using the Plugin link, additional help is available in the Parameters section by clicking the "?" icon. The Parameter section is populated according to type you chose to create. Different step types require different information.

#### To create a new command or subprocedure step

Enter information in the fields as follows:

Field Name	Description
<b><i>General section (for all step types)</i></b>	
Name	Enter a name for the step that must be a unique name within the procedure.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
<b><i>Command section (for command steps only)</i></b>	
Command(s)	A script to execute the step functions that is passed to the step's shell for execution.

Field Name	Description
Resource	<p>Enter a unique resource or resource pool name or click Browse to select a resource. If you leave this field blank, the procedure or project provides a default resource.</p> <ul style="list-style-type: none"> <li>• The job step must have the execute privilege on the resource or resource pool. If it does not, the job step will be canceled with an access denied error.</li> <li>• The resource or resource pool must be enabled. If the resource or pool is not enabled, no error is generated, and the step remains in the runnable state until the pool is enabled.</li> </ul>
Postprocessor	<p>If this field remains blank, no postprocessor runs for the step. If this field is not blank, it specifies a command (passed to the step's shell for execution) that analyzes the log file for the step and collects diagnostic information for reporting. <i>For more information</i>, see the <a href="#">Postprocessors</a> Help topic.</p>
<b><i>Subprocedure section (for subprocedure steps only)</i></b>	
Procedure	<p>Displays the current project and procedure. Click <b>Change</b> to use the pop-up menu to select a new project or procedure.</p>
Resource	<p>Enter a unique resource name or click Browse to select a resource. If you leave this field blank, the procedure or project provides a default resource.</p>
<p><b><i>Parameters section (for subprocedure steps only)</i></b></p> <p>This section expands automatically, entering the fields you need specifically for the Subprocedure you chose in the previous section. For additional help with field descriptions, click the "?" icon if available.</p> <p> To toggle between the standard view and property view for this section, click the  icon. This icon appears in the standard form when one or more of the parameter types are not <b>Text entry</b> or <b>Text area</b>. It appears in the custom form for all the supported parameter types when the form has at least one parameter.</p>	
<b><i>Advanced section (for both command and subprocedure steps)</i></b>	

Field Name	Description
Precondition	<p>By default, if this field is blank, the step has no precondition and will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a <i>precondition</i> is evaluated.</p> <p>A <i>precondition</i> is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a \"0\" or \"false\" is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.</p> <p>You cannot use timestamps in preconditions on any object that supports preconditions. This includes stages, gates, and tasks as well as procedures and process steps.</p> <p>Precondition example: Assume we defined these 4 steps:</p> <ol style="list-style-type: none"> <li>1. Build object files and executables</li> <li>2. Build installer</li> <li>3. Run unit tests</li> <li>4. Install bits on test system</li> </ol> <p>Step 1 is an ordinary serial step. Steps 2 and 3 can run in parallel because they depend only on step 1's completion. Step 4 depends on step 2, but not step 3.</p> <p>You can achieve optimal step execution order with preconditions:</p> <ul style="list-style-type: none"> <li>• Make steps 2-4 run in parallel.</li> <li>• Step 2 needs a job property set at the end of its step to indicate step 2 is completing (/myJob/buildInstallerCompleted=1).</li> <li>• Set a precondition in step 4: \$[/myJob/buildInstallerCompleted]</li> </ul>
Run Condition	<p>By default, if this field is blank the step will always run. This field accepts "fixed text" or text embedding property references that are evaluated into a logical TRUE or FALSE. A "0" or "false" is interpreted as FALSE. An empty string or any other result is interpreted as TRUE.</p> <p>The property reference can be a JavaScript expression, for example, this expression could test whether the name of a step is equal to the value of a property called "restartStep". \$[/javascript (myStep.stepName == myJob.restartStep)]</p>

Field Name	Description
Error handling	<p>This field determines what happens to the procedure if the step fails.</p> <p>The first choice, "procedure continues, but overall status will be error" means an error in the step does not abort the procedure; subsequent steps will run as usual. However, an error will be reflected in the overall outcome of the procedure. If this is the top-level procedure in the job, the job will have an error outcome.</p> <p>If this is a subprocedure, the step invoking the subprocedure will have an error outcome, which still could cause the job to abort, depending on the error handling for that step.</p> <p>The second choice for this field is "abort procedure but allow running steps to continue." In this case, if an error occurs, no new steps are initiated in this procedure except those where "always run" was selected. Any steps currently running are allowed to complete, then the procedure will abort and its outcome will be set to error as described previously.</p> <p>Six error handling options are:</p> <ul style="list-style-type: none"> <li>• <code>failProcedure</code>—The current procedure continues, but the overall status is error (default).</li> <li>• <code>abortProcedure</code>—Aborts the current procedure, but allows already-running steps in the current procedure to complete.</li> <li>• <code>abortProcedureNow</code>—Aborts the current procedure and terminates running steps in the current procedure.</li> <li>• <code>abortJob</code>—Aborts the entire job, terminates running steps, but allows <code>alwaysRun</code> steps to run.</li> <li>• <code>abortJobNow</code>—Aborts the entire job and terminates all running steps, including <code>alwaysRun</code> steps.</li> <li>• <code>ignore</code>—Continues as if the step succeeded.</li> </ul>
Time Limit	<p>The maximum amount of time the step can execute. If the step exceeds this time, it will be aborted. Specify a number and then use the pull-down menu to select the "time units" of the number you specified.</p>
Run in parallel	<p>If this box is "checked," this step will run concurrently with any adjacent steps marked as parallel. If this box is not checked, the step will NOT run until all previous steps in the procedure have completed, and it will complete before any following steps execute.</p>

Field Name	Description
Always run step	If a procedure is aborted (either because of an error in a step or because the job was aborted), under normal conditions no new steps will start in the procedure. However, if this box is "checked," the step will run even if the procedure is aborted. This facility is most commonly used for steps at the end of a job that generate reports or perform cleanup operations. <b>Note:</b> Remember that the Run Condition field is still evaluated and may cause the step to be skipped even if this box is checked.
Retain Exclusive	Select one of the following options: <ul style="list-style-type: none"> <li>• None—the "default", which does not retain a resource.</li> <li>• Job—keeps the resource for the duration of the job. No other job can use this resource, regardless of its step limit, until this job completes or "Release Exclusive" is used in a step. Future steps for this job will use this resource in preference to other resources—if this resource meets the needs of the steps and its step limit is not exceeded.</li> <li>• Step—keeps the resource for the duration of the step.</li> <li>• Call—keeps the resource for the duration of the procedure that called this step, which is equivalent to 'job' for top level steps.</li> </ul>
Workspace	Use this field to define a workspace for the step to use. You can either type-in a workspace name or click Browse to select a workspace. If you leave this field blank, the workspace is determined by the procedure or project.
<b><i>These "Advanced" fields are used for command steps only</i></b>	
Broadcast	"Checking" this box means replicate the step to execute (in parallel) on each of the specified resources (for example, if a resource pool is specified, run the step on each resource in the pool).
Release Exclusive	Select one of the following options: <ul style="list-style-type: none"> <li>• none—the "default"—no action if the resource was not previously marked as "retain".</li> <li>• release—releases the resource at the end of this step. If the resource for the step was previously acquired with "Retain exclusive" (either by this step or some preceding step), the resource exclusivity is canceled at the end of this step. The resource is released in the normal way so it may be acquired by other jobs.</li> <li>• releasetojob—allows a step to promote a Step exclusive resource to a Job exclusive resource.</li> </ul>

Field Name	Description
Shell	<p>This shell will be used to execute the step's commands on a resource. For example, using <code>sh</code> or <code>cmd /c</code>, the agent saves the command block to a temporary file with a <code>.cmd</code> extension and runs it:</p> <pre>sh foo.cmd or cmd /c foo.cmd</pre> <p>If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:</p> <p>Windows: <code>cmd /q /c "{0}.cmd"</code>  UNIX: <code>sh -e "{0}.cmd"</code></p> <p>When you specify a shell (in the step or resource), and omit the <code>cmd-file</code> marker, the agent notices the omission and takes the correct action. For example: a user specifies <code>sh -x</code>. The agent converts this to <code>sh -x "{0}.cmd"</code></p> <p>Two alternate forms of shell syntax where ElectricFlow uses a "marker," <code>{0}</code>, as a placeholder for the command file argument:</p> <ul style="list-style-type: none"> <li>• <b>&lt;myShell&gt; {0} &lt;potential extra shell args&gt;</b>  In this example, the command file is not meant to be the last argument in the final command line.  For example, <code>mysql -e "source {0}"</code>  This shell example runs the <code>mysql</code> command against this step's command containing <code>sql</code>.</li> <li>• <b>&lt;myShell&gt; {0} &lt;.file extension&gt; &lt;potential extra shell args&gt;</b>  In this example, the shell requires the command file to end in an extension other than <code>.cmd</code>.  For example, <code>powershell "&amp; '{0}.ps1'"</code>  This shell example runs Microsoft PowerShell against this step's command containing PowerShell commands.</li> </ul> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• When the agent parses the shell, it will parse the extension as everything after <code>{0}</code> . until it sees a space or non-alphanumeric character.</li> <li>• If your script uses International characters (non-ascii), add the following block to the top of your <code>ec-perl</code> command block:  <pre>use utf8; ElectricCommander::initEncodings</pre></li> </ul>

Field Name	Description
Working Directory	The directory where the commands for this step execute. A relative name is interpreted relative to the root directory for the job workspace. If you leave this field blank, the step's working directory will be the top-level directory in the job workspace. <b>Note:</b> If this step will run on a proxy resource, this directory must exist on the proxy target. The step will run in this directory on the proxy target.
Log File	The step's log file name, specified relative to the root directory in the job workspace. If you leave this field blank, ElectricFlow picks a unique name for the log file based on the step name.
<i><b>Impersonation section (for both command and subprocedure steps)</b></i>	
Credential Project	By default, the Current project is used, or click Browse and select a different project.
Credential Name	If you select a credential in this field, the step runs under the account from that credential. This field is usually blank, which means a default credential is used. For more detailed information about credentials, see the <a href="#">Credentials and User Impersonation</a> Help topic.

Click **OK** to create the step.

#### To edit an existing command or subprocedure step

You can modify any of your previously entered step information and add information to one or all of the four additional sections.

#### **Attached Credentials**

Click the **Attach Credential** link to retrieve an existing credential for this step. If you need to create a new attached credential, return to the Project Details page for this step.

#### **Attached Parameter Credentials**

Click the **Attach Parameter Credential** link to retrieve an existing parameter credential for this step.

#### **Email Notifiers**

Choose **Create On Start Email Notifier** or **Create On Completion Email Notifier** to go the respective page to create the email notifier you need.

#### **Custom Step Properties**

Choose from the **Create Property**, **Create Nested Property**, or **Access Control** links to add a custom property to this step. Each Property pop-up box has its own Help topic or go to the main [Properties](#) Help

topic for more information. For more information about Access Control, go to the main [Access Control](#) Help topic.

Click **OK** to save your modified step information.

### Publish Artifact Version Step

Use the EC-Artifact plugin to create a step to publish a new artifact version.

The following parameters are available to create this step:

Field Name	Description
Artifact	Artifact name, in the form <groupId>:<artifactKey>. If the artifact does not exist, it will be created if this procedure's launching user or this project principal has the required permissions.
Version	A full version string takes the form: <major>.<minor>.<patch>-<qualifier>-<buildNumber>. The version specification must be unique across all of this artifact's versions.
Repository	Name of the repository where this new artifact version will be published.
Enable Compression	Check this box to compress the artifact version before it is stored in the repository.
From Directory	Name of the directory in the job's workspace containing files that comprise the artifact version to be published. If not specified, the entire workspace is used.
Include Patterns	List file "include" patterns one pattern per line, to limit which files are published. If no patterns are specified, all files are included.
Exclude Patterns	List file "exclude" patterns one pattern per line, to limit which files are published. If no patterns are specified, no files are excluded.
Dependent Artifact Versions	List dependent artifact versions one per line, each in the form <groupId>:<artifactKey>:<versionRange>. All dependent artifact versions must exist for this artifact version to be retrievable. When this artifact version is successfully retrieved, its dependent artifact versions are retrieved also.

### Retrieve Artifact Version Step



Use the EC-Artifact plugin to create a step to retrieve an artifact version.

The following parameters are available to create this step:

Field Name	Description
Artifact	Artifact name, in the form <groupId>:<artifactKey>.
Version	Select the latest version ( <b>Latest</b> ), the exact version of the artifact ( <b>Exact</b> ), or a version range ( <b>Range</b> ). Version is in the form: <major>.<minor>.<patch>-<qualifier>-<buildNumber>
Retrieve to directory	If you want to retrieve this artifact version to a specific directory location, select the check box, then specify the full path to the directory where you want to retrieve this artifact version.
Overwrite	Use the drop-down menu to select one of the following options: <ul style="list-style-type: none"><li>• <code>true</code>—deletes previous content in the directory and replaces the content with your new version.</li><li>• <code>false</code>—(existing behavior) if the directory does not exist, one will be created and filled with the artifact's content. If the directory exists, a new directory is created with a unique name and the artifact contents is supplied there.</li><li>• <code>update</code>—this is similar to a merge operation—two artifact versions can be moved into the same directory, but individual files with the same name will be overwritten.</li></ul>

Field Name	Description
Retrieved Artifact Location Property	<p>Name or property sheet path used by the step to create a property sheet. This property sheet stores information about the retrieved artifact versions as XML in the <code>artifactVersionXML</code> child property, and the file system location of the retrieved artifact version in the <code>cacheLocation</code> child property.</p> <p>The initial value of this field includes <code>[\$assignedResourceName]</code> as one of the levels in the property path because different resources may have different cache directories, and you do not want a retrieval on one resource to clobber the data regarding a retrieval on a different resource.</p> <p>Typically, a step that needs to use files from an artifact retrieved by this step will specify it in a Perl script similar to this:</p> <pre> my \$cmdr = new ElectricCommander(); my \$xpath = \$cmdr-&gt;getProperty ("/myJob/retrieveArtifactVersions/[\$assignedResourceName]                                /MyGrp:MyKey/cacheLocation");  my \$retrieveDir = \$xpath-&gt;findvalue("//value")-&gt;value ();  system("java", "-cp", "\$retrieveDir/lib/bar.jar", "Bar"); </pre> <p>This example shows how to retrieve the location of the retrieved <code>MyGrp:MyKey</code> artifact version on the resource, and add a file (<code>bar.jar</code>) in its <code>lib</code> directory to classpath, so the <code>Bar</code> class can be run.</p>
Filters	Enter search filters, one per line, applicable to querying the ElectricFlow database for the artifact version to retrieve.

### Artifact Retrieval Dependency Order Explained

The order of dependencies registered for an artifact version are significant.

Consider this scenario:

- A depends on B (any version) and C [1.0, 2.0]
- B depends on C (any version)
- C versions 1.0, 2.0, and 3.0 exist

When retrieving A, the dependency algorithm evaluates B first. The algorithm finds that the max version of B depends on any version of C, so the algorithm looks for max version C and finds C 3.0. Because this chain is satisfied, the algorithm returns to A and evaluates its next dependency "C [1.0, 2.0)". This results in matching C 1.0.

The returned artifacts are: A, B, C 1.0, and C 3.0.

Consider if the A dependency is changed to:

- A depends on C [1.0, 2.0), B (any version)

The algorithm will choose C 1.0 first. Then the algorithm evaluates B, determines that its "C (any version)" is satisfiable by the already chosen C 1.0.

The returned artifacts are A, B, and C 1.0.

**Note:** In the version range syntax [] indicates inclusive, () indicates exclusive.

## Send Email Step

Use the EC-SendEmail plugin to create a step to send email notifications.

The following parameters are available to create this step:

Parameter Name	Description
Email Configuration	The name of the email configuration to use. If no configuration is specified, the configuration named "default" is used.
To	List the "To" recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.
CC	List the "CC" recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.
BCC	List the "BCC" recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.
Subject	The subject line for the email message.
Message	The body of the email message or a workspace file containing the body. If both a plain text and an HTML message are provided, both values are sent as alternates in a multipart message. If a raw message is provided, both values are sent as alternates in a multipart message. If a raw message is provided, the value should be a properly formatted RFC822 message.
<b>Advanced options</b>	
Multipart Mode	The multipart mode of the email message. Defaults to "none" unless there are multiple parts, in which case it defaults to "mixedRelated".
Header(s)	One or more RFC822 email header lines (for example: "reply-to: user@host.com").

Parameter Name	Description
Attachment(s)	One or more files from the job's workspace to send as attachments. The filename extension is examined to determine the content-type.
In-line Attachment(s)	One or more inline attachments specified as a <code>contentId</code> and a workspace filename. The filename extension is examined to determine the content-type.

### New Extract Preflight Sources Step

Choose one of the preflight plugins to create a step to retrieve an artifact version. There are numerous source code management (SCM) plugins. For example, Accurev, Bazaar, CVS, ClearCase, Git, Mercurial, Perforce, SVN, StarTeam, Team Foundation Server, and Vault.

Enter the following information:

Field Name	Description
Step Name	Enter a unique name for your preflight step. You can use any name of your choice.
SCM Configuration	Use the pull-down menu to select a source control configuration. If a configuration for your source control type does not appear in the drop-down menu, select the Administration > Source Control tabs to configure your source control system.
Destination Directory	This field appears after specifying your SCM from the pull-down menu. If this field does not specify "Required", you do not need to enter this information. The Destination Directory is a path relative to the job's workspace, where the source tree will be created.

Click **Submit** after entering your information.

After clicking **Submit**, the Edit Step page is displayed.

Use the Edit Step page to specify additional information for your preflight step. Also, you can attach a credential, create an email notifier, add custom properties, and so on to your step. For assistance using the Edit Step page, access the **Help** link in the upper right corner of the page.

For more information about preflight builds, see the [Preflight Builds](#) Help topic.

### Parameter—create new or edit existing parameter

## To create a new parameter

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique name to specify the parameter when a procedure or workflow is invoked.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
<b>Type</b> —Select the parameter type from the drop-down menu. The following "types" are available.	
Text entry	Allows a short text entry in the Default Value field.
Text area	Expands the Default Value field to allow adding a longer script-type entry.
Dropdown menu	<p>Creates a drop-down menu from which to select a value when the parameter is presented.</p> <ul style="list-style-type: none"> <li>Enter options—Click <b>+ Add Option</b> to add a new row. Type-in the text and value for each option. The text is what will be displayed in the menu, and the value is the parameter value if that option is selected.</li> <li>Load options from list—Enter a pipe-separated list of options (for example, <code>foo bar baz</code>). The text and value for the options will be the same.</li> <li>Load options from property sheet—Enter the path to property sheet that contains options for the parameter. The property sheet must be created in a specific format: <ul style="list-style-type: none"> <li>An <code>optionCount</code> property must exist whose value is the number of options.</li> <li>For each option, create a nested property sheet called <code>optionN</code>, where N is the option number, starting with 1.</li> <li>In each nested sheet, create two properties—<code>text</code> and <code>value</code>. The value of the property <code>text</code> will be displayed in the menu. The value of the property <code>value</code> is the parameter value if that option is selected.</li> <li>If <code>optionCount</code> is set to 3, you must create three nested sheets—<code>option1</code>, <code>option2</code>, and <code>option3</code>.</li> </ul> </li> </ul>

Field Name	Description
Radio selector	<p>Creates "radio" buttons to select an entry when the parameter is presented.</p> <ul style="list-style-type: none"> <li>• Enter options—Click + <b>Add Option</b> to add a new row. Type-in the text and value for each option. The text is what will be displayed in the menu, and the value is the parameter value if that option is selected.</li> <li>• Load options from list—Enter a pipe-separated list of options (for example, <code>foo bar baz</code>). The text and value for the options will be the same.</li> <li>• Load options from property sheet—Enter the path to property sheet that contains options for the parameter. The property sheet must be created in a specific format: <ul style="list-style-type: none"> <li>• An <code>optionCount</code> property must exist whose value is the number of options.</li> <li>• For each option, create a nested property sheet called <code>optionN</code>, where N is the option number, starting with 1.</li> <li>• In each nested sheet, create two properties—<code>text</code> and <code>value</code>. The value of the property <code>text</code> will be displayed in the menu. The value of the property <code>value</code> is the parameter value if that option is selected.</li> <li>• If <code>optionCount</code> is set to 3, you must create three nested sheets—<code>option1</code>, <code>option2</code>, and <code>option3</code>.</li> </ul> </li> </ul>
Checkbox	<p>Creates a checkbox for a value to select (or not) when the parameter is presented.</p> <ul style="list-style-type: none"> <li>• Value when unchecked—The value of the parameter when the checkbox is unchecked.</li> <li>• Value when checked—The value of the checkbox when the checkbox is selected.</li> <li>• Initially checked—Whether or not the checkbox should be checked initially. If true, set the "Default value" to match the "Value when checked". If false, set the "Default value" to match the "Value when unchecked".</li> </ul>
Credential	<p>Selecting this option requires the user to specify a user name and password to use this parameter at runtime.</p> <p><b>Note:</b> Credential parameters are not supported on state definitions.</p>
Project	<p>Creates a project selector field on the Run Procedure page to choose a different project name where the parameter needs to find additional information.</p>

Field Name	Description
<a href="#">Saved Filter</a>	Use this option to reference any saved filters, which is passing the filter into the procedure at runtime (primarily used for reports). Saved filters are stored as a property in your chosen project.
Default Value	Default value to assign to the parameter if no explicit value is provided.
Required?	Click the checkbox to select the parameter as "required." If the parameter is required, the procedure or workflow will not run without entering a value for that parameter. In this case, the default value is ignored. After the procedure or workflow begins execution, the parameter value is available in the job or workflow's property sheet with the same name as the parameter.
Defer Expansion?	<p>Determines whether to expand the parameter value. A parameter value expansion occurs in one of two places:</p> <ul style="list-style-type: none"> <li>• When the procedure request is made (the default) (the check box is unchecked)</li> <li>• When the step executes (the check box is checked)</li> </ul> <p>The check box is unchecked by default (meaning that expansion is not deferred).</p>

Click **OK** after completing the fields.

#### To edit an existing parameter

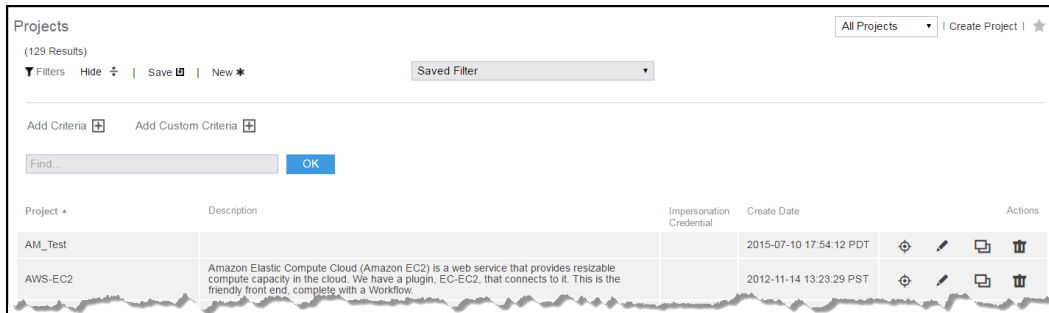
You may change any information or add new information as necessary. For example, to rename a parameter, enter a new parameter name in the **Name** field and then click **OK**.

For more information on property sheets, see the [Properties](#) Help topic.

## Projects

This page displays all projects available on this ElectricFlow server—the projects you create, ElectricFlow-supplied default projects, and ElectricFlow solutions. From this page you can navigate into projects to view its procedures, steps, schedules, credentials, workflows, and other components.

You can search for projects and save the search filters for later use. See [Context Searching and Filtering on page 843](#) for details on using the search capabilities on this page.



A project is a top-level container within ElectricFlow. Most information about software production processes, such as procedures, schedules, jobs, and workflows are contained within a project.

- The drop-down menu (at the top of the table) displays all "tags" you previously defined to mark, label, or group related or similar type projects. When you select a tag, the project list changes to display only the projects with that tag
- When you search for projects, the search result is limited to the projects with the selected tag if a tag was selected.
- To add a tag:
  1. Click the **Edit** link for the project you want to tag.
  2. On the Edit Project page, enter a tag name in the Tags field.
 After creating a tag, the tag name will appear in the drop-down menu.

**Note:** For more information on "tagging" projects, see the [Edit Project](#) Help topic.

- To create a new project, click the **Create Project** link.
- To **Edit**, **Copy**, or **Delete** an existing project, click a corresponding link in the Actions column.
 

**Note:** If deleting a project, the "background deleter" will mark the project for deletion, but the deletion process may not start until the server completes other tasks already queued or in progress. Deleting a project could take considerable time depending on the size of your project. For example, a project containing hundreds of jobs, steps, and other objects will take longer to delete than a simple project with 3 procedures and 10 steps.
- To see project details, click on a project name in the Project column to go to the Project Details page.

### Projects have two purposes

1. Projects allow you to create separate work areas for different purposes or groups of people so they do not interfere with each other.

For example, different projects can reuse the same names internally without conflict, and each project has its own access control that determines who can use and modify the project.

In a small organization, you might choose to keep all work within a single project, but in a large organization, you may want to use projects to organize information and simplify management.



## 2. Projects simplify sharing.

You can create library projects containing shared procedures and invoke these procedures from other projects.

After creating a library project, you can easily copy it to other ElectricFlow servers to create uniform processes across your organization.

### ElectricFlow includes default projects

Currently, ElectricFlow includes the following projects:

- **EC-Utilities**—This project contains procedures to perform basic ElectricFlow tasks. Also, these procedures can be used as examples—copy a procedure to another project and then modify it for your purpose.

**Note:** By default, only the "admin" user has execute privileges on the EC-Utilities project. The admin user can enable privileges for additional users or groups.

- **EC-Examples**—This project contains templates for procedures that perform basic ElectricFlow tasks.
- **Electric Cloud**—This project contains procedures to manage ElectricSentry, specifically the Sentry Monitor for schedules and also contains ElectricFlow global reports.

Procedures within each of these projects are maintained by Electric Cloud.

**IMPORTANT:** When you create project names, do not use "Electric Cloud" or any other ElectricFlow-supplied project name. Duplicating a project name creates a conflict.  
Also, the "EC-" prefix is reserved for ElectricFlow-supplied project names.

### ElectricFlow Solutions

ElectricFlow solutions are developed in the field by Electric Cloud SEs—our field team has the best experience in applying ElectricFlow "best practices" to solve real problems. In addition, ElectricFlow solutions can be contributed by ElectricFlow users from any customer site.

Potentially, any available solution can be considered a new ElectricFlow feature "waiting" to be included in the product if that solution gains wide, general appeal within the ElectricFlow customer base. However, because solutions are not part of the ElectricFlow product, and not developed by the ElectricFlow Engineering team, they are not supported by the Electric Cloud Technical Support team. If and when a solution becomes an integral part of the product, that solution will then have full Technical and Engineering support like any other ElectricFlow feature.

Currently, ElectricFlow solutions are posted to the Electric Cloud Forum Site at <http://forums.electric-cloud.com/ecforums/>—each solution, accompanied by its own installation instructions and Help file, can be downloaded from the forum site. If you have a solution you would like to contribute, the Electric Cloud / ElectricFlow Forum is where you need to post it.

When you install a solution on your ElectricFlow server, it will be displayed on the Projects web page as a project.

### *Installing an ElectricFlow Solution*

Add new or upgrade existing ElectricFlow solutions by running the built-in setup script:

1. Download the ElectricFlow <solution name>.jar file from the Electric Cloud Community Forums web site.  
For this example, the "solution name" is `Test`.
2. Save your download to a temporary directory on the system that hosts your ElectricFlow server.
3. Unpack the jar file in the temporary directory—the file creates a directory named `Test`.
  - If Java JDK is installed, use the included jar utility to unpack the .jar file: `%jar xf Test.jar`
  - For Linux, use any unzip utility, for example: `unzip Test.jar`
  - For Windows, use Windows Explorer to access the jar contents if you rename the file to `Test.zip`
4. Run the included `setup.pl` script in the jar through the `ec-perl` interpreter (installed in the `bin` directory). You must have "admin" or equivalent privileges to run the setup script.

```
ectool login admin
%cd <test>
%ec-perl setup.pl
```

## Project—Create New or Edit Existing Project

### Creating a New Project

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique project name. You may want your project names to describe the work groups or teams that will be using them. For example, you may set project names based on the products they support.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Default Resource	<p>Enter a resource name, or select <b>Browse</b> to find one. If you have not set up resource names or locations yet, click the Resources tab and then the Resources tab to see the Resources page.</p> <p><b>Note:</b> This field is optional. If you specify a resource in this field, it will be used as the default for all jobs that run under the project. This is a convenient way to use a single resource for an entire project. You can change the resource by changing the value. There are several other places where you can specify resources, such as procedures and individual job steps. If you specify a resource in another location, it will take precedence over the one specified in this field.</p>

Field Name	Description
Default Workspace	<p>Enter a workspace name, or select Browse to find one. If you have not set up workspace names or locations yet, click the Resources tab and then the Workspaces tab to see the Workspaces page.</p> <p><b>Note:</b> This field is optional. If you specify a workspace in this field, it will be used as the default for all jobs that run under the project. This is a convenient way to use a single workspace for an entire project. You can change the workspace by changing the value. There are several other places where you can specify workspaces, such as procedures and individual job steps. If you specify a workspace in another location, it will take precedence over the one specified in this field.</p>

Click **OK** to save the information you entered.

Your new project name will appear on the Projects page.

#### Editing an Existing Project

- To rename the project, enter a new name in the project Name field and click **OK**.
- You may modify the description or enter a text description if this field is blank.
- You can modify any previously entered information.
- If you would like to use a particular credential (by default) for all jobs that run under this project, select it here. If you leave this field blank, credential information from other sources is used.

**Tags**—(Optional) Enter a tag if you want to categorize or "mark" this project to identify its relationship to one or more other projects or groups. For example, you may want to tag a group of projects as "production" or "workflow", or you may want to use your name so you can quickly sort the project list to see only those projects that are useful to you.

- The tag name you enter in this field is displayed in the drop-down menu on the Projects page. When you select a specific tag from the drop-down menu, you see only the projects with that tag.
- Assigning a tag creates an "ec\_tag" property that can be seen (with its value—the tag name you chose) after selecting the Properties subtab from the Project Details page,
- Do not use "spaces" in tag names. For example, if you want to mark a project with the tag name, "Eng Team A", you need to specify, "eng\_team\_a".
- Do not use symbols in a tag name—results are unpredictable.
- If a project is related to several project categories, you can enter a space-delineated list to add numerous tags at the same time.  
Type a new name in the project Name field and click **OK**.
- To delete a tag, select the text and use your Delete key.

## Impersonation Credential

**Credential Project**—The default Credential Project is the current project, or select the other button and Browse for the project name you need.

**Credential Name**—This is the name of the credential for the project. You can select **Browse** to find it.

Click **OK** after entering new or updated information.

For more information, see the [Credentials and User Impersonation](#) Help topic.

## Project Details

This page displays project components, including procedures, workflow specifications, jobs, schedules, any credentials, properties, and reports.

### Links and actions at the top of the page

- **Edit**—use this link to go to the Edit Project page.
- **Access Control**—use this link to go the Access Control page for this project.
- The "star" icon allows you to save this job information to your Home page.
- The "curved arrow" icon returns you to the Projects page.
- **Pagination**—Use the "previous" and "next" arrow icons to view the previous or next project. The numbers between the arrow icons display the number of projects you can view and the first number indicates which project [in the list] you are viewing.

### The "tabbed" sections

The tabs at the top of the table allow you to select the type of information you want to see. See the 8 tabs illustrated in the following screen example:

Project Details / AWS-EC2							
Procedures Workflow Definitions Jobs Workflows Schedules Credentials Properties Reports							
Procedure ▼▲				Description ▼▲			
				Resource ▼▲			
				Create Date ▼▲			
				Actions			
Create Running Instance on EC2 - Te				Test			
CreateLinuxVMOnEC2				2012-11-14 13:24:15 PST			
CreateWindowsVMOnEC2				2012-11-14 13:24:15 PST			
Nitins Create Running Instance on EC2				2015-01-21 04:12:38 PST			
Ricks Create Running Instance on EC2				2012-11-15 14:32:12 PST			
StopAmazonInstance				2012-11-15 11:02:52 PST			

Records per page: 500 1 thru 6 of 6

The Project Details page opens with the Procedures tab highlighted, so the first table you see is the Procedures table.



You can use the DSL Export ( ) button to download the objects to as a DSL file.

### Procedures tab

The following links and actions are available in the Procedures table:

- Click the **Create Procedure** link (at the top of the table) to go to the New Procedure page to create another procedure.
- Click on a procedure name (first column) to go to the Procedure Details page for that procedure.
- Action column—click on any of the available links (**Run**, **Edit**, **Copy**, or **Delete**) to perform that function for the procedure listed in that row.

**Note:** The Run link provides two choices when you hover the mouse over the down-arrow. Select **Run Immediately** or **Run...**.

- **Run Immediately**—This option runs the procedure "as-is" immediately.
- **Run...**—This option produces the Run Procedure web page where you can modify any existing parameters for this procedure, or set an existing credential.

### Workflow Definitions tab

This tab provides a table listing all defined workflow definitions and includes the following functionality:

- Click the **Create Workflow Definition** link to go to the New Workflow Definition page to define additional definitions.
- Name column—Click on a workflow definition name to go to the Workflow Definition Details page (for that workflow definition).
- Action column
  - **Run**—use the down-arrow to select **Run...** or **Run Immediately**  
Selecting **Run...** takes you to the Run Workflow page where you can set the starting state for the workflow.  
Selecting **Run Immediately** runs the workflow "as-is", immediately.
  - **Copy**—use this link to make an exact copy of an existing workflow definition.
  - **Edit**—use this link to edit an existing workflow definition or just to change the name of the copy you created.
  - **Delete**—deletes an existing workflow definition on the same row.

The following screen example illustrates the Workflow Definitions table:

Project Details / AWS-EC2

Create Workflow Definition

Name ▼▲

Create Time ▼▲

Description ▼▲

Actions

ReserveEC2Instance

2012-11-15 14:11:31 PST

StartCluster

2012-11-15 14:11:31 PST

Records per page: 500 ▼

1 thru 2 of 2



You can use the DSL Export ( ) button to download the objects as a DSL file.

### Jobs tab

This tab provides a project-specific job table. Selecting the Jobs tab on the Project Details page displays only those jobs for the project you selected.

This table is a subset of the main Jobs tab that displays *all* jobs, regardless of the project of origin, and all Jobs page functionality is basically the same on either Jobs tab.

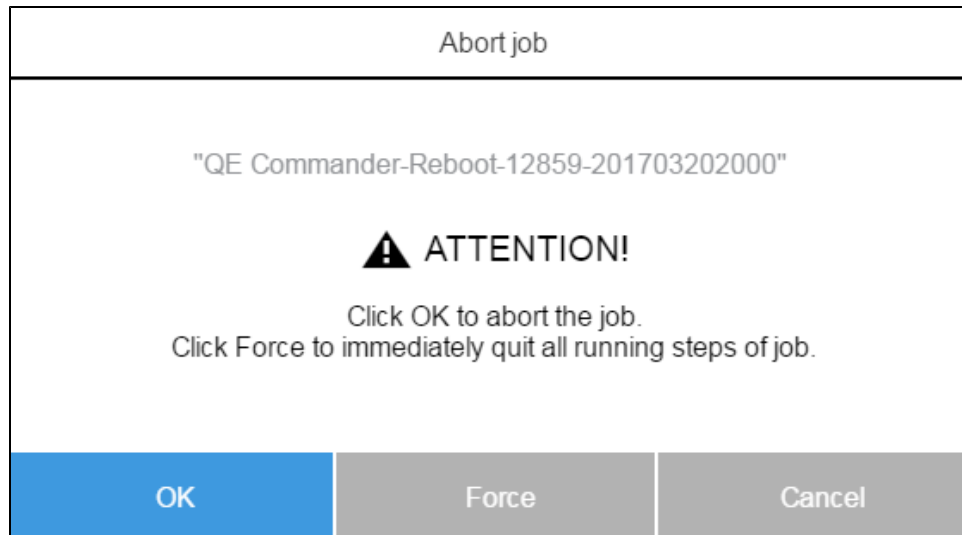
Project Details / AWS-EC2

<

The following links and actions are available on this Jobs page:

- **Job**—click on Job to sort the column alphabetically or click on a job name to go to that job's Job Details page.
- **Status**—click on Status to sort this column by Running, Success, Warning, Error, or Aborted.
- **Priority**—displays the job's priority set by a "run procedure" command or by the job's schedule.
- **Procedure**—click on a Procedure name to go to the Procedure Details page for that procedure.
- **Launched By**—click on a name in this column to go to the page for the schedule (Edit Schedule page) or the user that ran the job.

- Elapsed Time—click Elapsed Time to sort the time values from longest to shortest time, or the reverse.
- Start Time—click Start Time to sort this column from the start time of the first job to the start time of the most recent job, or the reverse.
- Actions—use this column to Abort a running job or Delete a completed job. If your job has finished running, you will not see the Abort link. Aborting a job requires the execute privilege on the job—not just the modify privilege.



Select either **OK** or **Force** to abort the job, or **Cancel** if you change your mind.

**Note:** Deleting a job on this page causes removal of job information from the ElectricFlow database, but information in the job's on-disk workspace area is not affected. You must delete workspace information manually.

### Workflows tab

The Workflows tab provides the following functionality:

- Name column—Click on a workflow name to go to its Workflow Details page.
- State column—Click on a state name to go to its State Details page.
- Modify Time—This time value represents the most recent workflow activity.
- Workflow Definition column—Click on a workflow definition name to go to the Workflow Definition Details page.
- Completed column—a "checkmark" in this column identifies this workflow as completed.
- Actions column—Click the Delete link to remove the workflow in that row.

The following screen example illustrates the Workflows table:

Project Details / AWS-EC2					
<div> <div>Procedures</div> <div>Workflow Definitions</div> <div>Jobs</div> <div>Workflows</div> <div>Schedules</div> <div>Credentials</div> <div>Properties</div> <div>Reports</div> </div>					
Name ▼▲	State ▼▲	Modify Time ▼▲	Workflow Definition ▼▲	Completed ▼▲	Actions
workflow_1238_20150413041244	Gather input and run instance	2015-04-13 04:12:45 PDT	ReserveEC2Instance	✓	
workflow_1013_20141125113304	Running Instance	2014-11-25 13:44:33 PST	ReserveEC2Instance		
workflow_1827_201309241856	Done	2013-09-24 19:18:56 PDT	ReserveEC2Instance	✓	
workflow_1107_201212041850	Running Instance	2012-12-04 18:50:43 PST	ReserveEC2Instance		
workflow_1097_201211151717	Stop Instance	2012-11-15 23:11:57 PST	ReserveEC2Instance		
workflow_1095_201211151633	Done	2012-11-15 18:03:54 PST	ReserveEC2Instance	✓	
workflow_1093_201211151616	Start Instance	2012-11-15 16:20:18 PST	ReserveEC2Instance	✓	
workflow_1092_201211151607	Done	2012-11-15 16:08:50 PST	ReserveEC2Instance	✓	
workflow_1090_201211151544	Running Instance	2012-11-15 16:07:27 PST	ReserveEC2Instance	✓	
workflow_1088_201211151542	Running Instance	2012-11-15 15:44:12 PST	ReserveEC2Instance	✓	
workflow_1087_201211151537	Running Instance	2012-11-15 15:42:26 PST	ReserveEC2Instance	✓	
workflow_1085_201211151535	Running Instance	2012-11-15 15:36:09 PST	ReserveEC2Instance	✓	
Records per page: 500 ▼				1 thru 12 of 12	

For more information about workflows, see the [Workflow](#) Help topic.

### Schedules tab

The Schedules tab provides the following functionality:

- To create a new schedule for this project, click either the Schedule link to create a new standard schedule to run at specific and/or days or the CI Configuration link to setup a new continuous integration schedule.
  - Choosing "Schedule" displays the New Schedule page.
  - Choosing "CI Configuration" displays the New CI Configuration page.

### Table column descriptions

- To edit an existing schedule, click on the schedule name (first column).
- Select the check box in the Enabled column to enable or disable the schedule in that row.
- The Priority column displays the job's priority you selected while creating the schedule for this procedure.
- Action column links—
  - **Run**—runs the schedule with the permissions of the logged in user.  
For example, if this schedule is timed to run every day at 11:00 pm, you might decide to run the schedule at 6:00 pm on a particular Thursday, without changing the regular schedule settings. However, if you do not have the appropriate permissions to run this schedule, it will fail.
  - **Copy**—makes a copy of the schedule on that row.
  - **Delete**—deletes the schedule in that row.



The following screen example illustrates the Schedules table:

Project Details / AWS-EC2							
<div>Procedures Workflow Definitions Jobs Workflows <b>Schedules</b> Credentials Properties Reports</div> <div>Create: Schedule   CI Configuration</div>							
Schedule	Enabled	Procedure	Priority	Description	When to run	Time Zone	Actions
ECSCM-SentryMonitor	<input type="checkbox"/>	ECSCM:ElectricSentry	normal	Periodically locate ECSCM sentry schedules to run	Run every 5 minutes from 07:00 to 23:00.	America/Los_Angeles	
Report Recent Job Outcome	<input type="checkbox"/>	EC-Reports:RunReport_CategoryPie	normal	Pie chart displaying the distribution of all job outcomes in the past 14 days	Run at 23:45.	America/Los_Angeles	
Report Recent Job Trend	<input type="checkbox"/>	EC-Reports:RunReport_MultiSeries	normal	Multi-line chart displaying the trend of all job outcomes in the past 14 days	Run at 23:50.	America/Los_Angeles	
ReportSchedule	<input type="checkbox"/>	runReports	normal	Run data collection, summarization, and report generation	Run at 02:00.	America/Los_Angeles	

For information on creating a standard schedule, see the [Schedule - create new or edit existing schedule](#) Help topic.

For information about CI Manager and adding a configuration, click the Home tab, the Continuous Integration subtab, then click the Help link in the upper-right corner of the page.

### Credentials tab

The Credentials tab provides the following functionality:

- To create a new credential for this project, click the **Create Credential** link at the top of the table.
- To edit an existing credential, click on the credential name (first column).
- Action column—the Delete link deletes the credential on that row.

The following screen example illustrates the Credentials table:

Project Details / BundledPlugins			
<div>Procedures Workflow Definitions Jobs Workflows Schedules <b>Credentials</b> Properties Reports</div> <div>Create Credential</div>			
Credential	User	Description	Actions
root	root		
root-linux-vm	root		

For information about credentials and access control, see the [Credentials and User Impersonation](#) or [Access Control](#) Help topics.

### Properties tab

The Properties tab provides the following functionality:

- To create a new property for this project, click the **Create Property** or **Create Nested Sheet** link.
- To view or change privileges on the property sheet, click the **Access Control** link.
- To edit an existing property, click on the property name (first column).
- Action column—the Delete link deletes the property on that row.

The following screen example illustrates the Properties table:

Project Details / AWS-EC2

<

For more information about properties, see the [Properties](#) Help topic.

### Reports tab

Selecting this subtab yields different results, depending on whether or not you have installed the additional ElectricFlow-supplied optional reports or have created custom reports for the specific information you need. Generally, if you have not yet configured additional reports, you will see the three installed, default ElectricFlow reports (Cross Project Summary, Daily Summary, and Resource Summary) as illustrated in the screen example below.

- When a report runs, the report "folder" is populated with the completed report. Reports are listed by date and time.
- Each individual report "date/time" entry is a link to see the full report.
- To create a new report, click the **Create Report** link to go to the web page to create a Multiple Series, Category, Count Over Time, or Procedure Usage report.

This is an example of the information on the Reports page :

+ Cross Project Summary	
- Daily Summary	
2010-11-09 09:53:42	
2010-11-09 09:53:32	
- Resource Summary	
+ 2010-11-09 09:53:42	
+ 2010-11-09 09:53:32	

For more information about reports, see the [Reports](#) Help topic series.

### Tips

Want to rename this project?

Click the **Edit** link at the top of this page and enter a new name.

Want to rename a procedure in this project?

Click the **Edit** link for the procedure (on this page) and enter a new name.

## Run Procedure

### Using the Run Procedure page

- You may see a message informing you that no parameters were defined for this procedure. If this is the case, click **Run** to run the procedure.
- If parameters were defined for this procedure, you will see specific fields based on those parameters. You may make changes to any field you choose if you want to run this procedure under different parameters at this time. However, any changes you make are specific to this run procedure only. Your changes on this web page will not affect previously defined parameters for this procedure. Click **Run** to run the procedure.
- You may see a "Required" field. To run the procedure, you must enter the required parameter previously defined on the Procedure Details page.

Click **Run** to run the procedure.

### Advanced section

Priority:

Use the drop-down menu to select the priority for this run procedure. Available priorities are: low, normal (default), high, or highest.

- You can select the job's priority here on the Run Procedure web page or when you schedule the procedure to run at a regular time or interval. When a job is launched, its priority cannot be changed.
- Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority. If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.
- If using ectool, the priority can be set by passing "`--priority=<low|normal|high|highest>`" to a `runProcedure`, `createSchedule`, or `modifySchedule` operation.

**Note:** To raise the job priority level above "normal," the user who launches the procedure must have execute permission on the system-level access control list for priorities.

Impersonation:

Select one of the following:

- **Use pre-defined credential**—(Default option) Use this option if you have not defined a credential for this procedure. ElectricFlow looks for a credential first in the top-level procedure and then in its project. If it finds a credential, it uses the login from that credential as the default for the job. If there is no credential in either place, by default, the job's steps run as the user under which the agent for the step is running.

- **Use specific credential**—If you select this option, more fields are displayed for you to choose a particular credential and enter its name from those defined for the project containing the procedure. The login user from that credential will be used as the default for the job.
- **Use a specific user**—If you select this option, more fields are displayed to enter a User Name and Password. The specified login is used as the default for the job.

Click **Run** to run the procedure.

**For more information** on credentials and user impersonation, see the [Credentials and User Impersonation](#) Help topic.

## Schedule—create new or edit existing schedule


Use this page to create or edit a standard schedule that specifies a set of times and days when a particular procedure should run. If you need to create a continuous build integration instead, see the Help information available from the Continuous Integration Dashboard web page.

For any schedule, click the "star" icon to add this schedule to the Shortcut section on your Home page.

### To create a new standard schedule

Enter information in the fields as follows:

Field Name	Description
<b>General section</b>	
Name	Enter a Schedule name. This must be a unique name among other schedule names in this project.
Procedure	Displays the current project and procedure. Click <b>Change</b> to use the pop-up menu to select a new project or procedure.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
<b>Parameters section</b>	
If the procedure has parameters, enter information in their values in this section. The procedure cannot execute unless all required parameters are provided. If you move the mouse over a field for a particular parameter, inline Help displays the description of that parameter if one was provided in the procedure's definition.	

Field Name	Description
	Click this icon to displays fields to add one or more parameters.
<b><i>Frequency section</i></b>	
Run at ???	This is a summary section: As you make selections for the following Days and Repetition sections, a summary of what you have selected appears here.
Days	Select weekdays, month days, or create a custom frequency when you want the schedule to run. <b>Note:</b> The "day" applies to the start time if the time range spans two days, that is, if the time range crosses the midnight boundary.
Repetition	If Run Once—the schedule will run once per selected day, at the time you specify.  If Run Every—the procedure will execute repeatedly during the specified time range. For example, if you select a time range from 11:00-14:00 and an interval of 40 minutes, the procedure will execute 5 times on each of the selected days: at 11:00am, 11:40am, 12:20pm, 1:00pm, and 1:40pm.  If Run Continuously—as soon as one job ends, the scheduler will trigger immediately to run the job again.
<b><i>Advanced section</i></b>	
Enabled	If this box is "checked," the schedule will run. You can disable this schedule whenever necessary.

Field Name	Description
Misfire Policy	<p>Choose between two options to manage how a schedule resumes in cases where the normal scheduled time is interrupted. The server may not be able to trigger a job at the scheduled time for several reasons:</p> <ol style="list-style-type: none"> <li>1) a running job extends past the next scheduled runtime, or</li> <li>2) the server cannot find enough available resources and a delay occurs, or</li> <li>3) the server is down or disconnected from the network for a period that overlaps one or more scheduled times. If any of these situations occur, the misfire policy defines two possible responses:</li> </ol> <p><code>skip</code>—all misfires are ignored and the job runs at the next scheduled time.</p> <p><code>run once</code>—after one or more misfires, the job runs at the soonest time that occurs within an active region. For example, at server startup a scheduled job will not trigger immediately on startup.</p>
Time Zone	<p>Default is the time zone of the ElectricFlow server, or select a county from the first pull-down menu, then select an area from the second pull-down menu. Another option: Select "other" from the first pull-down menu, then select GMT [or another selection] from the second pull-down list.</p>
Priority	<p>Use the pull-down menu to select one of four priorities for this procedure.</p> <p>Also, you can select the job's priority on the Run Procedure web page. When a job is launched, its priority cannot be changed.</p> <p>Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority.</p> <p>If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.</p> <p>If using ectool, the priority can be set by passing</p> <p><code>--priority=&lt;low normal high highest&gt;</code> to a <code>runProcedure</code>, <code>createSchedule</code>, or <code>modifySchedule</code> operation.</p> <p><b>Note:</b> Schedules are launched by the project principal user. To raise the priority above "normal," this user must have execute permission on the system-level access control list for priorities.</p>

Field Name	Description
<p><b><i>Impersonation Credential section</i></b></p> <p>If you select a credential for the schedule, it will be used as the default for jobs run from the schedule. For example, job steps will run under the login account specified in the credential. However, the schedule's credential is low in priority: it will be used only if there is no credential specified in the procedure or its project. Also, individual steps can override the credential with a specific credential for that step.</p> <p><b>For more information</b>, see the <a href="#">Credentials and User Impersonation</a> Help topic.</p> <p>Impersonation credentials are used to set the top-level impersonation credential for a job. If specified, the impersonation credential [on the job] is used as the default impersonation credential for all steps in the job.</p>	
Credential Project	The name of the credential for the project. By default, the current project is selected. Enter a different project name or select Browse to find this name.
Credential Name	The name of the credential for the project—you may need to Browse to find this name.

Click **OK** to save your schedule information.

#### To create a new continuous integration "schedule"

If you selected the **CI Configuration** link, the New CI Configuration page is displayed. **For information** on populating these fields, see the "Continuous Integration Manager" Help topic—click the **Help** link in the upper-right corner of the New CI Configuration page.

See the Standard Schedule information [above] to enter information in the fields common to both types of schedules.

#### To edit an existing schedule

Modify any of the information you previously specified.

The following additional links are available at the top of the page:

- **Save Configuration**—if you click this link, the information in this schedule will be copied into a new Job Configuration and displayed on your Home page for easy access.
- **Access Control**—click this link if you need to set permissions for this schedule.

#### Attached Credentials

Click the **Attached Credential** link if you need to attach an existing credential to this schedule. If you need to create a new credential for this schedule, return to the Project Details page.

#### Custom Schedule Properties

Select the **Create Properties**, **Create Nested Sheet**, or **Access Control** links if you want to assign properties to this schedule.

**For more information** on Properties or Access Control, see the following main Help topics: [Properties](#), [Access Control](#)

Click **OK** to save your modifications for this schedule.

## Credentials—create new or modify existing credential

### To create a new credential

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique name of the credential object.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; . . . &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
User Name	Enter the user name you choose to use for login.
Password	Enter the password that identifies the user account.

Click **OK** to save your new credential information.

### To edit a credential

Modify any previously entered credential information and click **OK** to save your changes.

Use the **Access Control** link to add or change existing permissions.

You can add Custom Credential Properties for this credential also. Click the **Create Property**, **Create Nested Sheet**, or **Access Control** link in this section if you need to specify any of these items.

**For more information**, see the following Help topics:

[Credentials and User Impersonation](#)

[Properties](#)

[Access Control](#)



## Property—create new or edit existing property

Use this pop-up window to create or modify a custom property attached to an object.

Enter information in the fields as follows:

Field Name	Description
Name	The property name can be an arbitrary text string, but unless you are an experienced ElectricFlow user avoid using slashes and brackets as a part of the property name.  <b>Note:</b> The names "properties" and "project" are not valid property names.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Value	This value can be an arbitrary text string.
Expandable	Do not select this check box if you do not want to allow property expansion.

Click **OK** to save your new or modified property information.

**For more information** on creating and using properties, see the [Properties](#) Help topic.

## Nested Property Sheet

Use this pop-up window to define or modify a nested property sheet.

1. Enter information in the fields as follows:

Name—The property name can be an arbitrary text string.

Description—A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a>` `<b>` `<br>` `<div>` `<dl>` `<font>` `<i>` `<li>` `<ol>` `<p>` `<pre>` `<span>` `<style>` `<table>` `<tc>` `<td>` `<th>` `<tr>` `<ul>`

2. Click **OK** to save your new or modified nested property sheet information.

For more information on creating and using properties, see the [Properties](#) Help topic.

## Reports

If you have upgraded ElectricFlow this page displays historical reports (Cross Project Summary, Daily Summary, and Resource Summary) from your previous ElectricFlow version. These reports are no longer being updated.

Click the Historic/web server local reports link to see any previously created custom reports.

- Cross Project Summary—this is a 30-day report summary
- Daily Summary—this is a daily report showing all the procedures that ran
- Resource Summary—this report shows resource usage for a specific day
- Historic/web server local reports

For more information, see the [Reports](#) Help topic.

## Create a new report

Use this page to create a new report. Select one of the report-type tabs to begin.

### Multiple Series Report

Field and pull-down menu descriptions:

Field/Menu Name	Description
Report Title	<p>This is your report title. Type over the default report name, choosing any unique name for your report.</p> <div> <b>IMPORTANT:</b> Do not use special characters in the report title. Some examples of special characters are : / ? # [ ] @ ! , \$ &amp; ' ( ) * + , ; =         </div>
Saved Filter	<p>Project—Click your mouse inside this field to see a list of projects from which to make a selection.</p> <p>Filter—After selecting a project, this drop-down menu will contain any available filters for this project.</p>
Time Period	Use the drop-down menu to select the time period.
Create thumbnail?	Check this box if you would like to make a thumbnail view of this report available on your Home page.
Object Type	Use the drop-down menu to select an object.

Field/Menu Name	Description
Table column choices	<p>Chart Type—Use the drop-down menu to choose the chart type.</p> <p>Function—Use the drop-down menu to choose the function you need.</p> <p>Property Name—Use the default property value or delete the text and click your mouse in the blank field to see a list of possible properties.</p> <p>Display Name—You can choose a different unique Display Name.</p> <p>Stacked—Select this checkbox to see your report results "stacked" versus overlaid.</p> <p>The "X" icon—Click this icon to delete any row you no longer need.</p>
<b>Add Series</b> button	Select the <b>Add Series</b> button if you would like to create additional table entries for additional report information.
Chart Options	Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.
Table Options	Use the down-arrow to adjust the Time Grouping and see the default for the Time Column label.
Advanced	Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.
<b>Run Report</b> button	Use this button to go to the Job Details page to run the report.
<b>Create Schedule</b> button	<p>This button displays a box with a default schedule name that you can change if you choose.</p> <p>Click <b>OK</b> to go to the Job Details page.</p>
<b>Cancel</b> button	Use this bottom to cancel the create report operation.

## Category Report

Field and pull-down menu descriptions:

Field/Menu Names	Description
Report Title	<p>This is your report title. Type over the default report name, choosing any unique name for your report.</p> <div> <b>IMPORTANT:</b> Do not use special characters in the report title. Some examples of special characters are : / ? # [ ] @ ! , \$ &amp; ' ( ) * + , ; = </div>
Saved Filter	<p>Project—Click your mouse inside this field to see a list of projects from which to make a selection.</p> <p>Filter—After selecting a project, this drop-down menu will contain any available filters for this project.</p>
Time Period	Use the drop-down menu to select the time period.
Create thumbnail?	Check this box if you would like to make a thumbnail view of this report available on your Home page.
Object Type	Use the drop-down menu to select an object.
Object Property	You can delete the default value and click your mouse inside the blank field to see a list of properties from which to choose.
Advanced	Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.
<b>Run Report</b> button	Use this button to go to the Job Details page to run the report.
<b>Create Schedule</b> button	<p>This button displays box with a default schedule name that you can change if you choose.</p> <p>Click <b>OK</b> to go to the Job Details page.</p>
<b>Cancel</b> button	Use this bottom to cancel the create report operation.

## Count Over Time Report

Field and pull-down menu descriptions:

Field/Menu Name	Description
Report Title	<p>This is your report title. Type over the default report name, choosing any unique name for your report.</p> <div> <b>IMPORTANT:</b> Do not use special characters in the report title. Some examples of special characters are : / ? # [ ] @ ! , \$ &amp; ' ( ) * + , ; = </div>
Saved Filter	<p>Project—Click your mouse inside this field to see a list of projects from which to make a selection.</p> <p>Filter—After selecting a project, this drop-down menu will contain any available filters for this project.</p>
Time Period	Use the drop-down menu to select the time period.
Create thumbnail?	Check this box if you would like to make a thumbnail view of this report available on your Home page.
Object Type	Use the drop-down menu to select an object.
Chart Options	Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.
Table Options	Use the down-arrow to adjust the Time Grouping and see the default for the Time Column label.
Advanced	Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.
<b>Run Report</b> button	Use this button to go to the Job Details page to run the report.
<b>Create Schedule</b> button	<p>This button displays box with a default schedule name that you can change if you choose.</p> <p>Click <b>OK</b> to go to the Job Details page.</p>
<b>Cancel</b> button	Use this bottom to cancel the create report operation.

## Procedure Usage Report

Field and pull-down menu descriptions:

Field/Menu Name	Description
Report Title	<p>This is your report title. Type over the default report name, choosing any unique name for your report.</p> <div> <b>IMPORTANT:</b> Do not use special characters in the report title. Some examples of special characters are : / ? # [ ] @ ! , \$ &amp; ' ( ) * + , ; = </div>
Project	<p>Click your mouse inside this blank field to see a list of projects. This does not have to be the current project.</p> <p>You can generate reports that show when one project's procedures call procedures in another project. You can also use the '%' wildcard, for example,</p> <p>Project: %</p> <p>or</p> <p>Project: D%</p>
Procedure pattern	Enter a SQL string match pattern for procedures to include in the report. The default % will use all procedures.
Advanced	Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.
<b>Run Report</b> button	Use this button to go to the Job Details page to run the report.
<b>Create Schedule</b> button	This button displays box with a default schedule name that you can change if you choose. Click <b>OK</b> to go to the Job Details page.
<b>Cancel</b> button	Use this bottom to cancel the create report operation.

## Resources

The **Cloud > Resources** page displays all resources on this ElectricFlow server and provides easy access to resource configuration and all other resource management functionality.

- Each resource has a logical name—a unique name to distinguish this resource from other resources.
- Each resource refers to an agent machine by its host name.

- Each resource can be assigned to one or more pools.

A *pool* is a group of interchangeable resources. For example, a pool of Windows servers.

If you name a pool in a procedure step, ElectricFlow can assign any resource in the pool to that step, which allows ElectricFlow to choose a lightly loaded resource. You can change the resources in a pool without modifying procedures that use the pool.

- Each resource can be assigned to a zone. A default zone is created during installation, and all resources are members of that zone until they are assigned to a different zone.

A *zone* is a collection of agents. Every agent, and all resources defined on that agent, belong to only one zone. When ElectricFlow is installed, a *default* zone is created. If a zone is deleted, all agents in that zone are moved to the *default* zone. The ElectricFlow server resides in the default zone.

**Note:** The *default* zone **cannot** be deleted.

- Several resources can correspond to the same physical host or agent machine.
- When you specify a resource name in a procedure step, the step executes on that resource.

### Supported Resource Categories

- **Standard**—This category specifies a machine running the ElectricFlow agent on one of the supported agent platforms, as specified in the *ElectricFlow Installation Guide*.
- **Proxy**—This category requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on other remote platforms or hosts that exist in your environment.
  - Proxy *agent*—This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform. A proxy agent is an ElectricFlow agent, channeling to a proxy target.
  - Proxy *target*—This is a machine on an unsupported platform that can run commands through an SSH server. Proxy targets have limitations, such as the inability to work with plugins or communicate with ectool commands.

**Help topic "Best Practice":** You should review this entire Help to become familiar with resource management features and functionality. Later, when using the Resources page, use the following quick links to go to the Help section that you need to review.

[Icons, Links, and Buttons Above the Table](#)

[Table View—Column Descriptions](#)

[Grid View](#)

[Filters Pane](#)

[New Resource Panel](#)

[New Proxy Resource Panel](#)

[Edit Resource Panel](#)

[Edit Proxy Resource Panel](#)

[Resource Details Panel](#)

Switching a Non-Trusted Agent to Trusted

Resource Page Information and Functions

Immediately after the *Resources* title above the table, you can see how many licensed resources are in use.

Links, Icons, and Buttons Above the Table




Hover your mouse over an icon or button to see the available actions. You can select one of these actions on a single resource or on multiple resources (selected using the check box in the first column) to perform the action on one or more resources at the same time.






- Select one or more resources from the table, and then select the button to perform the task or action.



- **Exception:** When you click the **Action** icon and select **Create Resource** or **Create Proxy Resource**, a panel opens where you can create one of these new objects. You can create only one object at a time.





Icon or Link Name	Description
	<p>Select one of these actions:</p> <ul style="list-style-type: none"> <li>• <b>Create Resource</b>—The <b>New Resource</b> panel opens. For information about the fields, see the <a href="#">New Resource</a> section.</li> <li>• <b>Create Proxy Resource</b>—The <b>New Proxy Resource</b> panel opens. For information about the fields, see the <a href="#">New Proxy Resource</a> section.</li> <li>• <b>Install Resource(s)</b>—A dialog box opens where you enter information about the agents to install. For more information, see the "Installing or Upgrading Remote Agents" section in the "Installing ElectricFlow" chapter of the <i>ElectricFlow Installation Guide</i> at <a href="http://docs.electric-cloud.com/eflow_doc/FlowIndex.html">http://docs.electric-cloud.com/eflow_doc/FlowIndex.html</a>.</li> </ul> <p>If the <b>Install Resource(s)</b> menu option is not visible, you must log out and then log in as a user with the required permissions. For details about required permissions, see the "Permissions for Installing or Upgrading Remote Agents" section in the "Installing or Upgrading Remote Agents" chapter of the <i>ElectricFlow Installation Guide</i> at <a href="http://docs.electric-cloud.com/eflow_doc/FlowIndex.html">http://docs.electric-cloud.com/eflow_doc/FlowIndex.html</a>.</p> <p><b>Note:</b> If you are upgrading one or more agents or resources, the label on this option is <b>Upgrade Resource(s)</b>. If the <b>Upgrade Resource(s)</b> menu option is not visible, you must log out and then log in as a user with the required permissions. For details about required permissions, see the "Permissions for Installing or Upgrading Remote Agents" section in the "Installing or Upgrading Remote Agents" chapter of the <i>ElectricFlow Installation Guide</i> at <a href="http://docs.electric-cloud.com/eflow_doc/FlowIndex.html">http://docs.electric-cloud.com/eflow_doc/FlowIndex.html</a>.</p> <div style="border: 1px solid black; padding: 5px;"> <p><b>IMPORTANT:</b> If the EC-AgentManagement plugin is not installed, you will not see this option.</p> </div>
	<p><b>Copy Resource</b>—Makes a duplicate copy of one or more resources that you selected.</p>
	<p><b>Delete Resource</b>—Deletes one or more resources that you selected.</p> <p><b>Note:</b> If a resource is on a "gateway agent", the gateway will be deleted.</p>



Icon or Link Name	Description
	<p><b>Ping Resource</b>—ElectricFlow pings one or more resources to check if they are available.</p> <p>When ElectricFlow pings a resource, it sends a message to the agent (for the resource) to make sure the agent is alive and running a version of software compatible with the ElectricFlow server. After the ping completes (or fails), the page refreshes to reflect the current resource state.</p> <p><b>Note:</b> A gateway must exist before you ping a resource in a remote zone.</p>
	<p><b>Enable Resource</b>—Enables one or more resources that you selected in the check boxes in the first column..</p>
	<p><b>Disable Resource</b>—Disables one or more resources that you selected in the check boxes in the first column.</p>
	<p>Select one of these actions:</p> <ul style="list-style-type: none"> <li>• When you click the button with no resources selected, the <i>Select some resources to edit</i> message appears.</li> <li>• When you select resources and click this button, these options appear: <ul style="list-style-type: none"> <li>• <b>Add to Pool</b>—Adds the selected resources to a pool.</li> <li>• <b>Remove from Pool</b>—This is available only if all the selected resources have at least one pool in common. If not, this link becomes <b>Remove from Pool &lt;name&gt;</b>.</li> <li>• <b>Move to Zone</b>—Moves the selected resources to a zone.</li> <li>• <b>Set Trusted</b>—This is not available if the selected resources are already <i>trusted</i>. If not, all the selected resource will be changed to <i>trusted</i>.</li> <li>• <b>Unset Trusted</b>—This is available only if all the selected resources are trusted. If not, the selected resources will be changed to <i>untrusted</i>.</li> </ul> </li> </ul>
 <p>or</p>	<p>Select this button to add this Resources page to your Home page for one-click access to return to this page. If the icon is yellow, the page is already accessible from your Home page .</p>
<p><b>New Search link</b></p>	<p>Use this link to go to the <a href="#">Searching and Filtering page</a> if you need to search for a particular object or set of objects. For example, job, resource, artifact, workflow, and so on.</p> <p>Use the "back" button to return to the Resources page.</p>






**Table View — Column Descriptions**

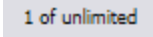
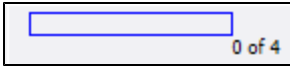

Not all resource configuration information appears within the table, but you can see all other information about the resource when you edit the resource or access other slide-out panels. For example, the action to see or add access control privileges to a resource is available on the Edit Resource panel or from the **Access Control** link on that panel.

**Note:** Most column headings can be sorted. Click on a column heading to re-sort the information in that column.

Column name / icon	Description
	Select this check box to enable the corresponding resource in that row for a single or batch action. For example, deleting or enabling multiple resources at the same time is a batch action.  <b>Note:</b> If you select this icon in the table header row, it will select or deselect all resources in the table.
	Status of the agent. If an agent machine is not available, any resources associated with that host will not be available.  <b>Note:</b> If an agent is down, the ElectricFlow server is not able to provide additional information about the cause.

Column name / icon	Description
Name	<p>Name of the resource. The icon to the left of the resource name indicates whether this resource is <i>enabled</i> or <i>disabled</i>. These icons are: Enabled  or Disabled </p> <p>If a resource is disabled, no job steps are assigned to it. If a step requests a particular resource and that resource is disabled, the step waits until the resource becomes enabled again. If the resource is in a pool, ElectricFlow uses any enabled resource in the pool to satisfy the request for the resource. Other actions:</p> <ul style="list-style-type: none"> <li>To change the enabled or disabled icon, select the check box (in first column) in the row for one or more resources, and then select the enabled or disabled icon above the table. Select multiple resources if this is a batch change.</li> </ul> <p><b>Note:</b> You can change the resource enable/disable specification from the Edit Resource panel too, but this is an individual operation for one particular resource.</p> <ul style="list-style-type: none"> <li>Click on a resource name to see the Resource Details panel—this panel displays how your resources is configured currently. To make changes, click the <b>Edit</b> link to go to the Edit Resource panel.</li> </ul>
Pools	A space-separated list of pool names where this resource is a member.
Type	<p>A resource can be <i>static</i> or <i>dynamic</i>.</p> <ul style="list-style-type: none"> <li>A static resource is part of your system or network (not in the cloud), such as a server, database, or agent machine.</li> <li>A dynamic resource is a cloud resource that can be provisioned and later spun up on-demand when an application is deployed.</li> </ul>
Resource Template Name	<p>The name of the resource template to which the resource is applied.</p> <p><b>Note:</b> Only dynamic resources can be applied to a resource template.</p>
Time running	If the resource is a dynamic resource, how long it has been running.

Column name / icon	Description
Job Status	<p>Indicates the current job status with the following icons:</p> <p> <i>Running job</i>—a job is still running, which means the resource is currently being used for one or more jobs. The names of all jobs using the resource are displayed next to the icon.</p> <p> <i>Success</i>—the job running on this resource completed successfully.</p> <p> <i>Error</i>—the job running on this resource encountered an error and may or may not have completed. One or more error messages will be listed in this column.</p> <p> <i>Warning</i>— the job running on this resource encountered a warning and may or may not have completed. One or more warning messages will be listed in this column.</p> <p> <i>Busy</i>— ElectricFlow is attempting to refresh the job status, but the resource is not responding or the UI cannot parse the response. Changing the value of 'Agent Host Name' to the IP address can sometimes resolve this issue.</p>
Description	<p>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>.</p>
Zone	The name of the zone where this resource is a member.
HTTPS & Host	The "Connection Type" you specified when this resource was created.

Column name / icon	Description
Step Load	<p>Resource <i>load</i> is indicated by one of the following:</p> <p> —this notation indicates 1 step is using this resource and an unlimited number of steps can use this resource at the same time. If 5 steps are using this resource, you would see "5 of unlimited".</p> <p> —this notation indicates that no steps are running on this resource and the step limit is set to 4. The bar indicates graphically how close you are to the step limit.</p> <p><b>Note:</b> Use the Create/Edit Resource panels to define the number of steps that can run on a resource. Setting the Step Limit to "0" or leaving the field blank defaults to NO step limit.</p>
Actions	<p>Actions you can perform on the resource, including:</p> <p><b>Copy</b>—Create a new resource by copying the this resource.</p> <p><b>Delete</b>—Delete this resource.</p> <p><b>Tear Down</b>—Remove (decommission) the dynamic resource from a dynamic environment.</p> <p> <b>Track Changes</b> --Open the Change History for the resource.</p>

## Grid View



Two icons above the Filters pane:

- The first icon (on the left) is the default *Table view* icon.
- The second icon (on the right) displays the resource *Grid view*.  
Use the drop-down menus to filter the Grid view:

- Grouping – Select the resource "grouping" you want to see—choose Pool, Job, Operating System, Platform, Proxy Agent, Version, or Zone.  
For example, if you have multiple resource pools defined and chose Pool, you will see groups labeled with your various pool names and a group (No Pool) for resources not included in a pool.
- Coloring – Select what you want to view in each group—choose Platform, Step Count/Limit, Status, Held Exclusive, Version, or Operating System to sort your group.

**Note:** Colors are dynamically assigned per the view you select. Within a single view, the same color "square" implies similar information.

- Hovering your mouse over a grid "square" provides more detailed information about that resource.

### Filters pane

Use the Filters pane to filter resources shown in either the Table or Grid view. The fields in the Filter pane correspond to columns in the Table view.

Enter the Filter criteria as follows:

Actions / Field	Description
<b>Save Filters</b>	Click this link to save your filter criteria. A dialog box appears so you can name your filter. For easy, repeat access, filters are saved in a "saved filters" box above the link. When you select a saved filter name, the Filter pane fields populate automatically.
<b>Reset</b>	Use this link to clear all entries in the Filter pane.
<b>Quick Search</b> field	Enter any text for your search. For example, enter a host name. You do not need to enter a full name or text string—this field filters on a partial text entry, sometimes 2-3 characters are all you might need.
<b>Status</b>	The status for the agent machine.
Drop-down menu	Default is <b>both</b> enabled and disabled resources. Use the drop-down arrow to choose enabled or disabled only.
<b>Pools</b> field	List one or more pool names, separated by a space. Pool names must be entered exactly—a shortened version of the pool name will fail.
<b>Hosts</b> field	List one or more full host names as shown in the Table view "HTTPS & Host" column (each name separated by a space). Entering a partial name will not yield a successful result.

Actions / Field	Description
<b>Step Limit</b> drop-down menu	Choose the step limit corresponding to your desired search.
<b>Proxy Agent</b> drop-down menu	Select No if not searching for a proxy agent or Yes if you are trying to locate a proxy agent.
<b>Filter</b> button	Select this button after you complete the fields/selections to define your filter criteria.

### New Resource Panel

To define a new standard resource, enter information in the following fields:

Field	Description
Name	Enter a unique name for this resource. <b>Do not use</b> "spaces" in a resource name. This is the name used to select the resource for a job step—it need not be the same as the host name for the machine.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Agent Host Name	Enter the domain name or IP address of the agent machine for this resource. This is the name all other machines in this agent/resource's zone will use to communicate with this agent host.
Agent Port Number	Enter the port number to use when connecting to the agent for the resource, Default port is 7800.
Default Workspace	Enter the workspace name or leave blank to use the local, default workspace. The workspace specification can be overridden at the project, procedure, or step level.
Pool(s)	A space-separated list of arbitrary names indicating the pools associated with this resource.



Field	Description
Host Type	<p>Use the drop-down menu to select the host type:</p> <ul style="list-style-type: none"><li>• <b>Concurrent</b></li><li>• <b>Registered</b></li></ul> <p>Depending on the license installed on the ElectricFlow server, this field may appear.</p> <ul style="list-style-type: none"><li>• If the license on the server is a concurrent resource license, the host type defaults to <b>Concurrent</b> and this field does not appear.</li><li>• If the license on the server is a registered host license, the host type defaults to <b>Registered</b> and this field does not appear.</li><li>• If the license on the server is a mixed-mode license (concurrent resources and registered hosts), you must specify the host type when adding a resource.</li></ul>

Field	Description
Default Shell	<p>The name of the shell program used to execute the step's commands on a resource. For example, using <code>sh</code> or <code>cmd /c</code>, the agent saves the command block to a temporary file with a <code>.cmd</code> extension and runs it: <code>sh foo.cmd</code> or <code>cmd /c foo.cmd</code>.</p> <p>If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:</p> <p>Windows: <code>cmd /q /c "{0}.cmd"</code>  UNIX: <code>sh -e "{0}.cmd"</code></p> <p>When you specify a shell (in the step or resource), and omit the <code>cmd-file</code> marker, the agent notices the omission and takes the correct action. For example: a user specifies <code>sh -x</code>. The agent converts this to <code>sh -x "{0}.cmd"</code>.</p> <p>Two alternate forms of shell syntax where ElectricFlow uses a "marker," <code>{0}</code>, as a placeholder for the command file argument:</p> <ul style="list-style-type: none"> <li>• <code>&lt;myShell&gt; {0} &lt;potential extra shell args&gt;</code>  In this example, the command file is not meant to be the last argument in the final command line.  For example, <code>mysql -e "source {0}"</code>  This shell example runs the <code>mysql</code> command against this step's command containing <code>sql</code>.</li> <li>• <code>&lt;myShell&gt; {0} &lt;.file extension&gt; &lt;potential extra shell args&gt;</code>  In this example, the shell requires the command file to end in an extension other than <code>.cmd</code>.  For example, <code>powershell "&amp; '{0}.ps1'"</code>  This shell example runs Microsoft PowerShell against this step's command containing PowerShell commands.</li> </ul> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• When the agent parses the shell, it will parse the extension as everything after <code>{0}.</code> until it sees a space or non-alphanumeric character.</li> <li>• If your script uses International characters (non-ascii), add the following block to the top of your <code>ec-perl</code> command block: <pre>use utf8; ElectricCommander::initEncodings</pre> </li> </ul>

Field	Description
Step Limit	<p>The maximum number of steps that can execute simultaneously on this resource—a step limit applies to a particular resource only, not to its underlying host.</p> <p>For example, if you define two resources, resource1 with a step limit of 5 and resource2 with a step limit of 1, both specifying the same host machine, it is possible for a total of 6 steps to execute simultaneously on the underlying host.</p> <p>The Resource Details panel displays this information.</p> <p><b>Note:</b> Setting the Step Limit to "0" or leaving the field blank defaults to NO step limit.</p>
Artifact Cache Directory	<p>The directory on this resource's agent host from which artifact versions are retrieved and made available to job steps.</p> <p>Enter an absolute path to the resource containing this cache directory.</p>
Zone	<p>The name of the zone where this resource is or will be a member—a zone is a top-level network containing one or more mutually accessible resources.</p>
Repository Names	<p>A "new-line" delimited list of repository names for this resource, if needed. When a step attempts to retrieve artifact versions from an ElectricFlow repository, it queries repositories specified here. If no repositories are specified, it will "fallback" to the default repository.</p>
Connection Type	<p>Use the drop-down menu to select your Connection Type:</p> <ul style="list-style-type: none"> <li>• <b>HTTP</b>—choose this option if you are not using SSL and the agent does not need to be "trusted".</li> <li>• <b>HTTPS</b>—choose this option if you are using SSL, but this agent does not need to be "trusted".</li> <li>• <b>Trusted HTTPS</b>—choose this option if you are using SSL and this agent must be "trusted". A trusted agent is "certificate verified"—the agent verifies the server or "upstream" agent's certificate.</li> </ul> <p>Agents can be either <i>trusted</i> or <i>untrusted</i>:</p> <ul style="list-style-type: none"> <li>• <i>trusted</i>—the ElectricFlow server verifies the agent's identity using SSL certificate verification.</li> <li>• <i>untrusted</i>—the ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk.</li> </ul>

Field	Description
Enabled	<p>Select this box to enable this resource.</p> <p>When this box is checked, the resource is enabled, which means job steps can be assigned to it. If a job step requests a pool containing this resource, the step executes on a resource in that pool.</p> <p>If disabled, and this is the only resource that satisfies a particular job step, the step's execution is delayed until the resource is re-enabled. If a resource is disabled while job steps are running on it, the running steps continue to completion but no new steps are assigned to that resource.</p>

Click **OK** to save your settings and see your new resource listed in the table.

### New Proxy Resource Panel

These are the definitions of a proxy agent and proxy target:

- Proxy *agent*—This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform.
- Proxy *target*—This is a machine on an unsupported platform that can run commands via an SSH server.

To define a new proxy resource, enter information in the following fields:

Field	Description
<b>General</b>	
Name	Enter a unique name for this resource. <b>Do not use</b> spaces in a resource name. This is the name used to select the resource for a job step; it does not need to be the same as the host name for the machine.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Proxy Agent Host Name	Enter the domain name or IP address of the proxy agent machine corresponding to this resource.
Proxy Agent Port Number	Enter the port number to use when connecting to the agent for the resource.
Default Workspace	Enter the workspace name for leave blank to use the local, default workspace.

Field	Description
Pool(s)	Enter a space-separated list of arbitrary names, indicating the pools associated with this resource.
Host Type	<p>Use the drop-down menu to select the host type:</p> <ul style="list-style-type: none"> <li>• <b>Concurrent</b></li> <li>• <b>Registered</b></li> </ul> <p>Depending on the license installed on the ElectricFlow server, this field may appear.</p> <ul style="list-style-type: none"> <li>• If the license on the server is a concurrent resource license, the host type defaults to <b>Concurrent</b> and this field does not appear.</li> <li>• If the license on the server is a registered host license, the host type defaults to <b>Registered</b> and this field does not appear.</li> <li>• If the license on the server is a mixed-mode license (concurrent resources and registered hosts), you must specify the host type when adding a resource.</li> </ul>
Step Limit	<p>Specify the maximum number of steps that can execute simultaneously on this resource—a step limit applies to a particular resource only, not to its underlying host.</p> <p>For example, if you define two resources, <code>resource1</code> with a step limit of 5 and <code>resource2</code> with a step limit of 1, both specifying the same host machine, it is possible for a total of 6 steps to execute simultaneously on the underlying host.</p>
Zone	The name of the zone where this resource will be a member.
Connection Type	<p>Use the drop-down menu to select your Connection Type:</p> <ul style="list-style-type: none"> <li>• <b>HTTP</b>—choose this option if you are not using SSL and the agent does not need to be "trusted".</li> <li>• <b>HTTPS</b>—choose this option if you are using SSL, but this agent does not need to be "trusted".</li> <li>• <b>Trusted HTTPS</b>—choose this option if you are using SSL and this agent must be "trusted". A trusted agent is "certificate verified"—the agent verifies the server or "upstream" agent's certificate.</li> </ul> <p>Agents can be either <i>trusted</i> or <i>untrusted</i>:</p> <ul style="list-style-type: none"> <li>• <i>trusted</i> –The ElectricFlow server verifies the agent's identity using SSL certificate verification.</li> <li>• <i>untrusted</i> –The ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk.</li> </ul>

Field	Description
Enabled	<p>Select this box to enable this resource.</p> <p>When this box is checked, the resource is enabled, which means job steps will be assigned to it. If a job step requests a pool containing this resource, the step executes on a resource in that pool.</p> <p>If disabled, and this is the only resource that satisfies a particular job step, the step's execution is delayed until the resource is re-enabled. If a resource is disabled while job steps are running on it, the running steps continue to completion but no new steps are assigned to that resource.</p>
<b>Proxy Target</b>	
Proxy Target Host Name	Enter the domain name or IP address of the proxy target machine corresponding to this resource.
Proxy Target Port Number	Enter the port number to use when connecting to the proxy target host or leave blank to use the default. The default port is 22, the SSH server port.

Field	Description
Proxy Target Default Shell	<p>The name of the shell program used to execute commands on this [the proxy target] resource—may be overridden at the step level.</p> <p>This shell will be used to execute the step's commands on a resource. For example, using <code>sh</code> or <code>cmd /c</code>, the agent saves the command block to a temporary file with a <code>.cmd</code> extension and runs it: <code>sh foo.cmd</code> or <code>cmd /c foo.cmd</code>.</p> <p>If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:</p> <p>Windows: <code>cmd /q /c "{0}.cmd"</code>  UNIX: <code>sh -e "{0}.cmd"</code></p> <p>When you specify a shell (in the step or resource), and omit the <code>cmd-file</code> marker, the agent notices the omission and takes the correct action. For example: a user specifies <code>sh -x</code>. The agent converts this to <code>sh -x "{0}.cmd"</code>.</p> <p>Two alternate forms of shell syntax where ElectricFlow uses a "marker," <code>{0}</code>, as a placeholder for the command file argument:</p> <ul style="list-style-type: none"> <li>• <code>&lt;myShell&gt; {0} &lt;potential extra shell args&gt;</code>  In this example, the command file is not meant to be the last argument in the final command line.  For example, <code>mysql -e "source {0}"</code>  This shell example runs the <code>mysql</code> command against this step's command containing <code>sql</code>.</li> <li>• <code>&lt;myShell&gt; {0} &lt;.file extension&gt; &lt;potential extra shell args&gt;</code>  In this example, the shell requires the command file to end in an extension other than <code>.cmd</code>.  For example, <code>powershell "&amp; '{0}.ps1'"</code>  This shell example runs Microsoft PowerShell against this step's command containing PowerShell commands.</li> </ul> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• When the agent parses the shell, it will parse the extension as everything after <code>{0} .</code> until it sees a space or non-alphanumeric character.</li> <li>• If your script uses International characters (non-ascii), add the following block to the top of your <code>ec-perl</code> command block: <pre>use utf8; ElectricCommander::initEncodings</pre> </li> </ul>
Proxy Customizations	This is proxy-specific customization data. Default is "none".

Click **OK** to save your settings.

### Edit Resource Panel

All of the fields on this panel are the same as those on the New Resource panel:

- All information you previously provided to create this resource is filled-in for you.
- You can change any information already supplied.
- You can add information in any blank fields.

Click **OK** to save your modifications.

**IMPORTANT:** If you want to change the Connection Type, using the UI by itself is insufficient. You must also use the `ecconfigure` utility to change the protocol. Run: `ecconfigure --agentProtocol [http|https]`

### Edit Proxy Resource Panel

All of the fields on this panel are the same as those on the New Proxy Resource panel:

- All information you previously provided to create this resource is filled-in for you.
- You can change any information already supplied.
- You can add information in any blank fields.

Click **OK** to save your modifications.

### Resource Details Panel

This panel displays how this resource is configured with the ElectricFlow server. Some of the information supplied is linked to its source. For example, the zone name for this resource is a link to its Zone Details panel.

- The name of the resource is shown below the panel title.
- The resource description is shown under the resource name.
- Links at the top of the panel:
  - Use the **View Usage** link to go to the Job Step Search Results page.
  - Use the **Edit** link to modify the resource specifications.
  - Use the **Access Control** link [at the top of the panel] to specify or view access privileges for this resource.
- The tabs:
  - General—by default, the panel opens to display the "general" resource configuration.



- Properties—select this tab to add properties to this resource or see existing resource properties if already configured.

#### Custom Resource Properties

You can define custom properties for any ElectricFlow object. For example, if configuration information varies from resource to resource, use custom properties to store this information and then reference it from procedure steps where it is needed.

For example, if you have a pool of test machines with test hardware in a different location on each machine, you could define a property named "testLocation" on each resource, then pass this property to procedure steps using a reference such as `$/myResource/testLocation`.

## Switching a Non-Trusted Agent to Trusted

If you have upgraded to ElectricCommander 4.2 or later, none of your existing agents were converted to "trusted" during the upgrade process. By default, the *local* agent is not trusted during a new or upgrade installation.

After an upgrade, if you want to use a trusted configuration, any **pre-existing** agent/host machines must be manually switched to "trusted."

### Manually switching a non-trusted agent to trusted status

Perform the following steps on the agent machine to change the agent status to trusted in your environment and in the customer's site.

1. Enter `ectool --server <COMMANDER_SERVER_IP> login admin` to log into the server and save the session ID.
2. Enter `eccert --server <COMMANDER_SERVER_IP> initAgent --remote --force` to install the agent with a self-signed certificate that needs to be overwritten.
3. Restart the agent.

If you do not restart the agent, it tries to use a previously cached certificate if one exists. The old certificate is invalid because a new one was just created.

4. In the ElectricFlow UI, ping the agent.

## Resource Pools

This page displays all resource pools currently available to ElectricFlow.

- To create a new resource pool, click the **Create Resource Pool** link.
- To find an existing resource pool, use the **New Search** link.

### Column descriptions

Column Name	Description
Pool Name	This is the name you supplied for this resource pool. Click on a Pool Name to go to the Resource Pool Details page.
Enabled	If this box is "checked", this resource pool is enabled.
Auto Delete	If this column is selected with a check mark, the pool will be deleted when the last resource is deleted or removed.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	<p>Use the <b>Copy</b> link to make an exact duplicate of an existing resource pool, then select the copy to go to the Resource Pool Details page to change the resource pool name or add or remove resources from the pool.</p> <p>Use the <b>Delete</b> link to delete the resource pool on the same row.</p> <p><b>Note:</b> Deleting a resource pool does not delete the resources referenced by the pool.</p>

## Resource Pool – Create a New Pool or Edit Existing Pool

### Creating a new resource pool

Enter information in the following fields:

Field Name	Description
Pool Name	Enter a name for the resource pool. This name must be unique within a list of multiple resource pool names and cannot be the same as any resource name.
Enabled	Select this check box to enable the resource pool.
Type	<p>A resource can be <i>static</i> or <i>dynamic</i>.</p> <ul style="list-style-type: none"> <li>• A static resource is part of your system or network (not in the cloud), such as a server, database, or agent machine.</li> <li>• A dynamic resource is a cloud resource that can be provisioned and later spun up on-demand when an application is deployed.</li> </ul>

Field Name	Description
# Resources	Number of resources in the resource pool.
Resource Template Name	The name of the resource template to which the resource is applied. <b>Note:</b> Only dynamic resources can be applied to a resource template.
Auto Delete	If you select this check box, the pool is deleted when the last resource is deleted or removed. <ul style="list-style-type: none"> <li>The <code>autoDelete</code> property flag is automatically set to "true" if the pool was created on the Create Resource page, as a side-effect of the resource API calls.</li> <li>By default, resource pools created explicitly on the Create Resource Pool page, have the <code>autoDelete</code> flag set to false—the checkbox is "unchecked".</li> </ul>
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	Actions you can perform on the resource pool, including: <p><b>Copy</b>—Creates a new resource by copying the this resource pool.</p> <p><b>Delete</b>—Deletes this resource pool.</p> <p><b>Tear Down</b>—Removes (decommissions) the dynamic resource pool from a dynamic environment.</p> <p><b>Track Changes</b>—Opens the Change History for the resource pool.</p>

Click **OK** to save the information to create a new resource pool. You will see your new resource pool listed on the Resource Pools page.

**Note:** Resource pools cannot be nested, which means if the name of a resource pool is added to a resource pool, it will be ignored.

**A resource pool can override the default algorithm by providing a JavaScript fragment** in the Ordering Filter (`orderingFilter`) intrinsic property. The JavaScript environment for this fragment is:

- A variable named `resourceList` – an array of the resources in the pool, sorted as described above
- A variable named `resourcePool` – the pool object

- The job step being scheduled is configured as the context object for property resolution

The evaluation result is expected to be an array of resources, in the order they should be considered by the scheduler.

Before evaluation, the JavaScript fragment is wrapped as a function, to make it possible to use the `return` statement in the script.

It is possible to return any resources in the result, not just those grouped in a pool, so this feature enables true dynamic resource selection. Resources are still subject to the "usable" criteria. See the "Unusable resources" section at the end of this Help topic.

Examples for the Ordering Filter field:

- Sort by resource name in descending order:

```
return resourceList.sort(function(a,b) {
return b.resourceName.localeCompare(a.resourceName);
});
```

- Ignore the default resources and return different resources:

```
var result = new Array();
result[0] = resources["resource1"];
result[1] = resources["resource2"];
return result;
```

### Editing an existing resource pool

Use this page to modify any specifications for the resource pool.

Click **OK** to save the information and update the resource pool.

### Unusable resources

Resources, whether in a pool or not, are not considered usable if any of the following are true:

- The resource does not exist.
- The resource is disabled.
- The resource does not have a host name.
- The agent where the resource is associated is not reachable.
- The number of steps running on the resource is equal to the resource step limit.
- The resource is exclusive to a different job using the job `exclusiveMode`.
- The resource is exclusive to a step in a different job using the step or call `exclusiveMode`.
- The resource is exclusive to a different step in the same job using the call `exclusiveMode` and the other step is not an ancestor of the step.
- The resource is exclusive to a different step in the same job using the step `exclusiveMode`.
- The job step does not have execute privileges on the resource.
- The resource assignment exceeds the license limit (if any).

Resource Pool Details

This page displays information for the resource pool you selected, including a summary of the specifications supplied to create the resource pool, current resources assigned to this pool, and the ability to add or remove resources.

Links and actions at the top of the page








- **Edit**—use this link to go to the Edit Resource Pool page.
- **Access Control**—use this link to go the Access Control page for this resource pool.
- The "star" icon allows you to save this information to your Home page.
- The "curved arrow" icon returns you to the Resource Pools page.
- **Pagination**—Use the "previous" and "next" arrow icons to view the previous or next project. The numbers between the arrow icons display the number of projects you can view and the first number indicates which project [in the list] you are viewing.

The "tabbed" sections

The tabs at the top of the table allow you to select the type of information you want to see. The Resource Pool Details page opens with the Resources tab highlighted, so the first table you see is the Resources table. See the following screen example.

This table displays the resources currently included in this pool. The name of the pool ("custom" in our example) follows the Resource Pool Details page title.







Resource Pool Details / default

1/1

Description: Default resource pool containing local agent created during installation.  
Ordering Filter:  
Auto Delete: no  
Enabled: yes

Resources

Properties

Resource Name	Status	Enabled	Description	Host	Proxy Agent	Version	HTTPS	Add Resource to Pool	Step Limit	Actions
local			Local resource created during installation.	flow-demo-uat.electric-cloud.com		6.0.0.94411				 


The summary section at the top of the table contains information previously defined when the pool was created:

- Description—The text previously supplied for this object when it was created.
- Ordering Filter—The Javascript ordering filter (see the [New Resource Pool](#) Help topic for more information) or "empty" if no filter was applied.
- Auto Delete—When "yes" is specified, the pool will be deleted when the last remaining resource is removed or deleted from the pool.
- Enabled—"yes" specifies this pool is enabled for use.

Links at the top of the table

**Add Resources to Pool**—Click this link to see a pop-up dialog to enter a resource name to add to this pool. You can type a name or select from a list of existing resource names. If other resources are already configured, you will see a list from which to select a resource. Click **OK** to add new resources to the pool.

### Column descriptions

Column Name	Description / Actions
Resource Name	The name of the resource. Click on a resource name to go to the Edit Resource page.
Status	Indicates the current status of the resource.
Enabled	Indicates whether the resource is enabled. If a resource is disabled, no job steps will be assigned to it. ElectricFlow will use other resources within the pool to satisfy requests for the pool.
Description	The text previously supplied for this object when it was created.
Host	Steps assigned to run on this resource will use this host.
Proxy Agent	The name or IP address of the proxy agent machine.
Version	The version of the ElectricFlow agent installed on this resource.
HTTPS	A "checkmark" indicates HTTPS was selected when this resource was created.
Step Limit	The maximum number of steps that can execute simultaneously on this resource.
Actions	 <b>Ping</b> - Use this link to check the status of the resource.  <b>Remove</b> —Use this link to remove a resource from this pool.

### Properties tab

This tab provides a table listing all properties for the resource pool and includes the following functionality:

Links at the top of the table

- To create a new property for this resource pool, click the **Create Property** or **Create Nested Sheet** link.
- To view or change privileges on the property sheet, click the **Access Control** link.

### Column descriptions

Column Name	Description / Action
Property Name	The name of the property. Click on a property name to edit that property.
Value	Indicates the value assigned to this property
Description	A text description previously supplied for your reference only.
Actions	<b>Delete</b> —Use this link to delete this property.

## Zones

This page displays zones currently available to ElectricFlow and provides other zone operations—create, edit, delete, and so on.

- A zone is a way to partition a collection of agents to secure them from use by other groups. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.
- A *default* zone is created during the ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).
- Every agent, and all resources defined on that agent, can belong to one zone only.
- Within a zone, agents can be either *trusted* or *untrusted*.
  - *trusted*—the ElectricFlow server verifies the agent's identity using SSL certificate verification.
  - *untrusted*—the ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk.

### Links and actions at the top of the table

- To create a new zone, click the **Create Zone** link.
- The "star" icon allows you to save this zone information to your Home page.

### Column descriptions

Column Name	Description / Actions
Name	The name supplied when this zone was created. Click on a Zone Name to see the Zone Details panel for that zone.

Column Name	Description / Actions
Descriptions	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	<p><b>Delete</b>—Use this link to delete the zone on the same row.</p> <p><b>Note:</b> Deleting a zone does not delete resources in the zone. All agents (and their respective resources) move to the default zone if their current zone is deleted. The <i>default</i> zone <b>cannot</b> be deleted.</p>

### Zone Details panel

This panel displays the zone name and description for the zone you selected.

#### Links and actions at the top of the table

- **Resources**—Use this link to go to the Resources page.
- **Edit**—Click this link to display the Edit Zone panel.  
On the Edit Zone panel, you can change the zone name ,or you can add or change the zone Description.  
Click **OK** after making any changes.
- **Access Control**—Use this link to go to the Access Control page for this zone.
  - Current access privileges are displayed, if any.
  - Add the access control privileges you need for this zone.

Select the Properties tab to view any properties created for this zone, or use the "create" property links to create properties for this zone.

### Creating a new zone

Enter information in the fields as follows:

Field Name	Description
Name	Enter a name of your choice for this zone. The name must be unique among other zone names.



Field Name	Description
Description	<p>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags.</p> <p>The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>.</p>

Click **OK** to see your new zone displayed in the table.

To add resources to this zone, go to the Resources page.

### Access Control notes

Resource and Resource Pool inherit their privileges from Resources privileges. To create a resource, you must have modify privileges on Resources, and you must have modify privileges on the zone.

In addition, to move a resource from one zone to another, you must have modify privileges on both zones and the resource you want to move.

## Gateways

To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source* zone and the other in the *target* zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

If your company requires the added security of a firewall between zones, gateway agents can be configured to communicate with/through the firewall. Gateway agents can be trusted or untrusted (meaning that they just use HTTPS).

This page displays all gateways currently defined in ElectricFlow and provides other gateway operations—create, edit, delete, and so on.

- A firewall between zones— A gateway resource can be configured to communicate with an intermediary firewall in its path as a proxy to communicate with its peer on the other side of the gateway.

**IMPORTANT:** If the actual gateway agents are behind a load balancer, do not register resources for them in ElectricFlow. The actual gateway agents should be pinged by ElectricFlow only via the load balancer.

- Each gateway records the host/port combination each gateway agent/resource must use to communication with its peer on the other side of the gateway.
- Multiple gateways can be defined for a zone if required.  
For example, you may have multiple resources in zoneA that need to communicate with each other, but some of those resources also need to communicate with zoneB, while others need to communicate with zoneC only. In this scenario, zoneA would require two gateways—one to zoneB and one to zoneC.
- One resource can participate in multiple gateways.  
For example, assume we have 3 zones, zone1, zone2, and zone3, each created to contain agent/resource machines for a different, specific purpose (production, testing), but we want to share or pass data from a resource in zone1 to another resource in zone2 or zone3:
  - We need two gateways:
    - Gateway1 connects ResourceA in zone1 to ResourceC in zone3
    - Gateway2 connects ResourceA in zone1 to ResourceB in zone2
  - With this gateway-resource configuration, ResourceA can communicate directly with zone2 or zone3.

### Links and actions at the top of the table

- To create a new gateway, click the **Create Gateway** link.
- The "star" icon allows you to save this gateway information to your Home page.

### Column descriptions

Column Name	Description / Action
Name	The gateway name specified when this gateway was created. Click a gateway name to see the <b>Gateway Details</b> panel for that gateway.
Enabled	A checkmark in the box indicates that this gateway is enabled.
Resource 1	The first of two resources required to create a gateway. For actual gateway agents that are behind a load balancer, this is the resource for the inbound or outbound load balancer (not the actual agent).
Host 1	The external name that Resource 2 uses to communicate with Resource 1. This contains the host name or IP address of Resource 1. If this is blank, the Agent Host Name attribute in Resource 1's definition is used at runtime.
Resource 2	The second of two resources required to create a gateway. For actual gateway agents that are behind a load balancer, this is the resource for the inbound or outbound load balancer (not the actual agent).

Column Name	Description / Action
Host 2	The external name that Resource 1 uses to communicate with Resource 2. This contains the host name or IP address of Resource 2. If this is blank, the Agent Host Name attribute in Resource 2's definition is used at runtime.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	<b>Delete</b> —Use this link to delete the gateway on the same row.

### Gateway Details Panel

This panel displays properties and access control privileges assigned to this gateway. Select the **Properties** tab to see any existing properties or to create properties for this gateway.

#### *Links and actions at the top of the panel*

- **Edit** —Click this link to display the **Edit Gateway** panel. On the **Edit Gateway** panel, you can change the gateway name or add or change the gateway description.
- **Access Control** —Click this link to go to the **Access Control** page to set access privileges for this gateway.

### Create Gateway Panel

Enter the following information:

Field Name	Description / Action
Name	Name of your choice for this gateway. The name must be unique among other gateway names.
Description	Plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code> .
Enabled	Enables the gateway.

Field Name	Description / Action
Resource 1	Name of your choice for the first of two required gateway resources. Do <i>not</i> include spaces in a resource name. For actual gateway agents that are behind a load balancer, specify the resource for the inbound or outbound load balancer (not the actual agent).
Host 1	Agent host name where Resource 1 resides. This external host name is used by Resource 2 to communicate with Resource 1. Specify only the host name or IP address of Resource 1. To use the host name from Resource 1's definition, leave this field blank.
Port 1	Port number used by Resource 1. The default is the port number used by the resource.
Resource 2	Name of your choice for the second of two required gateway resources. Do <i>not</i> include spaces in a resource name. For actual gateway agents that are behind a load balancer, specify the resource for the inbound or outbound load balancer (not the actual agent).
Host 2	Agent host name where Resource 2 resides. This external host name is used by Resource 1 to communicate with Resource 2. Specify only the host name or IP address of Resource 2. To use the host name from Resource 2's definition, leave this field blank.
Port 2	Port number used by Resource 2. The default is the port number used by the resource.

Click **OK** to see your new gateway displayed in the table.

### Edit Gateway Panel

This panel is populated with previously supplied information to define the gateway. You can change any existing specifications or add new information. Click **OK** to save your changes.

### Access Control Note

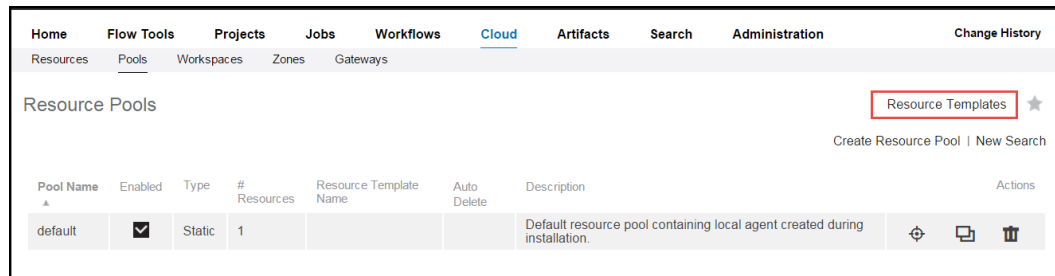
A gateway inherits privileges from the ZonesAndGateways ACL. See the [Access Control](#) on page 911 ("Server Objects" section) Help topic for more information.

## Accessing the Resource Templates in the Automation Platform

You can generate new resource pools in ElectricFlow by accessing the resource templates from the automation platform UI.

1. Go to **Cloud > Pools**.

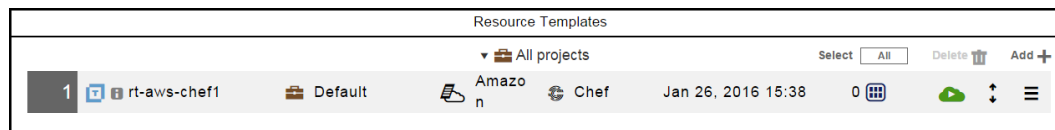
### Example:




2. Click **Resource Templates**.

The **Resource Templates** list opens.

### Example:



3. (Optional) To view details about a resource template, choose a template and click the **Menu** button (  ) for it.

The Context menu opens.

4. Click one of these options:

- **Details**—The **Edit Resource Template Details** dialog box opens.

The tabs that appear in the dialog box depend on the cloud provider specified in the resource template.


- **Properties**—The **Properties** dialog box opens.

You can view and edit the properties that apply to the resource template.

- **Access Control**—The Access Control page opens.

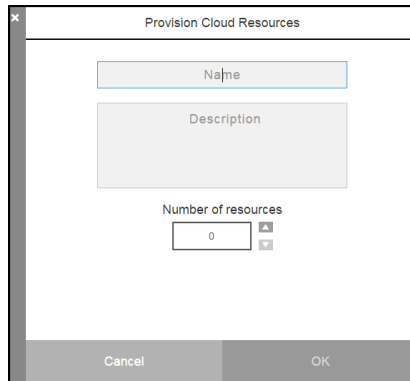
- **Track Changes**—The Change History for the resource template opens.



5. To provision the resource template, choose a resource template, click the **Menu** button (  ), and select **Details > Provision**.

The **Provision Cloud Resources** dialog box opens.

### Example:



Provision Cloud Resources

Name

Description

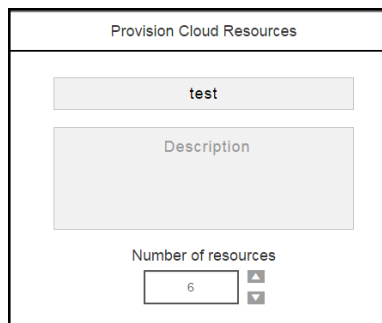
Number of resources

0

Cancel OK

6. Enter the resource pool name, an optional description, and the number of resources in the pool, and then click **OK**.

### Example:



Provision Cloud Resources

test

Description

Number of resources

6

You go to the Job Details page in the automation platform.

## Searching and Filtering

The page allows you to search for any supported object type.

Search

Object Type: Job

Project Name

contains

Electric Cloud

Procedure Name

contains

ECSCM

Add Criteria

Add Custom Criteria

OK

Cancel

Enter information in the fields as follows:

Field Name	Description
Object Type	Use the drop-down menu to select the object you wish to search.
Criteria	<p>Click <b>Add Criteria</b> one or more times to further define the criteria for your search.</p> <ul style="list-style-type: none"> <li>Use the drop-down arrow to select a criteria argument. These arguments are properties. For a description of any of these properties, see the <a href="#">Properties</a> Help topic.</li> <li>Use the drop-down arrow to select an operator for the search.</li> <li>Enter a value to search that is based on the selected operator and argument. For example, if you selected Project Name to begin your search and "contains" as the operator, you might want to enter the actual project name in this field or the first few letters if you have multiple projects named in a similar pattern.</li> </ul>
Custom Criteria	<p>Click <b>Add Custom Criteria</b> one or more times to enter custom criteria to further define your object search. Type the property name to search, and then select your search operator and the search value.</p>

Click **OK** after filling in the fields and to go to the Search Results page.

**Notes:**

- Only the first 450 characters of a property string are searchable. For example, if your property value happens to contain 1500 characters and the information you are trying to find is 800 characters into the property string, the search mechanism will not find it.
- When defining a search on this page, property path references are **not** allowed in search parameters. However, property path references are allowed in the Home page Quick View filters.
- The maximum number of search results that will be returned on the Search Results page is controlled by the server property `ec_ui/maxIds/default`. The out-of-the box default for this property is 1000. This default can be overridden for a specific object type. For example, the maximum number of jobs to display is controlled using the server property `ec_ui/maxIds/job` that is set to 500 out-of-the box.

- The default page size of 100 will be used to display the search results on the Search Results page, unless a user-specified page size is set (this user-specified setting will be used). You can save a user-specified page setting by changing the value in the Records Per Page drop-down field at the bottom of the Search Results page.
- The **Records Per Page** drop-down options are controlled through a server property `ec_ui/pageSizeOptions` with 10, 20, 50,100, 250, or 500 as the out-of-the-box value.
- Any changes to the properties within the server property sheet `ec_ui/maxIds` or the server property `ec_ui/pageSizeOptions` take effect after you log in again.

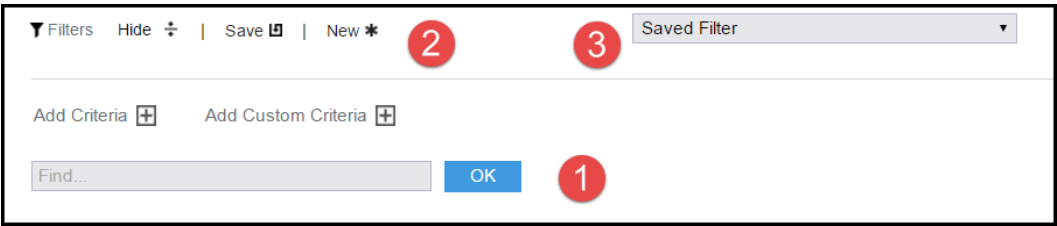
Context Searching and Filtering

Context searching allows you to search for objects on the current page without having to navigate to a separate Search page. It is available on these pages:

- Projects
- Jobs
- Artifacts
- Artifact versions
- Workflow

In-context search has these capabilities:

- Quick search: Type the search criteria in the text box and click **OK** to run a quick search.
- Search filters: Enter criteria to filter the results by specific attributes or properties on the selected object, and click **OK** to run the search.
- Saved searches: Save a search as a named saved search for later use.



1	Quick search The <b>OK</b> button also applies to the search filters.
2	Search filters
3	Saved searches



## Example

### Running Quick Searches

On the Jobs page, if you do a quick search for "mysql", you get these results:

Jobs

(500+ Results for quicksearch "mysql")

Filters Show : Save Save Filter

mysql OK

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
commander-main-sentry-mysql.109202-201608011348	Success	normal	Commander.Master	project: Electric Cloud	01:16:34.700	2016-08-01 13:48:58 PDT	
commander-6.4-full-mysql.109188-201607312200	Error	normal	Commander.Master	6.4_full	11:25:13.849	2016-07-31 22:00:15 PDT	
commander-main-sentry-mysql.109190-201608010342	Error	normal	Commander.Master	project: Electric Cloud	02:54:47.463	2016-08-01 03:42:44 PDT	
commander-main-sentry-mysql.109181-201607311258	Success	normal	Commander.Master	project: Electric Cloud	02:58:15.522	2016-07-31 12:58:50 PDT	
commander-main-sentry-mysql.109183-201607311258	Success	normal	Commander.Master	project: Electric Cloud	01:21:58.771	2016-07-31 12:58:53 PDT	

If you do a quick search for "mariadb", you get these results:

Jobs

mysql (373 Results for quicksearch "mariadb")

Filters Show : Save Save Filter

mariadb OK

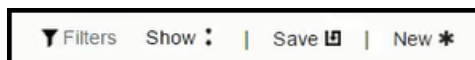
Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
commander-main-sentry-mariadb.109206-201608011512	Running	normal	Commander.Master	project: Electric Cloud	00:22:28.673	2016-08-01 15:12:45 PDT	
commander-main-lin-win-mariadb.109196-201608011100	Running	normal	Commander.Master	main_linux_windows	04:35:10.379	2016-08-01 11:00:04 PDT	

### Saving Filters

To save the filter for jobs containing "mysql" in the job name:

1. Click **Save**.

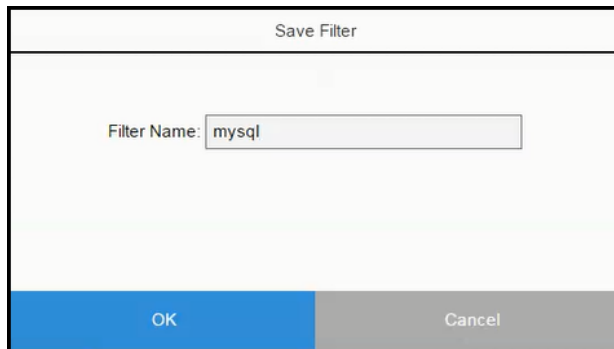
### Example:



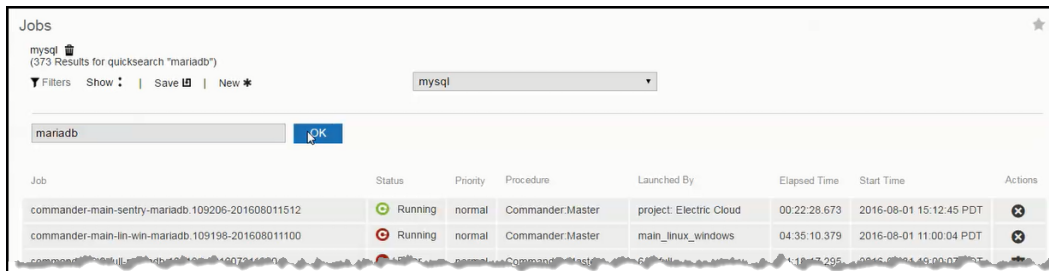
The **Save Filter** dialog box opens.

2. Enter the filter name in the **Filter Name** field and click **OK**.

### Example:

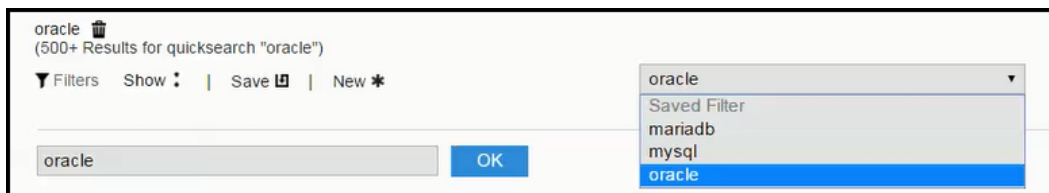


The **Saved Filter** field now shows that there is a saved filter called mysql.



Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
commander-main-sentry-mariadb.109206-201608011512	Running	normal	Commander.Master	project: Electric Cloud	00:22:28.673	2016-08-01 15:12:45 PDT	[X]
commander-main-lin-win-mariadb.109198-201608011100	Running	normal	Commander.Master	main_linux_windows	04:35:10.379	2016-08-01 11:00:04 PDT	[X]

When you have more than one saved filter, click on the down arrow to see the list of filters you have saved. The saved filters are user-specific so you will only see your saved filters and not other users' filters.



### Setting Search Filters

To add filters for search:

1. Click **Show** to show the filters.

The **Add Criteria** and **Add Custom Criteria** options appear along with the filter fields.

2. Click **Add Criteria** to add criteria.
3. In the first field, select the search filter argument.
4. In the second field, select the operator for the filter.

5. In the third field, select the criteria to narrow down your search. The available options depend on the argument you selected.
6. To add another filter, enter a value in the Quick Search text box, click **Add Criteria**, or click **Custom Criteria**.
7. Repeat the previous step to add as many filters as you want.
8. To run the search, click **OK**.

This is an example of a search with three filters:

Jobs

eflow (5 Results for "Status" equals "Completed" and "Priority" equals "High" and "Elapsed Time" less than "10:00")

Filters Hide Save New

Status equals Completed

Priority equals High

Elapsed Time less than 10:00

Add Criteria Add Custom Criteria

Find OK

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
job_404533_201009021004	Success	high	Test:stanton-test	stanton-admin	00:00:01.391	2010-09-02 10:04:07 PDT	
job_404532_201009021003	Success	high	Test:stanton-test	stanton-admin	00:00:01.438	2010-09-02 10:03:22 PDT	

You can also save this filter as "High priority jobs":

Jobs

High priority jobs (5 Results for "Status" equals "Completed" and "Priority" equals "High" and "Elapsed Time" less than "10:00")

Filters Hide Save New

Status equals Completed

Priority equals High

Elapsed Time less than 10:00

Add Criteria Add Custom Criteria

Find OK

High priority jobs

Saved Filter

eflow

High priority jobs

mariadb

mysql

oracle

## Search Results

This page displays the results of the search you defined.

- If the results were not as expected, click the **Edit Search** link to modify your search criteria.
- Click the **New Search** link to define a new object you need to find.

- Click the **Save Report Filter** link if you want to save this filter for future use in a report. In the pop-up screen, enter a name for the filter and click **OK**. The Saved Filter will be stored as a property in your chosen project.
- To continually monitor the status of your found object, click the **Refresh Search** link.

#### Notes:

If you need to refer to this page on a regular basis, mouse-over the "star" icon to add this page to the Shortcut section on your Home page.

If you use RSS, an active RSS icon is provided in Windows Explorer on this page for your convenience. If you use Firefox, click **Bookmarks** > Subscribe to this page to display the feed. You can then add the feed URL to a viewer of your choice.

## Server

This page displays overall information about the ElectricFlow server.

These links are at the top of the table:

- Click the **Settings** link to go to the Edit Server Settings page.  
Use this page to edit properties for the ElectricFlow server.
- Click the **Access Control** link to go to the Access Control page for the server.  
See the [Access Control](#) Help topic for more information.

The tables have this information:

- The System Access Control table displays top-level properties.  
Click on an item in the Category column to see, add, or modify privileges for that object.
- In the Custom Server Properties table, click on a Property Name to view the property content.  
If using *ectool*, these properties can be accessed using the property name starting with `"/server"`.

See the [Properties](#) Help topic for more information.

These links are provided within the table:

- **Create Property**—Use this link to create a new server property.
- **Create Nested Property**—Use this link to create a new nested server property.
- **Access Control**—This access control link allows you to create or edit privileges for the property sheet.
- The Actions column allows you to Edit or Delete the property in that row.

## Settings—edit existing property settings

Use this page to edit property settings for the ElectricFlow server or any integrations that you use with ElectricFlow. If you access this page from the Server page, the page is named **Edit Server Settings**. This page contains fields for editing ElectricFlow server properties. From Perforce, the page is named **Edit Perforce Settings**, and the editable fields are specific to Perforce functionality.

The following example is from the **Edit Server Settings** page. For more information about a setting, click the name to see a tooltip that describes the setting.

Home

Projects

Jobs

Workflows

Cloud

Artifacts

Search

Administration

Event Log

Groups

Users

Licenses

Directory Providers

Email Configurations

Database Configuration

Plugins

Server

South

## Edit Server Settings

Runtime settings for the ElectricFlow server.

### Server Settings

Agent abort timeout:

90000

Agent connection timeout:

60000

Agent heartbeat interval:

3600

Agent heartbeat spread:

☐

Idle connection timeout:

300000

Agent ping failure max retry interval:

300

Agent socket timeout:

60000

Agent waits for all descendants:

☐

Allow Artifact Publish from UI:

☒

Enabling/disabling change tracking at a project level:

adminOnly

Application process job name template:

\$/[increment /myApplication/jobCounter]\_\$/[myJob/processName]\_\$/[my

Artifact Version name template:

\$/[myArtifactVersion/groupId]\_\$/[myArtifactVersion/artifactKey]\_\$/[myArtifa

Number of retries for Retrieve Artifact:

3

Initial delay between retries for Retrieve Artifact:

100

Maximum delay between retries for Retrieve Artifact:

30000

Maximum Number of Records for Change Tracking:

0

How often to record cluster diagnostics:

000

Click **OK** to save the settings.

If you must change these settings frequently, add this page to your Home page for quick access by clicking the star icon in the upper right corner.

## Source Control Configurations

This web page displays all source control configurations you have created to communicate with ElectricFlow.

### [Link at the top of the table](#)

- Use the **Create Configuration** link to create a new or additional source control configuration.

### [Table column definitions](#)

**Configuration Name**—This is the name you chose for this source control configuration.

**Description**—This is the plain text or HTML description you provided for this source control configuration.

**Plugin**—This is the ElectricFlow plugin associated with this source control configuration.

**Actions** -

**Edit**—Use this link to modify information previously supplied to configure this source control system.

**Delete**—Use this link to remove this source control configuration.

## Source Control Configurations—create new or edit existing configuration

Use this page to define a new source control configuration (SCM) or modify an existing source control configuration. A configuration is a collection of properties that define how to communicate with a particular source control system.

ElectricFlow bundles and supports numerous source control types.

- After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page— to see this web page, select the Administration > Source Control tabs.
- Other SCM systems are bundled with ElectricFlow and available in the Plugin Catalog. Each integration contains options specific to that SCM.
- The following SCM integrations are provided as examples.

[AccuRev](#)

[ClearCase](#)

[File](#)

[Git](#)

[Perforce](#)

[Property](#)

[Subversion](#)

**Note:** If you need a different SCM, not specified in this Help topic, go to the Plugin Manager page to locate your SCM (Administration > Plugins). See the Help topic associated with your plugin—located on the Plugins page. At a minimum, you need to enter a name for your configuration and you may want a minimal text description.

### AccuRev

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration— any name you choose, but the name must be unique. For example, you might use "myAccuRevServer."

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Login As

User Name—The name ElectricFlow needs to use to communicate with your AccuRev system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password—The password for the specified User Name.

Retype Password—Type the password again.

Click **Submit** to save your information.

### ClearCase

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration— any name you choose, but the name must be unique. For example, you might use "myClearCaseServer."

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Click **Submit** to save your information.

### File

You may want to use this configuration with ElectricSentry to "watch" for changes in any files.

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration—any name you choose, but the name must be unique.

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Click **Submit** to save your information.

### Git

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration— any name you choose, but the name must be unique.

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Click **Submit** to save your information.

### Perforce

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration— any name you choose, but the name must be unique. For example, you might use "myPerforceServer."

Description—You can change or modify the default text description—ElectricFlow does not use this information.

#### Login As

User Name (P4USER)—The name ElectricFlow needs to use to communicate with your Perforce system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password (P4PASSWORD)—The password for the specified User Name.

Retype Password—Type the password again.

P4PORT—Sets the hostname and port number ElectricSentry uses to contact the Perforce server (hostname:1234).

P4HOST—The name of the host machine to impersonate.

P4TICKETS—The full path name of the ticket file used by the "p4 login." This value is set as an environment variable, not as a command-line option (fullPathAndFileName)

P4CHARSET—Sets the character set used for translation of Unicode files (characterSet)

P4COMMANDCHARSET—Used to support UTF-16 and UTF-32 character sets (commandCharSet).

Click **Submit** to save your information.

### Property

You may want to use this configuration with ElectricSentry to "watch" for any property changes.

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration—any name you choose, but the name must be unique.

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Click **Submit** to save your information.



## Subversion

Enter information in the fields as follows:

Configuration Name—Type a name for the configuration— any name you choose, but the name must be unique. For example, you might use "mySubversionServer."

Description—You can change or modify the default text description—ElectricFlow does not use this information.

Login As

User Name—This is the name ElectricFlow needs to use to communicate with your Subversion system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password—This is the password for the specified User Name.

Retype Password—Type the password again.

Click **Submit** to save your information.

## Checking out code from a source control system

Go to Projects > select a project > select a procedure.

To create a New Step for source code management, select the **Plugin** link.

- In the Choose Step panel, select Source Code Management from the left pane, then select the SCM you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the SCM integration you configured and the step you chose.
- Enter the remaining information to create your SCM step.

## To edit an existing source control configuration

Modify any of your source control configuration information by "typing-over" any previously entered information.

Click **Submit** to save your modified source control information.

## Active Users

This page displays all users known to this ElectricFlow server, including users defined locally within the server and those defined in external repositories such as LDAP or ActiveDirectory.

**Active Users** are those persons who have logged into ElectricFlow, although if a another user views a selection of user accounts, those users [viewed] will appear on the Active Users page also.

Click the **Show Inactive Users** link to go to the All Users web page—this page lists all users: local, LDAP or Active Directory, active, or inactive. If you delete an LDAP or Active Directory user from this [Active Users] page, the user will not be deleted from the All Users page.

- To edit **local** user content, click on the user name you want to modify.
- To create a new local user, click the **Create Local User** link at the top, right-side of the table.
- To delete a local user, click the **Delete** link in the Action column for that user.
- Click the "star" icon at the top, right-side of the table if you want to add this page to your Shortcut section on the Home page.

While you can view **external** user content, you **must** go to the LDAP or ActiveDirectory repository to edit external user information. However, you may associate properties with external users and then use those properties in ElectricFlow.

In the **Filter** field, enter a string to be used to filter users. The filter will automatically apply a trailing '\*' to find all users starting with the entered text. Use \* for wildcards (for example, searching for \*foo\* will return all users that include the string foo).

To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

## Users and Groups

Use this page to view a filtered list of ElectricFlow local users or groups.

Enter information in the fields as follows:

Field Name	Description
Filter	Enter a partial name to retrieve the list of all users or groups that match that name.
Maximum Results	Enter the number of results you would like to see returned. Default is 100. <b>Caution:</b> Currently, ElectricFlow has no upward limit, but if you enter a number of 1000 or higher, you may overload your browser, which will result in performance degradation or worse.
Include Inactive [User/Group]	Use this check box only if requesting external LDAP or Active Directory providers. <ul style="list-style-type: none"> <li>• If "checked," all available users or groups are returned.</li> <li>• If not checked, only those users or groups known to the ElectricFlow server are returned, for example, users who have logged in or groups containing users who have logged in.</li> </ul>

Click **OK** to begin the search.

### Links at the top of the page

**Create Local [User/Group]**—Click this link to create a new user or group—for users or groups *local* to the ElectricFlow server.

### Column descriptions

Column Name	Description
Name	The name of the user or group. The name combined with the location is the unique identifier for this user or group, <i>local</i> to the ElectricFlow server. Click the name to see more information.
Repository	The repository where the user or group is located. "Local" means local to the ElectricFlow server. Other names in this column refer to defined directory providers.
Location	Only viewable for users or groups from non-local directory providers.
Real Name (users only)	The full name of the user.
Email (users only)	The email address for the user.
Actions	<b>Edit</b> —Only available for local users and groups. Click to edit the user or group definition. <b>Delete</b> —Click to delete the user from the ElectricFlow server. <b>Note:</b> This delete function does not delete non-local users from an LDAP or Active Directory repository.

### User—create new or edit existing local user

Use this page to create or modify a *local* user **only**.

ElectricFlow supports two kinds of user accounts: those defined externally in an LDAP or Active Directory system, and *local* users defined in this ElectricFlow server.

Local users are not visible outside ElectricFlow.

We recommend using external accounts whenever available, but you may need to create local users if you do not have a shared directory service or if you need special accounts to use for ElectricFlow only.

#### To create a new local user

Enter information in the fields as follows:

Field Name	Description
User Name	Enter the name of the user account to be used for login
Real Name	Enter the user's real (given) name.
Email	Enter the user's email address.
Password	Enter the user's login password.

Click **OK** to save the new local user data.

**Note:** If you do not assign a password when creating the user, the user cannot log into ElectricFlow. You can use this mechanism while you are setting up the user account. Once the user account is fully set up, you only need to assign a password.

#### To edit an existing local user

- You may highlight and type-over any previously entered user information.
- If you leave the password fields blank and click **OK**, the existing password remains unchanged.
- To change the user's password, enter the new password for the user, AND also enter the current admin password.

Click **OK** to save the modified user data.

Use this page to modify user properties or assign Custom User Properties. Select the **Create Property**, **Create Nested Sheet**, or **Access Control** links to set the properties you need.

**Note:** To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow click the **Administration > Directory Providers** tabs.

## User Details

This page displays external user information retrieved from a repository such as LDAP or Active Directory.

To edit external user information, you *must* connect directly to the repository to modify external user content. However, you can associate properties with an external user and then use those properties in ElectricFlow.

Use this page to modify user properties or assign Custom User Properties. Select the **Create Property**, **Create Nested Sheet**, or **Access Control** links to set the properties you need.

#### Definitions for summary information at the top of page:

- **Name:** The name this user is known by in the system.
- **Repository:** Usually LDAP or Active Directory.
- **Real Name:** The real, given name for user.
- **Email:** The user's email address as known within the system.

- **Groups:** This field displays all groups where this user is a member. Clicking on a group name displays the Group Details page, which lists all members who belong to that group.
- **Parent Groups:** This field is displayed only for remote or external users if the repository (directory provider) to which the user belongs is configured to **Recursively Traverse Group Hierarchy** (the **Recursively Traverse Group Hierarchy** option is selected when directory provider is defined). This field displays all the groups in the LDAP or Active Directory server hierarchy in which the user's immediate groups are members.

If a user is in this hierarchy:

- The user belongs to "SFO" group.
- The "SFO" group belongs to "California" group.
- The "California" group belongs to "US" group.

Then the **Parent Groups** field for the user will display "California, US" while the **Groups** field will display "SFO".

**Note:** To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

## Edit User Settings

Use this page to modify your User Settings for the product tab view. Depending on which view you choose, you can have limited access to ElectricFlow features and functions.

In the Tab View, use the pull-down menu to make a new selection:

Default—Selecting this view provides all regular/standard product tab views, including plugins, which by default are installed into this view.

Base—This view removes the ability to use a plugin. You can see the plugin list (accessed by selecting the Plugins tab), but you are denied access to configure, install, uninstall, or promote a plugin.

Inherit—Frequently this view is set for a group. The UI searches for the property, `ec_ui/defaultView`, first on the user, second in any groups the user belongs to, and last, on the server. The inherit setting clears the user's private defaultView setting and then picks up the first value from the rest of the search path.

Click **OK** after selecting a different tab view.

## Groups

This page displays all groups known to this ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP.

- To edit a **local** group, click on its name.
- To create a new local group, click the **Create Local Group** link.

- Click on an **external** group to view its contents, but you cannot edit the content through ElectricFlow. Instead, you must go to the group's repository directly. You can, however, associate properties with external groups, which can then be used in ElectricFlow.

In the **Filter** field, enter a string to be used to filter groups. The filter will automatically apply a trailing **\*\*** to find all groups starting with the entered text. Use **\*** for wildcards (for example, searching for **\*foo\*** will return all groups that include the string **foo**).

To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

## Group—create new or edit existing local group

### To create a new local group

Enter information in the fields as follows:

**Name**—Type a name for the group. Choose any name, but it must be unique among other local group names.

**Users**—Type a list of users who need to belong to this group— type one user per line.

Click **OK** after populating the group.

### To edit a local group

- You can highlight the existing group name and type a new name—or
- You can scroll to the bottom of the list of users and type-in additional members for this group, one name per line—or
- You can highlight a user name and press the delete key (on your keyboard) to delete that user from the group.
- Click **OK** after completing your changes.

Also, you can associate custom properties with a group. Select either the **Create Property**, **Create Nested Sheet**, or the **Access Control** links to set up the properties you need.

## Group Details

This page displays external group information retrieved from a repository such as LDAP or ActiveDirectory.

- To edit external group information, you must connect directly to the repository to modify an external group.  
However, you can associate properties with an external group and then use those properties in ElectricFlow.
- Click the **Access Control** link (at the top of the table) to see the privileges assigned to this group, inherited privileges, add a user or group, and so on.
- You can associate also custom properties with a group. Select the **Create Property**, **Create Nested Sheet**, or the **Access Control** links to set up the properties you need.

### Definitions for summary information at the top of page:

- **Name:** The name this user is known by in the system.
- **Repository:** Usually LDAP or Active Directory.
- **Users:** This field displays all users that are members of this group.
- **Nested Groups:** This field is displayed only for remote or external groups if the repository (directory provider) to which the user belongs is configured to **Recursively Traverse Group Hierarchy** (the **Recursively Traverse Group Hierarchy** option is selected when directory provider is defined). This field displays all the nested groups that are members of this group's hierarchy in the LDAP or Active Directory server.

If the "SFO" a group is a member of the "California" group and the "California" group is a member of the "US" group, the **Nested Groups** field for the "US" group will display "California, SFO".

**Note:** To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

## Directory Providers

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository.

**Local** users and groups are defined within ElectricFlow.

### Links at the top of the table

Click the **Add Active Directory Provider** or the **Add LDAP Provider** link to go to a new web page to configure your Directory Provider.

After configuring your directory provider, that name will appear in the All Providers table, the Provider Name column.

### Column descriptions

Column Name	Description / Actions
Provider Name	Click on a Provider Name to make changes to an existing directory provider.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	<p><b>Copy</b>—Use this link to make a copy of the Provider Name configured on this row.</p> <p><b>Remove</b>—Use this link to remove the Provider Name on this row.</p>

Detailed Help for defining a directory provider in ElectricFlow is available from the [New Active Directory Provider](#) or the [New LDAP Provider](#) web page.

Click the **Help** link from either web page. The Help text also contains examples you may find useful.

## Directory Providers—create new or edit existing directory providers

ElectricFlow supports Active Directory and LDAP directory providers.

This Help topic contains instructions for creating an Active Directory or LDAP directory provider and editing those configurations if you need to make changes at a later time. Use the following links to go the section you need:

[To create a new Active Directory provider](#)

[To create a new LDAP directory provider](#)

[Examples for directory provider field descriptions](#)

[To edit an existing directory provider](#)

### To create a new Active Directory provider

Enter information in the fields as follows to specify your existing Active Directory users and groups to communicate with ElectricFlow. For examples of information you enter in the these fields, see the [table](#) after the following description sections.

Field Name	Description
<b><i>General section</i></b>	
Provider Name	This name identifies users and groups that come from this provider.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
URL Discovery	Select the method to retrieve the URL for the Active Directory server. Auto-discovery using DNS automatically discovers Active Directory servers on the given domain. Alternatively, you can specify a custom URL to an Active Directory server.
Domain Name	The domain where Active Directory servers are automatically discovered. For example, <code>my-company.com</code>



Field Name	Description
Use SSL	<p>Select this box if you want to use SSL when the ElectricFlow server contacts your Active Directory server.</p> <p><b>Note:</b> Transport Layer Security (TLS) has replaced Secure Sockets Layer version 3.0 (SSLv3) on the ElectricFlow web server and the ElectricFlow server.</p>
URL	<p>This is an explicit URL to the Active Directory server. The URL is in the form <i>protocol://host:port/basedn</i>. Protocol is either <i>ldap</i> or <i>ldaps</i> (for secure LDAP). The port is implied by the protocol, but you can override the port if you cannot use the default location (default is port 389 for <i>ldap</i> or 636 for <i>ldaps</i>). The <i>basedn</i> is the path to the top-level directory that contains users and groups at this site. Typically, this is the domain name where each part is listed with a <i>dc=</i> and separated by commas. <b>Note:</b> Spaces in the <i>basedn</i> must be URL encoded (use <i>%20</i> for spaces). If your site uses redundant directory servers for failover, you can enter multiple URLs separated by spaces.</p>
Query User Name	<p>The name of a user who has read-only access to user and group directories in Active Directory. This is the user name to use for fetching user and group information. When you provide a domain name, you can provide the simple name, for example, <i>myuser</i>. When you provide an explicit URL, you need to provide a distinguished name, for example:</p> <p><i>cn=myuser,ou=Users,dc=electric-cloud,dc=com.</i></p>
Query User Password	The password for the query user.
<p><b>Membership Options section</b></p> <p><b>Note:</b> The membership options control whether the nested group hierarchy in the configured Active Directory server will be used by ElectricFlow. See <a href="#">LDAP Group Hierarchy</a> on page 978 for details on how the nested group hierarchy in Active Directory is used by ElectricFlow.</p>	
Recursively Traverse Group Hierarchy	<p>Select this to enable recursive traversal of the group hierarchy for nested group membership information.</p> <p>Note: If <b>Recursively Traverse Group Hierarchy</b> is selected, select the <i>LDAP_MATCHING_RULE_IN_CHAIN</i> template for both the <b>Membership Filter</b> and <b>Group Member Filter</b> fields in the "Group Options" section to allow Active Directory to return the nested group membership information.</p>
Membership Filter	Active Directory filter to use when searching for groups to which an Active Directory user or group belongs.

Field Name	Description
Include Nested Group Users in Notifications	Select this to include users in nested Active Directory groups when notifications for a parent Active Directory group are sent and <b>Recursively Traverse Group Hierarchy</b> is selected.
Include Nested Group Users as Approvers	<p>Select this to allow users in nested Active Directory groups to complete or approve a manual task when a parent Active Directory group is assigned as an assignee or an approver for the task and <b>Recursively Traverse Group Hierarchy</b> is selected.</p> <p><b>Note:</b> Because users who are authorized to approve the manual task will typically also be notified of the approval request, we recommend that <b>Include Nested Group Users in Notifications</b> be selected (enabled) when <b>Include Nested Group Users as Approvers</b> is selected.</p>
<p><i><b>User Options section</b></i></p> <p><b>Note:</b> When creating an Active Directory provider, the ElectricFlow server automatically sets default values for any options (fields) that are empty. The default values match the most common Active Directory configurations. After the provider is created, you can view and modify defaults by modifying the provider.</p>	
User Base	This string is prepended to the <code>basedn</code> to construct the directory DN containing user records.
User Search Filter	This LDAP query is performed in the context of the user directory to search for a user by account name. The string "{0}" is replaced with the user's login ID. Typically, the query compares a user record attribute to the substituted user login ID.
User Name Attribute	This is the attribute in a user record that contains the user's account name.
Full User Name Attribute	(optional) This is the attribute in a user record that contains the user's full name (first and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's account name is used instead.
User Email Attribute	(optional) This is an attribute in a user record that contains the user's email address. If this attribute is not specified, the account name and domain name are concatenated to form an email address.
Search User Subtree	Select this check box to search the specified directory by the user base and all directories below. If this check box is not selected, the search is limited to the specified directory only.

Field Name	Description
<p><b>Group Options section</b></p> <p><b>Note:</b> If you do not need group information at this time, do not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both "user tests" are successful.</p> <p>When creating an Active Directory provider, the ElectricFlow server automatically sets default values for the options/fields that remain empty. These default values match the most common Active Directory configurations. After the provider is created, you can view and modify the defaults by modifying the provider.</p>	
Enable Groups	Select this check box to enable external groups for this directory provider.
Group Base	(optional) This string is prepended to the <code>basedn</code> to construct the directory DN containing group records.
Group Member Filter	(optional) This LDAP query is performed in the groups directory context to identify groups that contain a specific user. Two common forms of group records in LDAP directories are: <code>POSIX</code> style groups where members are identified by account name, and <code>groupOfNames</code> or <code>uniqueGroupOfNames</code> records where members are identified by the full user DN. ElectricFlow supports both forms, so the query is passed two parameters: " <code>{0}</code> " is replaced with the full user record DN, and " <code>{1}</code> " is replaced with the user's account name.
Group Member Attributes	(optional) This is a comma-separated attribute name list that identifies a group member. Most LDAP configurations only specify a single value, but if a mixture of <code>POSIX</code> and <code>LDAP</code> style groups exist in the directory, multiple attributes might be required.
Group Search Filter	(optional) This LDAP query is performed in the context of the groups directory to enumerate group records. You can choose from common templates that include either security or distribution groups (or both). These templates are based on the most common Active Directory settings.
Unique Group Name Attribute	(optional) This is the group record attribute that contains the group name. To prevent group name overlap between multiple directory providers (or within the same provider in a multi-forested Active Directory server), we recommend setting this attribute to the <code>distinguishedName</code> .
Common Group Name Attribute	The Unique Group Name Attribute may not be searchable if using the <code>distinguishedName</code> . In this case, the Common Group Name Attribute can be used to search for groups, depending on the filter used.

After filling-in all fields, click the **Test** button.

Three tests validate the information you supplied:

- user authentication
- user identified in Active Directory
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest.

Click **Save** after successful test results.

New, defined directory providers will appear in the table on the Directory Provider web page.

### To create a new LDAP directory provider

Enter information in the fields as follows to specify your existing LDAP users and groups to communicate with ElectricFlow. For examples of information you enter in the these fields, see the table after the following description sections.

Field Name	Description
<b>General section</b>	
Provider Name	This name identifies users and groups that come from this provider.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
URL	<p>The LDAP server URL is in the form <i>protocol://host:port/basedn</i>. Protocol is either <code>ldap</code> or <code>ldaps</code> (for secure LDAP). The port is implied by the protocol, but you can override the port if you cannot use the default (default port is 389 for <code>ldap</code> and 636 for <code>ldaps</code>). The <code>basedn</code> is the path to the top-level directory that contains users and groups at this site. Typically, this is the domain name where each part is listed with a <code>dc=</code> and separated by commas.</p> <p><b>Note:</b> Spaces in the <code>basedn</code> must be URL encoded (use <code>%20</code> for spaces). If your site uses redundant directory servers for failover, you can enter multiple URLs separated by spaces.</p>
Realm	This is the realm of the LDAP directory provider, which is used to create unique user names when you have multiple providers. For example, if the realm is <code>my-company.com</code> , users are saved as <code>myuser@my-company.com</code> .

Field Name	Description
Query User Name	This is the name of a user who has read-only access to the user and group directories in LDAP. This is the user name to use for fetching user and group information. When providing a domain name, you can provide the simple name, for example, myuser. When providing an explicit URL, you need to provide a distinguished name, for example: <code>cn=myuser,ou=Users,dc=electric-cloud,dc=com.</code>
Query User Password	This is the password for the query user.
<p><b>Membership Options section</b></p> <p><b>Note:</b> The membership options control whether nested group hierarchy in the configured LDAP server will be used by ElectricFlow. See <a href="#">LDAP Group Hierarchy</a> on page 978 for details on how the nested group hierarchy in the LDAP server is used by ElectricFlow.</p>	
Recursively Traverse Group Hierarchy	Select this to enable recursive traversal of the group hierarchy for nested group membership information.
Membership Attribute	Attribute defined on an LDAP user or group entry that is used by the LDAP provider for specifying the group membership. <code>memberOf</code> is the membership attribute used by most LDAP servers.
Nested Groups Depth Limit	Maximum number of group hierarchy levels that will be traversed for retrieving nested group membership information.  <b>Note:</b> Setting a high value for this option will impact the system performance when traversing the LDAP group hierarchy because a higher group hierarchy depth will result in a proportionally large number of network calls between the Electric Flow system and the LDAP server. The actual performance will depend on the system configurations of the ElectricFlow servers, the LDAP server, and the network latency.
Include Nested Group Users in Notifications	Select this to include users in nested LDAP groups when notifications for a parent LDAP group are sent and <b>Recursively Traverse Group Hierarchy</b> is selected.

Field Name	Description
Include Nested Group Users as Approvers	<p>Select this to allow users in nested LDAP groups to complete or approve a manual task when a parent LDAP group is assigned as an assignee or an approver for the task and <b>Recursively Traverse Group Hierarchy</b> is selected.</p> <p><b>Note:</b> Because users who are authorized to approve the manual task will typically also be notified of the approval request, we recommended that <b>Include Nested Group Users in Notifications</b> be selected (enabled) when <b>Include Nested Group Users as Approvers</b> is selected.</p>
<i>User Options section</i>	
User Base	This string is prepended to the <code>basedn</code> to construct the directory DN containing user records.
User Search Filter	This LDAP query is performed in the context of the user directory to search for a user by account name. The string "{0}" is replaced with the user's login ID. Typically, the query compares a user record attribute to the substituted user login ID.
User Name Attribute	This is the attribute in a user record that contains the user's account name.
Full User Name Attribute	(optional) This is the attribute in a user record that contains the user's full name (first and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's account name is used.
User Email Attribute	(optional) This is the attribute in a user record that contains the user's email address. If the attribute is not specified, the account name and domain name are concatenated to form an email address.
Search User Subtree	Select this check box to search the specified directory by the user base and all directories below. If this check box is not selected, the search is limited to the specified directory only.
<i>Groups Options section</i> <p><b>Note:</b> If you do not need group information at this time, do not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both user tests are successful.</p>	
Enable Groups	Select this checkbox to enable groups.

Field Name	Description
Group Base	(optional) This string is prepended to the <code>basedn</code> to construct the directory DN containing group records.
Group Member Filter	(optional) This LDAP query is performed in the groups directory context to identify groups containing a specific user. Two common forms of group records in LDAP directories are: <code>POSIX</code> style groups where members are identified by account name, and <code>groupOfNames</code> or <code>uniqueGroupOfNames</code> records where members are identified by the full user DN. ElectricFlow supports both forms, so the query is passed with two parameters: "{0}" is replaced with the full user record DN, and "{1}" is replaced with the user's account name.
Group Member Attributes	(optional) This is a comma-separated attribute name list identifying a group member. Most LDAP configurations only specify a single value, but if you have a mixture of <code>POSIX</code> and LDAP style groups in the directory, multiple attributes might be required.
Group Search Filter	(optional) This LDAP query is performed in the context of the groups directory to enumerate group records.
Unique Group Name Attribute	(optional) This is the group record attribute containing the group name.
Common Group Name Attribute	The Unique Group Name Attribute may not be searchable if using <code>distinguishedName</code> . In this case, the Common Group Name Attribute is used if searching for groups, depending on the filter.

After filling-in all fields, click the **Test** button.

Three tests validate the information you supplied:

- user authentication
- user identified in LDAP
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest.

Click **Save** after successful test results.

New, defined directory providers will appear in the table on the Directory Provider web page.

#### Examples for directory provider field descriptions

The following table provides examples for filling in the fields described above:

Field Name	LDAP example	ActiveDirectory example
Provider Type	LDAP	ActiveDirectory



Field Name	LDAP example	ActiveDirectory example
Domain Name	N/A	my-company.com

Field Name	LDAP example	ActiveDirectory example
Realm	my-company.com	N/A

Field Name	LDAP example	ActiveDirectory example
URL	ldap://dir.company.com/dc=company,dc=com	ldaps://server/dc=company,dc=com

Field Name	LDAP example	ActiveDirectory example
Query User Name	uid=JohnDoe,ou=People,dc=company,dc=com	cn=myuser,cn=Users,dc=company,dc=com

Field Name	LDAP example	ActiveDirectory example
Query User Password	mypw	mypw

Field Name	LDAP example	ActiveDirectory example
User Base	ou=People	cn=Users

Field Name	LDAP example	ActiveDirectory example
User Search Filter	uid={0}	(&( (userPrincipalName={0}) (sAMAccountName={0})) (objectClass=user))
User Name Attribute	uid	userPrincipalName
Full User Name Attribute	gecos	name
User Email Attribute	mail	mail
Group Base	ou=Group	cn=Groups
Group Member Filter	( (member={0})(memberUid={1}))	member={0}
Group Member Attribute	member,memberUid	member
Group Search Filter	( (objectClass=groupOfNames) (objectClass=posixGroup))	(objectClass=group)
Unique Group Name Attribute	distinguishedName	distinguishedName
Common Group Name Attribute	cn	cn

### To edit an existing directory provider

You may change any previously supplied information in the fields.

After editing any fields, click the **Test** button.

The same three tests validate the information you supplied:

- user authentication
- user identified in the directory provider
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest.

Click **Save** after successful test results.

Edited, redefined directory providers will appear in the table on the Directory Provider web page.

## Test Directory Provider

You must enter a valid User Name and Password on this page. Omitting or using an incorrect User Name and/or Password results in the test not completing or completing with an error. In either case, you will not obtain successful test results even if the Directory Provider information you supplied is valid and correctly entered into ElectricFlow.

Three tests validate the information you supplied:

- user authentication
- user identified in a directory provider
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest by clicking the **Test** button.

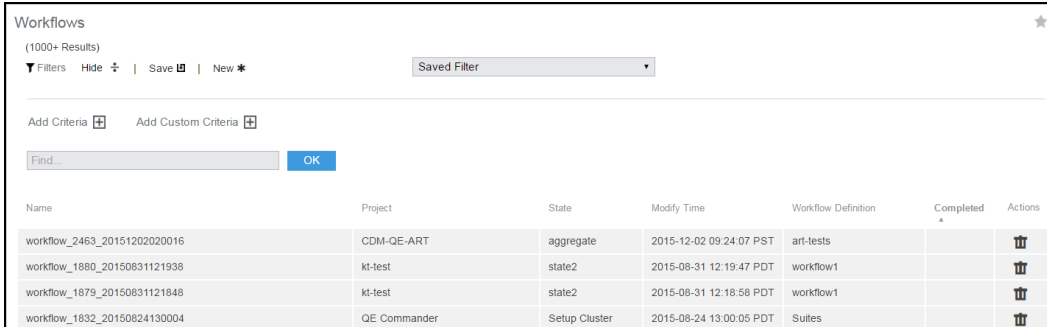
If you do not need group information at this time, and did not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both user tests are successful.

## Workflows

This page displays all workflows in the ElectricFlow system, both running and completed workflows.

You can search for workflows and save the workflow search filters for later use. See [Context Searching and Filtering on page 843](#) for details on using the search capabilities on this page.





Workflows  
(1000+ Results)

Filters Hide | Save | New \* Saved Filter

Add Criteria Add Custom Criteria

Find OK

Name	Project	State	Modify Time	Workflow Definition	Completed	Actions
workflow_2463_20151202020016	CDM-QE-ART	aggregate	2015-12-02 09:24:07 PST	art-tests		
workflow_1880_20150831121938	kt-test	state2	2015-08-31 12:19:47 PDT	workflow1		
workflow_1879_20150831121848	kt-test	state2	2015-08-31 12:18:58 PDT	workflow1		
workflow_1832_20150824130004	QE Commander	Setup Cluster	2015-08-24 13:00:05 PDT	Suites		

### Links and actions at the top of the table

- Sort the Name, Project, State, Modify Time, Workflow Definition, and Completed columns by clicking on the column name.  
After sorting a column, the page changes to a Workflow Search Results page and more search options are available.
- The "star" icon allows you to save this web page to your Home page.

### Column descriptions

**Name**—This is the ElectricFlow-generated workflow name, which is defined by the Workflow Name Template setting. Click on any workflow name to go to that workflow's Workflow Details page.

**Project**—The name of the project containing this workflow. Click on any project name to go to the Project Details page for that project.

**State**—The current state of the workflow.

**Modify Time**—The time this workflow was modified.

**Workflow Definition**—The name of the workflow definition that ran to create this workflow. Click on any workflow definition name to go to that workflow definition's Workflow Definition Details page.

**Completed**—A "checkmark" in this column indicates the workflow has completed.

**Actions**—**Delete**—Use this link to delete the workflow on the same row.

## Workflow Definition—create new or edit existing workflow definition

### To create a new workflow definition

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique workflow definition name of your choice. You may want your workflow definition name to reflect the project where it belongs or its purpose. For example, you might set a name based on a product or team using this workflow.

Field Name	Description
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Workflow Name Template	<p>This is the template used to determine the default name of jobs launched from the workflow definition.</p> <p>For example:</p> <pre> \$[projectName]_\${[/increment /myproject/workflowCounter]}_ \$[/timestamp] </pre> <p>(substitute your values for the names above)</p> <p>Produces a workflow name like:</p> <pre>projectFoo_123_20140102130321</pre> <p>Enter any combination of elements to create workflow names more meaningful to you. For example, you could choose to include the build number.</p> <p><b>Note:</b> Electric Cloud does not recommend using the ElectricFlow-generated <code>workflowId</code> because it is no longer a human-readable integer so it does not provide any identifiable information and cannot be used as a counter.</p>

Click **OK** to save the information you entered.

Your new workflow definition will appear on the Project Details > Workflow Definitions page.

#### To edit an existing workflow definition

1. To rename the workflow definition, type a new name in the **Name** field and click **OK**.
2. Change or add to the description or modify the template.
3. Click **OK** when your edits are complete.

## Workflow Definition Details

This Help topic provides a detailed overview for all views and functionality on this web page. You may want to read this topic in its entirety if this is your first experience with the ElectricFlow Workflow feature. If you are an experienced workflow user, the following quick links will take you to a specific topic section for quick review.

**A note to existing workflow users:** We recommend reviewing the Graph view section because workflow functionality previously found on other ElectricFlow web pages is now combined for ease-of-use on the Graph page.

[Graph view](#)

[To create a New State](#)

[To create a State Definition](#)

[Action](#)

[Notifiers](#)

[Parameters](#)

[Properties](#)

[To create a Transition Definition](#)

[Using the graph's quick-access features](#)

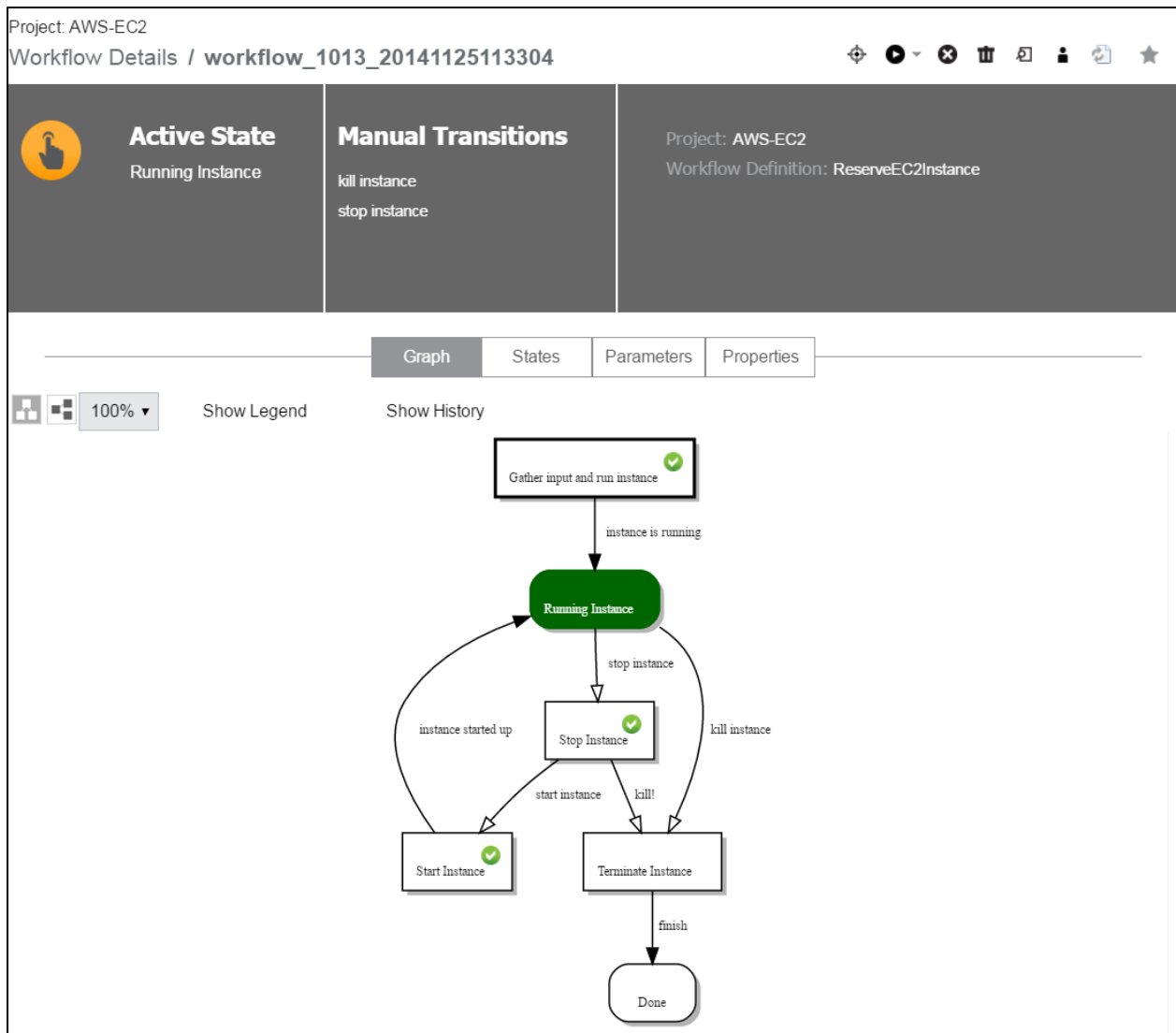
[Show Legend](#)

[List view](#)


[Properties view](#)


This page displays workflow definition components, including state and transition definition names, types, actions, descriptions, and various links to create additional transitions and state definitions, define access control, run the workflow, and so on. You can view any previously defined workflow objects and create new properties too.

When you open the Graph view, your first glance at this page will look similar to the following:



Links and actions at the top of the page:

- Above the Workflow Definition Details page title you see (in this example) "Project: Upgrade-End to End". This breadcrumb information tells you which project you are viewing or working with and provides a link back to the project, itself.
- Immediately after the page title, you see "workflow\_9", which (for our example) is the name of this workflow.
- Track Changes (  )—Click this to open the Change History page.

- Run (  )— Use this link to run the workflow definition. Hover your mouse over the drop-down arrow to

see these choices:

- Selecting **Run...**—allows you to pick the "starting state" to run the workflow. After clicking **OK** from the Run Workflow pop-up dialog box, the Run Workflow page is displayed. If you previously created parameters for this workflow, they are displayed. You can accept the parameter values or change them before running the workflow.
- Selecting **Run Immediately**—this option uses the first (default) "starting state" to run the workflow.  
**Note:** Clicking Run, without using the down-arrow to make a selection, is the same as selecting Run Immediately.
- **Access Control**—Use this link to set privileges for this workflow definition. ***For more information,*** see the Access Control Help topic.
- The "star" icon allows you to save this workflow definition to your Home page.

### *Navigation and view summary*

Each button has its own expanded description section following this summary.

- **Graph**—the page opens in this view. The main portion of this view contains the work area for visually creating your workflow.
- **List**—this view provides a table displaying states, transitions, and so on in list form.
- **Properties**—this view provides a table displaying previously created properties and provides links to create additional properties.
- **Show Legend**—displays a legend for workflow objects.
- **Create State**—this button produces the State Definition panel where you can create new states as you build or modify your workflow.
- The multi-square directional icons allow you to change your workflow graph from vertical to horizontal, depending on how you choose to see the graph.
- The drop-down menu for percentages allows you to diminish or expand the workflow graph size.

### **Graph view**

To create a workflow, minimally you need to create state definitions and transition definitions. Optimally, those objects will have parameters and properties, and you will want to create or enforce access control and perhaps create one or more email notifiers too. To begin, the following sections describing functionality in this view will familiarize you with how to create workflow objects and end with exploring the graph's quick-access features.

Click the **Create State** button to create a new state using the State Definition panel.

In the following screen example, you see a New State object added next to the Start state in an existing workflow graph.

Project: AWS-EC2

Workflow Definition Details / ReserveEC2Instance

Graph

List

Properties

100%

Show Legend

Create State

Gather input and run instance

instance is running

Running Instance

stop instance

Stop Instance

instance started up

Start Instance

start instance

kill!

kill instance

Terminate Instance

finish

Done

New State

State Definition

Name: New State

Description:

Startable: ☐

OK

Cancel

You can use the DSL Export ( ) button to download the objects as a DSL file.

To create a new state

After clicking the Create State button, enter information in the State Definition panel as follows:

Field Name	Description
Name	(Required) Provide any name of your choice. The name must be unique to this workflow definition. If you do not provide a name, a system-generated name is created: New State, New State 2, and so on.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code> .

881

Field Name	Description
Startable	Select this checkbox if you want this state to be your workflow "starting" state. The first state in any workflow definition is saved as <i>Startable</i> , but you can change this later.

Click **OK** and the State Definition panel provides options to configure your new State Definition.

### To configure the new state definition

Project CDM-QE-ART  
Workflow Definition Details / art-tests

Graph List Properties

100% Show Legend Create State

Document Changes

State Definition

Document Changes Access Control Edit View in list Create Transition

Document changes to the workflow definition details

Action Notifiers Parameters Properties Credentials

☒ No action ☐ Procedure ☐ Workflow

No action

OK Cancel

In the State Definition Panel, the state name appears at the top. In this example in this topic, "New State" is the state name.

Configure the following settings.

### Links at the top of the panel

- **Access Control**—use this link to add or modify access control privileges for this state (link not illustrated in the State Definition panel example above).
- **Edit**—use this link to modify this state's name, description, or whether or not the state is *Startable*.
- **View in list**—displays the List view to see the state definition in the Workflow Definition Details table. This state will be highlighted in the List view.
- **Create Transition**—displays the Transition Definition panel to create a transition for this state.

## The "tabbed" or button sections

### Action

As each state in a workflow becomes active, it performs an *action*. The state's action can be to create a job from a procedure or to start a workflow from a workflow definition. When the job or called workflow completes, On Completion transitions are evaluated to see if the workflow should change to a different state, possibly based on the outcome of the action.

Selecting *No action*, *Procedure*, or *Workflow* changes the fields that appear under these choices.

- No action—if selected, no other information is required. Click **OK**.
- Procedure—this selection displays the following fields:
  - Current—this selection refers to the project that contains the workflow definition.
  - Project—if selected to call a different project, start typing in the text box to display a list of (non-plugin) projects from which to select. Only the first 10 matches are displayed. Type more characters to refine the list.
  - Plugin—if selected, start typing in the text box to display a list of plugin projects from which to choose. Only the first 10 matches are displayed. Type more characters to refine the list.
  - Procedure—start typing in this field to see a list of available procedures from which to select, depending on your previous choice of Current, Project, or Plugin. Only the first 10 matches are displayed. Type more characters to refine the list.
- Workflow—this selection displays the following fields:
  - Similar to selecting Procedure (above), select Current, Project, or Plugin.
  - Workflow—if selected to call another workflow definition, start typing in this text box to display a list of workflow definitions from which to choose. Only the first 10 matches are displayed. Type more characters to refine the list.
  - Starting State—start typing in this field to see a list of available starting states definitions in the workflow definition you selected. Only the first 10 matches are displayed. Type more characters to refine the list.

After selecting the procedure or starting state, press the <Tab> key to leave the field and see a list of parameters for the selected action. After entering any procedure values, click **OK** to save the changes.

### Notifiers

Select this tab to see a list of email notifiers previously created for this state definition or to create an email notifier. Notifiers are commonly used to inform interested parties about transitions to the state being defined.

**Note:** Before you can set up an email notifier, you need an email configuration. If you have not already defined an email configuration, you can do it now. Go to Administration > Email Configurations and select the **Add Configuration** link.

The Notifiers table contains a list of all previous created notifiers for this state definition.



### Column descriptions

Column Name	Description / Actions
Name	The name of the email notifier. Select a name to go to the "edit" page for that notifier if you need to make changes.
Type	The type of email notifier specified during creation.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Actions	<b>Delete</b> —Use this link to delete the notifier on that row.

State Definition

Document Changes

Access Control Edit View in list Create Transition

Document changes to the workflow definition details

Action

Notifiers

Parameters

Properties

Credentials

Currently, there are no records to display in this list.

Create Notifier

**To create an email notifier**, click the **Create Notifier** link to access the Email Notifier panel.

Email Notifier

Name:

New Email Notifier

Required

Description:

Type:

On Enter

Condition:

Always

Template:

Default notification

Subject: ElectricFlow notification

Message body goes here.

Required

Email Config:

Destination:

Required

OK

Cancel

Enter information in the fields as follows:

Field Name	Description
Name	(Required) This name can be any text string you choose. The name must be unique among other notifier names in this project, on procedures or workflow definitions called from other projects.

Field Name	Description
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Type	<p>Use the pull-down menu to choose a type:</p> <ul style="list-style-type: none"> <li>• On Completion Notifier—sends an email after the state's job or workflow completes. If no job or workflow is defined for that state, these notifiers will not be sent.</li> <li>• On Enter Notifier—sends an email when the state becomes the workflow's active state.</li> <li>• On Start Notifier—sends an email after the state's job or workflow starts. If no job or workflow is defined for that state, these notifiers will not be sent.</li> </ul>
Condition	Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty or non-zero, the message is sent. If the result is "0", the message is not sent.
Template	<p>Use the pull-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different.</p> <p>(Required) To customize your template, edit the auto-supplied text in the text box or you can add a completely new script for your purpose. Any edits made in this text box will not be saved to the global template.</p> <p>To create a custom template, the basic structure is:</p> <ul style="list-style-type: none"> <li>• zero or more email header lines</li> <li>• blank line</li> <li>• message body</li> </ul>
Email Configuration	Click inside this field or start typing to bring up a list of possible email configuration names. An email notifier that does not specify an email configuration will use the configuration named 'default' if it exists.

Field Name	Description
Destinations	(Required) This is a space-separated list of valid email addresses, email aliases, or ElectricFlow user or group names, or a property reference that expands into such a list, or you can enter an LDAP DL name (group name).

Click **OK** to save your email notifier configuration. The next time you view the Notifier table, you will see this notifier in the list.

### Parameters

Similar to Notifiers, a parameter table is displayed containing all formal parameters defined for this state definition. Parameters are presented when launching the workflow definition (if it is startable), or when taking a manual transition to the state. A transition may enter values for some or all of the formal parameters defined by the state definition, in which case only the unmapped parameters are presented to the user.

- **Create Parameter**—Use this link to go to the New Parameter page to create a parameter for this state definition.

If you need assistance with creating a parameter, click the **Help** link in the upper-right corner of the New Parameter page.

### Properties

Similar to the Notifiers and Parameters table, a properties table is displayed containing available properties for this state definition. If no properties were defined for this state definition, the table does not exist.

Click one of the available links to create one or more properties that will be displayed in the table when created:

- **Create Property**—Click this link to go to the New Property pop-up box to create a new property for this state definition.
- **Create Nested Sheet**—Click this link to go the New Nested Property Sheet pop-up box to create a nested property.
- **Access Control**—Click this link to go to the Access Control page for the property sheet.

The property pop-up boxes contain a Help link if you need assistance creating a property.

### To create a transition definition

On the State Definitions panel, click the **Create Transition** link to see the Transition Definition panel:

### Transition Definition ✕

Name:

Description:

Target State:

Trigger:

Enter information in the fields as follows:

Field Name	Description
Name	(Required) Enter a unique name for the transition definition. It can be any name you choose, but the name must be unique within the state definition. If you do not provide a name, a system-generated name is created: <i>New Transition</i> , <i>New Transition 2</i> , and so on.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Target State	This field displays the "best guess" for the target state. If not correct, or you intended to create a transition for a different state, use the down-arrow to choose an available target state from the list.

Field Name	Description
Trigger	<p>Use the drop-down menu to choose the transition type.</p> <p>The four types of transitions are:</p> <ul style="list-style-type: none"> <li>• On Completion—transition occurs when the action completes. These transitions are ignored if no action is specified for the source state. <b>Note:</b> On Completion transitions are taken only if the state is still active when the action completes, and are ignored if the workflow has transitioned to another state—this can occur if an On Start or Manual transition occurred before the action completed.</li> <li>• On Enter—transition occurs before sending notifiers or starting the action.</li> <li>• On Start—transition occurs immediately after starting the action. These transitions are ignored if no action is specified for the source state.</li> <li>• Manual—transition occurs when a user selects the transition in the UI and specifies parameters. The same action can occur using ectool or the Perl API by calling <code>transitionWorkflow</code>. Only users who have "execute" permission on the transition are allowed to use a Manual transition.</li> </ul>
Condition	<p>Use the drop-down menu to choose a condition. After selection, the text box is populated with a sample JavaScript string to edit for your purposes.</p> <p><b>Note:</b> If you select Custom, no sample is provided. Enter a script in the text box. We recommend using JavaScript.</p>

Click **OK** to save your transition definition.

Notice the new links and options available now:

- **Access Control**—Use this link to add or modify access control privileges to this transition definition.
- **Edit**—Use this link to modify the transition definition.
- **View in list**—Use this link to see the new transition definition in the List view (table) on the Workflow Definition Details page. You can use the List view to move the transition to a different position within the state definition.
- **Parameters**—If parameters were defined on the State Definition Details page, you will not see them here. If parameters are defined on this page, you need to enter values. Manual transitions allow you to defer parameter assignment until transition time.
- **Properties**—Displays properties available for this object or you can create one or more properties at this time.

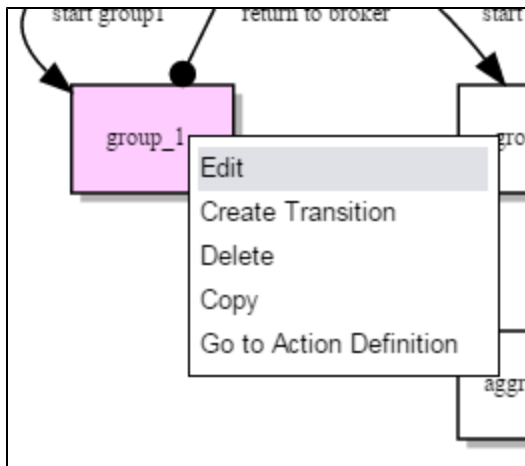
### Using the graph's "quick-access" features

The following screen example is a portion of a workflow graph.

In the graph, states and transitions are links:

- Click on a state to open the State Definition panel to modify that state.
- Click on a transition to open the Transition Definition panel to modify that transition.  
(Hover your mouse over a transition or transition name and click when it changes color.)

However, if you **right-click** on a state or transition, a context-sensitive menu with other options is available. In the following example, right-clicking on the "group\_1" state provided the quick-link pop-up menu.



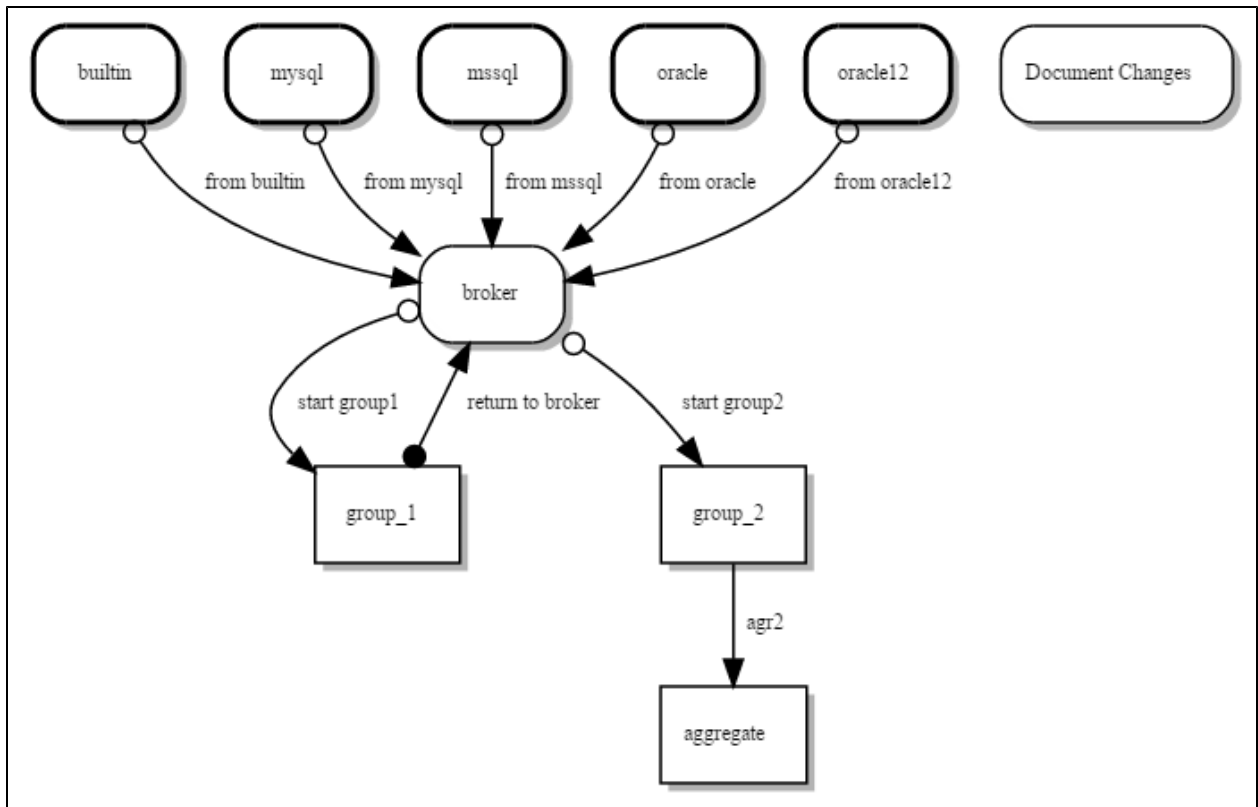
Available pop-up links include:

- For states calling a procedure or another workflow, menu choices can be:
  - Edit—opens the State Definition panel to make modifications. This is the same as selecting the Edit link on the State Definition panel.
  - Create Transition—opens the Transition Definition panel.
  - Delete—deletes the state.
  - Copy—makes a copy of the state with all associated transitions preserved.
  - Go to Action Definition—for states calling a procedure, the Procedure Details page is opened. For states calling a workflow, the Workflow Definition Details page for the "subworkflow" is opened.
- For states with "No action", the choices are the same, except the "Go to Action Definition" option is not available.
- For transitions, menu options include: Rename, Delete, and Copy.
- Right-clicking anywhere on the graph canvas provides two more choices:
  - Create State—allows you to quickly create a new state. This is the same as clicking the Create State button at the top of the graph.
  - Rotate Graph—acts as a "toggle", rotating the graph from a vertical to horizontal view and back again.

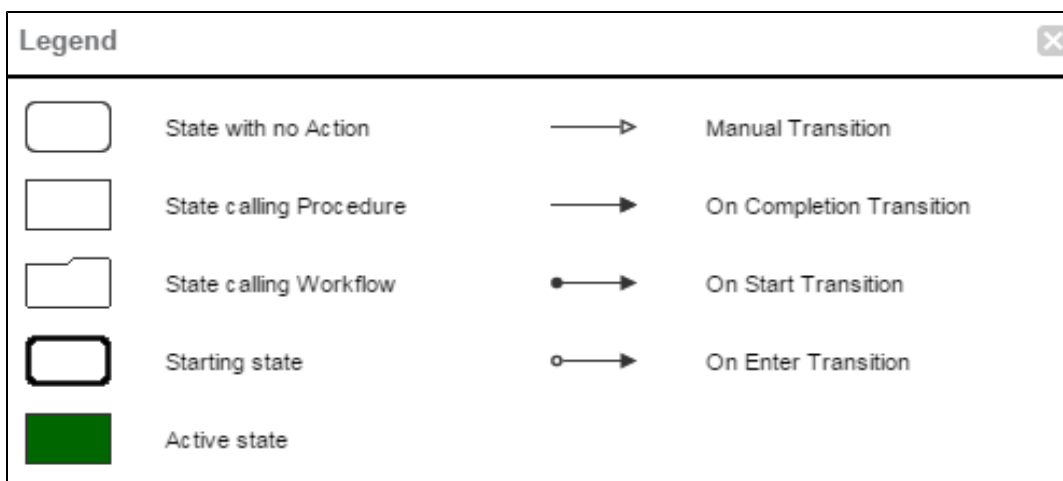
## Show Legend

The following screen is another example of a workflow graph. Depending on your workflow, your graph could be very simple or much more complex than the example below.

Notice the transition line-endings and different shapes used for states.



The legend is available for reference anytime to help you become familiar with state shapes and line-ending definitions.





## List view

This view will be empty until you build a workflow in the Graph view. You can view this page at any time to see a list of states and transitions in your workflow definition.

The following screen is an example of a populated Workflow Definition Details page. A **Create State Definition** link is available above the Action column, which has the same function as clicking the Create State button in the Graph view.

Project: CDM-QE-ART  
Workflow Definition Details / **art-tests**

Graph
List
Properties

Create State Definition

Name	Type	Action	Startable	Description	Actions
builtin	No action		✓		
from builtin	On Enter	Target: broker			
group_1	Subjob	CDM-QE-ART : main2-db-3comm-workflow			
return to broker	On Start	Target: broker			
group_2	Subjob	CDM-QE-ART : main2-db-3comm-workflow			
agr2	On Completion	Target: aggregate			
aggregate	Subjob	CDM-QE-ART : aggregate_workflow			
broker	No action				
start group2	On Enter	Target: group_2			
start group1	On Enter	Target: group_1			
mysql	No action		✓		
from mysql	On Enter	Target: broker			
mssql	No action		✓		
from mssql	On Enter	Target: broker			
oracle	No action		✓		
from oracle	On Enter	Target: broker			
oracle12	No action		✓		
from oracle12	On Enter	Target: broker			
Document Changes	No action			Document changes to the workflow definition details	

Column Name	Description / Actions
Name	<p>This column displays state definition and transition definition names currently defined for this workflow definition.</p> <ul style="list-style-type: none"> <li>• Transition definition names are indented under a state definition name.</li> <li>• Clicking a state definition name displays the State Definition panel (in the Graph view) for that state to see how it was defined or to make modifications.</li> <li>• Clicking a transition definition name displays the Transition Definition panel (in the Graph view) for that transition to see how it was defined or to make modifications.</li> </ul>
Type	<p>This is the type of action or trigger currently assigned to the state definition or transition definition.</p> <ul style="list-style-type: none"> <li>• For states—the type may show calling a subjob, subworkflow, or no action.</li> <li>• For transitions—the trigger type is provided.</li> </ul>
Action	<p>This is the action previously defined for the state or transition.</p> <ul style="list-style-type: none"> <li>• For states—(where the Type is "subjob") the format for actions is <code>&lt;projectName&gt;:&lt;procedureName&gt;</code>. Clicking the first link displays the Project Details page for the workflow project. Clicking the second link displays the Procedure Details page for the procedure used by that state.</li> <li>• For states—(where the Type is subworkflow) the format for actions is <code>&lt;projectName&gt;:&lt;workflowName&gt;</code>. Clicking the first link displays the Project Details page for the workflow project. Clicking the second link displays the Workflow Definition Details page for the workflow used by that state.</li> <li>• For transitions—clicking the Target action displays the State Definitions panel in the Graph view.</li> </ul>
Startable	<p>A "checkmark" in this column shows this state was defined as startable, which means this state is the beginning point for your workflow.</p>
Description	<p>A plain text or HTML description for this object.</p>

Column Name	Description / Actions
Actions	<p>You can perform some or all of these actions:</p> <p><b>Create Transition</b>—Click this link to go to the Transition Definition panel to create a new transition definition for this state.</p> <p><b>Access Control</b>—Click this link to go to the Access Control page to define access privileges for this transition definition.</p> <p><b>Copy</b>—Use this link to make a copy of either the state definition or the transition definition. <b>Note:</b> Copying a state also copies its transitions, however, you must have modify privileges on the workflow project to make a copy.</p> <p><b>Move</b>—Use this link to move a state to another position in the workflow. You will be prompted to choose a state name to move this state to a location <b>before</b> that state. If moving a transition, note that transition can be moved only to another location for the same state—transitions cannot be moved from one state to another state.</p> <p><b>Delete</b>—Use this link to delete the state definition or transition definition on the same row.</p>

## Properties view

Select the Properties view button to see the Properties table. If no properties were defined for this workflow definition, no table appears.

The following screen is an example of the Properties table.

Project CDM-QE-ART

Workflow Definition Details / art-tests

The following links and actions are available in the Properties table:

- Links and actions at the top of the table
  - **Create Property**—Click this link to go to the New Property pop-up box to create a new property for this workflow definition.
  - **Create Nested Sheet**—Click this link to go the New Nested Property Sheet popup to create a nested property.
  - **Access Control**—Click this link to change access control privileges on the property sheet.
- Column descriptions

Column Name	Description / Actions
Property Name	Select a property name to edit that property. You can change its name, value, or add/change its description. If the property name is preceded by a folder icon, this is a property sheet. Click on the property name to open the "folder".
Value	The value currently assigned to the property.
Description	A plain text or HTML description for this object.
Actions	<b>Delete</b> —Click this link to delete the property on that row.

## Run Workflow

Use this page to run a workflow.

- The "star" icon allows you to save this job information to your Home page.
- The "bread crumbs" Project: Upgrade-End to End / Workflow: Upgrade-Linux provide links to a previous web page.
- The name after the Run Workflow page title is the name of the workflow you intend to run.

Project: Upgrade-EndToEnd / Workflow Definition: Upgrade-Linux  
 Run Workflow / Upgrade-Linux ★

Starting State: Upgrade-EndToEnd  
 Parameters: build\_name:

**Starting State**—This is the name of the current starting state for this workflow. If this workflow has multiple starting states and this is not the one you want to use, return to the Run Workflow pop-up dialog and select a different starting state.

**Parameters** -

- Any parameters previously specified for this starting start are displayed. If no parameters were defined, this area will be blank.
- If values are supplied, these are the default values specified when the parameter was created. If necessary, you can "type-over" these values to change them before running this workflow.
- You must enter a value for any blank value field labeled "Required".

Click **OK** to run the workflow when your selections are complete.

## Workflow Details

This page displays workflow details, including the workflow state, project name, workflow definition name, and any properties. The following links are provided for quick access to topic sections you may want to review again.

[Graph](#)

[Show Legend](#)

[Using the graph's "quick-access" features](#)

[Show History](#)

[States](#)

[State Details panel](#)

[Parameters](#)

[Properties](#)

The name after the Workflow Details page title is the name of the workflow created after running a Workflow Definition. The number at the end of the workflow name is the workflow definition ID number. The ID number is auto-generated by ElectricFlow. Your workflow name will be different, depending on the information you supplied in the workflow definition.

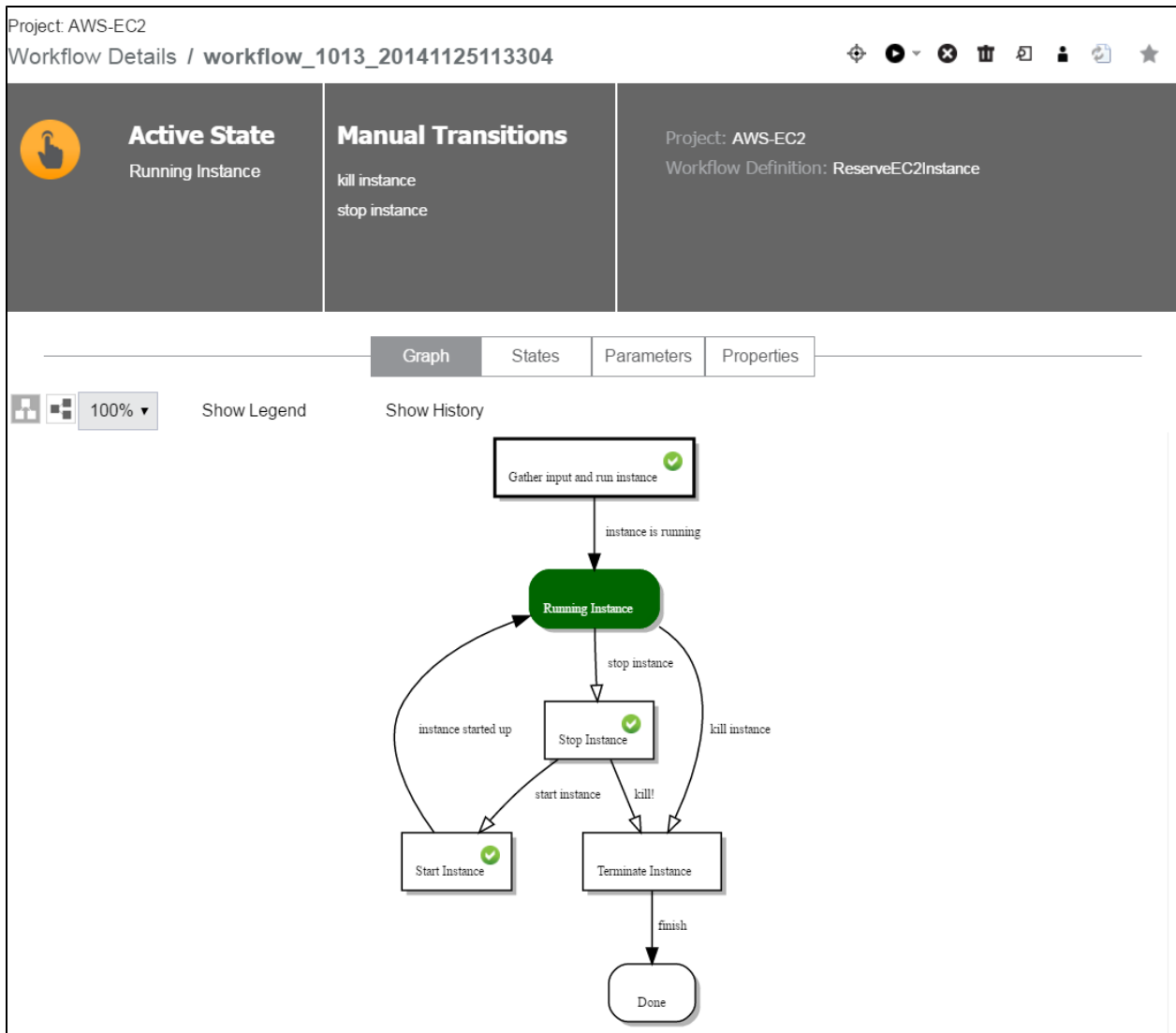
### *Links and actions at the top of the table*

Additional links are available if the workflow is running. When the workflow is complete, some links are no longer available.

- **Run Again**—Use this link to run the workflow definition again.  
When you select the **Run Again** button, you are requesting to re-run the workflow definition with the same parameter values as the original invocation.  
If you want to change the parameter values, you can select "**Run...**" from the dropdown menu (small down-arrow) next to the Run Again button.
- **Stop Workflow**—Select this option to stop the workflow. Any unfinished processes will complete, but no new transitions will occur.
- **Delete**—Deletes this workflow.
- **View Log**—Use this link to view the log created by this workflow.

- **Access Control**—Use this link to set privileges for this workflow. For more information, see the [Access Control](#) Help topic.
- **Stop Refresh**—This link is available only if a workflow is currently running. Click this link if you do not want the page to refresh the page automatically while the workflow is running.
- The "star" icon allows you to save this workflow information to your Home page.

While the workflow is running, your Workflow Details page will be similar to the following example:



#### Summary section—at the top of a running workflow page

- Next to the icon, notice that the state name, "Approval needed", is a link. Click this link to open the State Details panel for this state.

- The **Manual Transitions** section allows you select a manual transition if any were defined. However, if the manual transition contains any parameters whose values were not supplied at definition time, selecting that transition takes you to the Transition Workflow page to enter values.
- The **General Information** section provides links from the Project name to the corresponding Project Details page and from the Workflow Definition name to its corresponding Workflow Definition Details page.

## Links

This page can include a Links section also, which will appear on the far right-side of the Summary section.

To add a link to this section:

- **Create a link to any file:**

To add a link, run a command in any job's job step using this format (this works for both local [disconnected] and non-local workspaces):

```
ectool setProperty "/myJobStep/report-urls/<myReportName>"  
"/commander/jobSteps/<jobStepId>/<artifactDirectoryName>/<file-path>"
```

Example command:

```
ectool setProperty "/myJobStep/report-urls/Test Report" "/commander/jobSteps/  
$/myJobStep/jobStepId]/testreport/index.html"
```

**Note:** If you are using this format (from ElectricCommander 4.2 and earlier):

```
ectool setProperty "/myJob/report-urls/<myReportName>" "/commander/jobs/<jobId>/  
<workspaceName>/<artifactDirectoryName>]/<file-path>"
```

Example command:

```
ectool setProperty "/myJob/report-urls/Test Report" "/commander/jobs/$[myJob/jo  
bId]/  
$/myJobStep/workspaceName]/testreport/index.html"
```

It will continue to work only for non-local workspaces. We recommend, however, that you change the command to use the newer format.

- **Create a link to any directory:**

To add a link, run the following style command in any job's job step:

```
ectool setProperty "/myJobStep/report-urls/Main Job Workspace"  
"file:///WinStor2/scratch/chron55build/$[myJob/jobName]"
```

**Note:** Links to a directory automatically work in Internet Explorer, but if using Firefox, local links are disabled unless the default security policy is modified or an extension is used. Refer to [http://kb.mozillazine.org/Links\\_to\\_local\\_pages\\_don%27t\\_work](http://kb.mozillazine.org/Links_to_local_pages_don%27t_work) for more details.

## When the workflow is complete...

- When the workflow is complete, fewer links are available at the top of the table and the Manual Transitions section is no longer available.
- The "checkmark" icon indicates the workflow is complete. Click the state shown under Final State ("Success" in our example), to open that state's State Details panel.

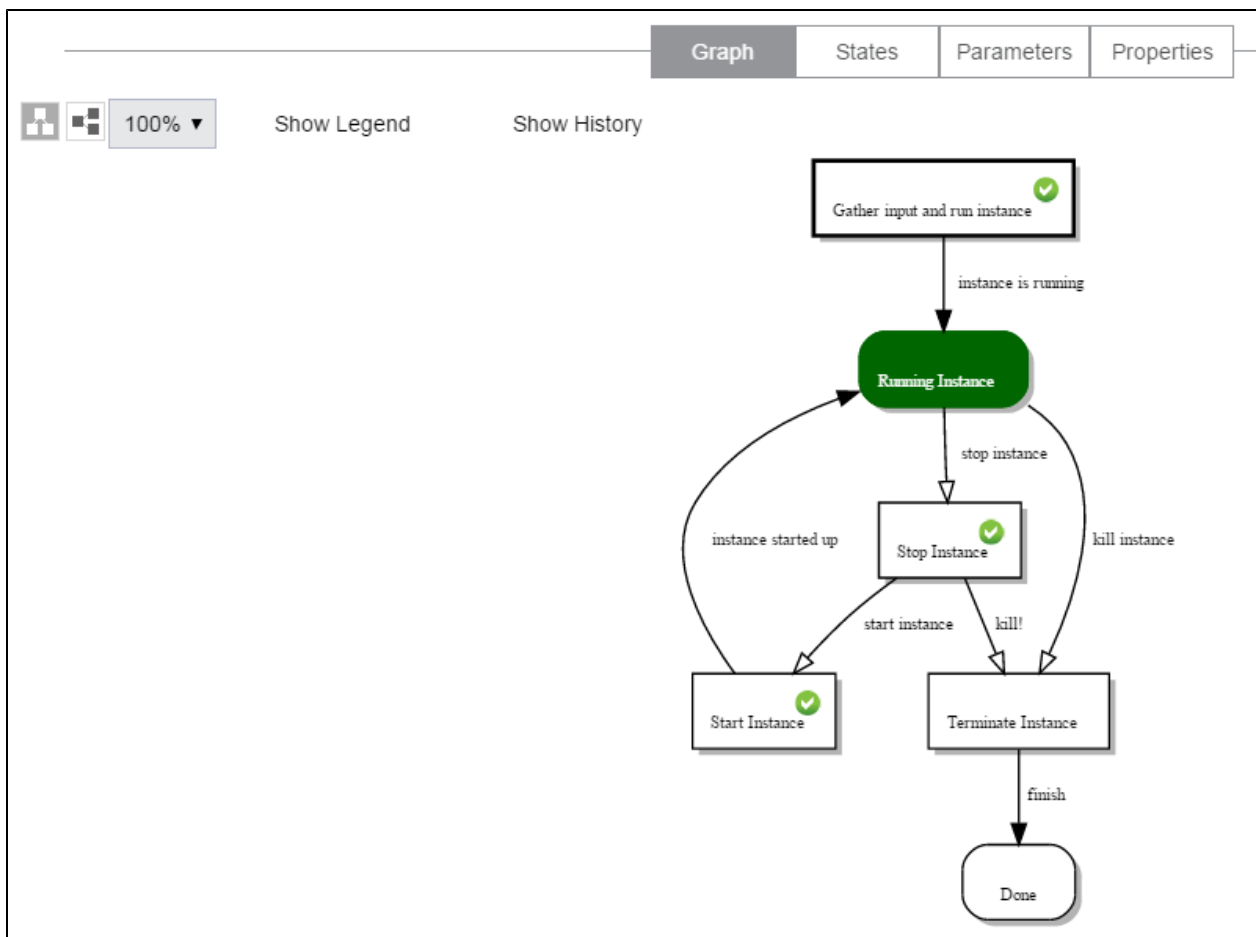
- The **General Information** section is the same as when the workflow was running.

## Graph tab

The Graph tab displays your workflow in a visual format. This format is the default view. The following screen is an example of a workflow graph. Depending on your workflow, your graph could be very simple or much more complex than the example below.

**Note:** This graph updates in real-time, which means you will see the "active" state highlighted with a color. An icon on the state represents an action.

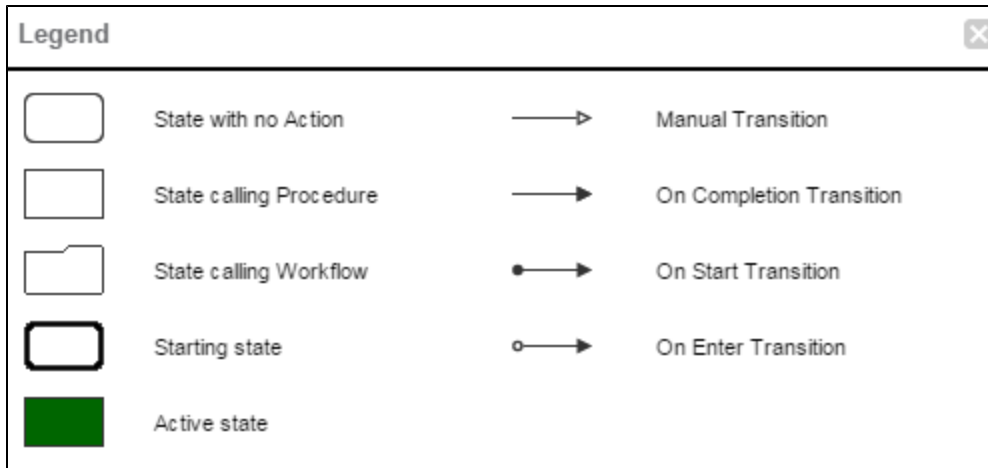
Use the icons below the Graph tab to rotate the graph for better use of your screen viewing area, and you can re-size the graph using the "%" drop-down menu to choose another size.



## Show Legend tab

The graph above illustrates all state and transition types. The state and transition names in this graph are labels for the type of state or transition represented. Use the Show Legend tab to see a quick reminder of state shape and transition line-ending definitions.





### Using the graph's "quick-access" features

The following screen example is a portion of a workflow graph.

#### *In the graph, states and transitions are links*

- Clicking on a state takes you to the State Details panel to that state's transitions, parameters, and properties.
- Clicking on a transition takes you to the Transition Details panel to see details specifically about that transition, including its condition information.  
(Hover your mouse over the transition or transition name and click when the color changes.)

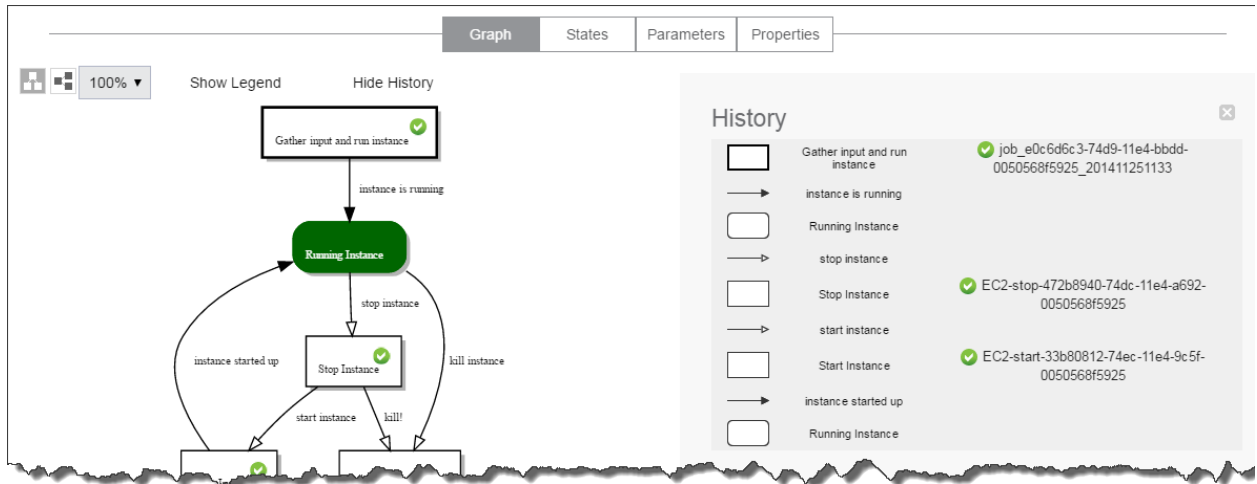
However, if you **right-click** on a state or transition, other link options are available. These options are different for a running or completed workflow versus the options on the Workflow Definition Details page that were available to you while you were defining your workflow.

#### *Available pop-up context-sensitive links include:*

- For states, depending on which actions were defined for the state, you may have one or more of the following options:
  - Go to Action—opens the Workflow Details or Job Details page for that state.
  - Go to Action Definition—for states calling a procedure, the Procedure Details page is opened. For states calling a workflow, the Workflow Definition Details page for the "subworkflow" is opened.
  - Go to State Definition—opens the State Definition panel for that state.
- For transitions, the only link available is: Go to Transition Definition, which opens the Transition Definition panel.

### Show History

Selecting Show History allows you to see at-a-glance how your workflow progressed through its states and transitions, or for example, how many times the same state was visited and depending on outcome, which transitions were taken and then the outcome of those target states.



Notice the links displayed in the History panel. You can select links for completed jobs or workflows, which display the Job Details or Workflow Details page, respectively.

## States tab

Selecting the States tab provides a table containing all state names and actions for this workflow.

Project: AWS-EC2  
Workflow Details / workflow\_1013\_20141125113304

**Active State**  
Running Instance

**Manual Transitions**  
kill instance  
stop instance

Project: AWS-EC2  
Workflow Definition: ReserveEC2Instance

Graph States Parameters Properties

State Name	Action
Gather input and run instance	job_e0c6d6c3-74d9-11e4-bbdd-0050568f5925_201411251133 [Show All]
Done	
Terminate Instance	
Stop Instance	EC2-stop-472b8940-74dc-11e4-a692-0050568f5925 [Show All]
Start Instance	EC2-start-33b80812-74ec-11e4-9c5f-0050568f5925 [Show All]
Running Instance	

### The following links are available in the States table

- State Name—Click any state name in this column to go to that state's State Details panel.
- Action—Actions are available in this column only if you are using a subjob or a subworkflow. If so, links in this column connect you to the Job Details or Workflow Details page for the subjob or subworkflow, respectively.
- [Show All] link—If the state executed multiple times during a workflow run, only the last subjob or subworkflow is displayed. However, clicking on Show All displays the results for all subjobs or subworkflows executed during a workflow run.

### State Details panel

This panel displays state components, including transitions, parameters, and properties.

- Use the **Access Control** link to set privileges for this state. *For more information*, see the [Access Control](#) Help topic.
- The state name, "Build" (in our example), is shown at the top of the panel.
- Job or Workflow status links to the job or workflow created by the action.
- The Transitions tab is open to display the transition table listing all transitions for this state.

### Column descriptions

Column Name	Description / Actions
Name	One or more names of transitions currently defined for this state. Click on a transition name to open the Transition Details panel.
Trigger	The type of trigger currently defined for this transition.
Target	The target state for this transition. Click on a target state name to open the State Details panel for that state.
Condition	This condition was specified when the transition was created. A condition specifies under which circumstances the transition is taken. You can edit this condition on the Transition Definition pane, but if you edit the condition during a running workflow, the change will not take effect until you run the workflow again.
Actions	<b>Access Control</b> —Use this link to set permissions on this transition.

State Details

Stop Instance

Access Control

No Description

✓

EC2-stop-472b8940-74dc-11e4-a692-0050568f5925

[Show All]

Transitions

Parameters

Properties

Name	Trigger	Target	Condition	Actions
start instance	manual	Start Instance		Access Control
kill!	manual	Terminate Instance		Access Control

### Parameters tab

The **Parameters** tab provides a table listing all defined parameters for this state. You will see any parameters passed to this state the last time this state was entered, but only if parameters were created on the State Definitions Details panel. This table does not allow you to edit the parameter's value.

These parameters are copied automatically to the top-level property sheet and you will see them in the properties table also.

State Details

Gather input and run instance

Access Control

No Description

job\_e0c6d6c3-74d9-11e4-bbdd-0050568f5925\_201411251133
 [\[Show All\]](#)

Transitions

Parameters

Properties

Name	Value
config	realMoneyAmazon
platformFromState	linux

### Column descriptions

Name—The name of the parameter defined for this state.

Value—The value currently defined for this parameter.

### Properties tab

Select the Properties tab to see the Properties table. If no properties were defined for this workflow definition, this table will be blank.

The **Properties tab** provides a table containing all defined properties for this state. If no properties were defined for this state definition, this table will be blank. All defined parameters are automatically copied to the top-level property sheet. Any custom properties defined for the state will be included in this table also.

State Details

Gather input and run instance

Access Control

No Description

✓ job\_e0c6d6c3-74d9-11e4-bbdd-0050568f5925\_201411251133

[Show All]

Transitions

Parameters

Properties

Create Property | Create Nested Sheet | Access Control

Property Name	Value	Description	Actions
config	realMoneyAmazon		
platformFromState	linux		

### Links at the top of the table

- **Create Property**—Click this link to go to the New Property pop-up box to create a new property for this state.
- **Create Nested Sheet**—Click this link to go the New Nested Property Sheet pop-up box to create a nested property sheet.
- **Access Control**—Click this link to add or decrease access control on the property sheet.

### Column descriptions

Column Name	Description / Actions
Property Name	Select a property name to edit that property. You can change its name, value, or add/change its description. If the property name is preceded by a folder icon, this is a property sheet. Click on the property name to open the "folder".
Value	The value currently assigned to the property.
Description	A plain text or HTML description for this object.
Actions	<b>Delete</b> —Click this link to delete the property on that row.

## Workflow Log

This page displays the workflow log.

Notice the name after the page title, "template-1257" — this is the name of the workflow, which includes the workflow name plus the ElectricFlow auto-generated ID number, and it is the object of the workflow log in our example.

### Links and actions above the table

- Drop-down menu—Use the down-arrow to select Error, Warn, or Info. The first time you choose a severity level, it will become your default level—the one you always see first when you view this page. Selecting another level changes your default view.
- The "star" icon allows you to save this workflow definition to your Home page.
- The "bread crumbs" *Project: SoftwareBuild / Workflow: template-1257* provide links to a previous web page.


Project: SoftwareBuild / Workflow: template-1257

#### Workflow Log – template-1257

INFO 

7 Results

Time	Severity	User	Subject	Message
2010-12-06 15:12:42 PST	INFO	admin	wip	User 'admin' has completed the workflow
2010-12-06 15:12:28 PST	ERROR	project: SoftwareBuild	wip	Failed to start the sub-job for state 'wip': Missing parameter(s) to 'wf_start_wip': plugin, version
2010-12-06 15:12:28 PST	INFO	project: SoftwareBuild	wip	Sending onEnter email notifiers for state 'wip'
2010-12-06 15:12:28 PST	INFO	admin	start_work	User 'admin' is taking manual transition 'start_work' from state 'stable' to state 'wip'.
2010-12-06 14:55:30 PST	INFO	project: SoftwareBuild	stable	Sending onEnter email notifiers for state 'stable'
2010-12-06 14:55:30 PST	INFO	project: SoftwareBuild	stable	Starting state: 'stable'
2010-12-06 14:55:30 PST	INFO	admin	workflow_53	Created workflow 'workflow_53'

Records per page:  1 thru 7 of 7 

### Column descriptions

**Time**—Displays the time when an event occurred that caused the server to generate a message.

**Severity**—the three severity levels are:

- **ERROR**—An unexpected failure was encountered while entering a state or launching a sub-action. Generally, this error indicates a critical problem with the workflow that requires fixing the workflow definition.
- **WARN**—A non-critical issue was encountered while the workflow was running.
- **INFO**—Provides workflow activity information including the state entered, transitions taken, and so on.

**User**—The name of the user or project principal that explicitly launched the job. This property is blank when the job is launched by a schedule.

**Subject**—Objects displayed in this column are the subject of the message. These objects are linked to either the Workflow Details or the State Details page.

**Message**—A text message generated by the ElectricFlow server while the workflow was running.

## Transition Workflow


Use this page to transition your workflow to a different startable state.

Note the name after the page title, "template-99"—this is the name of the workflow in our example.

### Links and actions above the table

- The "star" icon allows you to save the Transition Workflow page to your Home page.
- The "bread crumbs" *Project: SoftwareBuild / Workflow: template-99* provide links to a previous web pages.

Project: SoftwareBuild / Workflow: template-99

**Transition Workflow** – template-99 

Transition: start\_work

State: stable

Target State: wip

Parameters version:  Required

### Field descriptions

Enter information in the fields as follows:

Field Name	Description
Transition	The name of this transition.
State	The name of the state that owns the transition— the active state of the workflow.
Target State	The name of the target state— the state where the workflow will transition.
Parameters	In the screen example above, "version" is the name of the parameter and you must enter a value for this parameter. This is a required field.

Click **OK** to transition the workflow to the target state.

## Workspaces



This page displays all workspaces currently available to ElectricFlow. At a glance, you can see all paths to every workspace.

- To create a new workspace, click the **Create Workspace** link.
- To find a workspace, use the **New Search** link.

### Column descriptions

Column Name	Description / Actions
Workspace Name	The name created for this workspace. Click on a Workspace Name in this column to edit that workspace.
Zone	The name of the zone where this workspace resides.
Enabled	This workspace is enabled if this box is "checked". <b>Note:</b> When this box is checked, the workspace is enabled, which means it can be accessed. In the case where a job or job step cannot access the workspace, the job will "queue", waiting for the workspace to become available.
Local	If the box is "checked", the workspace is "local", which means files in the local workspace are accessible only from the resource that originally created the file.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code> .
Drive Path / UNC Path / UNIX Path	The path to the workspace.
Actions	<b>Copy</b> —Use this link to make an exact duplicate of an existing workspace, then select the copy to go to the Edit Workspace page to change the workspace name.  <b>Delete</b> —Use this link to delete the workspace on the same row.

**Note:** Add access control privileges to a workspace on the Edit Workspace page.

## Workspace—create new or modify existing workspace

### To create a new workspace

Enter information in the fields as follows:

Field Name	Description
Name	Enter a unique name to distinguish this workspace from other workspace names.
Description	A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code>
Enter three paths to use on resources to access the workspace root directory:	
UNC Path	A path in UNC notation (such as <code>//server/ec/a/b/c</code> ) to use on Windows machines. The path can use either slashes or backslashes for separators.
Drive Path	A second path for Windows machines, based on drive notation such as <code>N: /b/c</code> . If the drive path contains more than just a drive letter, additional directory names must match the trailing directories of the UNC path. For example, if the UNC path is <code>//server/ec/a/b/c</code> , then <code>N: /b/c</code> can be used as the drive path (agents automatically map <code>N:</code> to <code>//server/ec/a</code> ), but <code>N: /x/c</code> is not allowed.
UNIX Path	The path to use for UNIX machines, typically based on an NFS mount. You must ensure appropriate mounts were created on all machines where the path will be used. <i>ElectricFlow does NOT automatically mount filesystems for UNIX.</i>
<p><b>Note:</b> If the workspace will be used only on UNIX machines, you can omit the UNC and drive paths. Conversely, if the workspace will be used only on Windows machines, you can omit the UNIX path.</p> <p><b>For more information</b>, see the <a href="#">Workspaces and Disk Space Management</a> Help topic.</p>	
Zone	Use the drop-down arrow to select a zone for this workspace.
Local	Select this checkbox if the workspace is "local", which means files in the local workspace are accessible only from the resource that originally created the file.

Field Name	Description
Enabled	"Check" this box to enable this workspace. When this box is checked, the workspace is enabled, which means it can be accessed. In the case where a job or job step cannot access the workspace, the job will "queue", waiting for the workspace to become available.
Credential Project and Credential Name	If you need to enter a user name and password to mount the workspace, you must enter the credential project name and then choose the appropriate credential name, which contains the required user name and password. Click the <b>Browse</b> link to select information for these fields.

Click **OK** to save your workspace specification and see it listed on the Workspaces page.

If you need to add properties or privileges to this workspace:

Click **OK** to create the workspace and return to the Workspaces page, then click on the workspace name to go to the Edit Workspace page.

#### To edit an existing workspace

All previously supplied workspace information is available on this page and you can modify existing information or add new properties or privileges.

- Click the **Access Control** link [at the top of the page] to add access privileges to this workspace.
- To assign a new workspace name, highlight the existing name and type-in a new name.
- Re-assign paths if necessary.
- Use the drop-down menu to select a different zone if necessary.
- Add or modify the Credential Project name or the Credential Name if necessary.

Click **OK** to save your modified information.

If Custom Workspace Properties were already assigned, you may modify these properties or add new ones. If a property name is preceded by a "folder" icon, this denotes a Nested Sheet.

Click the "star" icon at the top of the page to add this page to your Shortcut section on the Home page.

**For more workspace information**, see the [Workspace and Disk Space Management](#) Help topic.

## Workspace File

This page displays a file from the workspace for a job, typically the log file for a job step. For log files, this file contains both standard output and standard error from the step.

If you view a file while the job step generating the file is still running, the page refreshes automatically as information is added to the file.

### *Tip*

If the log does not contain the output that you were expecting, check the job step commands. If the step redirects its output to a different location, this information will not appear in the log file.

## Automation Platform Objects and Functionality

All the topics in this section are about a particular object or functionality in the ElectricFlow platform. They are the same as the topics in the Help system on the automation platform UI.

From the automation platform UI, you can access the topics as follows:

- Direct access to these Help topics is from the Help system Table of Contents. Although these topics are not directly linked within the ElectricFlow product, many "page-specific Help topics contain links to one or more of these topics to provide more detailed information quickly.
- To access these Help topics while using ElectricFlow, click the **Help** link at the top-right corner on any automation platform web page.

## Access Control

[Privileges](#)

[Users and Groups](#)

[Special users and groups](#)

[Access Control Lists—allow and deny](#)

[Inheritance](#)

[System Objects](#)

[Access Control and Jobs](#)

[Examples for Increased Security](#)

## Overview

ElectricFlow provides a comprehensive mechanism to control how individuals use the system.

- Users must log in to view information or perform operations.
- After you log in, system access is limited based on:
  - username
  - the groups to which that user belongs
  - permissions specified for various ElectricFlow objects

Access Control is the ElectricFlow functionality that provides security for all system objects. **After** you are familiar with the following information describing the Access Control system, review the two examples, Basic

ACL Setup and Team ACL Setup (at the end of this Help topic), which may provide guidance or insight for how you might setup enhanced ElectricFlow security at your site.

## Privileges

ElectricFlow supports four privilege types for each object:

- **Read**—Allows object contents to be viewed.
- **Modify**—Allows object contents (but not its permissions) to be changed.
- **Execute**—If an object is a procedure or it contains procedures (for example, a project), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.
- **Change Permissions**—Allows object permissions to be modified.

## Users and Groups

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository:

- Both user and group information is retrieved from the repository
- Local users and groups can be defined within ElectricFlow

**Note:** To view user and group information, and to modify local user and group information, click the Administration tab and select either the Users or Groups subtab. External account information **cannot** be modified from ElectricFlow.

If the same user exists in multiple sources, only the highest priority name is used. A priority order is defined among external repositories, but local names have the highest priority. Thus, if you define a local user with the same name as an LDAP user, you will effectively mask the user in the LDAP account.

For local user accounts, only local groups are considered—group information from external repositories is not used. For accounts from a particular repository, groups from that repository are used along with local groups, but groups in other repositories are not considered.

In other words, you can define local groups in ElectricFlow to supplement groups defined in external repositories. When you view information about users in ElectricFlow, only relevant groups are shown. For example, when you view group information for a local user, only local groups are displayed.

**Note:** Groups are managed by name only, without regard to source. If a particular group name exists in different repositories, there is no way to distinguish between these groups inside ElectricFlow. Access given to one group is the same for any other group with the same name.

## Special Users and Groups

The **admin** local user has special significance. If you are logged in as "admin," you automatically have all privileges on all objects, regardless of any other system settings. This privilege set is a fallback mechanism in the event too many privileges get removed for an object, leaving it unusable.

The admin account cannot be deleted.

If the admin account is missing, ElectricFlow will recreate the account the next time it starts up with password "changeme."

The **Everyone** group is predefined by ElectricFlow and cannot be deleted. Every user is automatically a member of the Everyone group.

For each project, ElectricFlow uses the project name and automatically defines a user associated with that project, called the project principal. For example, the **project principal** for a project named "nightly builds" is "project: nightly builds" (notice that there are two spaces in this name)—this principal is used for jobs running under the project, as described in the "[Access control and jobs](#)" section later in this Help topic.

## Access Control Lists—allow and deny

Each ElectricFlow object, such as a project, procedure, job, property sheet, workspace, schedule, or resource contains an access control list (ACL). Individual properties do not have their own access control, but instead use access control lists from their parent containers.

To view the access control list for an object, go to the web page displaying the object and click the **Access Control** link. An access control list can contain any number of entries—each entry names a particular user or group and indicates *allow*, *deny*, or is blank for each of the four privileges.

To determine whether a user can perform an operation on a particular object, ElectricFlow determines which of the four privileges is required for that operation, then searches all access control entries that refer to that user or groups containing that user. To be allowed access, at least one of the matching entries must specify "allow" and none of the entries can be "deny." A "deny" entry overrides an "allow" entry in the same ACL.

## Inheritance

If an object's access control list does not indicate what to do for the user who is trying to access it, ElectricFlow looks in the access control list for the object containing the target object, then its parent, and so on up to a top-level object covering the entire server. This mechanism is called *inheritance*.

For example, a nested property sheet on a procedure inherits access control information from its parent property sheet, the procedure, the project containing the procedure, and the server. When you view the object access control list, you also see inherited access control lists so you can trace the object's inheritance chain.

When ElectricFlow performs an access check on an object, it begins with the access control list for that object.

- If a "deny" entry matches an entry in that list, access is denied.
- If there is no "deny" entry, but a matching "allow" entry is found, access is allowed.
- If there is no matching entry that specifies either "allow" or "deny," ElectricFlow moves to the next access control list in the inheritance chain and repeats the process.
- A matching entry in a lower-level access control list takes priority over entries in higher-level access control lists. If no matching entry in any list is found, access is denied.

Inheritance allows you to control access to a collection of objects because you can make changes in just one place. When new objects are created, their access control lists are empty, so all access control for the entire system is determined by the server-level list.

- Typically, when a new project is created, you define an access control list for the project and allow everything in the project to inherit from the project.
- If you do not define additional access control information in project components, all project access is determined by the project's access control list.

In some situations you may want tight control over object access, so changes in parent objects do not affect access to the object or its children. To achieve this, you can "break inheritance," which means a particular object does not inherit from its ancestors. The ElectricFlow web interface allows you to break and restore inheritance for any object on which you can change permissions. However, ***if you break an object's inheritance, it affects all children of that object.***

#### Additional Information about "deny"

If a user matches a deny rule, however indirectly, the user is denied access. Even if a specific ACL entry granting (for example) read access by username exists, a less specific deny ACL entry overrides that specific rule. Therefore, avoid "deny" rules if at all possible (especially to groups), or you may experience some unexpected permissions issues.

You can, however, enforce an implicit "deny" by allowing an object to fall off the end of the inheritance chain. This practice allows denial behavior without the risks associated with an explicit ACL entry to deny access.

**IMPORTANT:** If you break inheritance on an object with an empty access control list, the object will become completely inaccessible. You will not be able to restore inheritance because you no longer have the right to change permissions on that object. If this happens, you must contact your system administrator who can login as admin and restore inheritance.

Consider ElectricFlow principals (actors) from two perspectives:

- A running job or workflow runs using the project as the identity, so if a job requires special permissions you must use the project as the principal in the ACL entry.
- Users and groups come into play when humans manipulate the GUI or execute ectool commands from the command line (or via a shell script) -- basically anywhere that a script or human needs to log in to ElectricFlow. Having logged in, a group and id exist, which can be used in ACL entries.

For example, consider a property that will store a build number. You can set an ACL that breaks inheritance (implicit deny), and then add an ACL entry granting permissions for the project to be able to increment the property value. This prevents humans from manipulating the build number but permits a running job to increment the build number at will.

#### Notes:

- When it is practical, a job will run with multiple identities—the project and the user that launched the job. You cannot, however rely on this behavior for security because jobs run from a schedule (such as CI jobs) and jobs started by a workflow do not have a user principal, just the project principals.
- A job can have multiple project principals because it "accumulates" new project principals when it calls into another project's subprocedure (and then releases the other project's identity when the subprocedure returns). This makes it possible to create trusted libraries.

## System Objects

A few special *system objects* contain access control lists related to overall ElectricFlow system administration. These access control lists are available from the Administration page. The system objects are:

- **Server**—an ElectricFlow system top-level object. Every other object in the system is contained in the server object and inherits access control information from the server object unless inheritance is broken.
- **Administration**—*Read* permission allows access to the `getStatus`, `getDatabaseConfiguration[s]`, `getEmailConfig[s]`, and `export(global)` API functions.

*Modify* permission allows access to the `shutdown`, `setDatabaseConfiguration`, `createEmailConfig`, `deleteEmailConfig`, `modifyEmailConfig`, and `import(global)` API functions.

For Change Tracking, the *Read*, *Modify*, and *Execute* permissions allow you to revert changes to a tracked object and its tracked contents in the UI (see for more details) or access to the `revert` API function.

- **Artifacts**—*Read* permission allows access to the `getArtifact` API functions. *Modify* permissions allows access to `createArtifact` and `deleteArtifact` functions.
- **Directory**—*Read* permission allows access to the `getUsers`, `getGroups`, and `getDirectoryProviders` API functions.

*Modify* permission allows access to the `createUser`, `createGroup`, `deleteUser`, `deleteGroup`, `createDirectoryProvider`, `modifyDirectoryProvider`, `deleteDirectoryProvider`, `testDirectoryProvider`, and `moveDirectoryProvider` API functions.

- **Email Configurations**—*Modify* permission allows access to the `createEmailConfig` and `deleteEmailConfig` API functions.
- **Force Abort**—*Execute* permission controls access to the `--force` flag on `abortJob`. By default, the ACL is created with Everyone: execute permission in addition to inheriting from the "Server". To force abort a job, the user must have execute permission on the job and execute permission on the `forceAbort` ACL.
- **Logging**—*Modify* permission allows access to the `logMessage` API function.
- **Licensing**—*Read* permission allows access to the `getLicense[s]` API functions. *Modify* permission allows access to the `importLicenseData` and `deleteLicense` API functions. *Execute* permission allows access to the `getAdminLicense` API function.
- **Plugins**—*Modify* permission allows access to the `createPlugin`, `deletePlugin`, `installPlugin`, `uninstallPlugin`, `promotePlugin` API functions, and the `modifyPlugin` API function requires modify permission on the target plugin. For `getPlugin`, *Read* permission is required on the target plugin.
- **Priority**—*Execute* permission allows the user who launches a procedure (using the `runProcedure` API function) to raise the priority of the job.
- **Projects**—*Modify* permission allows access to the `createProject` and `deleteProject` API functions.
- **Repositories**—*Read* permission allows access to the `getRepository` API function. *Modify* permission allows access to the `createRepository`, `deleteRepository`, `modifyRepository`, and `moveRepository` API functions.
- **Resources**—*Modify* permission allows access to the `createResource` and `deleteResource` API functions.



- **Session**—*Execute* permission allows access to the `login` API function.
- **Workspaces**—*Modify* permission allows access to the `createWorkspace` and `deleteWorkspace` API functions.
- **ZoneAndGateways**—*Modify* permission allows access to the `createZone` and `deleteZone` API functions. *Modify* permission also allows access to the `deleteResource` API function when the resource belongs to a Gateway.

## Access Control and Jobs

When a job executes, it usually needs to access objects in ElectricFlow. For example, a job step command may refer to a parameter value, which is a property associated with the job object, or a step may invoke *ectool* to modify properties or any other ElectricFlow state. This process leads to questions:

- ***Under which username does the job execute?***

Procedures always run under the project principal user ID for the project that contains the procedure. If a procedure invokes a subprocedure in another project, that subprocedure will run under its own project's project principal and the project principal of its calling procedure. When a procedure is running under multiple project principals, its steps will perform any operations for which any one of its project principals allow.

- ***How does ElectricFlow initialize job permissions when the job starts?***

This question pertains to job object permissions. When a job starts, ElectricFlow sets full access control entries on the job for the project principal and the user who launched the job— assuming the job was launched by a user and not a schedule.

- ***What permissions are needed to abort a job?***

Aborting a job requires *execute* permission on the job. If a job is launched by a user, that user is given all privileges on the job. If a job is launched by a schedule, the schedule's execute privileges are copied to the job.

The access control system determines whether jobs can be executed or not.

- For a user to run a job without creating a schedule, the user must have *execute* permission on the top-level procedure being executed.
- To create a schedule to run a procedure, a user must have *modify* permission for the project containing the schedule. After a schedule is created, no additional permissions are required to start jobs under the auspices of that schedule.

## Examples for Increased Security

Initially, the *Everyone* group had Read and Execute permission on all ElectricFlow objects by default. The following examples illustrate how you might customize ElectricFlow default Access Control settings for your organization.

**Caution:** Make sure you are familiar with the Access Control system before making changes. Incorrectly setting ACLs can severely impact ElectricFlow behavior.

### Abbreviations used in the examples

**A** = Allow

**I** = Inherit (some places referred to as "Don't Care")

**D** = Deny

Change Permission = Change

### Example 1—Basic ACL Setup

This example illustrates how you might change Access Control defaults to set up a basic level of security. The easiest way to manage ACLs is by using different ElectricFlow groups that allow users to perform specific roles.

For our example, we will create and use the groups called EC-administrator and EC-designer, and we will modify the default Everyone group. (When setting up your groups, you would choose any group names that suit your organization, but note that the "EC-" prefix is reserved for Electric Cloud use only.) This is how we want to define our groups:

- EC-administrator group  
This group has most of the power and abilities of the 'admin' user login, but allows for more flexibility.
- EC-designer group  
This role is more significant. Users in this group can create and modify most ElectricFlow objects.
- Everyone group  
This predefined group is used for people who only need to run ElectricFlow procedures, and have no need to create or modify them.

As you begin to modify the Access Control system, note that the system has some project principal ACEs that should remain in place for correct system operation.

### Server ACLs

The Server is the foundation for almost all ACL checks. Generally, every other object in the system inherits these privileges. For this basic ACL configuration we want to set Server ACLs this way:

Type	Name	Read	Modify	Execute	Change
group	EC-administrator	A	A	A	A
group	Everyone	I	I	I	I

### Custom Server Properties ACLs

An often overlooked ACL setting is Server Property Sheet. Allow the Everyone group Read permission on this object.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**System Object ACLs**

There are 14 categories of System objects with ACLs.

**1—Administration** – allow the EC-designer group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	EC-designers	A	I	I	I

**2—Artifacts** – allow the EC-designer group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	EC-designers	A	A	I	I
group	Everyone	A	I	I	I

**3—Directory** – allow the Everyone group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	EC-designers	A	I	I	I

**4—Email Configurations** – allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**5—Force Abort**—no changes needed for this category.

**6—Logging**—no changes needed for this category.

**7—Licensing**—no changes needed for this category.

**8—Plugins**—allow the Everyone group Read privilege.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**9—Priority**—no changes needed for this category.

**10—Projects**—allow the Everyone group Read and Execute privileges, and the EC-designer group everything except Change privilege.

Type	Name	Read	Modify	Execute	Change
group	EC-designers	A	A	A	I
group	Everyone	A	I	A	I

**11—Repositories**—allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**12—Resources**—allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**13—Session**—allow the Everyone group Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	I	I	A	I

**14—Workspaces**—allow the Everyone group to have Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**Note:** Sites that want a slightly more open system might consider granting the "EC-designers" group Modify access to Resources and Workspaces.

### Plugin Project ACLs

Generally, you will want to allow the Everyone group Read privileges on every plugin you expect to use. (Each plugin has its own name, which is the project name also.)

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

### Project ACLs

Next are special Electric Cloud projects, Default, EC-Utilities and EC-Examples.

**Projects:** Default, EC-Utilities, EC-Examples

Use caution when setting privileges on the EC-Utilities project. These are powerful procedures and some have their own ACL settings. Remember the 'admin' user will always be able to use these utilities. Allowing the EC-administrator group full privileges accomplishes the same goal for users in that group. We allow the Everyone group Read only privileges. This is a unique project because it does not inherit ACLs from anywhere else (for example, Server or Projects).

Type	Name	Read	Modify	Execute	Change
group	EC-administrator	A	A	A	A
group	Everyone	A	I	I	I

### Example 2—Team ACL Setup

Some organizations may want to have two or more different and separate teams use ElectricFlow at the same time. In this example, people on one team have little knowledge about the other team who uses ElectricFlow and no direct access to any objects used by the other team. Our "Team" example describes how to modify default ElectricFlow Access Control settings to create a multi team security configuration using ACLs.

To divide your ElectricFlow system for use by separate teams, you will want to create one or more separate Projects for each team. You may decide to share some projects across teams.

**Create your teams (groups).** For our example, we will begin with two teams, T1 and T2. Each team has a designer group and a user group. Using groups allows the flexibility to have a designer from one group work as a user in another group.

- Create the EC-administrator group  
This group has most of the power and abilities of the 'admin' user login, but allows for more flexibility. Assigning people to the EC-administrator group allows better tracking of ElectricFlow administrative activity.

- Create two designer groups: T1-designer and T2-designer  
Members of the designer groups will have the ability to create and modify procedures and other ElectricFlow objects for their team. A member of the designer group from one team will not be able to view or use the objects of the other team.
- Create two user groups: T1-user and T2-user  
Members of the user groups will have the ability to run procedures that belong to their team. A member of the user group from one team will not be able to view or use objects that belong to the other team. who are not in any other group. This setup allows other users to access ElectricFlow without exposing the work of any of the teams. A person not in a group for either team will not be able to see objects of either of the teams.

As you begin to modify the Access Control system, note that the system has some project principal ACEs that should remain in place for correct system operation.

### Server ACLs

The Server is the foundation for almost all ACL checks. Almost all objects in the system inherit these privileges. For this basic Team configuration, we will set the Server ACLs this way:

Type	Name	Read	Modify	Execute	Change
group	EC-administrator	A	A	A	A
group	Everyone	I	I	I	I

### Custom Server Properties ACLs

An often overlooked ACL setting is Server Property Sheet. Allow the Everyone group Read permission on this object.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

### System Object ACLs

There are 14 categories of System objects with ACLs.

**1—Administration** – allow both designer groups Read privileges.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	I	I	I
group	T2-designer	A	I	I	I

**2—Artifacts** – allow the Everyone group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**3—Directory** – allow the Everyone group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**4—Email Configurations** – allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**5—Force Abort**—no changes needed for this category.

**6—Logging**—no changes needed for this category.

**7—Licensing**—no changes needed for this category.

**8—Plugins** —allow the Everyone group Read privilege. Generally, privileges set here will be inherited by all plugins.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**9—Priority**—no changes needed for this category.

**10—Projects**—no changes needed for this category. Privileges for projects are now handled on a case by case basis.

**11—Repositories** – allow the Everyone group Read privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**12—Resources**—allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**13—Session**—allow the Everyone group Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	I	I	A	I

**14—Workspaces**—allow the Everyone group Read and Execute privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

### Plugin Project ACLs

Generally, you will want to allow the Everyone group Read privileges on every plugin you expect to use. (Each plugin has its own name, which is also the project name.) Because you may want to use many plugins, you might want to use a script.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

### ACLs for Existing Projects

Next are a few Electric Cloud projects, and two sample projects that can be seen and used by their respective team members only.

#### Project: EC-Examples

These are nice examples and we want to grant Everyone the ability to see and run them.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I



**Project: Default**

Inherited settings will allow the EC-administrator group full privileges.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**Project: EC-Utilities**

Use caution when setting privileges on the EC-Utilities project. These are powerful procedures and some have their own ACL settings.

Remember the 'admin' user will always be able to use these utilities. Allowing the EC-administrator group full privileges accomplishes the same goal for users in that group. We allow the Everyone group Read only privileges. This is a unique project because it does not inherit ACLs from anywhere else (for example, Server or Projects).

Type	Name	Read	Modify	Execute	Change
group	EC-administrator	A	A	A	A
group	Everyone	A	I	I	I

**Project: Electric Cloud**

This project has one procedure and we want to grant everyone the ability to see it.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	I	I

**ACLs for New Projects**

Now we introduce the concept of ACL settings as they would be in a multiple team environment. For this example, we assume you have five projects being used by two teams in the following way.

- Project-A used by Team1
- Project-B used by Team1
- Project-C used by Team2

- Project-D used by Team2
- Project-E used by Team1 and Team2

### Project-A

This project is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group. Notice that the designer group receives full permissions.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	A	A	A
group	T1-user	A	I	A	I

### Project-B

This project is the same as Project-A.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	A	A	A
group	T1-user	A	I	A	I

### Project-C

This project is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group. Notice that the designer group receives full permissions.

Type	Name	Read	Modify	Execute	Change
group	T2-designer	A	A	A	A
group	T2-user	A	I	A	I

### Project-D

This project is the same as Project-C.

Type	Name	Read	Modify	Execute	Change
group	T2-designer	A	A	A	A
group	T2-user	A	I	A	I

**Project-E**

This project is a superset that includes both teams.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	A	A	A
group	T1-user	A	I	A	I
group	T2-designer	A	A	A	A
group	T2-user	A	I	A	I

**Enabling Same Team Subprocedures**

To enable procedures in one project to use procedures in another project, one more step is necessary.

Add the project principals for both T1 projects to the T1-user group.

In this case, these are called: “project: Project-A” and “project: Project-B”.

Add the project principals for both T2 projects to the T2-user group.

In this case, these are called: “project: Project-C” and “project: Project-D”.

**Optional: Restricting Resources and Workspaces by Team****Resource ACLs**

**Resource:** local

Because each team will have dedicated resources, it is useful to keep one resource available for everyone to use.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

**T1-resource**

This resource is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group. This resource also needs Execute permission for the project itself to allow it to run from a schedule.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	I	A	I
group	T1-user	A	I	A	I

### T2-resource

This resource is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group. This resource also needs Execute permission for the project itself to allow it to run from a schedule.

Type	Name	Read	Modify	Execute	Change
group	EC-administrator	A	A	A	A
group	Everyone	I	I	I	I

### Workspace ACLs

#### Workspace: default

Because there will be dedicated workspaces for each team, it is useful to keep one workspace available for Everyone to use.

Type	Name	Read	Modify	Execute	Change
group	Everyone	A	I	A	I

#### T1-workspace

This workspace is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group.

Type	Name	Read	Modify	Execute	Change
group	T1-designer	A	I	A	I
group	T1-user	A	I	A	I

#### T2-workspace

This workspace is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group.

Type	Name	Read	Modify	Execute	Change
group	T2-designer	A	I	A	I
group	T2-user	A	I	A	I

## Artifact Management

[Understanding Artifact Objects](#)

[Configuring Access Control](#)

[Publishing Artifact Versions](#)

[Uploading and Publishing Artifacts from a Local File System Using the UI](#) on page 941

[Enabling Compression](#)

[Using Include and Exclude Patterns](#)

[Retrieving Artifact Versions](#)

[Entering Filters During a Retrieve Operation](#)

[Entering Dependent Artifact Versions](#)

[Understanding the Artifact Cache](#)

[Cleaning Up Repositories and Caches](#)

## Overview

During the development process, project components or "outputs" are produced for consumption by other projects or the main project to create a whole entity. Applications are assembled by combining these various outputs (dependencies) and packaging them together into a deployable software application.

Outputs can be libraries, scripts, graphics, and so on. This output is an *artifact* that can be consumed by other projects.

Every stage in the application lifecycle produces and consumes artifacts. Artifacts are critical to the *build-test-deploy* process.

Using artifacts can:

- Improve performance across builds.
- Provide better reusability of components.
- Improve cross-team collaboration with greater traceability.

For example, instead of each developer repeatedly downloading third-party packages from external sources, these components can be published and versioned as an artifact. A developer then simply retrieves a specific artifact version from a local repository, which guarantees a consistent package from build to build.

## About Artifact Objects

ElectricFlow has three types objects to support Artifact Management functionality: *artifact*, *artifact version*, and *repository*. Similar to other ElectricFlow objects, each of these objects supports custom properties and access control.

### Artifact

An *artifact* is a top-level object containing artifact versions, a name template for *published* artifact versions, artifact specific properties, and access control entries to specify privileges. If an artifact is deleted, all published artifact versions within that artifact will be deleted also.

You can create artifacts in several ways:

- Use the New Artifact web page
- Use the `createArtifact` API command with the command-line tool (ectool) or an ec-perl script
- An artifact is created when you publish an artifact version if the artifact did not already exist, and the user issuing the publish command has permission to create artifacts. See the "Access Control" and "Publishing Artifact Versions" sections below for more information.

To create an artifact, you enter a Group Id and Artifact Key and together, these create an artifact name in the form `groupId:artifactKey`. After ElectricFlow creates the artifact name from your supplied Group Id and Artifact Key specifications, you cannot modify the name.

**Note:** Plan your artifact Group IDs and Artifact Keys carefully to prevent the extra work of deleting a name and beginning your specifications again. The use of a `groupId` and `artifactKey` allow two "namespaces" for added flexibility in organizing artifacts within your company or organization.

### Examples

- If your development team uses GWT for web development and JUnit for unit testing, you may want to create artifacts `"ThirdParty:GWT"` and `"ThirdParty:JUnit"`.
- Your organization may have two different development teams (OS and Apps) who want to use artifacts. In building each product, both development groups want to publish and use an "SDK" with their product. But each SDK is different and unique. One solution would be to create one artifact named `"os:SDK"` and another artifact named `"apps:SDK"`. By using different group Id's, each development team is free to name their artifacts however they choose without worrying about name collisions with artifacts produced by the other team.

To reference an artifact, you can use the `groupId` and `artifactKey` combination or simply use the `artifactName`. The property path `/artifacts/<artifactName>` allows you to access any properties of a given artifact.

## Artifact Version

An *artifact version* is a collection of 0 to N files that were published to an artifact repository. Artifact version metadata is stored in an `artifactVersion` object in the ElectricFlow server.

Tips for working with artifact versions:

- To group a collection of files (typically from build output in an ElectricFlow workspace) into an artifact version, specify the "from" directory containing those files.
- If you want to include files from multiple directories in your artifact, you need to specify a common root directory to include these directories when publishing your artifact.
- To restrict which files and subdirectories in the "from directory" to include in the artifact version, you can specify "include" and "exclude" patterns.
- Artifact versions are stored on an artifact repository server in either uncompressed `tar` archives or compressed `tar-gzip` archives.
- Artifact versions can be created using the `publishArtifactVersion` API, which includes creating the object in the ElectricFlow server and publishing the artifact version to the artifact repository.

**Note:** Interactively creating an artifact version using the automation platform web UI is not supported.

- When you retrieve an artifact version, the original directory structure of the directory where files were published "from" is preserved.
- When you retrieve/publish artifacts, directories containing symlinks are always resolved; they are not preserved.

Artifact versions are referenced by *Group Id*, *Artifact Key* (or artifact name) and a version string.

- The artifact version's name is set based on the name template on the "owning" artifact. By default, the name template is in the form `groupId:artifactKey:version`.
- Each artifact version name must be unique within an ElectricFlow server installation.

The property path `/artifactVersions/<artifactVersionName>` allows access to any properties for a particular artifact version. Because you may not know the artifact version name (because of the name template), this path supports the form `<groupId>:<artifactKey>:<version>` as a substitute for the name of the artifact version.

All ElectricFlow API's that take an `artifactVersionName` argument also accept this alternate form as a substitute, similar to how other API's that accept a `jobId` argument accept the job name as a substitute.

## Version Strings

A version string must be provided when publishing an artifact version.

For example:

`5.8.8-EN-55842` or `5.8.8.55842-EN` —In either form, the version string is interpreted as:

Major version number: 5

Minor version number: 8

Patch level number: 8

Qualifier: EN

Build number: 55842

You must provide separator punctuation. When interpreting (parsing) the first version string form, ElectricFlow interprets the text after the first hyphen as the build number if this string contains numeric characters only. Otherwise, the string is interpreted as the *qualifier*.

Version string examples and how ElectricFlow interprets them:

	Input (version string)	Major	Minor	Patch	Qualifier	Build Number
1	2.0.3-44834	2	0	3	<empty/null>	44834
2	3.8.4-RC1	3	8	4	RC1	0
3	3.8.4-RC1-36	3	8	4	RC1	36
4	3.8.4.36	3	8	4	<empty/null>	36
5	1-36	1	0	0	<empty/null>	36
6	3.8.4.36-RC1	3	8	4	RC1	36

In this table:

- Row 5 shows that you are not required to specify all three of `<major, minor, patch>` when publishing an artifact version if your organization's versioning conventions do not use all three fields. However, there is a caveat with this level of flexibility. You can create two artifact versions in the system with equivalent versions.  
Version string "1-36" is equivalent to "1.0-36" but they are not the same so you can publish two artifact versions with these version strings successfully. When retrieving an artifact version, in some cases it could be unclear as to exactly which one you will get. For this reason, we recommend that you adopt a convention and abide by it for a particular artifact.

The artifact version object exposes components of the version string by using these intrinsic properties:

- **version**— the version component is the combination of *major.minor.patch-qualifier-buildNumber*. A "version" component does not need to include all of the following intrinsic properties. See the table above.
- **majorMinorPatch**— this is the *major.minor.patch* version component as specified in the version string. For example, if you specified a version string of "1-36, the *majorMinorPatch* component would be "1", not "1.0.0", which makes it possible for you to meet your naming conventions by reconstituting the version string a different way in the artifact version name template.
- **qualifier**—the qualifier component of the version .
- **buildNumber**—the build number component of the version.



### The `artifactVersionState` property

Artifact versions have an `artifactVersionState` property whose value can be one of the following:

`publishing`—The artifact version is currently being published and is not available for retrieval.

`available`—The artifact version is available for retrieval if needed.

`unavailable`—The artifact version is not available for retrieval while in this state.

You can manipulate the state between available and unavailable on the Edit Artifact Version web page. This action can be useful if an artifact version seems to be corrupt in some way, but you want to investigate before potentially deleting it from the system.

By making the artifact version unavailable, retrievers can acquire an older (potentially more stable) artifact version while you look into the problem. If the artifact version is good, you can simply make it available again.

### Repository

The artifact repository is a machine where artifact versions are stored. The repository server is configured to store artifact versions in a directory referred to as the repository backing store.

By default, the backing store is the `<data_dir>/repository-data` directory in the repository installation. This default setting can be changed by running `ecconfigure --repositoryStorageDirectory` on the repository server. The repository server listens on port 8200 for HTTPS requests to publish and retrieve artifact versions.

Connection information is stored in the repository object on the ElectricFlow server.

You can create a repository objects in several ways:

- Use the New Repository web page in the ElectricFlow UI
- Use `createRepository` API
- Repository objects can be created automatically during the ElectricFlow installation.

When you are installing a repository *server*, the installer creates a corresponding repository *object* on your ElectricFlow server. If you are installing a repository *server* on the same machine as your ElectricFlow server, a repository *object* named "default" is automatically created. If you are installing a repository *server* on a different machine than your ElectricFlow server, the installer will prompt you for information it uses to create the corresponding repository *object*.

**Note:** When installing a repository server, we recommend installing an agent also to ease maintenance tasks such as clearing out stale artifact versions from the repository backing store.

Click the Artifacts tab, then the Repositories subtab to see your list of created repositories.

Repositories <span>★</span>						
All Repositories						<a href="#">Add Repository</a>
	Repository Name	Zone	URL	Enabled	Description	Actions
≡	default	default	https://flow.electric-cloud.com:8200	✓	Default repository created during installation.	🗑️
≡	two	default	http://two:8201	✓	Created by the installer on two.	🗑️
≡	San Francisco	default	https://sf.electric-cloud.com:8200	✓	Repository for San Francisco development	
≡	Los Angeles	default	https://la.electric-cloud.com:8200	✓	Repository for the Los Angeles team	🗑️

You can re-order the repository search order (for retrieving artifact versions) by using the mouse to grab and drag the icon in the left column to the row position you prefer, effectively re-ordering the repository list.

For distributed environments, where the preferred repository search order varies depending on which resource is performing the retrieval, you can specify a preference order on the Edit Resource panel. See the illustration below.

## Resource Details ✕

**local** [View Usage](#) [Edit](#) [Access Control](#)

Local resource created during installation.

General Properties

Status: **The agent is alive**

Version: **6.0.0.94361**

Host OS: **Linux flow-demo-uat 3.2.0-45-generic #70-Ubuntu SMP Wed May 29 20:12:06 UTC 2013 x86\_64 x86\_64 x86\_64 GNU/Linux**

Host Platform: **linux**

Agent Host Name: **flow-demo-uat.electric-cloud.com**

Agent Host Type:

Agent Port Number: **7800**

Default Workspace:

Pools: **default**

Default Shell:

Step Limit:

Zone: **default**

Gateway(s):

Artifact Cache Directory:

Repository Names:

Connection Type: **HTTPS**

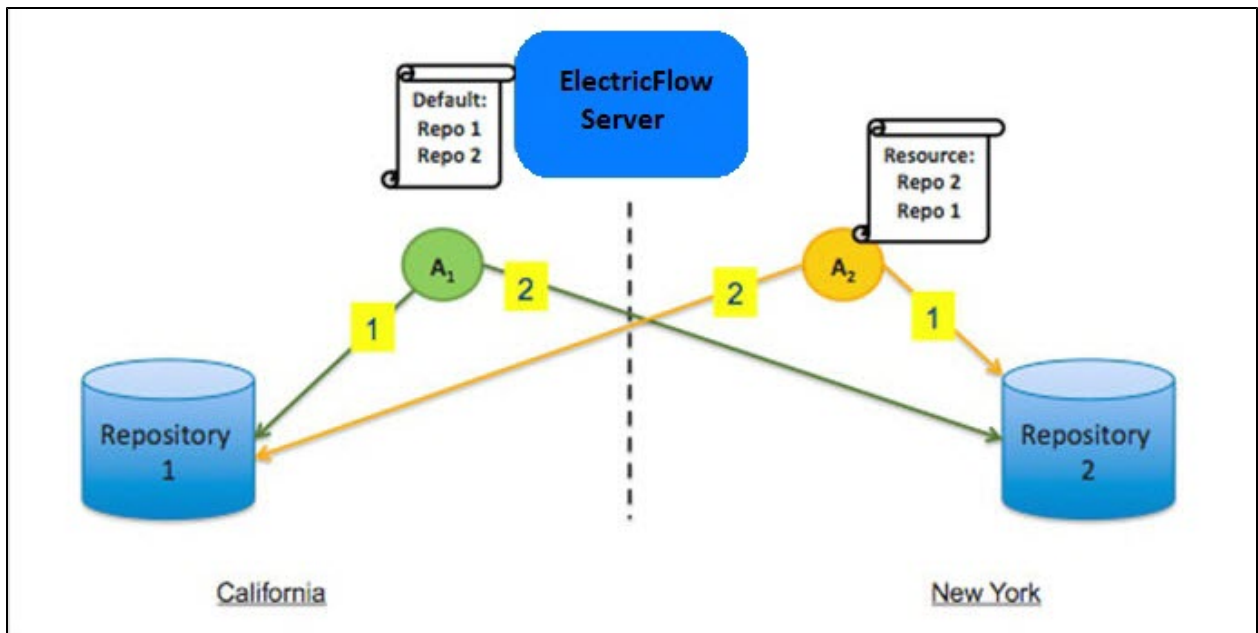
Enabled: **true**

To go to the Edit Resource panel; from the Repositories page, select the Cloud tab, which opens to the Resources page, then select a resource name

Enter one repository name per line in the Repository Names field.

In the following example, a resource in California (A1) uses the "default" repository search order (that is, the order on the Repositories page). A1 searches for artifact versions by first requesting an artifact version from Repository 1. If the artifact version requested is not found, it will then request the artifact version from Repository 2.

The resource in New York (A2) has a specific search order specified where it searches for artifacts from Repository 2, first, then searches Repository 1.



### Using Multiple Repositories

ElectricFlow supports multiple repositories, however you cannot share a repository between multiple ElectricFlow servers. Multiple repository servers may be required in your organization because of business or organizational reasons, government and compliance requirements, or for performance and data protection.

For example:

**Business or Organizational Structure**— Within a company, two different development teams want to have artifact repositories containing artifacts and artifact versions specific to their product. A repository server is created for each team. The two teams publish artifact version to their respective repositories.

**Performance**—A company has multiple development sites. Instead of having a single repository server, which would create significant network performance issues from retrieving artifact versions during the build process, they create a repository at each development location and have artifact versions synchronized between the repository servers. In this way, when artifact versions are retrieved for use by a build process, they are retrieved from a local repository.

Data Protection and disaster recovery—A company has a single ElectricFlow server with two artifact repository server machines. The contents of the repository servers are synchronized and replicated between both machines. In the event repository 1 is unavailable during a retrieve, repository 2 is searched for the requested artifact retrieval.

### Copying Artifacts to Multiple Repositories

You can synchronize (copy) artifacts from a source artifact repository to one or more target repositories. This helps to support distributed architectures with multiple artifact repositories. You can use pattern matching to select specific artifact versions to synchronize. This feature uses the EC Artifact plugin.



To set up artifact synchronization, choose **Administration > Plugins > EC Artifact** and click  (edit) to edit the SyncArtifactVersion procedure.

Run Procedure / SyncArtifactVersion
★

Parameters
?

Artifact:  Required

Version:  Required

Source Repository:  Required

Target Repository:  ⊖ Remove Required

+ Add target repository.

Overwrite?: ☐

Upload in parallel?: ☐

Advanced


Priority: normal ▼

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

Run Cancel

### Entering Parameters

Enter the following parameters as needed.

Parameter	Description
<b>Artifact</b>	Artifact name. The format is <code>&lt;groupId&gt;:&lt;artifactKey&gt;</code> .
<b>Version</b>	Full artifact version string. The format is <code>&lt;major&gt;.&lt;minor&gt;.&lt;patch&gt;-&lt;qualifier&gt;-&lt;buildNumber&gt;</code> . The version string must be unique across all of this artifact's versions. For more information, see <a href="#">Version_Strings</a> .
<b>Source Repository</b>	Name of the repository from which this artifact version will be retrieved.
<b>Target Repository</b>	Name of the repository to which this artifact will be copied. You can add more  repositories by clicking <b>(Add target repository)</b> .
<b>Overwrite?</b>	(Optional) Specifies whether to overwrite any existing artifact with the same name and version on the target repositories. This option is disabled by default.
<b>Upload in parallel?</b>	(Optional) Specifies whether to copy artifacts to the target repository in parallel instead of serially. This option is disabled by default.
<b>Priority</b>	(Optional) Priority of the job. The choices are <b>low</b> , <b>normal</b> , <b>high</b> , or <b>highest</b> .
<b>Impersonation</b>	(Optional) Credential impersonation. The choices are: <ul style="list-style-type: none"> <li>• <b>Use pre-defined credential</b>—Uses the predefined credential. This is the default.</li> <li>• <b>Use specific credential</b>—You must specify a project name and a credential name.</li> <li>• <b>Use a specific user</b>—You must specify a user name under which you want to log in and the password for the user name to be used for LDAP testing.</li> </ul>

Then click **Run**.

### Understanding Overwrite Behavior

See the following table for an example that illustrates the overwrite behavior.

Repository	Result with Overwrite disabled	Result with Overwrite enabled
Repo1 (source): Repository containing artifact1 to be copied	—	—
Repo2 (target): Repository without artifact1	artifact1 is copied to Repo2	artifact1 is copied to Repo2

Repository	Result with Overwrite disabled	Result with Overwrite enabled
Repo3 (target): Repository containing artifact1		artifact1 is overwritten on Repo3
Repo4 (target): Repository that does not exist	Error	Error

## Troubleshooting

The SyncArtifactVersion procedure finishes with an error in the following situations:

- Repository is unreachable: The target repository might be down.
- Insufficient access rights: Access rights for writing to the target repository might be missing.

## Configuring the Artifact Repository Server for Amazon S3

You can configure the repository server to use Amazon S3 as the backing store and connect to Amazon S3 using IAM roles. This section describes the changes to make in the `/opt/electriccloud/electriccommander/conf/repository/server.properties` file.

Before starting this procedure, make sure the following have been created and are available on the AWS Management Console (<https://aws.amazon.com/console/>):

- An Amazon S3 bucket for the backing store.
- The IAM role with a policy that grants all the `s3:*` access to the Amazon S3 bucket you want to use with the repository server.

For example, the IAM role called `s3repositoryFullAccess` has a policy called `s3fullaccessAndAccessToInstallers` that grants all the `s3:*` access to the *backing store bucket* called `ec-test-repository-backingstore`.

Follow these steps to set up the artifact repository for Amazon S3:

1. In the `/opt/electriccloud/electriccommander/conf/repository/server.properties` file, set `REPOSITORY_BACKING_STORE` to use Amazon S3 by changing

```
REPOSITORY_BACKING_STORE=repository-data
```

to

```
REPOSITORY_BACKING_STORE=s3://<name of the backing store bucket>
```

You can get the `<name of the backing store bucket>` by going to **IAM > Roles > <name of the IAM role>** page on the AWS Management Console. Then click **Show Policy** to open the **Show Policy** window to view the name of the backing store bucket.

In the following example, `<name of the backing store bucket>` is `ec-test-repository-backingstore`:



```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "Stmt1451514091000",
      "Effect": "Allow",
      "Action": [
        "s3:*"
      ],
      "Resource": [
        "arn:aws:s3::ec-test-repository-backingstore/*"
      ]
    }, {
      "Effect": "Allow",
      "Action": [
        "s3:Get*",
        "s3:List*"
      ],
      "Resource": [
        "arn:aws:s3:::s3flowinstallers/*",
        "arn:aws:s3:::s3flowinstallers"
      ]
    }
  ]
}

```

- Restart the artifact repository server using a command like this:

```
ubuntu@ip-10-101-214-28:~$ sudo /etc/init.d/commanderRepository restart
```

- To test the `REPOSITORY_BACKING_STORE`, create two files in a `/tmp/<your username>` directory, publish the directory, and verify that it is published using commands like this:

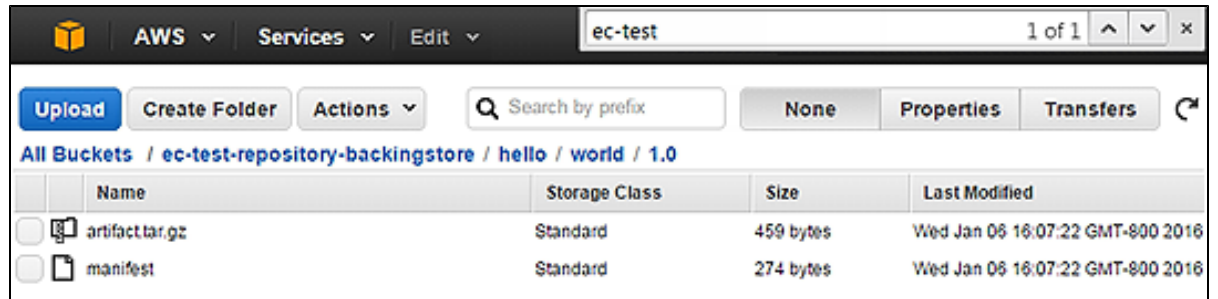
```

ubuntu@ip-10-101-214-28:~$ cd /tmp
ubuntu@ip-10-101-214-28:/tmp$ mkdir <your username>
ubuntu@ip-10-101-214-28:/tmp$ cd <your username>
ubuntu@ip-10-101-214-28:/tmp/<your username>$ touch abc
ubuntu@ip-10-101-214-28:/tmp/<your username>$ ectool --server localhost login admin changeme
ubuntu@ip-10-101-214-28:/tmp/<your username>$ ectool publishArtifactVersion --version 1.0 --artifactName hello:world

```

4. Verify that the `/tmp/<your_username>` is published to the Amazon S3 backing store.

Example:



### The `repositoryDisabled` Intrinsic Property

The repository object has a `repositoryDisabled` property that dictates whether or not artifacts can be published or retrieved from a particular repository. If you take a repository offline for maintenance, you can disable the repository in the ElectricFlow server rather than shutting down the repository machine or the service. Steps that attempt to publish to this repository will fail, and steps that attempt to retrieve artifact versions will skip this repository during the search for available repositories.

### Configuring Access Control

You can apply access control permissions to artifacts and artifact versions to control who can create an artifact versus who can publish an artifact version versus who can read or retrieve an artifact version.

Action	Required permission	Object
Create an artifact	Modify	Artifacts system object
Read artifact metadata	Read	The relevant artifact
Modify an artifact	Modify	The relevant artifact
Delete an artifact, which deletes all artifact versions within the artifact	Modify	Artifacts system object



Action	Required permission	Object
Publish an artifact version	Modify	The artifact into which a new version is being published
Read artifact version metadata (required for retrieval)	Read	The relevant artifact version
Modify an artifact version	Modify	The relevant artifact version
Delete an artifact version	Modify	The artifact that owns the artifact version

**Note:** The Execute privilege does not take part in artifact or artifact version access control.

By default, an `<Everyone, modify>` access control entry is available that allows anyone to publish an artifact version to any artifact and allows anyone to create an artifact. You might consider removing this access control entry and setting up tighter control for individual artifacts. See the EC-Security plugin for help with this effort.

For more information about access control for artifact management, see the [Access Control](#) Help topic.

The following scenarios provide ideas for how you might set up access control for artifact management.

### Control who can create new artifacts and publish artifact versions

ElectricFlow administrator, Adam, received communication from development manager, Max, requesting that only he should be able to create artifacts in ElectricFlow -- developers of ElectricFlow procedures under him should only be able to create steps to publish artifact versions under pre-defined artifacts.

His reasoning is that it is too easy for a developer to introduce a typo during publish (which does auto-create the artifact if the user has the appropriate privilege and the artifact doesn't exist).

Adam accommodates the request by giving Max the modify privilege on the artifacts system object and removing the `<Everyone, modify>` access control entry. Max then creates artifacts and assigns modify privileges to those artifacts for his development group, effectively allowing them to publish artifact versions.

At run-time, a step belonging to some project actually performs the publish, so Max adds project principal access control entries for the relevant projects as well, providing modify privileges.

### **Control which projects can retrieve artifact versions at run time**

Acme Corporation's router product has a software stack consisting of OS, PlatformLibraries, and Apps. Each of these has a ElectricFlow project with several procedures that work together to build the relevant component. PlatformLibraries builds against some of the C header files and libraries produced by the OS build. Similarly, Apps builds against libraries produced by PlatformLibraries.

The lead developer for the OS component, creates a `Router:OSLib` artifact and gives the PlatformLibraries project principal read privileges so that project can retrieve any OSLib artifact version it needs to build PlatformLibraries. Similarly, Paul from the PlatformLibraries team creates a `Router:PlatformLib` artifact and gives the Apps project principal read privileges.

### **Group 1 publishes an artifact version and wants only Group 2 to be able to retrieve it**

An organization wants to create artifacts for each of the third-party packages used by developers. Among the tools shared is the GWT package. The build manager chooses to create an artifact called `3rd-party-PKGS:GWT`. Because of licensing concerns, the build team must control or regulate who has access to the GWT and who can publish artifact versions used within the company's product.

In this case, the build team will publish a GWT artifact version and test it. During the test and approval cycles, only the build team has access to read and modify the artifact or publish new artifact versions. After a version has passed internal testing and approvals, the build team then grants read access to each of the developer groups.

## **Uploading and Publishing Artifacts from a Local File System Using the UI**

You can use the Automation Platform UI to upload artifact files from a file system. This makes development and testing of new flows easier than other methods that use the EC-Artifact plugin and APIs. You can upload artifact files for publishing a new version of an existing artifact, or you create a new artifact and upload artifact files to publish the first version. You can upload a single file or a folder.

This functionality requires that the **Allow Artifact Publish from UI** check box in the **Edit Server Settings** page in the Automation Platform is checked. Note that this functionality is not supported in Internet Explorer or Safari.

### **Uploading Files to Publish a New Version of An Existing Artifact**

To upload artifact files for publishing a new version of an artifact that already exists:

1. In the Automation Platform, choose **Artifacts> Artifacts**.

The list of existing artifacts appears. For example:

[Home](#) [Projects](#) [Jobs](#) [Workflows](#) [Cloud](#) [Artifacts](#) [Search](#) [Administration](#) [Change History](#)

[Artifacts](#) [Artifact Versions](#) [Repositories](#)

## Artifacts

Create Artifact | ★

(398 Results)

▼ Filters Hide | Save | New Saved Filter ▼

Add Criteria + Add Custom Criteria +

Find... OK

Name ▼▲	Group Id ▼▲	Artifact Key ▼▲	Description
EC-Tutorials:MyArtifact	EC-Tutorials	MyArtifact	
QE1:MyArtifact1	QE1	MyArtifact1	
QE:MyArtifact	QE	MyArtifact	
com.ec:shoppify	com.ec	shoppify	
com.ec:taxengine	com.ec	taxengine	
com.electriccloud:clusterRelatedFiles:clusterRelatedFiles	com.electriccloud:clusterRelatedFiles	clusterRelatedFiles	
com.electriccloud:EC-ALM	com.electriccloud	EC-ALM	
com.electriccloud:EC-AWS-Lambda	com.electriccloud	EC-AWS-Lambda	
com.electriccloud:EC-Admin	com.electriccloud	EC-Admin	
com.electriccloud:EC-AgentManagement	com.electriccloud	EC-AgentManagement	
com.electriccloud:EC-Agitar	com.electriccloud	EC-Agitar	
com.electriccloud:EC-AmazonECS	com.electriccloud	EC-AmazonECS	
com.electriccloud:EC-AmazonECS-Grapes	com.electriccloud	EC-AmazonECS-Grapes	
com.electriccloud:EC-Android	com.electriccloud	EC-Android	

2. Click the artifact for which you want to upload a new version.

The **Artifact Details** page appears. For example:

The screenshot shows the 'Artifact Details' page for the artifact `com.electriccloud:EC-AmazonECS-Grapes`. The page has a top navigation bar with links: Home, Projects, Jobs, Workflows, Cloud, Artifacts (selected), Search, Administration, and Change History. Below the navigation bar, there are sub-tabs: Artifacts, Artifact Versions, and Repositories. The main content area displays the artifact details: Artifact: `com.electriccloud:EC-AmazonECS-Grapes`, Group Id: `com.electriccloud`, Artifact Key: `EC-AmazonECS-Grapes`, and Description: (empty). Below this, there are two tabs: 'Artifact Versions' (selected) and 'Properties'. A blue 'Publish Artifact' button is visible. At the bottom, there is a table with columns: Artifact Version, Description, and Actions.

Artifact Version	Description	Actions
<code>com.electriccloud:EC-AmazonECS-Grapes:1.0.0</code>	JARs that EC-AmazonECS plugin procedures depend on	

3. Click **Publish Artifact**.

If this button is not visible, you might not have the proper permissions to create an artifact version.

The **Publish Artifact Version** page appears. For example:

Home Projects Jobs Workflows Cloud Artifacts Search Administration Change History

Artifacts Artifact Versions Repositories

Publish Artifact Version / **com.electriccloud:EC-AmazonECS-Grapes** ★

Artifact Name: com.electriccloud:EC-AmazonECS-Grapes

Latest Version: 1.0.0

Version:  Required

Repository:  Required

Artifact Files:

☒ File upload  No file chosen

☐ Folder upload  No file chosen

Enable Compression: ☒

[+Add Dependent Artifact Version](#)

4. Complete the page as follows:

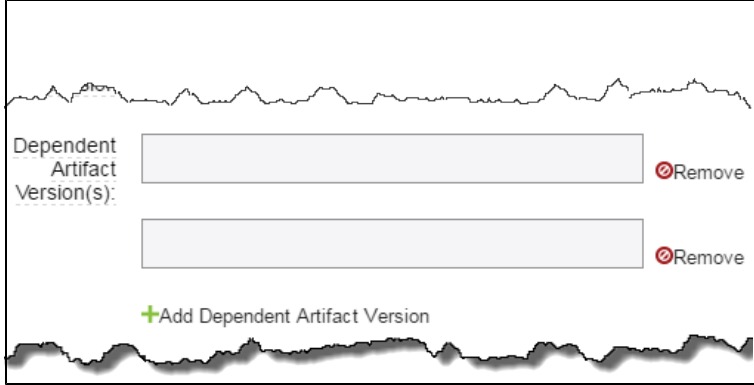
Field name	Description
Version	Fully-qualified artifact version string. The version string must be of the form <code>&lt;major&gt;.&lt;minor&gt;.&lt;patch&gt;-&lt;qualifier&gt;-&lt;buildNumber&gt;</code> . The version string must be unique across all of this artifact's versions.

Field name	Description
Repository	Name of the repository where the new artifact version will be published.



Field name	Description
Enable Compression	Compress the artifact version before storing it in the repository. The default is enabled (the check box is checked).

Field name	Description
Artifact Files	<div><p>Browse files or folders for publishing to the repository:</p><ul style="list-style-type: none"><li>• <b>File Upload</b>—Lets you choose a single artifact.</li><li>• <b>Folder Upload</b>—Lets you choose a folder that contains one or more artifacts. If you choose this option, you can add any combination of include or exclude patterns to filter files in or out:</li></ul><div><div><div><div><div><div></div><div>File upload</div><div>Choose Files</div><div>No file chosen</div></div></div><div><div><div></div><div>Folder upload</div><div>Choose File</div><div>No file chosen</div></div></div></div><div><div>Artifact Files:</div><div><div>Include Pattern(s):</div><div></div><div>Remove</div></div><div><div>+</div><div>Add Include Pattern</div></div><div><div>Exclude Pattern(s):</div><div></div><div>Remove</div></div><div><div>+</div><div>Add Exclude Pattern</div></div></div></div><p>The browser does not allow the upload if a linked file or folder with a broken link is specified.</p></div></div>

Field name	Description
Add Dependent Artifact Version	<p>(Optional) Dependent artifact version. You can enter one dependent artifact version per line, each in the form <code>&lt;groupId&gt;:&lt;artifactKey&gt;:&lt;versionRange&gt;</code>.</p> <p>All dependent artifact versions must exist for this artifact version to be retrieved. When this artifact version is successfully retrieved, its dependent artifact versions are retrieved also.</p> 

- Click **Publish**.

The page that shows the list of existing artifacts appears.

### Creating a New Artifact and Uploading Files to Publish the First Version

To upload and publish the first version of an artifact that you create:

- In the Automation Platform, choose **Artifacts > Artifacts**.

The list of existing artifacts appears. For example:

[Home](#)
[Projects](#)
[Jobs](#)
[Workflows](#)
[Cloud](#)
[Artifacts](#)
[Search](#)
[Administration](#)
[Change History](#)

[Artifacts](#)
[Artifact Versions](#)
[Repositories](#)

## Artifacts

Create Artifact | ★

(398 Results)

▼ Filters
Hide ▴
|
Save
|
New
Saved Filter ▼

Add Criteria +
Add Custom Criteria +

Name ▼▲	Group Id ▼▲	Artifact Key ▼▲	Description
EC-Tutorials:MyArtifact	EC-Tutorials	MyArtifact	
QE1:MyArtifact1	QE1	MyArtifact1	
QE:MyArtifact	QE	MyArtifact	
com.ec:shoppify	com.ec	shoppify	
com.ec:taxengine	com.ec	taxengine	
com.electriccloud:clusterRelatedFiles:clusterRelatedFiles	com.electriccloud:clusterRelatedFiles	clusterRelatedFiles	
com.electriccloud:EC-ALM	com.electriccloud	EC-ALM	
com.electriccloud:EC-AWS-Lambda	com.electriccloud	EC-AWS-Lambda	
com.electriccloud:EC-Admin	com.electriccloud	EC-Admin	
com.electriccloud:EC-AgentManagement	com.electriccloud	EC-AgentManagement	
com.electriccloud:EC-Agitar	com.electriccloud	EC-Agitar	
com.electriccloud:EC-AmazonECS	com.electriccloud	EC-AmazonECS	
com.electriccloud:EC-AmazonECS-Grapes	com.electriccloud	EC-AmazonECS-Grapes	
com.electriccloud:EC-Android	com.electriccloud	EC-Android	

2. Click **Create Artifact**.

The **New Artifact** page appears:

HomeProjectsJobsWorkflowsCloudArtifactsSearchAdministrationChange History

ArtifactsArtifact VersionsRepositories

## New Artifact

★

Name: (Supply Group Id and Artifact Key to create the Artifact Name.)

Group Id:

Required

Artifact Key:

Required

Description:

Artifact Version Name  
Template:

⊕ Publish Artifact Version

OKCancel

952

3. Click **Publish Artifact Version**.

The page expands to let you upload files from a file system to publish a version of the new artifact:

The screenshot shows the 'Artifacts' section of the Automation Platform. The top navigation bar includes Home, Projects, Jobs, Workflows, Cloud, **Artifacts**, Search, Administration, and Change History. Below this, a sub-navigation bar shows Artifacts, Artifact Versions, and Repositories. The main content area is titled 'New Artifact' and contains the following fields:

- Name:** (Supply Group Id and Artifact Key to create the Artifact Name.)
- Group Id:** [Text input field] Required
- Artifact Key:** [Text input field] Required
- Description:** [Large text area]
- Artifact Version Name Template:** [Large text area]

Below the 'New Artifact' section is the 'Publish Artifact Version' section, which is expanded. It contains the following fields and options:

- Version:** [Text input field] Required
- Repository:** [Text input field with 'default' selected] Required
- Artifact Files:**
  - ☒ File upload: [Choose Files] No file chosen
  - ☐ Folder upload: [Choose File] No file chosen
- Enable Compression:** ☒
- + Add Dependent Artifact Version** (link)

At the bottom right of the 'Publish Artifact Version' section are two buttons: **OK** and **Cancel**.

Notice that the **Name** field is derived from the group ID and the key of the artifact version, which you will enter in the next step.

4. Complete the page as follows:

Field name	Description
Group Id	Group ID of the artifact version.



Field name	Description
Artifact Key	Artifact ID of the artifact version.

Field name	Description
Description	Text that describes this object. ElectricFlow does not interpret this text.

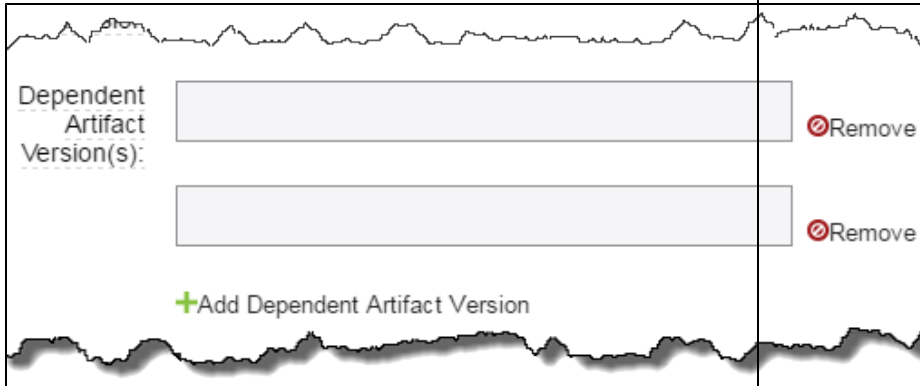
Field name	Description
Artifact Version Name Template	Template used to determine the default names of artifact versions.

Field name	Description
Publish Artifact Version	

Field name	Description
Version	Fully-qualified artifact version string. A full version string must be of the form <code>&lt;major&gt;.&lt;minor&gt;.&lt;patch&gt;-&lt;qualifier&gt;-&lt;buildNumber&gt;</code> . The version string must be unique across all of this artifact's versions.

Field name	Description
Repository	Name of the repository where the new artifact version will be published.

Field name	Description
Artifact Files	<div><p>Browse files or folders for publishing to the repository:</p><ul style="list-style-type: none"><li>• <b>File Upload</b>—Lets you choose a single artifact.</li><li>• <b>Folder Upload</b>—Lets you choose a folder that contains one or more artifacts. If you choose this option, you can add any combination of include or exclude patterns to filter files in or out:</li></ul></div> <div><div><div><div><div><div></div><div>File upload</div><div>Choose Files</div><div>No file chosen</div></div></div><div><div><div></div><div>Folder upload</div><div>Choose File</div><div>No file chosen</div></div></div></div><div><div>Artifact Files:</div><div><div>Include Pattern(s):</div><div></div><div>Remove</div><div>+Add Include Pattern</div></div><div><div>Exclude Pattern(s):</div><div></div><div>Remove</div><div>+Add Exclude Pattern</div></div></div><div><p>The browser does not allow the upload if a linked file or folder with a broken link is specified.</p></div></div></div>

Field name	Description
Enable Compression	Compress the artifact version before storing it in the repository. The default is enabled (the check box is checked).
Add Dependent Artifact Version	<p>(Optional) Dependent artifact version. You can enter one dependent artifact version per line, each in the form <code>&lt;groupId&gt;:&lt;artifactKey&gt;:&lt;versionRange&gt;</code>.</p> <p>All dependent artifact versions must exist for this artifact version to be retrieved. When this artifact version is successfully retrieved, its dependent artifact versions are retrieved also.</p> 

- Click **OK**.

The page that shows the list of existing artifacts appears.

## Publishing Artifact Versions

An artifact version is published by using a procedure step or the *ectool* / *ec-perl* command-line interface. In most cases, using the Publish Artifact Version step is sufficient.

The following screen illustrates the parameters section for creating the Publish Artifact Version step:



**Parameters**

Artifact:  Required

Version:  Required

Repository:  Required

Enable Compression? ☒

Follow Symbolic Links? ☒

From Directory: 

+Add Include Pattern
+Add Exclude Pattern
+Add Dependent Artifact Version

## Enabling Compression

When publishing an artifact, consider whether or not to enable compression. Using compression reduces transfer time during publish. However, compression also adds overhead when computing the compressed data. If files included in the artifact version are primarily text files or are another highly compressible file format, the benefit of reduced transfer time outweighs the cost of computing compressed data.

Artifact versions that contain installers, jars, audio, and video are almost certainly **not** compressible because these file types are already compressed, so the cost of compressing outweighs the (near zero) benefit of reducing transfer time. Another consideration: Artifact versions are stored in the same format as they are transferred, so highly compressible artifact versions use less space in the repository backing store.

## Using Include and Exclude Patterns

When publishing an artifact, you can choose which files to include by using include and exclude patterns. File patterns are expressed as relative paths under the From Directory. Pattern syntax and behavior is the same as Ant and uses the following wildcard characters:

?—matches a single character

\*—matches any number of characters, but only at a single directory level

\*\*—matches any number of directory levels

Examples:

Use \*.jar to match any .jar file in the top-level directory.

Use \*/\*.jar to match any .jar file in any child directory.

Use \*\*/\*.jar to match any .jar file at any level.

## Retrieving Artifact Versions

An artifact version is retrieved using a procedure step, or the `retrieveArtifactVersion` API call, used by the `ectool/ec-perl` command-line tools. This API call returns the most current artifact version that meets your criteria, per the algorithm described below.

Typically, you specify a version number range. Artifact version ranges are specified using interval notation. Brackets `[]` indicate versions to include and parentheses `()` indicate versions to exclude.

For example, the following artifact versions are published:

```
foobar:test:3.0.1-3645
foobar:test:1.2.3-2139
foobar:test:2.0.0-4000
foobar:test:2.0.0-DE-3395
foobar:test:2.0.0-DE-2445
foobar:test:2.0.0-DE
foobar:test:3.0.0-3539
foobar:test:4.0.0-5584
```

You want to retrieve the most current artifact version for the `foobar:test` artifact. To do this, you do not need to provide a version or version range, but instead enter retrieve parameters in the Retrieve Artifact Version step page as follows:

**Parameters**

Artifact:  Required

Version: ☒ Latest

☐ Exact:

☐ Range:

Minimum:  ☐ Inclusive?

Maximum:  ☐ Inclusive?

Retrieve to directory: ☐  Overwrite:

Retrieved Artifact Location Property:

The equivalent command using `ectool` is:

```
ectool retrieveArtifactVersions --artifactName foobar:test
```

and with ec-perl, the syntax is:

```
my $cmdr = newElectricCommander();  
  
$cmdr->retrieveArtifactVersions({artifactName => "foobar:test"});
```

Version numbers for two artifact versions (Artifact Version 1 and Artifact Version 2) are compared in the server as follows:

1. Compare `major.minor.patch`.
2. If they are equal, compare `qualifiers`.
3. If they are equal, compare `buildNumbers`.

**Note:** This comparison algorithm does not take the time of publish into account. "Current" means the artifact version with the greatest version per the above algorithm.

So the above list of artifact versions would be sorted (most current to least) as follows:

```
foobar:test:4.0.0-5584  
foobar:test:3.0.1-3645  
foobar:test:3.0.0-3539  
foobar:test:2.0.0-DE-3395  
foobar:test:2.0.0-DE-2445  
foobar:test:2.0.0-DE  
foobar:test:2.0.0-4000  
foobar:test:1.2.3-2139
```

If you want to retrieve the latest 3.0.0 artifact version, set maximum version to 3.0.1 "exclusive". The parameters entered in the retrieve step would look like this:

**Parameters**

Artifact:
foobar:test
Required

Version:

☐ Latest

☐ Exact:

☒ Range:

Minimum:
Maximum: 3.0.1

☐ Inclusive?
☐ Inclusive?

Retrieve to directory:

☐

Overwrite: update

Retrieved Artifact Location Property:
/myJob/retrievedArtifactVersions/\${assigned}

+Add Filter

Setting this constraint ensures the entire "version string" is properly evaluated. In other words, you want to ensure all artifact versions with 3.0.0, including qualifiers and build numbers, are included in the evaluation.

The equivalent command using ectool is:

```
ectool retrieveArtifactVersions --artifactName foobar:test
--versionRange "(,3.0.1)"
```

And with ec-perl, the syntax is:

```
my $cmdr = newElectricCommander();
$cmdr->retrieveArtifactVersions({artifactName => "foobar:test",
versionRange => "(,3.0.1)"});
```

Note the use of parentheses to exclude version "3.0.1".

Generally, while in development, you will want to specify a minimum artifact version and take the latest version published, then when an artifact has reached a "released" state, indicate a specific version.

## Parameters and Environment Variables for Artifact Retrieval Retry Attempts

The following parameters for artifact retrieval retry attempts are available in the Automation Platform server settings:

**Number of retries for Retrieve Artifact**

**Initial delay between retries for Retrieve Artifact**

**Maximum delay between retries for Retrieve Artifact**

The following environment variables for artifact retrieval retry attempts are available:

```
COMMANDER_NUMBER_OF_RETRIES_FOR_RETRIEVE_ARTIFACT  
COMMANDER_INITIAL_DELAY_BETWEEN_RETRIES_FOR_RETRIEVE_ARTIFACT  
COMMANDER_MAXIMUM_DELAY_BETWEEN_RETRIES_FOR_RETRIEVE_ARTIFACT
```

You set these variables on a client machine before doing a manual retrieval from the client via the `ectool retrieveArtifactVersions` command.

## Entering Filters During a Retrieve Operation

At times, a company might want to distinguish between artifact versions not just by version range but also by some other property of the artifact version. Examples are:

- Specifying a qualifier in the version string when publishing.

For example, you might want to publish an artifact version for your product's English or German variants. You could publish the English version as `2.0.4-EN-55497` and the German version as `2.0.4-DE-55497`.

When the qualifier string is used this way to classify artifact versions, it should be used as a filter to retrieve the latest version. This is described in the following example.

- Setting a custom property on the artifact version.

For example, after your QA team has tested an artifact version, they could show approval by setting a `qaApproval` custom property, including the name of the QA engineer.

For either case, filters can be applied when retrieving an artifact version. To retrieve the latest German version for the artifact, the parameters entered on the retrieve artifact custom step page look like this:

**Parameters**

Artifact:  Required

Version:

☐ Latest

☒ Exact:

☐ Range:

Minimum:  ☐ Inclusive?

Maximum:  ☐ Inclusive?

Retrieve to directory: ☐  Overwrite: 

Retrieved Artifact Location Property: 

Filter(s):

Because `DE` was used as the qualifier, ElectricFlow will retrieve the latest artifact version for the `perl:pkg` artifact where the qualifier equals `DE`.

Only the following filter operators can be applied to the intrinsic property version:

```

equals
greater than (greaterThan, for use in the API)
less than (lessThan, for use in the API)
greater than or equals (greaterOrEqual, for use in the API)
less than or equals (lessOrEqual, for use in the API)

```

"equals" is special because it does a string comparison on the version string of the artifact version, while the other operators compare the interpretation of the version string as described earlier.

All filter operators can be applied to version string components: `majorMinorPatch`, `qualifier`, or `buildNumber`. To find artifact versions with no qualifier, specify a filter on "qualifier" with operator "is not set" (or `isNull` in the API).

So for the QA approval case in a previous example, if a procedure is interested in an artifact version that was approved by QA, the retrieve step would specify a filter for `"qaApproval is set"`.

ectool does not currently support the filters argument, but you can write a Perl script as follows:

```
my $cmdr = new ElectricCommander();  
  
$cmdr->retrieveArtifactVersions({artifactName => "perl:pkg",  
    filters => {propertyName => "qaApprover",  
        operator => "isNotNull"}});
```

## Entering Dependent Artifact Versions

A published artifact version can be dependent on a list of artifact versions. These dependent artifact versions are retrieved when the primary artifact version is retrieved and they are specified with a query syntax when publishing the primary artifact version.

For example:

An artifact version for the ElectricFlow product could include dependent artifact versions for the core product, the SDK, and online Help:

- the latest `commander:Core` artifact version greater than or equal to version 3.5 (including 3.5)
- the most recent version of the `commander:SDK` artifacts
- the `commander:onlineHelp` artifact with a version greater than version 3.10 (excluding 3.10)

Because dependent artifact versions are evaluated during the retrieve process, specify them using the same syntax as you would for retrieving any artifact version, which is by including the group Id, the artifact key, and a specific artifact version or a version range.

Parameters for the "publish" custom step page would be similar to the following:

**Parameters**

Artifact:
commander:PKG
Required

Version:
4.0.0-[\$jobId]
Required

Repository:
default
Required

Enable Compression?
☒

Follow Symbolic Links?
☒

From Directory:

Include Pattern(s):
Remove
Add Include Pattern

Exclude Pattern(s):
Remove
Add Exclude Pattern

Dependent Artifact Version(s):
commander:Core:[3.5, ]
Remove
commander:SDK:[1, ]
Remove
commander:onlineHelp:[3.10, ]
Remove
Add Dependent Artifact Version

A published artifact version could have zero files, that is, no files are published as part of the artifact version, but it still could have a list of dependent artifact versions. An empty artifact version might be useful as modular convenience container for retrieving a group of artifact versions in downstream processes.

## Understanding the Artifact Cache

Artifact versions are retrieved to an artifact cache directory before being consumed by a build process. Properly configured, the artifact cache directory can significantly improve efficiency as you work with artifacts.

The artifact cache directory is set in one of these ways:

- Enter information in the Artifact Cache Directory field on the Edit Resource page.
- Use the `modifyResource` API to set the `artifactCacheDirectory` intrinsic property.
- Set the `artifactCache` field in the `agent.conf` file.

Thus, each resource can have its own artifact cache location (directory). Alternatively, multiple resources and an entire site can share an artifact cache if the cache directory resides on a shared file server.



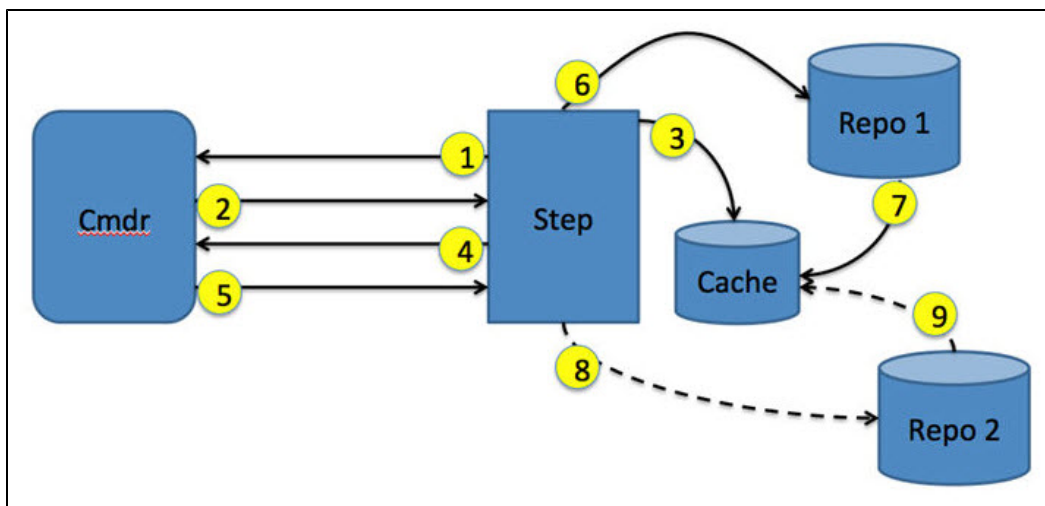
When an ElectricFlow step retrieves an artifact version, remember that often a version range or no version at all is specified. For example, to retrieve the latest ElectricFlow SDK artifact version, you could issue the following command:

```
ectool retrieveArtifactVersions --artifactName commander:SDK
```

No version is specified because we want the "latest" artifact version published.

In the following example, the step sends a request (1) to the ElectricFlow server:

1. The ElectricFlow server replies (2) with a fully qualified artifact version name. In this case, it returns `commander:SDK:1.2.0.43552`.
2. The step then looks in its artifact cache for the artifact version (3).
3. If the artifact is not found in the artifact cache, a request is issued (4) to get a list of repositories to search to find the artifact version.
4. The ElectricFlow server replies (5) with a list of repositories and the order in which to search them.
5. The step requests the artifact version from the first (6) repository in the list.
6. If the artifact version is found in the repository, the artifact version is retrieved to the cache (7).
7. If the artifact version is not found, the step requests the artifact version from the next repository in the search order (8).
8. If the artifact version is found in that repository, the artifact version is retrieved to the cache (9).
9. Otherwise, if the artifact version is not found in any repository, an error is displayed.



In this example, if the requested artifact version was found in the artifact cache (step 3), the resource would not have communicated with either of the repository servers. Also, any potential network latencies would have been avoided from retrieving the artifact version from the repository server.

If you have a cache shared by multiple resources and steps that run on those resources need to use the same artifact version, the first step requesting an artifact version retrieves it from the repository to the cache. Subsequent job steps using the artifact version will have immediate access to the artifact version in the cache, eliminating the need for each step to retrieve its own copy of an artifact version.

## Cleaning Up Repositories and Caches

**Note:** This method does not work for artifacts in an Amazon Simple Storage Service (Amazon S3) repository.

Deleting an artifact version in the ElectricFlow server does not delete it in the repository backing store, and it does not remove the artifact version from an artifact cache.

*ectool* and the ElectricFlow Perl module include a function for each of these tasks: `cleanupRepository` and `cleanupArtifactCache`. Both of these API calls are intended to be run on the machine containing the `cache/backingstore` directory that needs to be cleaned up.

The cleanup algorithm is as follows:

1. Reviews the directory tree looking for directories three-levels deep.
2. For each such directory, interprets the three path components as `<groupId, artifactKey, version>`.
3. Issues a `findObjects` request to the ElectricFlow server to see if an artifact version with that specification exists.
4. Deletes all directories identified by `<groupId, artifactKey, version>` and not recognized by the ElectricFlow server.

To operate correctly, using the `cleanupRepository` API *requires* read access to all artifact version objects stored in ElectricFlow and therefore must be run in an "admin" session. We also recommend running `cleanupArtifactCache` in an "admin" session—if not, artifact versions that are simply not readable by the user invoking the cleanup will be deleted from the cache.

In addition, both functions fail if the server does not recognize any of the chosen artifact versions. Thus, if the cleanup function is called on a directory that is not a `backingstore` directory or an artifact cache, it will not delete anything.

The recommended approach for removing stale artifact versions from a backing store is to use an ElectricFlow maintenance procedure that periodically runs on each repository server (which presumably has an agent install). Similarly, use a procedure with a broadcast step to run on each agent to clean up its cache. Note that the job step session does not necessarily have read privileges on all artifact versions, so it is important to login as a privileged user, then perform cleanup with those credentials.

## Authenticating Users for LDAP and Active Directory

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. **Local** users and groups are defined within ElectricFlow.

Use the following LDAP information and examples to enter information in your LDAP template. If you are using the Active Directory template, you may still use the LDAP information as reference—the templates are similar with only a slight difference in the Active Directory template.

## Configuring LDAP

A number of options need to be customized for any LDAP configuration. The following sample configuration shows how we have our own LDAP configuration set up. After the sample, see a list of properties with a

description.

### Sample LDAP Configuration

```
<bean id="LdapDirectoryProvider"
  class="com.electriccloud.security.ldap.
  LdapDirectoryProviderImpl">
  <property name="providerName" value="LDAP"/>
  <property name="url" value="ldap://dir.
    electric-cloud.com/dc=electric-cloud,dc=com"/>
  <property name="managerDn" value="uid=JohnDoe,ou=People,=
    electric-cloud,dc=com"/>
  <property name="managerPassword" value="****"/>
  <property name="userBase" value="ou=People"/>
  <property name="userSearchFilter" value="uid={0}"/>
  <property name="userNameAttribute" value="uid"/>
  <property name="fullUserNameAttribute" value="gecos"/>
  <property name="emailAttribute" value="mail"/>
  <property name="groupBase" value="ou=Group"/>
  <property name="groupMemberFilter" value="(| (member={0})
    (memberUid={1}))"/>
  <property name="groupMemberAttributes" value="member,
    memberUid"/>
  <property name="groupSearchFilter" value="(| (
    groupOfNames) (objectClass=posixGroup))"/>
  <property name="groupNameAttribute" value="cn"/>
</bean>
```

### The following properties configure LDAP mapping:

**emailAttribute**—(optional) The attribute in a user record that contains the user's email address. If the attribute is not specified, the account name and domain name are concatenated to form an email address.

**fullUserNameAttribute**—(optional) The attribute in a user record that contains the user's full name (first and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's account name is used instead.

**managerDn**—(optional) The DN of a user who has read-only access to LDAP user and group directories. If this property is not specified, the server attempts to connect as an unauthenticated user. Not all servers allow anonymous read-only access.

**Note:** This user does not need to be an admin user with modify privileges.

`managerPassword`—(optional) If the `managerDn` property is set, this password is used to authenticate the manager user.

`providerName`—This human readable name will be displayed in the user interface to identify users and groups that come from this provider.

`userBase`—This string is prepended to the `basedn` to construct the directory DN that contains user records.

`userNameAttribute`—The attribute in a user record that contains the user's account name.

`userSearchFilter`—This LDAP query is performed in the context of the user directory to search for a user by account name. The string "`r; {0}`" is replaced with the user's login ID. Typically, the query compares a user record attribute with the substituted user login ID.

`url`—The LDAP server URL is in the form `protocol://host:port/basedn`. Protocol is either `ldap` or `ldaps` for secure LDAP). The port is implied by the protocol, but can be overridden if it is not at the default location (389 for `ldap`, 636 for `ldaps`). The `basedn` is the path to the top level directory that contains users and groups at this site. This is typically the domain name where each part is listed with a `dc=` and separated by commas.

**Note:** Spaces in the `basedn` must be URL encoded (`%20`).

In addition to user information, the LDAP server can be queried for group information. This query is optional because the local group mechanism can refer to LDAP users and *local* users. However, the following elements can be used to tell the server how to map groups in LDAP

`groupBase`—(optional) This string is prepended to the `basedn` to construct the directory DN that contains group records.

`groupMemberAttributes`—(optional) A comma separated attribute names list that identifies a group member. Most LDAP configurations only specify a single value, but if there is a mixture of POSIX and LDAP style groups in the directory, multiple attributes might be required.

`groupMemberFilter`—(optional) This LDAP query is performed in the groups directory context to identify groups that contain a specific user as a member. There are two common forms of group record in LDAP directories: POSIX style groups where members are identified by account name, and

`groupOfNames` or `uniqueGroupOfNames` records where members are identified by the full user DN. Both forms are supported, so the query is passed two parameters: "`r; {0}`" is replaced with the full user record DN, and "`r; {1}`" is replaced with the user's account name.

`groupNameAttribute`—(optional) The group record attribute that contains the name of the group.

`groupSearchFilter`—(optional) This LDAP query is performed in the context of the groups directory to enumerate group records.

## Determining LDAP Mapping

A typical POSIX user record in LDAP looks similar the example below. To set up a mapping for this record, it is necessary to identify various record components. First, identify the path in the directory that contains user records. In this example, the build user has a distinguished name (dn) of

`uid=build,ou=People,dc=mycompany,dc=com`. This name uniquely identifies the build user account and this path splits into three parts:

**base dn:** `dc=mycompany,dc=com`

**user base:** `ou=People`

**user element:** `uid=build`

The `baseDn` is the parent of the directory that contains users. This value should be combined with the protocol and server to form the URL. In this case, the URL is `ldaps://dir/dc=mycompany,dc=com`.

Next, the `userBase` is the portion of the path that identifies the directory containing all user account records. This value is used directly as the `userBase` configuration element.

The remaining portion identifies the user without the People directory: `uid=build`. The user name is replaced in this value with the string `"r;{0}"` to form the `userSearchFilter: uid={0}`. This query allows the server to search for a user's account name by looking for a record with a matching `uid` attribute.

The final mapping step is to identify user record attributes that hold the account name, full user name, and (optionally) the user's email address. In this example, the account name is `uid` (identified earlier), the full user name attribute is `gecos`, and there is no email attribute.

At this point, the server is able to authenticate a user, look up a user by name, and determine the user's full name. For many installations this is sufficient.

### Sample LDAP User Record

```
# build, People, electric-cloud.com
dn: uid=jdoe, ou=People, dc=mycompany,dc=com
loginShell: /bin/bash
uidNumber: 508
gidNumber: 508
objectClass: account
objectClass: posixAccount
objectClass: top
objectClass: shadowAccount
uid: jdoe
gecos: John Doe
cn: John
homeDirectory: /net/filer/homes/build
```

Also, you can configure the server to look for **LDAP groups** that refer to user accounts. A typical group record is shown below. Like a user account, an LDAP group has a distinguished name with a `baseDn`, a group base, and a group element. In this case, the `basedn` is still `dc=mycompany,dc=com`. The `groupBase` configuration element is `ou=Group`, and the group name is `cn=build_users`.

The server needs to identify records in the directory that correspond to groups—it does this by applying the `groupMemberFilter` to the records in the `groupBase` directory. In this case, group records are members of the `posixAccount` object class, so the filter can be set to `objectClass=posixGroup`. To display a group by its name, the server needs to know which attribute represents the group name. In this case, set the `groupNameAttribute` to `cn`.

Finally, the server needs a filter to determine which accounts belong to the group and the attribute name that represents a single group member. Group membership can be identified in one of two ways. Either the members are listed by account name, or by their LDAP distinguished name. In this case, POSIX group membership is determined by account name, so set the `groupMemberAttributes` property to `memberUid`, and set the `groupMemberFilter` to `memberUid={1}`.

### Sample LDAP Group Record

```
# build_users, Group, mycompany.com
dn: cn=build_users,ou=Groups,dc=mycompany,dc=com
objectClass: posixGroup
objectClass: top
gidNumber: 100
memberUid: jdoe
      memberUid: mary
cn: build_users
```

### Sample Active Directory Configuration File

The following XML file defines parameters needed to connect to an Active Directory server and the query to use for looking up user information.

```
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:
      xmlns:tx
      xmlns:aop
      xsi:schemaLocation
      http://www.springframework.org/schema/beans/spring-beans-2.0.xsd
      http://www.springframework.org/schema/tx
      http://www.springframework.org/schema/tx/spring-tx-2.0.xsd
      http://www.springframework.org/schema/aop
      http://www.springframework.org/schema/aop/spring-aop-2.0.xsd" default-lazy-
      init="true"

  <bean id="ADDirectoryProvider"
        class="com.electriccloud.security.ldap.ActiveDirectoryProviderImpl">
    <property name="providerName" value="ActiveDirectory" />
    <!-- START OF CUSTOMIZATIONS -->
    <!-- URL to AD server of the form: "r;ldap://host:port/base_dn" -->
    <property name="url" value="ldap://server:389/dc=company,dc=com" />
    <!-- Required credentials for an account that has read-only access to the server
    -->
    <property name="managerDn"
      value="cn=myuser,cn=Users,dc=company,dc=com" />
    <property name="managerPassword" value="mypw" />
```

```
<property name="userBase" value="cn=Users" />
<property name="userSearchFilter" value="(&(sAMAccountName={0})
(objectClass=user))" />
<property name="userNameAttribute" value="sAMAccountName" />
<property name="fullUserNameAttribute" value="name" />
<!-- Optional group configuration. This is only needed if you intend -->
<!-- to manage groups externally via AD. -->
<!-- <property name="groupBase" value="value=""/>-->
<!-- <property name="groupMemberFilter" value="member={0}"/> -->
<!-- <property name="groupMemberAttributes" value="member"/>-->
<!-- <property name="groupSearchFilter" value="(objectClass=group)"/>-->
<!-- <property name="groupNameAttribute" value="cn"/>-->
<!-- Max number of results to get back in one query. This must be -->
<!-- no greater than the AD server's setting, which is typically 1000. -->
<property name="pageSize" value="500" />
<!-- END OF CUSTOMIZATIONS -->
</bean>
</beans>
```

## LDAP Group Hierarchy

The LDAP or Active Directory provider can now be configured to recognize the nested group hierarchy in the LDAP or Active Directory server in the following use cases.

### Access Control

When **Recursively Traverse Group Hierarchy** is selected (enabled) for the directory provider and access control is set up for a given LDAP group in ElectricFlow, the users belonging to any nested groups in LDAP will automatically inherit the access control rules defined for the parent groups. For more information about **Recursively Traverse Group Hierarchy**, see the "Membership Options" sections in [To create a new Active Directory provider](#) on page 859 and [To create a new LDAP directory provider](#) on page 863 for the directory provider configuration details.

In this LDAP hierarchy:

- Group1
  - User11
  - Group11
    - User111
    - User112
    - Group111

- Group12
  - User121
  - User122

These access control rules have been set up with **Recursively Traverse Group Hierarchy** enabled:

- Group1: Project:Default Read->Allow, Modify->Allow, Execute->Deny
- Group12: Project:Default Read->Allow, Modify->Deny, Execute->Allow

Because the users in Group111 and Group11 are also considered to be members of Group1, the access control rules defined for Group1 also apply to them:

```
Project:Default Read->Allow, Modify->Allow, Execute->Deny
```

Because the users in Group12 are also considered members of both Group1 and Group12, the access control rules defined in both groups may apply to the users in Group 12. However, ElectricFlow does not support the inherent group hierarchy. Thus, ElectricFlow does not apply special precedence logic based on the group hierarchy, and the same precedence logic that is currently applied for a user belonging to two or more groups will apply in this situation, giving `Deny` a higher precedence:

```
Project:Default Read->Allow, Modify->Deny, Execute->Deny
```

## Manual Task Assignees and Approvers

If **Recursively Traverse Group Hierarchy** and **Include Nested Group Users as Approvers** are both enabled for the directory provider, users in nested LDAP groups are allowed to complete or approve a manual task when a parent LDAP group is assigned as an assignee or an approver for the task. For more information about these membership options, see the "Membership Options" sections in [To create a new Active Directory provider](#) on page 859 and [To create a new LDAP directory provider](#) on page 863 for the directory provider configuration details.

In the following LDAP hierarchy with both **Recursively Traverse Group Hierarchy** and **Include Nested Group Users as Approvers** enabled:

- Group1
  - User11
  - Group11
    - User111
  - Group12
    - User121

When Group1 is assigned as an approver for a manual task, User11, User111, and User 121 can approve the task.

## Notifications

If **Recursively Traverse Group Hierarchy** and **Include Nested Group Users in Notifications** are both enabled for the directory provider, users in nested LDAP groups will be included when sending notifications to a parent LDAP group. For more information about these membership options, see the "Membership Options" sections in [To create](#)



[a new Active Directory provider](#) on page 859 and [To create a new LDAP directory provider](#) on page 863 for the directory provider configuration details.

In the following LDAP hierarchy with both **Recursively Traverse Group Hierarchy** and **Include Nested Group Users in Notifications** enabled:

- Group1
  - User11
  - Group11
    - User111
  - Group12
    - User121

When notifications are set up to be sent to Group1, they are sent to User11, User111, and User 121.

## Change Tracking

Change Tracking is designed to track every change between every state of non-runtime ElectricFlow objects and to allow you to revert to any previous state of these objects. ElectricFlow tracks the changes to tracked objects including applications, procedures, workflows, workspaces, resources, and project-owned components such as library components and records a *Change History* of the historical states of the system and the changes between them. The change history has a copy of every state in which every non-runtime object has been, the object's current state, and indexing records for searching through the database. The tracked objects are not affected when ElectricFlow executes an object that is usually created or modified at execution time, such as a workflow or process.

Change tracking allows you to do the following:

- When debugging a failed job or looking for more information about a component in an ElectricFlow, see the Change History for the changes relevant to that object.
- When searching for specific change history records, filter the records by time frame, change type, entity type, or developer.
- Revert changes to an object or to an objects and its children.
- When you want to determine the differences between objects, export them at various levels in the object hierarchy.

In ElectricFlow, you can use Change Tracking in all aspects of the ElectricFlow end-to-end solution:

- In build-test automation, track the Change History of artifacts, resources, and ACLs.
- In deployment automation, track the Change History of components, environment tiers, and process steps (application or component). You also use Change Tracking with snapshots to make it easier to deploy reliable and repeatable software for Continuous Delivery.
- In Releases and Pipelines, track the Change History of stages and tasks.

## Configuring Change Tracking

Change Tracking must be enabled when ElectricFlow starts for your system to track changes and record the Change History.

By default, Change Tracking is enabled for projects created in ElectricFlow 5.3 or later. It is disabled for projects created in ElectricFlow versions before ElectricFlow 5.3, but can be enabled manually.

### Enabling Change Tracking Globally

When installing ElectricFlow:

1. Add this line to the `database.properties` file:

```
COMMANDER_DB_AUDITING_ENABLED=true
```

2. Restart the ElectricFlow server.

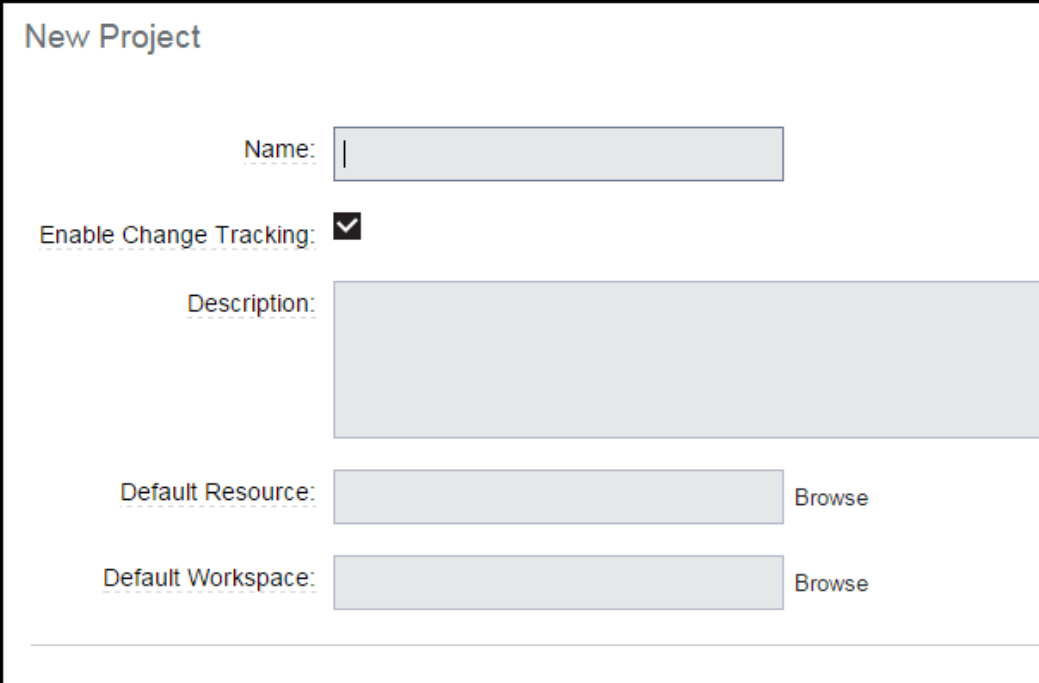
### Enabling Change Tracking on a Per-Project Basis

**IMPORTANT:** Unless the `allowEnablingDisablingChangeTrackingProjectLevel` setting has been altered, only admin users are allowed to perform this task. The default setting is `adminOnly`. If the setting is changed to `anyoneWithAccess`, any user with access to the project can enable or disable Change Tracking for the project

You can enable Change Tracking one of the following ways:

#### In the ElectricFlow Platform UI

Change Tracking is enabled when the **Enable Change Tracking** check box is selected.



The screenshot shows the 'New Project' form with the following fields and controls:

- Name:** A text input field.
- Enable Change Tracking:** A checkbox that is checked (indicated by a checkmark icon).
- Description:** A large text area for project description.
- Default Resource:** A text input field with a 'Browse' button next to it.
- Default Workspace:** A text input field with a 'Browse' button next to it.

To disable Change Tracking, click the **Enable Change Tracking** check box to clear it, and click **OK**.

### Using ectool

- Enter `ectool modifyProject <projectName> --tracked true` to enable Change Tracking.
- Enter `ectool modifyProject <projectName> --tracked false` to disable Change Tracking.

### Using ec-perl:

- Enter `$cmdr->modifyProject(<projectName>, {tracked => true});` to enable Change Tracking.
- Enter `$cmdr->modifyProject(<projectName>, {tracked => false});` to disable Change Tracking.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

```
ectool:ectool modifyProperty <projectName> -- path <propertyPath> -- counter true
```

or

```
ec-perl:$cmdr-> modifyProperty (<projectName>, {path => <propertyPath>, counter => true});
```

When the `counter` flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

CAUTION: Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted,.

### Upgrading to ElectricFlow 6.x

Change Tracking is enabled when you upgrade to ElectricFlow 6.x. This can significantly increase the time it takes to complete the upgrade.

If you want to upgrade with Change Tracking disabled, add this line to the `database.properties` file before starting the upgrade:

```
COMMANDER_DB_AUDITING_ENABLED=false
```

### Customizing the Change History Page

The performance of the Change Tracking feature is affected by number of records in the Change History as well as the number of entries being tracked. For example, a page showing 5000 entries may be slow to load and update and does not provide much useful information.

This ElectricFlow server uses the lowest of the following limits to determine the maximum amount of records to display in the Change History page:

- Maximum amount of records on the Change History page

To change the maximum number of records in the Change History page:

1. Set the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file to a new value.

The default value is 1000.

2. Restart the ElectricFlow server.

- Maximum number of records retrieved

Set the `TrackingMax Records` server setting to a new value not exceeding the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file.

To set `TrackingMaxRecords`, do one of the following:

Change the value in the UI. See the Server Settings page in the automation platform UI.

Use `ectool` to change the value. For example, enter the following command to limit the number of records retrieved to 100:

```
ectool setProperty /server/settings/changeTrackingMaxRecords --value 100
```

## Viewing the Change History for Artifacts, Jobs, Projects, and Workflows

When troubleshooting why a job failed, you can view the Change History for artifacts, jobs, projects, and workflows in the automation platform.

- [Artifacts](#) on page 983
- [Jobs](#) on page 984
- [Projects](#) on page 985
- [Workflows](#) on page 986

### Artifacts

Starting from the Home page:












1. Go to the Artifacts tab.
2. Choose an artifact.

- Click the **Track Changes** button.

### Example:

Artifacts

4 Results New Search | Create Artifact

Name	Group Id	Artifact Key	Description	Actions
com.ec.myapp	com.ec	myapp		  
com.mycompany.heatclinic.config	com.mycompany.heatclinic	config		  
com.mycompany.heatclinic.warfile	com.mycompany.heatclinic	warfile		  
com.mycompany.heatclinic.warfileWildfire	com.mycompany.heatclinic	warfileWildfire		  



Records per page: 20 1 thru 4 of 4

The Change History for the selected artifact opens.

The default time increment is **Past 60 Minutes**.



### Example:

Change History

Change History for com.ec:myapp  

▼ Last changes 4

7/10/15 - 1:02 PM Now - 7/10/15 - 6:49 PM Most Recent

View All Changes	When	What	Name	By...	Change	Path
<ul style="list-style-type: none"> <li>Objects</li> <li>Ac1 (2)</li> <li>Property Sheet (1)</li> <li>✓ Artifact (1)</li> </ul>	✓ 1 Jul 10, 2015 1:02 PM Pacific...	artifact	com.ec:...	<a href="#">admin</a>	 created	

- Changes
- ✓ Created (4)
- Changed by...
- ✓ Admin (4)

## Jobs

Starting from the Home page:

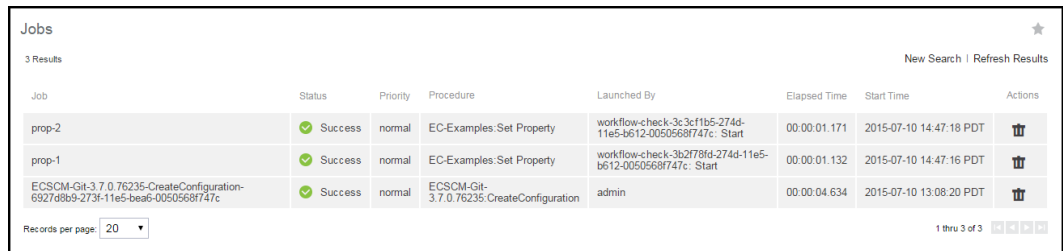
- To go to the Job Details page, do one of the following:
  - Use the Jobs tab.
  - Use the Jobs Quick View list.

2. If you use the Jobs tab, follow these steps:

a. Click the Jobs tab.

The Jobs page opens.

### Example:



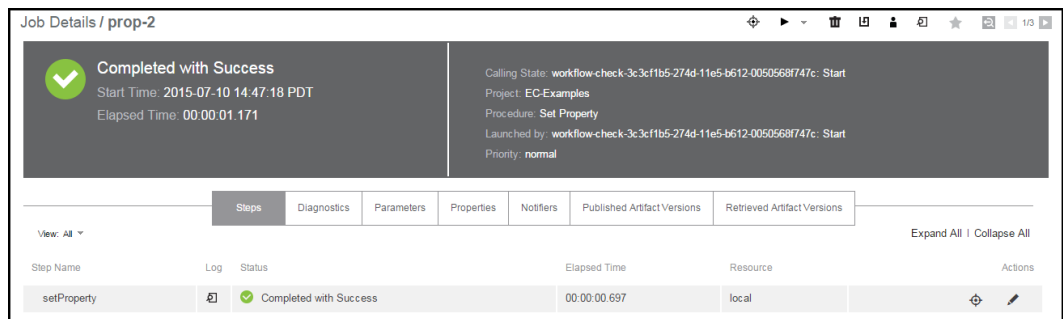
The screenshot shows the 'Jobs' page with a table of results. The table has columns for Job, Status, Priority, Procedure, Launched By, Elapsed Time, Start Time, and Actions. There are three rows of job results, all with a 'Success' status. The first row is for 'prop-2', the second for 'prop-1', and the third for a specific ECSCM-Git job. A 'Records per page' dropdown is set to 20, and the page shows '1 thru 3 of 3' records.

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
prop-2	Success	normal	EC-Examples:Set Property	workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start	00:00:01.171	2015-07-10 14:47:18 PDT	
prop-1	Success	normal	EC-Examples:Set Property	workflow-check-3b2f78fd-274d-11e5-b612-0050568f747c: Start	00:00:01.132	2015-07-10 14:47:16 PDT	
ECSCM-Git-3.7.0.76235-CreateConfiguration-6927d8b9-273f-11e5-bea6-0050568f747c	Success	normal	ECSCM-Git-3.7.0.76235:CreateConfiguration	admin	00:00:04.634	2015-07-10 13:08:20 PDT	

b. Click a job name to select a job.

The Job Details page opens.

### Example:



The screenshot shows the 'Job Details / prop-2' page. It features a large green checkmark icon and the text 'Completed with Success'. Below this, it shows the 'Start Time' as '2015-07-10 14:47:18 PDT' and 'Elapsed Time' as '00:00:01.171'. To the right, there is a summary of the job details: 'Calling State: workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start', 'Project: EC-Examples', 'Procedure: Set Property', 'Launched by: workflow-check-3c3cf1b5-274d-11e5-b612-0050568f747c: Start', and 'Priority: normal'. Below the summary, there are tabs for 'Steps', 'Diagnostics', 'Parameters', 'Properties', 'Notifiers', 'Published Artifact Versions', and 'Retrieved Artifact Versions'. The 'Steps' tab is selected, showing a table with columns for Step Name, Log, Status, Elapsed Time, Resource, and Actions. The first step is 'setProperty', which is 'Completed with Success' and took '00:00:00.697' seconds on a 'local' resource.

Step Name	Log	Status	Elapsed Time	Resource	Actions
setProperty		Completed with Success	00:00:00.697	local	

3. If you use the Jobs Quick View list, click a job name to select a job.

The Job Details page opens.

4. Choose a job or job step.

5. Click **Track Changes** for the job or job step.

The Change History for the job or job step opens.

The default time increment is **Past 60 Minutes**.

## Projects

Starting from the Home page:

1. Go to the Projects tab.

2. Choose a project.

- Click the **Track Changes** button.

The Change History for the project opens.

### Example:

Project	Description	Impersonation Credential	Create Date	Actions
Branch_1_2_9	Branch_1_2_9		2015-07-10 15:51:41 PDT	[Track Changes] [Edit] [Clone] [Delete]
Default	Default project created during installation.		2015-07-10 12:56:39 PDT	[Track Changes] [Edit] [Clone] [Delete]
DemoLibrary	Library of procedures used by the ElectricFlow Demo System.		2015-06-12 00:56:23 PDT	[Track Changes] [Edit] [Clone] [Delete]
DeployObjects-1.7.8			2015-07-10 13:02:26 PDT	[Track Changes] [Edit] [Clone] [Delete]
EC-Examples	This project contains templates for procedures that perform basic tasks within ElectricCommander.		2015-07-10 12:56:40 PDT	[Track Changes] [Edit] [Clone] [Delete]
EC-Tutorials-1.0.0.69904	This project contains small pieces of code which show how to use features in ElectricCommander.		2015-07-10 12:57:51 PDT	[Track Changes] [Edit] [Clone] [Delete]
EC-Utilities	This project contains procedures that perform basic tasks within ElectricCommander. Also, the procedures can be used as examples that can be copied and modified in another project.		2015-07-10 12:56:50 PDT	[Track Changes] [Edit] [Clone] [Delete]
Electric Cloud	Electric Cloud Procedures		2015-07-10 12:57:18 PDT	[Track Changes] [Edit] [Clone] [Delete]
beanstalk	AWS procedures to manipulate Amazon resources for <i>Elastic Beanstalk</i> operations: <ul style="list-style-type: none"> <li>S3 storage for file deployments</li> <li>Elastic Beanstalk Environments</li> <li>Elastic Beanstalk Applications</li> </ul>		2015-01-06 06:47:18 PST	[Track Changes] [Edit] [Clone] [Delete]
ec-library	Library of Electric Cloud utility procedures.		2015-01-07 05:55:23 PST	[Track Changes] [Edit] [Clone] [Delete]
jpetstore			2015-02-19 05:06:40 PST	[Track Changes] [Edit] [Clone] [Delete]

Records per page: 20 1 thru 11 of 11

## Workflows

Starting from the Home page:

- Go to the Workflows tab.
- Choose a workflow.
- Click **Track Changes**.

The Change History for the workflow opens.

## Modifying What You See the Change History

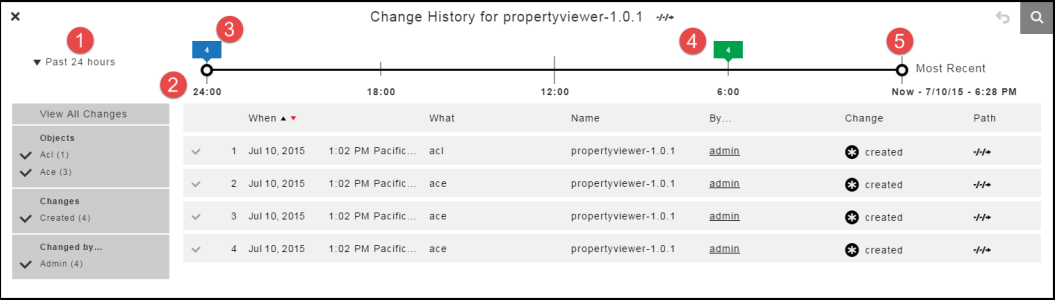
You can modify the information that appears in the Change History with these settings:

- Time line—Go to [Change History Time Line](#) on page 986.
- Filters—Go to [Change History Filters](#) on page 992.

### Change History Time Line

The time line is at the top of the Change History page.

This example shows the Change History for a property called *propertyviewer-1.0.1*.



1	<p>Time increment.</p> <p>The default is <b>Last Changes</b>.</p> <p>Click the down arrow to select another time increment.</p>
2	<p>The system automatically calculates the minutes, hours, and days since the last successful run.</p> <p>In the example, the last successful run occurred 24 hours ago. The time line is divided into four 6 hour subdivisions.</p>
3	<p>Total number of changes in the selected time increment.</p>
4	<p>The number of changes that occurred between 6 hours ago and now is 4.</p> <p>When you click the change number, the Change History is updated and shows only those changes.</p>
5	<p>Drag the start and end time markers to view specific changes.</p>

Default Settings

The default time increment is **Last Change**.

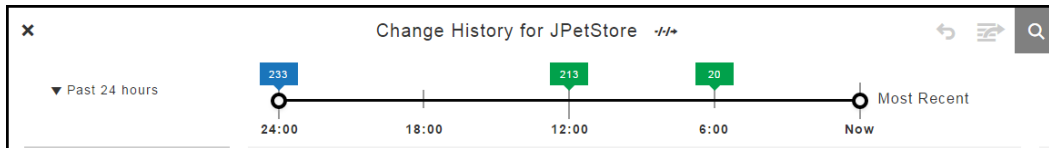
The entire time line is displayed, and all the changes are in the list below the time line.

Number of Changes

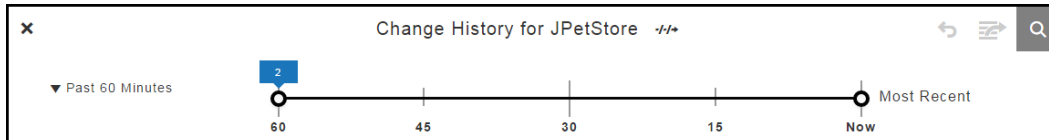
The time line shows the number of changes throughout the time increment. In the following example:

- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.

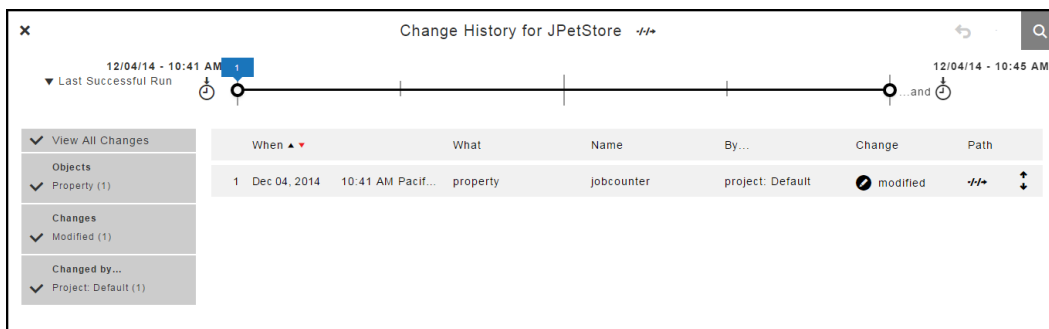




When you change the time increment, there have been two changes in the previous 60 minutes.



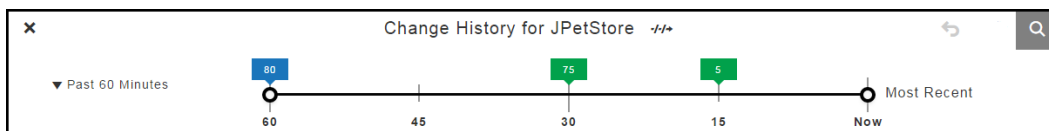
## Time Increment



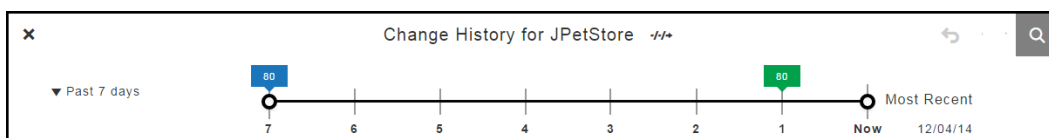
The system automatically determines how the time line is divided for the selected time increment.

When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.



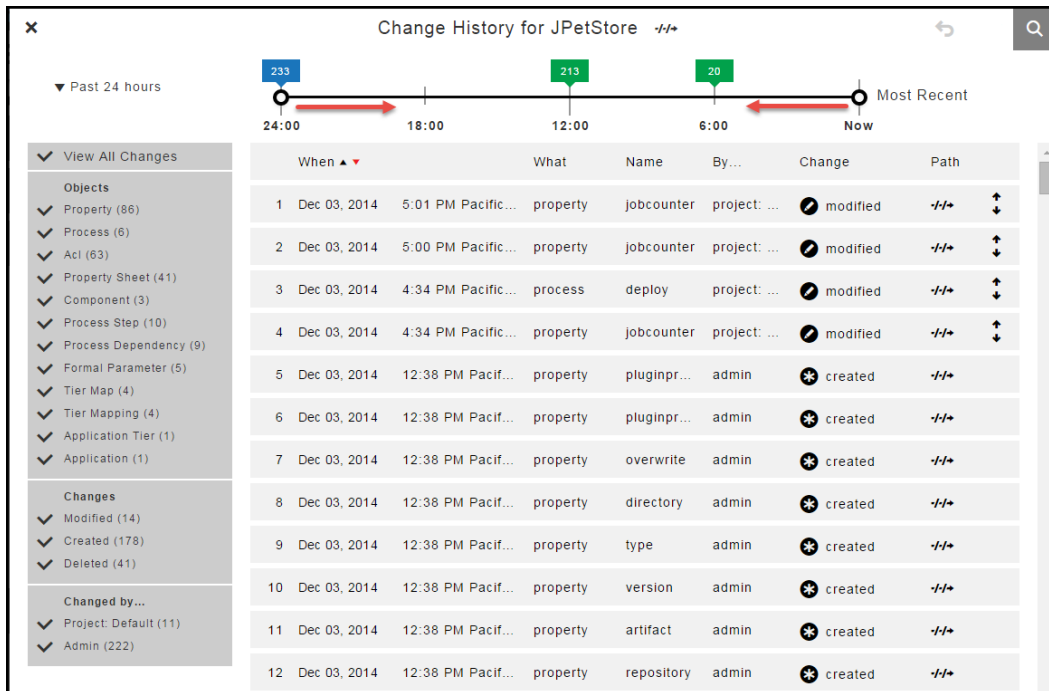
If the increment is **Past 7 Days**, the time line has seven one-day divisions.



## Moving the Start and End Times Manually

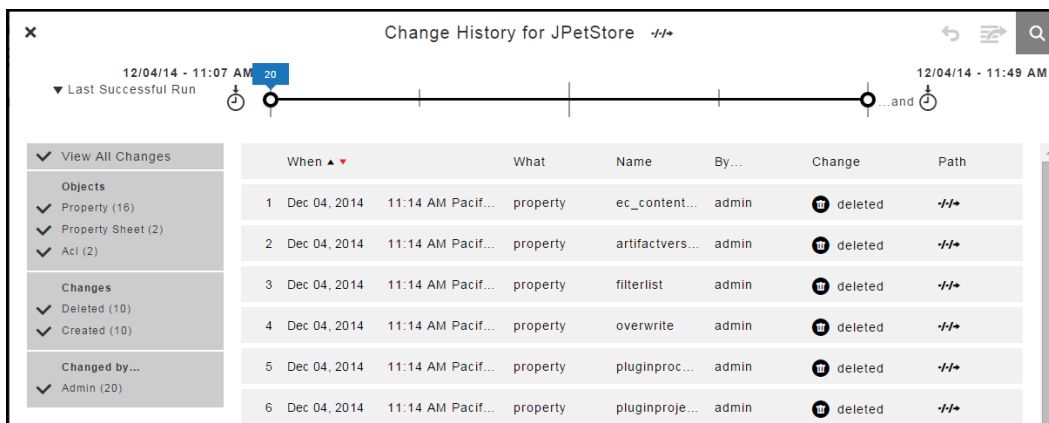
You can manually move the start and end times on the time line.

When you move the start time to 18:00 and the end time to 6:00, the list of objects in the change history changes.



## Setting Custom Time Increments

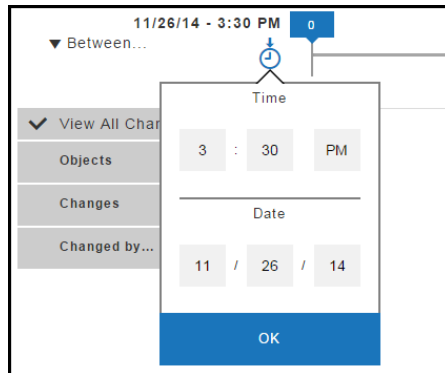
### Example:



1. Select **Between**.

A drop down dialog box opens.

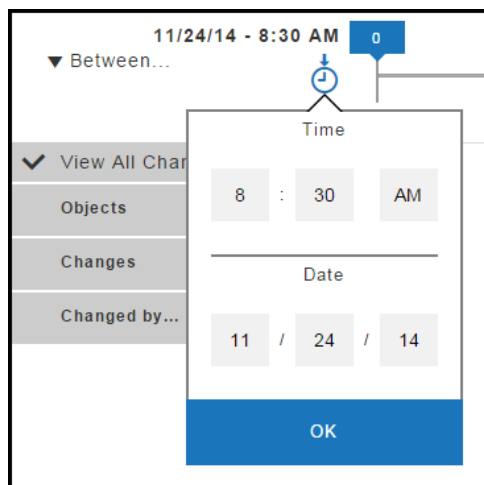
**Example:**



2. Select the time and date for the start of the time line.

The default settings are **3:30 PM** and eight days before the current date.

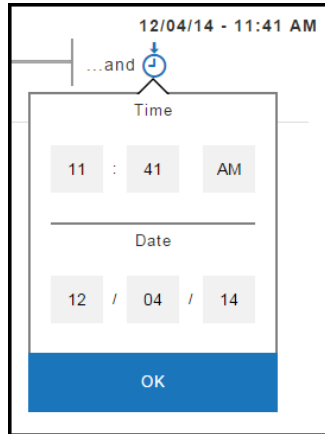
**Example:**



3. Click **OK**.

A drop down dialog box opens at the other end of the time line.

**Example:**

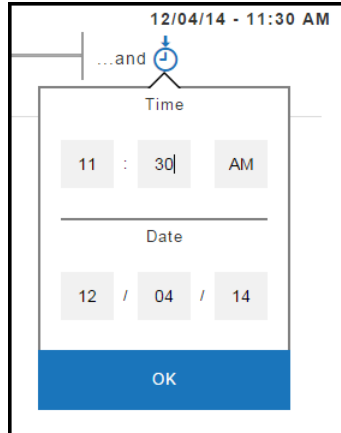


The screenshot shows a dialog box for selecting time and date. At the top, it displays "12/04/14 - 11:41 AM". Below this, there is a section labeled "Time" with input fields for "11", ":", "41", and "AM". Below the time section is a section labeled "Date" with input fields for "12", "/", "04", "/", and "14". At the bottom of the dialog is a blue button labeled "OK".

4. Select the time and date for the end of the time line.

The defaults are **3:30 PM** and the current date.

**Example:**



The screenshot shows the same dialog box as before, but the time has been changed to "30" in the minutes field, resulting in "11 : 30 AM". The date remains "12 / 04 / 14". The "OK" button is still at the bottom.

5. Click **OK**.

The time line changes to show only the changes from the start and end times and dates that you selected.

**Example:**

The screenshot shows the 'Change History for JPetStore' window. At the top, a timeline is displayed with a date range from 11/24/14 - 8:30 AM to 12/04/14 - 11:30 AM. Below the timeline, a table lists changes. The left sidebar contains filters for 'View All Changes', 'Objects', 'Changes', and 'Changed by...'. The table has columns: When, What, Name, By..., Change, and Path.

When	What	Name	By...	Change	Path
1 Dec 04, 2014 10:28 AM Pacif...	acl	jpetstore	admin	* created	-/-/
2 Dec 04, 2014 10:28 AM Pacif...	acl	jpetstore	admin	* created	-/-/
3 Dec 04, 2014 10:28 AM Pacif...	propertySh...	jpetstore	admin	* created	-/-/
4 Dec 04, 2014 10:28 AM Pacif...	propertySh...	ec_deploy	admin	* created	-/-/
5 Dec 04, 2014 10:28 AM Pacif...	application	jpetstore	admin	* created	-/-/
6 Dec 04, 2014 10:28 AM Pacif...	property	ec_notifier...	admin	* created	-/-/
7 Dec 04, 2014 10:28 AM Pacif...	property	ec_deploy	admin	* created	-/-/
8 Dec 04, 2014 10:28 AM Pacif...	acl	ec_deploy	admin	* created	-/-/
9 Dec 04, 2014 10:28 AM Pacif...	acl	apptier	admin	* created	-/-/
10 Dec 04, 2014 10:28 AM Pacif...	propertySh...	apptier	admin	* created	-/-/
11 Dec 04, 2014 10:28 AM Pacif...	acl	apptier	admin	* created	-/-/

**Change History Filters**

The Change History has records only for an object and its tracked entities, not all entities belonging to the object. You can use filters to view changes to specific objects, the types of changes, and the users how made those changes if they are are tracked.

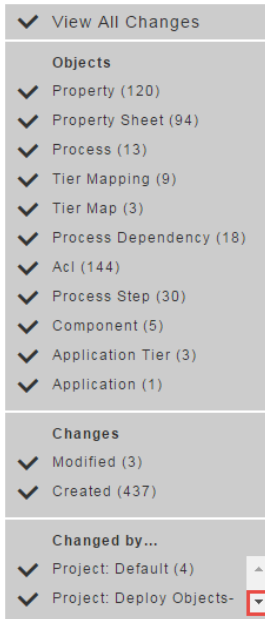
In this example, instead of selecting **View All Changes**, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.

The screenshot shows the 'Change History for JPetStore' window with filters applied. The left sidebar shows 'View All Changes' selected, and the table displays only modified changes. The filters are: Objects (Property (43), Process (2), Property Sheet (20), Acl (27), Component (1), Process Step (6), Process Dependency (8)), Changes (Modified (6)), and Changed by... (Project: Default (2), Admin (105)).

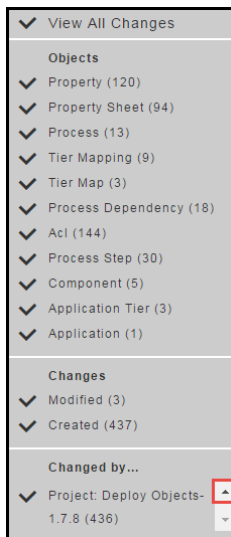
When	What	Name	By...	Change	Path
1 Dec 03, 2014 4:34 PM Pacific...	property	jobcounter	project: ...	modified	-/-/
2 Dec 03, 2014 4:34 PM Pacific...	process	deploy	project: ...	modified	-/-/
3 Dec 03, 2014 11:35 AM Pacif...	process	deploy	admin	modified	-/-/

When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.



Click the down arrow to see the other users.



## Searching the Change History

Follow these steps to start a search in the Change History.

You can start a Change History search from most pages in the ElectricFlow UI.

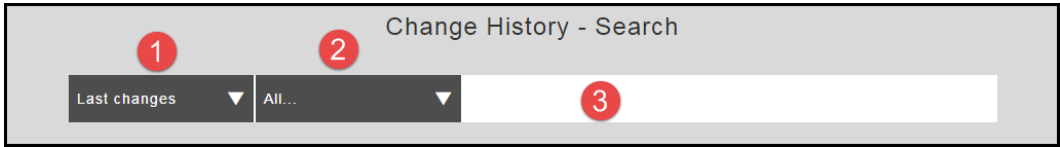
1. Click the **Search** button or click **Change History**.

Example:



The **Change History—Search** dialog box opens.

Example:

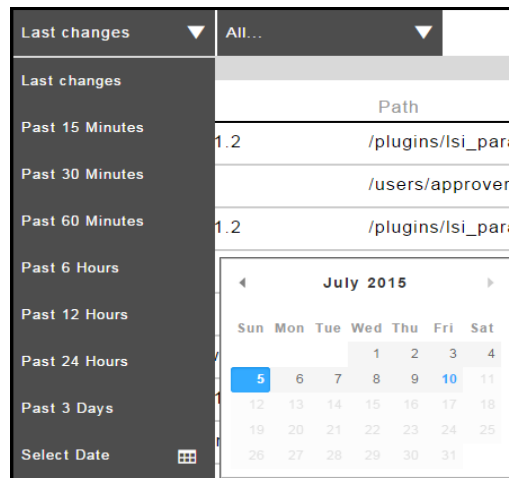


1	<p><b>Time range</b> field.</p> <p>Click the down arrow to open the drop-down list of start times.</p> <p>The end time is the current time.</p>
2	<p><b>Objects</b> field.</p> <p>Click the down arrow to open the drop-down list of objects to include in the search. You can select <b>All</b> or specific objects.</p> <p>By default, seven of the most commonly tracked objects are selected.</p>
3	<p>Search criteria.</p> <p>After you type, the system starts searching for objects based on the time range and objects that you selected.</p> <p>The search results are in the Change History.</p>

2. To select a time range for the search:
  - a. Click the down arrow in the **Time range** field to open the drop-down list.
  - b. Select a time range.
  - c. If you want to use a time increment longer than three days, do the following:
    - a. Click **Select Date**.

The Date Picker opens.

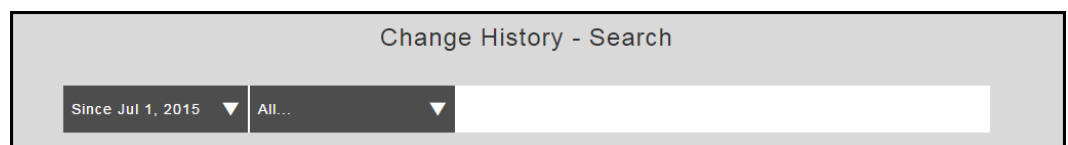
### Example:



- b. Select a date.

The Date Picker closes and the date that you selected appears in the Time Increment field.

### Example:



3. To select an objects for the search:
  - a. Click the down arrow in the **Object** field to open the drop-down list.
  - b. Select the objects for the search.
4. Enter the search criteria.
 

As you type, the system starts to search for objects that match your search criteria.

A list of objects matching your search criteria appears in the results section.



5. Select an object in the list.

### Example:

Since Jul 1, 2015 ▼	All... ▼	property	✕
Access Control En...	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	
	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
Access Control List	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	
Plugin	statetemplate_fullprope...	/server/ec_notifiertemplates/statetemplate_fullpropertypaths	
	propertyviewer-1.0.1	/plugins/propertyviewer-1.0.1	
Property	ecscm-property-2.0.1.6...	/plugins/ecscm-property-2.0.1.65837	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	
	artifactversionlocationp...	/projects/default/applications/jpetstore-aws-beanstalk/compone...	
	label	/server/ec_notifiertemplates/statetemplate_fullpropertypaths/la...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	artifactversionlocationp...	/projects/default/applications/heat clinic store 1.1/components/...	
	series 1 property function	/projects/electric cloud/schedules/report recent job trend/series...	
	artifactversionlocationp...	/projects/default/applications/heat clinic (killer app)/component...	

The change history for the object that you selected appears.

### Example:

Change History for propertyviewer-1.0.1 ↗						
<div> <div>▼ Last changes</div> <div> <div>7/10/15 - 1:02 PM</div> <div>Now - 7/10/15 - 6:18 PM</div> </div> </div>						
View All Changes	When ▼	What	Name	By...	Change	Path
Objects						
✓ Acl (1)	1 Jul 10, 2015	1:02 PM Pacific...	acl	propertyviewer-1.0.1	admin	created ↗
✓ Ace (3)	2 Jul 10, 2015	1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created ↗
Changes						
✓ Created (4)	3 Jul 10, 2015	1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created ↗
Changed by...						
✓ Admin (4)	4 Jul 10, 2015	1:02 PM Pacific...	ace	propertyviewer-1.0.1	admin	created ↗

## Reverting Changes to a Tracked Object and Its Tracked Contents

The Change History displays a list of changes in reverse chronological order (from latest to oldest) for tracked entities in objects such as applications, procedures, workflows, workspaces, resources, and project-owned components such as library components. Each row in the Change History or a tracked object is a record of a change made either to the tracked object or to a tracked object owned by the object (directly or indirectly). For example, the Change History of a project would show both changes to the project itself and changes to any tracked object in the project, such as its procedures, the ' steps for each procedure, or properties belonging to the procedure steps.

Some types of objects (mostly run-time objects such as jobs, because tracking those would be resource-intensive and seldom useful) are not tracked by the Change Tracking feature. For a few types of tracked objects, some of their attributes are not tracked (for example, agents are tracked, but certain attributes of agents that vary frequently in real-time, such as their current status, are not). Changes to untracked objects, or to untracked attributes of tracked objects, are not shown in the Change History and cannot be reverted. In general, objects that are normally created or changed manually are tracked, and objects that are normally created or modified during automated processing are not. However, depending on your specific usage patterns, this behavior may not be recorded in the Change History, such as when you frequently run jobs that use `ectool` or API commands to automate the creation of new procedures or steps.

**Note:** You must have the *Read*, *Modify*, and *Execute* permissions to revert changes in the UI or to access to the `revert` API function.


Follow these steps to select a tracked object and its tracked entities that you want to revert:

1. Go to the Change History for the object that you want to revert using one of these methods:



- Click the **Track Changes** button (  ) for the object.



- From the ElectricFlow Home page, click the **Search** button (  ) to go to the "Change History—Search" page and search for the object.


2. Locate the time period in which you are interested.

A list of changes for the tracked object appears.

3. If you decide to revert the changes for an object owned by the tracked object or for an object that owns the tracked object, use one of the methods to view the list of changes for this object:

- Close the current Change History and navigate to the Change History for the object.




- Click the **View Path** button (  ) on the top of the current Change History, copy the path, go to the "Change History—Search" page, and search for a suitable addition to or truncation of that path.

4. Select a row (record) in the Change History corresponding to the earliest of the changes that you want to undo.

You will be reverting the object and all its tracked contents to their state directly before the selected change was made.



- a. If the **Revert** button (  ) becomes enabled, ElectricFlow is capable of reverting the selected changes to the object. is tracking the changes to this object.

Go to Step 5.

- b. If the **Revert** button is still disabled, ElectricFlow is not currently capable of reverting changes to the selected object. This could be due to tracking of this object being disabled and re-enabled, or the Change History feature being disabled and re-enabled. Also, not all types of tracked objects can currently be reverted (and due to mutual consistency requirements in the database format, certain types of objects cannot be reverted).

If you are unable to revert the selected object, you may still be able to achieve what you need to do one of these ways:

- Revert the parent object that owns the object you want to revert.
- Separately revert the individual objects owned by the selected object or even nested partial-reversions-of-reversions, possibly combined with manually reversion (undoing) certain changes.

Go to Step 3 to search for an owned or owning tracked object.

5. Before clicking the **Revert** button, make certain that you know all the changes that will be reverted, and have confirmed that this is what you want to do. (While it is possible to re-revert the changes caused by a mistaken reversion operation, doing so leaves a lot of activity in the Change History.)

**IMPORTANT:** All of the changes for tracked entities will be reverted, even the ones that you do not see in the Change History because of the timeline and filter settings.

- a. You may need to modify the timeline and filter settings to display all records in the Change History before you verify that all of the records are changes you want to revert.
- b. Make sure that the end of the timeline is set to **Now** and that the filters are set to **View All Changes**.
- c. Look through the entire list of changes from the most recent to the one you have selected, expanding them to see the details if needed, and confirm that you really want to revert all of them.

**IMPORTANT: Tip on how to further refine what changes will be reverted**

If you want to revert some of the changes shown but not others, you may be able to achieve what you want to do with some combination of the following methods:

- Reverting just certain objects owned by the object that you want to revert.
- Using nested or overlapping sets of reverts of owned objects.
- Undoing individual changes manually using the ElectricFlow UI.
- Using nested partial-reverts-of-reverts.

If you fully understand the XML format used for ElectricFlow exports, you can use the `export` API call to export the past and current states of a part of the object hierarchy, diff and merge them using a suitable tool for diffing and merging XML files, and then re-import the results. Caution is strongly suggested if you are using this approach to revert objects for which ElectricFlow does not currently support reversion, because:

- There are some places in the ElectricFlow XML data hierarchy where peer objects refer to each other in ways that need to be kept consistent (such as by index of current position in a list).
- For some types of objects, re-importing them can change their IDs and break references-by-id.

6. Click the **Revert** button. Depending on the size of the object and every tracked object it owns, this operation could take some time (as long as exporting a past state of them and then re-importing it).

If this operation is successful, the object and its tracked entities are reverted back to the state at the date and time of the record selected in Step 3. A message appears that the Revert operation was successful.

If this operation is not successful, the object and its tracked entities are not reverted, and a message appears about the failed operation.

## Change History Search Form

**How to get here:** From most pages, click the **Search** button to open the "Change History—Search" form.

### Example:



The "Change History—Search" form has the following information:

1

Last changes

▼

2

All...

▼

3

Change History - Search

1	<p><b>Time range</b> field.</p> <p>Click the down arrow to open the drop-down list of start times.</p> <p>The end time is the current time.</p>
2	<p><b>Objects</b> field.</p> <p>Click the down arrow to open the drop-down list of objects to include in the search. You can select <b>All</b> or specific objects.</p> <p>By default, seven of the most commonly tracked objects are selected.</p>
3	<p>Search criteria.</p> <p>After you type, the system starts searching for objects based on the time range and objects that you selected.</p> <p>The search results are in the Change History.</p>

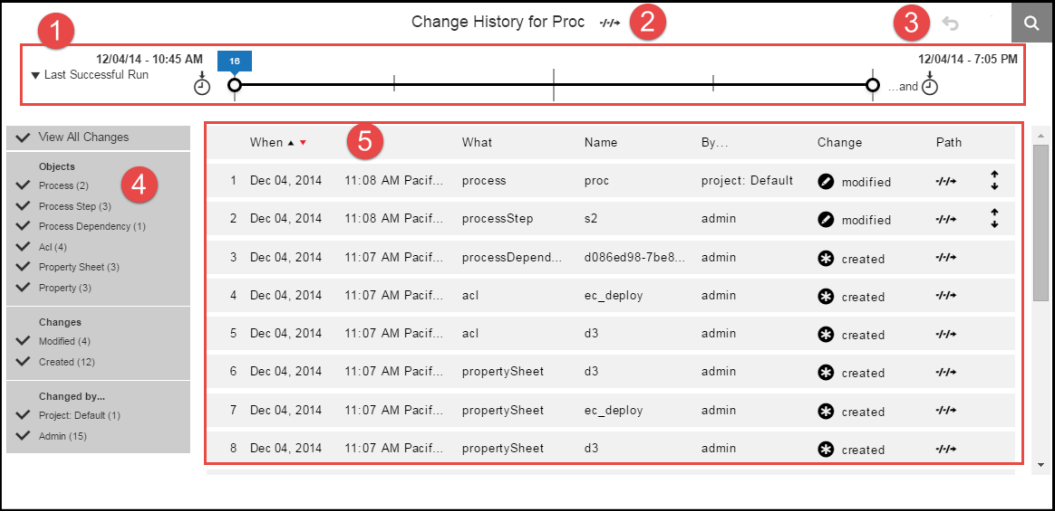
Change History Page

**How to get here:** Click the **Change History** button for a tracked object.

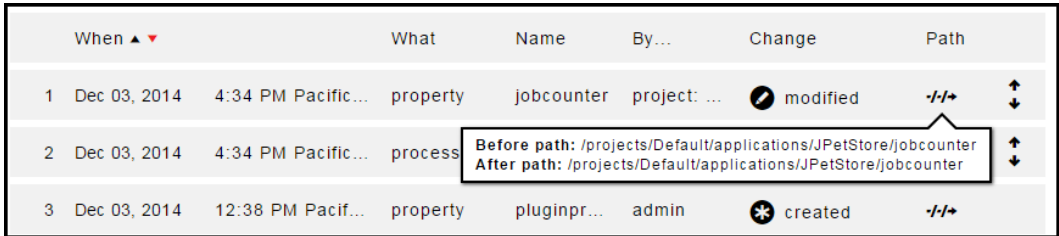
Example:



The Change History has this information about the object called *Proc*:

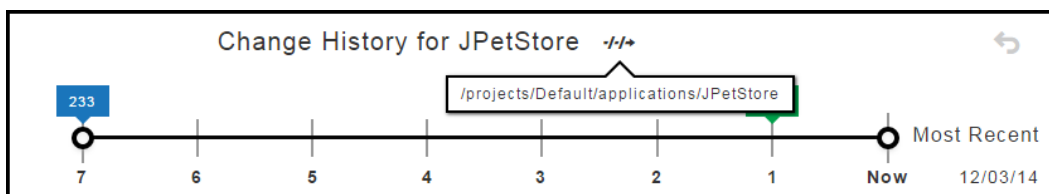


1	<p>Time line</p> <p>You can modify the start and end times.</p> <p>Default:</p> <ul style="list-style-type: none"><li>• The entire time line is selected. All changes appear in the Change History list.</li><li>• The time increment is from the Last Successful Run to the most current change.</li><li>• The start time is based when the last successful run occurred.</li><li>• The end time is when the most recent changed occurred.</li></ul>
2	<p>Path to the tracked object.</p> <p>Example:</p> <p>Change History for JPetStore</p> <p>233</p> <p>/projects/Default/applications/JPetStore</p> <p>7 6 5 4 3 2 1 Now Most Recent 12/03/14</p>
3	<p>Click to revert the selected changes.</p>

6	<p>Time line.</p> <p>The start time is based on the time range that you selected.</p> <p>The end time is the current time.</p> <p>You can manually change the start and end times after you run the search and get the search results.</p>
4	<p>Filters for the change history.</p> <p>You can view all changes or view only selected changes.</p> <p>The objects in the list are the objects in the change history search results.</p>
5	<p>Change history for the selected object.</p> <ul style="list-style-type: none"> <li>• When—the date and time that the object changed.</li> <li>• What—The type of object.</li> <li>• Name—The name of the object.</li> <li>• By—The "user" that changed the object, which can be a project or a user.</li> <li>• Change—The type of change.</li> <li>• Path—Click the <b>View Path</b> button to see the path to the object.</li> </ul>  <p>Click the <b>View</b> button to view more information about a specific change in the change history.</p>

## Paths to Objects

Click the **View Path** button next to the "Change History for JPetStore" title to see the path to the application.



Click the **View Path** button to see the change in the path to the object before and after the change.

	When		What	Name	By...	Change	Path
1	Dec 03, 2014	4:34 PM Pacific...	property	jobcounter	project: ...	modified	-/-+
2	Dec 03, 2014	4:34 PM Pacific...	process	Before path: /projects/Default/applications/JPetStore/jobcounter After path: /projects/Default/applications/JPetStore/jobcounter			
3	Dec 03, 2014	12:38 PM Pacif...	property	pluginpr...	admin	created	-/-+

Detailed Object Changes

Click the **View** button to see the change in the property called emailNotifier.

Past 60 Minutes

View All Changes

Objects

Changes

Modified (3)

Changed by...

Admin (3)

Timeline for Test

60

45

30

15

Now

Most Recent

When	What	Name	By...	Change	Path
1 Dec 17, 2014 1:37 PM Pacific...	emailNotifier	notifier for jennifer	admin	modified	-/-+
2 Dec 17, 2014 1:37 PM Pacific...	emailNotifier	notifier for jennifer	admin	modified	-/-+

Column Changed

From...

To...

Current state

1. destinations

john doe@electric-cloud.com

doe jane@electric-cloud.com

john doe@electric-cloud.com

Click the **Expand** button to all the changes to the property,

Example:



When you click the **Expand** button in a cell, you can see more details in the current change in the cell.

If you click the **Select All** button, all the changes about the object appear.

2 Dec 17, 2014 1:37 PM Pacific Standard Time

emailNotifier

notifier for jennifer

By: admin

modified

-/-+

Column Changed

From...

To...

Current state

1. destinations

doe jane@electric-cloud.com

doe jane@electric-cloud.com

john doe@electric-cloud.com

To select an object to revert or import the changes to an XML file, select the row of the object in the expanded view.

2 Dec 17, 2014 1:37 PM Pacific...

emailNotifier

notifier for jennifer

admin

modified

-/-+

Column Changed

From...

To...

Current state

1. destinations

john doe@electric-cloud.com

doe jane@electric-cloud.com

john doe@electric-cloud.com

Credentials and User Impersonation

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## What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, *stored* or *dynamic*:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project Details page.
- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

## Defining a Credential

After a credential is created, no one can view the password for the credential's account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click **Create Credential**.

Click the **Help** link on the New Credential page if you need more information about what to enter in the fields.

## Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.

In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

## Credential Access Control

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and *attached* credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly *attached* to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:

- Set the impersonation credential for a step, procedure, project, or schedule.

You can also set the impersonation credential for an application process, component process, or a process step.

Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.

- Explicitly attach the credential to a step or schedule using the UI or the `attachCredential` API.

To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.

## Using Credentials for Impersonation at the Platform Level

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.

However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:

- If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
- You may need to run jobs as particular users to access ClearCase views for those users.
- There may be certain steps that require special privileges.

For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called *impersonation*, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this *impersonation* is implemented using credentials. The use of credentials creates special security challenges.

**Note:** It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

## Setting the Impersonation Credential in the Automation Platform

### Attaching Impersonation Credentials to Steps, Procedures, and Projects

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:

1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

### Attaching Impersonation Credentials to Schedules

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule's credential receives the lowest priority.

### Attaching Impersonation Credentials to Jobs

You can specify a credential when you launch a job manually one of these ways:

- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

### Attaching a New Impersonation Credential

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.
4. Do one of the following:
  - a. For a **procedure**:
    - i. Click **Create Procedure** to go to the New Procedure page.
    - ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
  - b. For a **step**:
    - i. Select a procedure to go to the Procedure Details page.
    - ii. Select a step name to go to the Edit Step page.
    - iii. On the Edit Step page, scroll down to the Impersonation section.
  - c. For a **schedule**:
    - i. Select the Schedules subtab.
    - ii. Select a schedule to go to the Edit Schedule page.
    - iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a **Help** link in the upper-right corner.

### Accessing Credentials From a Step at the Platform Level

The ElectricFlow server supports an operation called `getFullCredential` that can return a password when called from inside a step. The ectool interface for this operation is:

```
getFullCredential <credential name>  
  
[--value <password|user>]
```

Without the `--value` option, the response is the same as that returned by `getCredential`, with the addition of a "password" element.

With `--value`, the simple text password or user name value is returned on *stdout* so it can be used directly without XML parsing.

The `getFullCredential` API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

### Attaching a Credential to a Procedure Step, Procedure, or Schedule

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:

1. Go to an "Edit" page.

For example, to create a credential for a step, a step must already exist.

2. Select a step that needs a credential. The Edit Step page opens.
3. Scroll to the lower section of the page and click **Attach Credential**.

If you are an ectool command-line user, use the `attachCredential` API command. For more information on the command-line interface, go to the *ectool* Help topics within the online Help system.

### Passing Credentials as Parameters

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named InnerProj.
2. Within that project create a procedure named InnerProc with a parameter 'cred' of the type credential.
3. Within that procedure create a step named InnerStep with:
  - Command: `ectool getFullCredential cred`
  - Attached Parameter Credential: cred
4. Create a project named OuterProj with two credentials: cred1 and cred2.
5. Within that project create a procedure named OuterProc with two parameters, cred1 and cred2, of the type credential.
6. Within that procedure create two subprocedure steps that both call InnerStep from the InnerProj project:
  - OuterStep1 with Attached Parameter Credential cred1, and cred1 in the Parameters section
  - OuterStep2 with Attached Parameter Credential cred2, and cred2 in the Parameters section

If you are an ectool command-line user, you can use the `createFormalParameter` and `attachParameter` API commands. For more information on the command-line interface, go to the *ectool* Help topics within the online Help system.

### Credential References

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.

For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step's transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A *relative* path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An *absolute* path includes a project name like `"/projects/MyProject/credentials/rootCred"` and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.

## Best Practices for Retrieving Credentials

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

### First Class

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

### Second Class

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:

#### Does the step's command use properties?

If so, someone could potentially change the property value to change the step behavior.

For example, suppose the step's command is defined like this:

```
echo ${/myProject/x}
```

Anyone with write access to property *x* can hijack the step by placing the value `"nothing; myCommand"` in the property.

After property substitution, the final command will be:

```
echo nothing; myCommand
```

that will cause `"myCommand"` to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

### **Does the step execute code or commands that can be modified?**

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.

For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

### **Avoid passing passwords on the command line**

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via `stdin`.

## **Defect Tracking**

The Defect Tracking plugin enables linking existing defects to an ElectricFlow job. "Existing defects" are those defects previously created in the defect tracking system and already associated with the ElectricFlow job in some way.

For example, a defect is associated with a ElectricFlow job if the fix for the defect is part of the source code snapshot being built and tested in the job.

ElectricFlow pre-installs numerous defect tracking plugins including Bugzilla, ClearQuest, Fortress, JIRA, Quality Center, Ration Team Concert, Rally, Team Foundation Server, TeamForge, TestTrack, and more, using plugin integrations.

The following examples and instructions are for a JIRA integration. The steps for other defect tracking systems are similar to those for JIRA.

### Scenario example

A developer fixes a defect in the "ABC" project and checks in the fix to the source control system, along with a comment that includes the fixed defect ID, for example:

```
ABC-123: fixed EFG bug
```

When the next ElectricFlow job is triggered for the ABC project, ElectricFlow checks out a source code snapshot from the source control system and queries the source control system for a log containing check-in details. This log, which should contain the above comment, will be stored in a property on the job.

The JIRA plugin will then do the following:

- Parse the property containing the source control system log to identify defect IDs.
- Query the configured JIRA server with identified defect IDs, including "ABC-123".
- Construct a descriptive URL to point to the JIRA defect on the JIRA server.
- Include the URL in the JIRA Report.
- Link to this JIRA Report from the Job Details page.

### Example: Enabling the JIRA integration in your procedure

To ensure ElectricFlow links existing defects to a job, create a step to link the defects.

Go to Projects > select a Project > select a Procedure. To create a New Step, select the **Plugin** link.

- In the Choose Step panel, select Defect Tracking from the left pane, then select the defect tracking system you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the defect tracking integration you configured and the step you chose.

On the New Step page, enter information in the following fields:

General section:

**Name**—Enter a unique name for your subprocedure step (any name of your choice).

**Description**—(optional) A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a>` `<b>` `<br>` `<div>` `<dl>` `<font>` `<i>` `<li>` `<ol>` `<p>` `<pre>` `<span>` `<style>` `<table>` `<tc>` `<td>` `<th>` `<tr>` `<ul>`

Subprocedure section:

**Resource**—(optional) You do not need to change the resource you previously chose to run the procedure.



## Parameters section:

config—(required) This is the name of the Defect Tracking configuration you created on the New Defect Tracking Configuration page.

**Note:** If you did not previously create a Defect Tracking configuration, you must do that now before you proceed. Go to Administration > Defect Tracking > click the **Create Configuration** link to see the New Defect Tracking Configuration page. Access the **Help** link on that page for more information.

prefix—(optional) This is the key used by JIRA as the prefix for defects within a project. If the "prefix" field is blank, a regular expression is used to try and match defect IDs.

propertyToParse—(optional) This is the property or property sheet to search for defect IDs. If the "propertyToParse" field is blank, the default property `/myJob/ecscm_changeLogs` is used.

## Advanced section:

You do not need to enter any information in these fields.

The following screen is an example of the New Step page where you will create your Defect Tracking subprocedure step.

The screenshot shows the 'New Step' configuration page. It includes the following sections and fields:

- General:**
  - Name: [Text Field]
  - Description: [Text Area]
- Command:**
  - Subprocedure: EC-DefectTracking-JIRA: LinkDefects
  - Change: [Text Field]
  - Resource: [Text Field]
- Parameters:**
  - Configuration Name: [Text Field] (Required)
  - Prefix: [Text Field]
  - Property To Parse: [Text Field]
- Advanced:**
  - Precondition: [Text Area]
  - Run Condition: [Text Area]

## ElectricSentry

ElectricSentry is the ElectricFlow **engine** for continuous integration, integrating with Source Control Management (SCM) systems. ElectricSentry is installed automatically with ElectricFlow and is contained in an ElectricFlow plugin named ECSCM. When ElectricSentry detects a new or modified source file check-in, it

launches a user-defined procedure to build and test the latest version of source files. Using a few simple properties, the entire process is controlled by the user who determines when ElectricSentry is active and which projects and branches are monitored and built.

While you can interact with ElectricSentry directly, you may want to use the Continuous Integration Dashboard, *the front-end user interface* for ElectricSentry, which provides a visual display of your builds, and automates the configuration process for your branch, project, or procedure so you can start using continuous integration schedules quickly.

This Help topic describes using ElectricSentry directly, and NOT the Continuous Integration Dashboard, which has its own Help topic for dashboard use. To get started with the "dashboard", select the Home > Continuous Integration tabs.

## How ElectricSentry works

ElectricSentry finds procedures the user wants to monitor by scanning for a special type of ElectricFlow schedule. From the schedule, ElectricSentry retrieves the name of the procedure to run, along with values to use as actual parameters when the procedure runs.

ElectricSentry can run at a regular interval you determine. When it runs, ElectricSentry scans all ElectricFlow projects, looking for schedules configured for use with ElectricSentry. When it finds one, ElectricSentry checks to see if there is already a job running based on that schedule and will not start a second job for the same schedule until the previous job completes.

Next, ElectricSentry queries the SCM system to see if new check-ins have occurred since the last attempted build. If the most recent check-in is different from the last attempted build, ElectricSentry then checks a "quiet period" by comparing the current time to the check-in time. If the user-configured time interval has elapsed since the most recent check-in, ElectricSentry runs the procedure to start a new job.

Finally, ElectricSentry deletes previous runs of itself, so only the most recent run appears in the jobs list. If using the Continuous Integration Dashboard, this is slightly different—you will see the previous 10 builds that ran.

## Configuring ElectricSentry

ElectricSentry does not require any specific configuration, but it does allow fine tuning for some key settings. To change any setting, you must be logged into ElectricFlow and then navigate to the Electric Cloud project.

### Quiet time

When setting up a continuous integration system, it is common to require an inactivity period before starting a build. This time period allows developers to make multiple, coordinated check-ins to ensure a build does not start with only some of the changes—assuming all changes are checked-in within the specified inactivity time period. This time period also gives developers an opportunity to "back-out" a change if they realize it is not correct.

With ElectricSentry, the inactivity time period can be configured globally for all projects or individually for a single project. The global setup is stored in the ECSCM-SentryMonitor schedule in the Electric Cloud project, using a property named `ElectricSentrySettings/QuietTimeMinutes`. You can set this property to the number of minutes you prefer for the quiet time prior to starting a build. If you remove this property, ElectricSentry will use a five-minute default time.

## Resource

The ECSCM plugin contains a procedure named `ElectricSentry`. This procedure has a parameter named `sentryResource` that determines where `ElectricSentry` will run. The parameter defaults to a resource named *local*, which is created by the ElectricFlow installer. The local resource is configured to run on the machine named *localhost*, which refers to the machine where the ElectricFlow server is running.

You may need to change the resource where `ElectricSentry` runs, if for example, the server machine is not configured to run your SCM tools. You can change this configuration by modifying the ECSCM-SentryMonitor schedule to specify a different resource in the `sentryResource` parameter.

To do this:

1. Go to the Projects page.
2. Select the Electric Cloud project name to go to the Project Details page.
3. Click the Schedules subtab.
4. Select the ECSCM-SentryMonitor schedule.
5. Change the `sentryResource` field to the name of the resource (or the resource pool name) where you want `ElectricSentry` to run.
6. Click **OK** to save your new information.

## Polling frequency

`ElectricSentry` is set to look for new check-ins every five minutes. If you want `ElectricSentry` to check more or less often, open the ECSCM-SentryMonitor schedule in the Electric Cloud project. Change the number of minutes to speed up or slow down the `ElectricSentry` polling frequency entry.

## Time-of-day and day-of-week

The initial setting allows `ElectricSentry` to run between 7 am and 11 pm every day of the week, but you can change this time period to monitor check-ins at different hours. The time period should cover the most likely hours developers would be checking-in changes, then frees the resources (after the last job started by `ElectricSentry` finishes) to run overnight builds. You can modify the ECSCM-SentryMonitor schedule to change the hours or days `ElectricSentry` monitors check-ins.

## Configuring a build for continuous integration

You can control which projects and branches `ElectricSentry` monitors for continuous integration by creating a schedule that runs a procedure and by adding `ElectricSentry` settings. These tasks are made easier using the Continuous Integration Dashboard.

## Source Control Management (SCM) configurations

ElectricFlow bundles and supports a number of source control types. After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page—to see this web page, select the Administration > Source Control tabs.

**IMPORTANT:** Click the **Create Configuration** link to configure your source control system.

**Note:** Electric Cloud has tested numerous SCM versions and where possible, all SCM integrations were created in a generic manner to avoid SCM release-specific differences. In most cases, Electric Cloud supports any version of Perforce, ClearCase, Subversion, AccuRev, CM Synergy, Borland's StarTeam, and many others.

Select the Administration > Plugins tabs to go to the Plugin Manager page to the current list of available SCM plugins. If you do not see the SCM you need, it may be available in the Plugin Catalog—select the View Catalog tab.

### Create a procedure

Navigate to your project and create a procedure that checks out sources from your SCM system and then runs your build process. We recommend having the procedure take a "branch name" parameter, then use this single procedure to build multiple branches of the same project.

### Create a schedule

In your project, create a schedule that calls the procedure and specifies parameters to call the procedure. On the Project Details web page, select the Schedules tab and click the **CI Configuration** link to go to the New CI Configuration page. Enter a name for the new schedule and choose the SCM Configuration you want to use. For more information on this page, click the **Help** link in the upper-right corner of the screen. If you set up your procedure with a parameter for a branch, create one schedule for each branch you want to monitor.

### Optional—running ElectricSentry on multiple resources

ElectricSentry normally runs as a single procedure executing queries against all SCM systems configured by ElectricSentry "trigger schedules." Because all queries are executed in a single step, these queries are executed by the same ElectricFlow resource. This process works very well for many companies, but for some large enterprise companies this process is not adequate.

You can benefit from using ElectricSentry on multiple resources if any of the following items apply to your organization:

- Connectivity—No one single resource has access to all SCM systems in your organization.
- Security/Authentication —Specific resources may contain Authentication tickets required for access to certain parts of your SCM depots, and no single resource contains all of these tickets.
- Scalability—You may need too many trigger schedules to monitor in a single execution interval, which can cause unnecessarily long execution times for ElectricSentry jobs.
- Scheduling—ElectricSentry is most useful during the work day when developers are adding new code check-ins. At night, it is common to redeploy resources to do nightly builds. If ElectricSentry runs on a central resource that serves development teams in multiple time zones, there is no way to schedule independent Sentry operation for different time zones.

### Overview

The solution to all of these issues [above] is to run multiple ElectricSentry instances concurrently.

- Each Sentry instance can choose its own resource and its own operation schedule.
- Each instance can be restricted to monitoring schedules for one or more ElectricFlow projects.
- Also, you can create a global instance to monitor all projects not monitored by a restricted instance.

Each ElectricSentry instance is implemented by reusing the ElectricSentry procedure in the ECSCM plugin. This procedure has two parameters, `sentryResource` and `projectList`, that allow you to specify the configuration for different instances.

Each instance will have its own copy of the SentryMonitor schedule—one for each resource where you want ElectricSentry to run.

The default configuration has no projects specified in the "projectList" parameter—this is called the *global* instance. The global instance monitors all projects not explicitly monitored by any other instance. If a global instance is your only instance, it will monitor all projects.

### Configuring ElectricSentry to use multiple resources

When ElectricFlow is installed, it creates a project called Electric Cloud that contains ElectricSentry's Sentry Monitor schedules. By default, all steps will run on the resource named local and all projects will be monitored. To use multiple resources, you need to create new schedules in the Electric Cloud project, creating new ElectricSentry instances.

1. Navigate to the Electric Cloud project and select it.
2. Select the Schedules tab.
3. Disable the schedule named ECSCM-SentryMonitor.
4. Click the **Copy** link next to the ECSCM-SentryMonitor schedule—**repeat** for each new ElectricSentry instance you want to create.
5. Re-enable the schedule named ECSCM-SentryMonitor.
6. Navigate to one of the new schedules you created and select it to edit it—change the name from ECSCM-SentryMonitor copy n to something more meaningful, for example, "ECSCM-SentryMonitor for ABC team".
7. In the Parameters section:
  - projectList box—enter the project names you need to monitor—one project name per line.
  - sentryResource box—enter the resource or pool name where you want this ElectricSentry instance to run.
8. In the Frequency section:
  - Adjust the "time of day" and "days of the week" settings to schedule this ElectricSentry instance to run.

**Note:** If you are setting up ElectricSentry to run in a different time zone, make sure you set the Time Zone field for the location where ElectricSentry will run.

- a. In the Advanced section, click the Enabled check box.
- b. Click the **Save** button.

**Note:** For each new schedule you create, repeat steps 6-10 above.

## The Job Step Execution Environment

## Terms and definitions

Various factors influence job step execution. Both a job step and its postprocessor (if any) run in the same environment, except shell. The shell used to run a command comes from what is specified in the step. If a shell is not specified on the step, the shell specified on the resource is used— this is also the same shell used for running the postprocessor.

### Machine

The machine where a job step is executed is determined by the resource specified in the corresponding procedure step. If a pool is specified in the procedure step, ElectricFlow picks a specific resource from that pool. A job step can determine its actual resource by querying the property `/myResource/resourceName` or assigned `resourceName` property on the job step. The host where a step is expected is `/myResource/hostname`. If the resource is a proxy agent, this property contains the name of the proxy target. The agent host name is in `/myResource/proxyHostName`.

### OS-level access control

For its resource, a job step executes under the same account as the ElectricFlow agent. You may want to contact Electric Cloud technical support for help configuring ElectricFlow agents. Basically, the agent needs to know what account it will run as, and Windows agents require additional setup if impersonation is used. If using impersonation, the job step runs under the credential effectively attached to the step.

### Environment variables

For its resource, a job step inherits environment variables from the ElectricFlow agent. The agent's environment variables can be configured as part of the agent configuration. In particular, the `PATH` environment variable typically includes the ElectricFlow installation directory for easy access to applications such as *ectool* and *postp* (the ElectricFlow postprocessor).

### Working directory

The default job step working directory is the top-level directory in the job's workspace. However, you can configure the working directory with a property on the procedure step. When you run on a proxy agent, the step actually runs on the proxy target, in the working directory specified in the step. If the working directory is not specified, the step runs in the UNIX path to the workspace.

### Standard I/O

Standard job step output and errors are both redirected to the step log file.

### ElectricFlow access

For easy access to ElectricFlow, the following environment variables are set automatically for a job step:

#### COMMANDER\_HOME

A variable whose value is the base installation directory for an agent. On Windows, this directory is typically `C:\Program Files\Electric Cloud\ElectricCommander`. On UNIX platform, this directory is typically `/opt/electriccloud/electriccommander`.

#### COMMANDER\_SERVER

IP address for the ElectricFlow server machine.

COMMANDER\_PORT

Port number for normal communication with the ElectricFlow server.

COMMANDER\_PLUGINS

(configurable) The directory where installed plugins live (for example, C:\Documents and Settings\All Users\Application Data\Electric Cloud\ElectricCommander\Plugins)

COMMANDER\_HTTPS\_PORT

Port number for secure communication with the ElectricFlow server.

COMMANDER\_JOBID

Unique identifier for the job containing the current job step.

COMMANDER\_JOBSTEPID

Unique identifier for this job step.

COMMANDER\_SESSIONID

ElectricFlow session identifier for the current job, which allows ectool to access ElectricFlow with job associated privileges, without an additional login.

COMMANDER\_WORKSPACE\_UNIX

Absolute path to the workspace directory for this job, in a form suitable for use on UNIX machines.

COMMANDER\_WORKSPACE\_WINDRIVE

Absolute path to the workspace directory for this job, in a form suitable for use on Windows, and starting with a drive letter.

COMMANDER\_WORKSPACE\_WINUNC

Absolute path to the workspace directory for this job, in a form suitable for use on Windows, specified using UNC notation.

COMMANDER\_WORKSPACE

Absolute path suitable for accessing the top-level workspace directory for this job on this machine. On a UNIX machine, this has the same value as COMMANDER\_WORKSPACE\_UNIX. For Windows, it is the same as COMMANDER\_WORKSPACE\_WINUNC.

COMMANDER\_WORKSPACE\_NAME

This is the name of the workspace on the ElectricFlow server.

These environment variables allow you to invoke ectool without specifying a `--server` argument. They also provide a context for accessing properties in ectool. For example, `"ectool getProperty foo"` looks for the property named "foo" on the current job step. Environment variables provide ectool with a session including all user privileges associated with the job.

Also, if the resource is a proxy agent, these environment variables are available in the step's environment on the proxy target.

## Preflight Builds

[Preflight Build Solution](#)

[Preflights with ElectricFlow](#)

[Samples](#)

[Default SCMs](#)

[Troubleshooting](#)

## Why use Preflight Builds?

When developers make changes, they generally build and test their code locally and *commit* their changes if the code ran successfully. Unfortunately, this process is not sufficient.

Code changes may break the production build because of environment differences, platform-specific issues, or incomplete commits. These issues leave the product in a broken state until the changes are backed-out of the product or the developer commits a fix, which often affects the entire development team. It is a time-consuming process to find the problem when multiple developers commit their changes simultaneously and the build breaks.

## Preflight Build Solution

A **Preflight Build** is used to build and test a developer's changes before those changes are committed. A "post-commit" source tree is simulated by creating a clean source snapshot and overlaying the developer's changes on top of it. These sources are then passed through the production build procedure to validate the changes work successfully.

Developers are allowed to commit their changes only if the preflight build is successful. Because developer changes are built and tested in isolation, many common reasons for broken production builds are eliminated.



## Preflights with ElectricFlow

### Workflow

After a preflight build is configured, the general flow of interaction between the server, agent, and client is:

- A developer invokes the client preflight program either through an IDE or via the command-line. The following arguments are specified in the XML configuration file or on the command-line:
  - Define which ElectricFlow server to use (hostname, ports, and so on),
  - Define the project, procedure, and parameters to use to start the preflight build, and
  - SCM-specific information to use (ports, changelists, and so on).
- Next, the client preflight program connects to the ElectricFlow server and launches the specified procedure.
  - The job is started and the developer's changes are uploaded.
  - If auto-commit was turned on, the client program waits for the job to complete. Otherwise, the client program exits immediately.
- The job progresses until it gets to the special step added to the procedure to extract sources and overlay changes.
  - The agent-side driver creates a clean source snapshot based on configuration information passed to it from the client-side.
  - The step overlays changes [uploaded by the client] on top of the snapshot to simulate the developer's check-in.
- The build continues as usual, using the modified sources.
- If the developer chose to auto-commit changes, the preflight program was waiting for the job to complete. If the job is successful, the changes are committed if:
  - No files were added or removed from the change sets.
  - No files were modified since the preflight build started.
  - All conditions set in the driver script were met.

### Components

Three components are required for an ElectricFlow preflight build:

- **Server**—This is the main ElectricFlow server that will run the preflight builds.
- **Agent**—This is any ElectricFlow agent machine that is setup as a resource for the server. This machine must be able to communicate with the source control system because it is responsible for creating a clean source snapshot on which the developer's changes are overlaid.
- **Client**—This is the machine where a developer has active code changes to submit for a preflight build. Like the agent, this machine must be able to communicate with the source control system because it is responsible for determining which files were modified so it can transmit these files to the agent.

### Installation

Preflight is automatically installed with SCM plugins. ElectricFlow pre-installs numerous source code management (SCM) plugins including Accurev, Bazaar, CVS, ClearCase, Git, Mercurial, Perforce, SVN,

StarTeam, Team Foundation Server, and Vault. Before you can use your preferred SCM, you will need it to communicate with the ElectricFlow server.

## Configuration

This section provides details for setting up and running Preflight builds in a typical build environment.

### Server

#### Adding the preflight snapshot step

A typical production build procedure has a step that extracts a clean source code snapshot before the actual build starts. For preflight builds, a special step needs to run in place of this snapshot step. This special step is responsible for creating the base snapshot and then overlaying the developer's changes.

- On the Procedure Details page, to create a new step click the Plugin link.
- On the Choose Step panel, select Source Code Management.
- Choose the ECSCM plugin for your SCM or from the right-pane, select the "Preflight" step for your SCM.
- On the New Step page, notice that your SCM is displayed in the Subprocedure section.
  - Set the Resource name for the step to an agent that can communicate with the SCM system, so it can create the source snapshot.
- The Parameter section also displays appropriate fields to enter information for your SCM. The following two fields are common to most SCMs:
  - Configuration—Enter the name you created for your SCM configuration.
  - Destination Directory—This is a path relative to the job's workspace, where the source tree will be created.
- Enter all other information required for your new step.
- Click **OK**.

#### Choosing between snapshot steps

Only one snapshot step should run depending on whether a production or preflight build is invoked. To enable the appropriate step, add a checkbox-style parameter to the build procedure to determine whether or not the build is a preflight. Now, use that parameter in the Run Condition field on the two snapshot steps. In the following example, the parameter is named "preflight", with an unchecked value of "false" and a checked value of "true".

- For the preflight snapshot step, set the run condition to `${preflight}`
- For the production snapshot step, set the run condition to `[/javascript getProperty("preflight") == "false"]`

#### Choosing how files are uploaded

By default, when developers run preflight builds, their changes are uploaded to the job workspace via the server. However, if the job workspace is on a network share, accessible to the developer's machine, a useful optimization is for files to be copied directly into the job workspace. To use the network share approach, set a flag on the top-level procedure that is invoked when running a preflight build. This property can be created on the Procedure Details web page as follows:

1. Create a nested property sheet on the procedure called `ec_preflight`.
2. Create a property in that procedure called `waitForStep` with a value of "1".  
This property can be created from the command-line by calling:

```
ectool setProperty ec_preflight/waitForStep 1 --projectName <project> --  
procedureName <procedure>
```

### Agent

The agent machine must be able to communicate with the SCM system to create the source snapshot.

### Client

From a developer's machine, there are two ways to start preflight builds:

- From an IDE:
  - Eclipse  
Open a Run dialogue, select Launch Commander Procedure, then select an existing preflight configuration or create a new one.  
For more information, see the *ElectricCommander Eclipse Integration Tech Note* PDF file or the Eclipse plugin.
  - Visual Studio (See the *ElectricCommander Visual Studio Tech Note* PDF file or the Visual Studio plugin)
- From the command line:  
The executable program, `ecclientpreflight`, is used to run a preflight build from the command-line. This program is included in the ElectricFlow "Tools" installation. When you run `ecclientpreflight`, configuration options can be passed in an XML configuration file or on the command-line.

If the same option is specified in both the configuration file and on the command-line, the value passed on the command-line takes precedence. The XML configuration file can be passed to the program via the `--config` option. If the XML configuration file is not passed in, current and ancestor directories are searched for a file named `".preflight"`, using the first one it finds as the configuration file.

Generally, a `".preflight"` file is stored at the root of a developer's workspace, containing configuration information specific to that workspace.

### Samples

In the following samples, the SCM was set to Perforce.

**The following table is output from `"ecclientpreflight --help"`, enumerating the command-line options.** Some options may be specified using an abbreviated format (`-c`, with a single dash) or a more verbose format (`--config`, with two dashes).

Electric Cloud Client-Side Preflight Tool, Version: 4.x  
Copyright (C) 2012 Electric Cloud, Inc. All rights reserved.  
Usage: ecclientpreflight [options]

<b>General Options</b>
------------------------

<code>-c, --config &lt;file&gt;</code>	Load configuration options from the specified XML file. If <code>&lt;file&gt;</code> is '-', read standard input. If not supplied, the current and ancestor directories will be searched for a .preflight file. The first .preflight found will be used as the preflight configuration.
--	---

<code>--load &lt;file&gt;</code>	Evaluate <file> after option processing. May appear multiple times.
----------------------------------	---

<code>-d, --debug</code>	Display debugging information.
--------------------------	--------------------------------



<code>-v, --version</code>	Display version information.
----------------------------	------------------------------

<code>-h, --help</code>	Display this information.
-------------------------	---------------------------

<b>Server Communication Options</b>
-------------------------------------

<code>--server &lt;name&gt;</code>	The host name (defaults to localhost).
------------------------------------	--

<code>--port &lt;port&gt;</code>	The HTTP port (defaults to 8000).
----------------------------------	-----------------------------------

<code>--securePort &lt;port&gt;</code>	The HTTPS port (defaults to 8443).
--	------------------------------------

<code>--secure</code>	If set, only secure connections are used. Off, by default.
-----------------------	--

<code>--timeout &lt;timeout&gt;</code>	The response timeout in seconds (defaults to 180).
--	--



<code>--userName &lt;name&gt;</code>	The name of the ElectricFlow user to login as.
--------------------------------------	--

<code>--password</code> <code>&lt;password&gt;</code>	The password for the specified user. If blank and the user has no active session, a prompt to enter the password will be provided.
--	--

<code>--driverLocation</code>	Property path to a property sheet containing the driver scripts that will be loaded and run after a connection to the server is established. Defaults to <code>/server/ec_preflight</code> .
-------------------------------	--

<code>--mainDriver</code>	The name of a property in the sheet specified by <code>driverLocation</code> . This is the main driver script that will be loaded and run after a connection to the server is established.
---------------------------	--

Logging Options

<code>-l, --log</code>	If specified, debug information is logged. Off, by default.
------------------------	---

<code>--logDir</code>	Where to store log and other files. Defaults to the user's home directory.
-----------------------	--

<b>Procedure Invocation Options</b>
-------------------------------------



<code>--projectName &lt;name&gt;</code>	The name of the ElectricFlow project containing the procedure to invoke.
---	--

<code>--procedureName</code> <code>&lt;name&gt;</code>	The name of the ElectricFlow procedure to invoke.
---	---

<code>-p, --param &lt;name&gt;=&lt;value&gt;</code>	Enter additional parameters to the procedure. May appear multiple times. If any parameters were specified in the config file, those supplied on the command-line append to that list, overriding parameters with the same name.
---	---

<code>--priority</code>	The priority of the job. Possible values are low, normal, high, highest. If left unspecified, defaults to normal.
-------------------------	---

<code>--jobTimeout</code> <code>&lt;timeout&gt;</code>	The number of seconds to wait for the job to complete when auto-committing changes. Defaults to 3600 seconds (1 hour).
---	--

<code>--waitForJob</code>	Wait for the job to complete and report its outcome. This action does not occur by default unless a set of SCM charges are being committed automatically.
<code>--runOnly</code>	Run the procedure and exit immediately. The SCM driver is not downloaded in this case.
<b>SCM Options</b>	
<code>--scmType</code>	The name of the SCM, required, unless the procedure is invoked in 'run only' mode. The driver is downloaded from <code>\$driverLocation/clientDrivers/\$scmType</code> .  Valid values: ECSCM-Accurev, ECSCM-Bazaar, ECSCM-ClearCase, ECSCM-CVS, ECSCM-Git, ECSCM-Mercurial, ECSCM-Perforce, ECSCM-Repo, ECSCM-StarTeam, ECSCM-SVN, ECSCM-TFS, ECSCM-Vault.
<code>--autoCommit &lt;1 0&gt;</code>	Whether or not the changes should be automatically committed if the job completes successfully. Off, by default.
<code>--commitComment &lt;comment&gt;</code>	A comment for the auto-commit.
<b>Perforce Options</b>	
<code>--p4port &lt;port&gt;</code>	The value of P4PORT. May also be set in the environment. This is a required value.
<code>--p4user &lt;user&gt;</code>	The value of P4USER. May also be set in the environment. This is a required value.
<code>--p4passwd &lt;password&gt;</code>	The value of P4PASSWD. May also be set in the environment.
<code>--p4client &lt;client&gt;</code>	The value of P4CLIENT. May also be set in the environment. This is a required value.
<code>--p4template &lt;template&gt;</code>	The name of a Perforce client used to create a base snapshot before overlaying local changes. Defaults to the value of <code>--p4client</code> if not specified.
<code>--p4changelist &lt;change&gt;</code>	The changelist number (or default) whose changes are being tested. May be specified multiple times. If no changelists are specified, all client changelists will be used.

The following is a sample XML configuration file with all options specified:

```
<?xml version="1.0" encoding="utf-8"?>
<data>
  <server>
    <userName>myUser</userName>
    <password>myPass</password>
    <hostName>ElectricFlowServer</hostName>
    <port>1234</port>
    <securePort>2345</securePort>
    <stompPort>3456</stompPort>
    <secure>0</secure>
    <timeout>3456</timeout>
    <driverLocation>/server/ec_preflight/alternateDrivers</driverLocation>
    <mainDriver>myMainClientDriver</mainDriver>
  </server>
  <procedure>
    <projectName>myProject</projectName>
    <procedureName>myProcedure</procedureName>
    <parameter>
      <name>branch</name>
      <value>main</value>
    </parameter>
    <parameter>
      <name>preflight</name>
      <value>true</value>
    </parameter>
    <priority>high</priority>
    <waitForJob>1</waitForJob>
    <jobTimeout>3600</jobTimeout>
  </procedure>
  <scm>
    <type>perforce</type>
    <port>perf:1234</port>
    <user>myUser</user>
    <password>myPass</password>
    <client>myUser-main-client</client>
    <template>myUser-main-template</template>
    <changelist>default</changelist>
    <changelist>67382</changelist>
    <autoCommit>1</autoCommit>
    <commitComment>Fixing bug 38582.</commitComment>
  </scm>
</data>
```

In most cases, a developer does not need to override all default values, and will probably want to specify passwords and some SCM-specific options on the command-line.

**The following is a more typical XML configuration:**

```
<?xml version="1.0" encoding="utf-8"?>
<data>
  <server>
    <userName>myUser</userName>
    <hostName>commanderServer</hostName>
  </server>
  <procedure>
    <projectName>myProject</projectName>
    <procedureName>myProcedure</procedureName>
    <parameter>
      <name>branch</name>
      <value>main</value>
    </parameter>
    <parameter>
      <name>preflight</name>
      <value>true</value>
    </parameter>
    <jobTimeout>3600</jobTimeout>
  </procedure>
  <scm>
    <type>perforce</type>
    <port>perf:1234</port>
    <user>myUser</user>
    <client>myUser-main-client</client>
  </scm>
</data>
```

If this file is stored in a .preflight file at the top-level of a source tree, the command to start the preflight would look something like this:

```
ecclientpreflight --p4changelist 56793 --autoCommit 1 --commitComment "Fixing
bug 38582."
```

## Default SCMs

ElectricFlow includes preflight support for some of the most common Source Control (SCM) systems. For an SCM plugin you installed, look for a Help link for that plugin (on the Plugins page). Command-line options are included in this Help topic for the following SCMs:



Acc uR ev	Git	Star Tea m
Baz aar	Me rcu rial	Sub vers ion
Cle arC ase	Pe rfo rce	TFS
CV S	Re po	Vau lt

**Perforce**

The command-line options for the Perforce driver for `ecclientpreflight` are:

Perforce Options / Descriptions	
<code>--p4port &lt;port&gt;</code>	<b>Required:</b> The value of P4PORT may be set in the environment also.
<code>--p4user &lt;user&gt;</code>	<b>Required:</b> The value of P4USER may be set in the environment also.
<code>--p4passwd &lt;password&gt;</code>	The value of P4PASSWD may be set in the environment also.
<code>--p4client &lt;client&gt;</code>	<b>Required:</b> The value of P4CLIENT may be set in the environment also.
<code>--p4template &lt;template&gt;</code>	The name of a Perforce client used to create a base snapshot before overlaying local changes. Defaults to the value of <code>--p4client</code> if not specified.
<code>--p4changelist &lt;change&gt;</code>	The changelist number (or default) whose changes are being tested and can be specified multiple times. If no changelists are specified, all client changelists will be used.
<code>--p4synctochange &lt;change&gt;</code>	The changelist number the Preflight Job should use when sync'ing the source tree. Values are: <i>head</i> —The most recent changelist anywhere in the P4 depot (default). <i>have</i> —The changelist for the most recent file that was synced to 'p4client' changelist. This is a p4changelist number.

## Subversion

The command-line options for the Subversion driver for `ecclientpreflight` are:

Subversion Options / Descriptions	
<code>--svnpath &lt;path&gt;</code>	The path to the locally accessible source directory in which changes were made.
<code>--svnupdatetohead</code>	Use this option to update the agent workspace created during preflight -- updated to HEAD. By default, the agent workspace is updated to the revision found in the client workspace.
<code>--svnignoreexternals</code>	Causes the preflight process to ignore svn externals.

## AccuRev

The command-line options for the AccuRev driver for `ecclientpreflight` are:

AccuRev Options / Descriptions	
<code>--accurevuser &lt;user&gt;</code>	The value of ACCUREVUSER may be set in the environment also. If not specified, the default is to the ElectricFlow user.
<code>--accurevpasswd &lt;password&gt;</code>	<b>Required:</b> The value of ACCUREVPASSWD may be set in the environment also. This is a required value.
<code>--accurevpending &lt;pending&gt;</code>	Use this option to scan the client workspace for all pending elements using the "stat -fn -p" command. By default, the workspace is scanned for all kept elements using the "stat -fn -k" command.
<code>--accurevpath &lt;path&gt;</code>	<b>Required:</b> The value of the ACCUREVPATH. Also may be set in the environment.

## ClearCase

Preflight support for ClearCase is available only for snapshot views. The command-line options for the ClearCase driver for `ecclientpreflight` are:

ClearCase Options / Descriptions	
<code>--ccpath &lt;path&gt;</code>	The path to the locally accessible source directory where changes were made.
<code>--ccUnixCSpecPath &lt;unixCSpecPath&gt;</code>	The path to the appropriate config spec on a UNIX platform for the current view.
<code>--ccWinCSpecPath &lt;winCSpecPath&gt;</code>	The path to the appropriate config spec on a Windows platform for the current view.
<code>--ccUnixRelativePath &lt;unixRelativePath&gt;</code>	The relative path for the current view [on a UNIX platform] from the view root to the directory where changes were made.
<code>--ccWinRelativePath &lt;winRelativePath&gt;</code>	The relative path for the current view [on a Windows platform] from the view root to the directory where changes were made.

## Bazaar

The command-line options for the Bazaar driver for `ecclientpreflight` are:

Bazaar Options / Descriptions	
<code>--workdir &lt;path&gt;</code>	The developer's source directory.
<code>--branch &lt;name&gt;</code>	Branch name for the preflight.
<code>--method=&lt;local  remote&gt;</code>	local—get tracked and untracked changes in the current workingdir remote—get changes between working tree and remote branch

## Git

The command-line options for the Git driver for `ecclientpreflight` are:

Git Options / Descriptions	
<code>--gitdir=dir</code>	The Git directory to process.
<code>--method=&lt;local_all   local_tracked   remote&gt;</code>	<ul style="list-style-type: none"><li>• <code>local_all</code>—get tracked and untracked changes between working tree and local repo</li><li>• <code>local_tracked</code>—get tracked changes between working tree and local repo</li><li>• <code>remote</code></li></ul>

## CVS

The command-line options for the CVS driver for `ecclientpreflight` are:

CVS Options / Descriptions	
<code>--cvsroot &lt;path&gt;</code>	The path to the repository.
<code>--module &lt;module&gt;</code>	The module name for the preflight.
<code>--workdir &lt;path&gt;</code>	The developer's source directory.

## Mercurial

The command-line options for the Mercurial driver for `ecclientpreflight` are:

Mercurial Options / Descriptions	
<code>--hgpath &lt;path&gt;</code>	The path to the locally accessible source directory in which changes were made. Generally, this path is to the root of the workspace.

## Repo

The command-line options for the Repo driver for `ecclientpreflight` are:

Repo Options / Descriptions	
<code>--repoworkdir &lt;path&gt;</code>	The developer's source directory.
<code>--agentworkdir &lt;path&gt;</code>	The path to the source directory, used by the agent.

## StarTeam

The command-line options for the StarTeam driver for `ecclientpreflight` are:

StarTeam Options / Descriptions	
<code>--STProjectName &lt;project&gt;</code>	The StarTeam project name.
<code>--workingdir &lt;path&gt;</code>	Working dir for the updated files.

## TFS

The command-line options for the Team Foundation Server driver for `ecclientpreflight` are:

TFS Options / Descriptions	
<code>--server &lt;url&gt;</code>	The equivalent value to Collection in VS2008 and under. If you use this option, it is assumed you are using TF version VS2008 or under and it will use the option <code>/server</code> in the preflight. This field is required if you have VS2008.
<code>--collection &lt;url&gt;</code>	The URL that points to <code>/collection</code> . This value is used for VS2010. If you specify this value, the command uses the option <code>/collection</code> when it executes the TF query for preflight. This field is required if you have VS2010.
<code>--localfolder</code>	The path to the locally accessible source directory in which changes were made. Generally, this is the path to the root of the workspace.
<code>--workspace &lt;workspace&gt;</code>	The workspace containing the data for the preflight.

## Vault

The command-line options for the Vault driver for `ecclientpreflight` are:

Vault Options / Descriptions	
<code>--workingdir &lt;path&gt;</code>	Working dir for the updated files.

## Troubleshooting

### Client

The `--debug` option to `ecclientpreflight` provides additional information about internal actions taken when starting the preflight build. By modifying the properties containing driver scripts, debug output can be added where needed. If you want to capture debug information to a log file, use the `--log` option. By default, logs are stored in the user's home directory. To change this location, use the `--logDir` option.

### Agent

The step log for the custom preflight step provides information about the snapshot being created and the files being overlayed. Debug output can be added where needed by modifying the properties containing the driver scripts

## Properties

[Creating or modifying properties](#)

[Using property values](#)

[Property sheets and intrinsic properties](#)

[Property names and paths](#)

[Context-relative "shortcuts" to property paths](#)

[Property path shortcuts in ElectricFlow 5.0 and later on page 1069](#)

[Property name substitutions](#)

[Expandable properties](#)

[The property hierarchy](#)

[Special property references](#)

[Intrinsic properties listed by object type](#)

[Automation Platform intrinsic properties](#)

### Overview

ElectricFlow provides a powerful data model based around the notion of a *property*.

- A property is a string value with a name.
- Properties can have arbitrary names and values.
- You can attach properties to any object in the ElectricFlow system, such as a project, procedure, or job.
- After a property is created, it is stored in the ElectricFlow database.
- You can retrieve and modify the property value later.
- You can delete properties that you no longer need.

Properties are used extensively throughout the ElectricFlow system and provide a flexible and powerful mechanism to manage data about your builds.

### **Property Use Case Examples**

- When a job starts, it computes a unique identifier for that build and saves it in a property. Later build steps can retrieve the property value to embed the build number in binaries generated during the job.
- When a build executes, it can set a property on the procedure to identify the source code version used for the build (for example, a tag or timestamp from your source code control system). The next time the build executes, it can retrieve the property value from the procedure and use it to extract information from your source code control system about the files that changed since the last run.
- Suppose you have a collection of machines for testing, and some machines have older test hardware and some machines have newer hardware with slightly different characteristics. You can set a property on each test machine resource to indicate which version of test hardware is available on which machine. Later, when a test executes, the test can retrieve the property for the machine where it ran and configure tests appropriately for that hardware. If you upgrade test hardware on a machine, all you need to do is change the property on that resource to reflect the new version.
- You can set job properties to indicate the build status produced by that job. For example, if your QA team finds fatal flaws in a build, it can mark the job accordingly. Builds that need to be preserved (release candidates or builds undergoing beta testing at customer sites) can be marked with properties so those builds are not deleted.
- When a job executes, properties are set for its job steps that hold metrics such as how many files compiled during a build step, how many tests executed during a test step, or how many errors were detected in the step. These property values are included in reports and can be examined later to compute trends over time. You can define additional properties for metrics useful to you.

**ElectricFlow provides Intrinsic properties and allows you to create Custom properties.** This Help topic enumerates properties available within ElectricFlow (Intrinsic properties), distinguishes between relative and absolute property paths, and describes property hierarchies.

**Note:** Intrinsic properties are case-sensitive. Custom properties, like all other object names in the ElectricFlow system, are "case-preserving," but *not case-sensitive*.

- **Intrinsic properties**

These properties represent attributes that describe the object to which they are attached, and are provided automatically by ElectricFlow for each similar type object. For example, every project has a `Description` property that can be referenced with a non-local property path such as `/projects/Examples/description`.

- **Custom properties**

Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner, and behave in every way like an intrinsic object-level property with one exception: they are *not* created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution.

### **Creating or modifying properties**

You can set a property value by using one of the following three methods or applications: the automation platform web interface, the **ectool** command-line application, or the Perl API.



- Using the web interface, you will see a table labeled Custom Properties on the pages that display details for projects, procedures, and so on.  
Click **Create New Property** to create a new property for that object, or click on an existing property to change its value.
- Using the ectool application, set a property value with a command like:

```
ectool setProperty /myJob/installStatus complete
```

This command sets the property named `/myJob/installStatus` to the value `complete`, and creates the property if it did not already exist (the meaning of property names like `/myJob/installStatus` is explained below). You can use `ectool` from within one job step to set properties accessed by later steps in the same job.

- Using the Perl API, you can use an external script or a script in a step with `ec-perl` as the shell.  
A Perl code example:

```
use ElectricCommander ();  
my $ec = new ElectricCommander;  
$ec->setProperty ("/myJob/installStatus", "complete", {jobStepId =>  
$ENV{COMMANDER_JOBSTEPID})
```

**Note:** Using the Perl API may yield better performance if you are requesting multiple API calls in one step.

For more information, see the "Using the ElectricFlow API" topic in the ElectricFlow API Guide.

## Using property values

A job step can access a property value by two methods. The first method is *substitution*, using the `$( )` notation. Suppose you enter the following text as a command for a step:

```
make PLATFORM=$(platform]
```

Before running the step, ElectricFlow finds the property named `platform` and substitutes its value in the command string in place of `$(platform]`. For example, if the property contains the value `"windows"`, the actual command executed is:

```
make PLATFORM=windows
```

The substitution method can be used for a command in a step and for any step fields, such as the resource or working directory. This method allows you to compute configuration information in an early step of a job, then use that configuration information to control later steps in the job.

Another way for a step to access the property value is with the `ectool getProperty` command. For example, the following command returns the property value named `platform`:

```
ectool getProperty platform
```

## Property sheets and intrinsic properties

A property value can be a simple string or a nested *property sheet* containing its own properties. Property sheets can be nested to any depth, which allows you to create hierarchical collections of information.

Most objects have an associated "property sheet" that contains "custom properties" created by user scripts. The property sheet is an intrinsic property of the containing object called "property sheet", so to reference a project's custom property "branchName", you could specify `/projects/aProject/propertySheet/branchName`.

As a convenience, ElectricFlow allows the "property sheet" path element to be omitted and the path written as `/projects/aProject/branchName`. If there is no intrinsic property with the same name, the path will find the property on the property sheet.

Custom properties in a property sheet can be one of two types: *string property* or a *property sheet* property. String properties hold simple text values. Property sheet properties hold *nested* properties. Nested properties are accessed via the property sheet property of their containing sheet.

For example:

```
/projects/aProject/propertySheet/topSheet/propertySheet/propB
- or -
/projects/aProject/topSheet/propB
```

All information managed by ElectricFlow exists in the form of properties and property sheets and your own custom-created properties. For example, each project, procedure, and step is represented internally as a property sheet—the command for a step is actually a property associated with the step, and so on. Every value in the ElectricFlow system can be accessed as a property, using the naming facilities described below. These properties are called *intrinsic* properties. *ElectricFlow enforces some restrictions on intrinsic property values, whereas custom properties can have any value you choose.*

To learn more about intrinsic properties defined for an object by ElectricFlow, see the "Using the ElectricFlow Perl API" topic in the ElectricFlow API Guide. For example, to learn about intrinsic properties associated with each project, find the documentation for the `getProject` ectool command. The result of running this command is an XML document whose field names and values represent the properties for the project.

For details about the intrinsic properties for each object in ElectricFlow Deploy, see the *Intrinsic Properties in ElectricFlow Deploy Objects* document at [http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html). For details about the intrinsic properties for each object in the Automation Platform, see [Intrinsic properties listed by object type](#) on page 1076.

## Property names and paths

Properties are named using multi-level paths such as `first/second/third`, which refers to a property named "third" in a property sheet named "second" in a property sheet named "first." ElectricFlow also supports an equivalent notation using brackets instead of slashes. In this format, slashes are not considered separators when they appear between brackets.

For example, `first[second]/third` and `first[second][third]` both refer to the same property as `first/second/third`. The bracket `[ ]` notation is based on matching brackets. For example, `steps[build[1]]` refers to a property named "build[1]" inside a property sheet named "steps" (it does not treat "build" as a property sheet containing a property named "1").

Property names/paths have two forms: *absolute* and *relative*.

## Absolute property paths

Absolute property paths are referenced by a fully-qualified path syntax that begins with a slash character ("/") followed by a top-level name. This path syntax is similar to a file system path specification. The first component after the "/" must be one of several reserved words that select a starting location to look up the property name. For example, consider the property name `/server/Electric Cloud/installDirectory`. `/server` means "lookup" starts in the topmost property sheet associated with the ElectricFlow server. This property name refers to the "installDirectory" property inside the server property sheet.

The system defines the following top-level names (absolute property names):

`/applications/...`

Start in the property sheet containing all applications. For example, `/applications[deploy]` refers to an application named "deploy" and `/applications[deploy]/processes[install]` refers to a process named "install" in that application.

`/artifacts/...`

Start in the property sheet containing all artifacts. For example, `/artifacts/myGrp:myKey/prop1` refers to the `prop1` property on the artifact whose name is "myGrp:myKey".

`/artifactVersions/...`

Start in the property sheet containing all artifact versions. For example, `/artifactVersions/myGrp:myKey:1.0-36/prop1` refers to the `prop1` property on the artifact version whose name is "myGrp:myKey:1.0-36".

**Note:** Throughout the API, you can substitute "groupId:artifactKey:version" wherever an `artifactVersionName` argument can be specified. This is the same if the `artifactVersionNameTemplate` specified in the artifact is in the form "groupId:artifactKey:version". When the template is different, it is convenient to be able to specify this tuple if you do not know the `artifactVersionName`.

`/components/...`

Start in the property sheet containing all components. For example, `/components[warfile]` refers to a component named "warfile" and `/component[warfile]/processes[backup]` refers to a component process named "backup" in that component.

`/environments/...`

Start in the property sheet containing all components. For example, `/environments[qeserver]` refers to an environment named "qeserver".

`/groups/...`

Start in the property sheet containing all groups. For example, `/groups[dev]` refers to the group named "dev".

`/jobs/...`

Start in the property sheet containing all jobs. For example, `/jobs[ecloud.4096]` refers to the job named "ecloud.4096." You can name a job using either its name (as in the preceding example) or using the unique identifier assigned to it by ElectricFlow.

/plugins/...

Start in the property sheet containing all plugins. For example, `/plugins[EC-AgentManagement]` refers to the currently promoted plugin named "EC-AgentManagement" and `/plugins[EC-AgentManagement]/project/procedures[scpCopyFile]` refers to a procedure named "scpCopyFile" in that plugin.

**Note:** There is a subtle difference between

```
ectool setProperty /plugins/EC-AgentManagement/project/foo 'bar'
```

and

```
ectool setProperty /plugins/EC-AgentManagement/foo 'bar'
```

The former places the property on the plugin's project and can be referenced by `$/myProject/foo` while the latter places the property on the plugin object and will not be found via `$/myPlugin/foo`.

/projects/...

Start in the property sheet containing all projects. For example, `/projects[nightly]` refers to the project named "nightly," and `/projects[nightly]/procedures[main]` refers to a procedure named "main" in that project.

/repositories/...

Start in the property sheet containing all artifact repositories. For example, `/repositories/repo1/prop1` refers to the `prop1` property on the repository whose name is "repo1".

/resourcePools/...

Start in the property sheet containing all resource pools. For example, `/resourcePools[linuxA]` refers to the resource pool named "linuxA".

/resources/...

Start in the property sheet containing all resources. For example, `/resources[linux1]` refers to the resource named "linux1".

/server/...

Start in the top-level server property sheet. For example, `/server/a` refers to the server property named "a".

/users/...

Start in the property sheet containing all users. For example, `/users[Bob]` refers to the username "Bob".

/workspaces/...

Start in the property sheet containing all workspaces. For example, `/workspaces[default]` refers to the workspace named "default."

## Relative property paths

Property names that do not begin with "/" are *relative* and looked up starting in the *current context*. For example, when executing a job step, the current context includes properties defined for the job step, parameters for the current procedure, and global properties on the current job.

Relative property paths are distinguished from absolute property paths because they do not begin with one of the top-level names. To avoid having to construct full property paths, ElectricFlow supports the concept of a relative property path.

In use, the relative property path value is resolved by its context and a defined search order, which results in accessing the value of an absolute fully-specified property value. Contexts and search orders are as follows:

1. In a job step context, ElectricFlow searches for relative property paths in the following order:
  - a property on the job step object
  - a property of the parent job step object, which includes parameters of the procedure on which the step is defined
  - a property on the job object

### Notes:

- The search can be enabled or disabled by using the `--extendedContextSearch` option on the `ectool getProperty` or `setProperty` commands. When searching for a property value, disable the search by setting the `--extendedContextSearch` switch to "false", requiring the property to exist on the job step object or return false. When writing a new value to a property, enable the search by setting the `--extendedContextSearch` switch to "true", allowing the search for a property within the search order before creating a new one. New properties are created on the job step object.
  - Parameters for subprocedure calls from job steps are searched for in a job step context.
  - For procedure parameters for nested subprocedures, properties referenced by parameters are looked up as described [above] for job steps.
2. When expanding schedule parameters, ElectricFlow searches the relative property path in the following order:
    - a property on the procedure being called
    - a property on the project on which the procedure being called is defined
    - a property on the server
  3. In a job name template context, ElectricFlow searches for the relative property path as a property on the job.
  4. In any other context, ElectricFlow searches for the relative property path as a property on the context object.

## jobSteps Paths

Some properties can be specified by using the property name and a globally unique identifier for the property, such as `jobSteps`. The format of the property path is similar to an absolute property path even though the property is not a top-level (absolute) property. For example, you can specify a job step as

`/jobSteps/<jobStepID>/`.

You can also specify a property on a job step as `/jobSteps/parent/propertyName` where:

- `parent` is the root parent of the job step that is not visible on the ElectricFlow UI.
- `propertyName` is the name of the property.

### Context-relative "shortcuts" to property paths

A shortcut can be used to reference a property without knowing the exact name of the object that contains the property. You might think of a shortcut as another part of the property hierarchy. Shortcuts resolve to the correct property path even though its path elements may have changed because a project or procedure was renamed. Shortcuts are particularly useful if you do not know your exact location in the property hierarchical tree.

Shortcuts to property paths that provide convenient run-time access include:

`/myApplication/...`

Start in the property sheet for the `application` associated with the current job or job step.

`/myApplicationTier/...`

Start in the property sheet for the `applicationTier` associated with the current job step.

`/myArtifactVersion/...`

Start in the property sheet for the `artifactVersion` associated with the current context. The only context where this property has any value is in the `artifactVersionNameTemplate` field for the artifact.

`/myComponent/...`

Start in the property sheet for the `component` associated with the current context.

`/myCredential/...`

Start in the property sheet for the `credential` associated with the current job step. This form produces an error if the current job step does not have a credential.

`/myEvent/...`

This is a special property used only within an "email notifier." `/myEvent/` allows you to refer to fields associated with the notifier itself. You can include these properties, for example, in the text of the email you send out for notification:

`/myEvent/notifier`—This property contains the name of the notifier that created the notifier event. You created this name when you created the notifier.

`/myEvent/entity`—This property contains the object where the notifier is attached. Two possible values are "job" or "jobStep," depending on where the notifier is attached.

`/myEvent/source`—This property contains the name of either the job or the jobStep where the notifier is attached.

`/myEvent/type`—This property defines whether the notifier is an "On Start" or an "On Completion" notifier. Two possible values are "STARTED" or "COMPLETED".

`/myEvent/time`—This property contains the time when the notifier occurred. The time is always specified in GMT and uses a formatted string, for example,  
2009-06-11T21:00:56.502Z

`/myEvent/timeMillis`—This property contains the "timestamp" in milliseconds when the notifier occurred. This value is the number of milliseconds since January 1, 1970 GMT. The `timeMillis` corresponding to the time in the previous example is: 1244754056502

`/myEnvironment/...`

Start in the property sheet for the `environment` associated with the current job or job step.

`/myEnvironmentTier/...`

Start in the property sheet for the `environmentTier` associated with the current job step.

`/myGate/...`

`/myGate/` is currently limited to `myGate.gateType` (PRE or POST) or `myGate.parentStage`. It is useful to include information about the active gate and stage in email notifications templates.

`/myJob/...`

Start in the global property sheet for the current job. `/myJob/` points directly to the job object so you can reference built-in job properties (`jobName`, `createTime`, `outcome`, and so on) and custom properties. This property sheet can also be used to hold working data that needs to be passed from one step to another within the job.

`/myJobStep/...`

Start in the property sheet for the current job step.

`/myParent/...`

Start in the global property sheet for the parent job step or job if this is a top-level step. `/myParent/` points directly to the job or job step object, so you can reference intrinsic or custom properties. For example, you can reference the parameters that were passed to this procedure.

In addition, you can reference a sibling step by calling `/myParent/jobSteps/<sibling step name>`.

Or, you can create additional properties on `/myParent/` to pass information from one step in the procedure to another:

step1 calls `setProperty /myParent/results 100`

step2 can call `getProperty /myParent/results`

`/myParent/`.

`/myPipeline/...`

Start in the property sheet for the `pipeline` associated with the current job or job step. This can be used by a plugin, procedure, or process step executed from a stage task to retrieve property information defined in the pipeline.

`/myPipelineRuntime/...`

Start in the property sheet for the `pipelineRuntime` associated with the current job or job step. This can be used by a plugin, procedure, or process step executed from a stage task to retrieve property information stored on the pipeline runtime

`/myPipelineStageRuntime/...`

Start in the property sheet for the `pipelineStageRuntime` for a pipeline stage where the current job or job step was defined. This can be used by a procedure step executed from a stage task to retrieve information for the summary property of the stage runtime.

`/myProcedure/...`

Start in the property sheet for the procedure in which the current job step was defined. If the current job step is executing as part of a nested procedure, `/myProcedure/` refers to the innermost nested procedure.

`/myProcess/...`

Start in the property sheet for the application or component process in which the current job or job step was defined.

`/myProcessStep/...`

Start in the property sheet for the application or component process step in which the current job step was defined.

`/myProject/...`

Start in the property sheet for the project in which the current job step was defined. If the job step has nested procedure invocations, this is the project associated with the innermost nested procedure, for example, the project associated with `/myProcedure/`.

`/myResource/...`

Start in the property sheet for the resource assigned to the current job step.

`/myResourcePool/...`

Start in the property sheet for the resource pool that provided the resource for the current job step. Returns null if the step did not specify a resource pool.

`/myStage/...`

Start in the property sheet for the pipeline stage in which the current job or job step was defined.

`/myStep/...`

Start in the property sheet for the current step. "Step" refers to the (static) definition of a step, which is part of a procedure—this is different from a job step, which represents a step when it executes (dynamically) in a job. Use `/myJobStep/` to access the job step.

`/myState/...`

Start in the property sheet for the state object so you can reference built-in and custom state properties or find parameter values passed to that state. When accessed from a state, `/myState/` refers to that state. When accessed from a transition, `/myState` refers to the transition's owning



state. When accessed from a job or job step, `/myState/` refers to the state that launched that job as a subjob.

`/mySubjob/...`

Start in the property sheet for the subjob so you can reference built-in and custom job properties, parameters passed to the job, and properties on steps within that job. When accessed from a transition, `/mySubjob/` refers to the subjob started by the state that owns that transition. This property path is particularly useful in conditions for On Completion transitions because the outcome or other information for the subjob can influence which state the workflow transitions to next.

`/mySubworkflow/...`

Start in the property sheet for the subworkflow so you can reference built-in and custom workflow properties. When accessed from a transition, `/mySubworkflow/` refers to the subworkflow started by the state that owns that transition. This property path is particularly useful in conditions for On Completion transitions because the active state and other information for the subworkflow can influence which state the workflow transitions to next. You can access information about states and transitions belonging to the workflow by using the path `/mySubworkflow/states/someState` or `/mySubworkflow/states/someState/transitions/someTransition`.

`/myTask/...`

Start in the property sheet for the pipeline task in which the current job or job step was defined.

`/myTransition/...`

Start in the property sheet for the transition object so you can reference intrinsic and custom transition properties. `/myTransition/` is accessible only from a transition.

`/myUser/...`

This property can be used only if the current session is associated with: the predefined "admin" user, a user defined as "local", or a user defined by a Directory Provider (LDAP or ActiveDirectory). This property cannot be used if the user is a "project principal", which is normally the case when running inside an ElectricFlow step.

For example, with an interactive login you can use:

```
ectool getProperty /myUser/userName (to get the username of the logged in user, or...)
```

```
ectool getProperty /myUser/email (to get the email address)
```

`/myWorkflow/...`

Start in the property sheet for the workflow object so you can reference built-in and custom workflow properties. When accessed from a state or transition, `/myWorkflow/` refers to the "owning" workflow. When accessed from a job or job step, `/myWorkflow/` refers to the workflow whose state launched that job as a subjob. You can access information about states and transitions belonging to the workflow by using the path `/myWorkflow/states/someState` or `/myWorkflow/states/someState/transitions/someTransition`.

`/myWorkflowDefinition/...`

Starts in the property sheet for the workflow definition object so you can reference built-in and custom workflow properties.

`/myWorkspace/...`

Start in the property sheet for the workspace associated with the current job step.

### Property path shortcuts in ElectricFlow 5.0 and later

The following shortcuts to property paths are available in ElectricFlow 5.0 and later. For more information, go to [Context-relative "shortcuts" to property paths](#) on page 1065.

Shortcuts	Descriptions	For jobs	For job steps
<code>/myApplication/...</code>	Starts in the property sheet for the application associated with the current job or job step.	Yes	Yes
<code>/myApplicationTier/...</code>	Starts in the property sheet for the application tier associated with the current job step.	No	Yes
<code>/myComponent/...</code>	Starts with the property sheet for the component associated with the current job step.	No	Yes
<code>/myCredential/...</code>	Starts with the property sheet for the credential associated with the current job step.	No	Yes
<code>/myEnvironment/...</code>	Starts in the property sheet for the environment associated with the current job or job step.	Yes	Yes
<code>/myEnvironmentTier/...</code>	Starts in the property sheet for the environment tier associated with the current job step.	No	Yes
<code>/myGate/...</code>	<code>/myGate/</code> is currently limited to <code>myGate.gateType</code> (PRE or POST) or <code>myGate.parentStage</code> . It is useful to include information about the active gate and stage in email notifications templates.	Yes	Yes
<code>/myInventoryItem/...</code>	Starts in the property sheet for the environment inventory..	Yes	Yes
<code>/myJob/...</code>	Starts in the property sheet for the job associated with the current job or job step.	Yes	Yes
<code>/myJobStep/...</code>	Starts in the property sheet for the job step associated with the current job step.	No	Yes

Shortcuts	Descriptions	For jobs	For job steps
/myParent/...	Starts in the global property sheet for the parent job step.	No	Yes
/myPipeline/...	Start in the property sheet for the pipeline associated with the current job or job step.	Yes	Yes
/myPipelineRuntime/...	Start in the property sheet for the <code>pipelineRuntime</code> associated with the current job or job step.	Yes	Yes
/myPipelineStageRuntime/...	Start in the property sheet for the <code>pipelineStageRuntime</code> for a pipeline stage where the current job or job step was defined. This can be used by a procedure step executed from a stage task to retrieve information for the summary property of the stage runtime.	Yes	Yes
/myPlugin/...	Starts in the property sheet for the plugin associated with the current job.	Yes	No
/myProcedure/...	Starts in the property sheet for the procedure in which the current job or job step was defined.	Yes	Yes
/myProcess/...	Starts in the property sheet for the process in which the current job or job step was defined.	Yes	Yes
/myProcessStep/...	Starts in the property sheet for the process step in which the current job step was defined.	No	Yes
/myProject/...	Starts in the property sheet for the project in which the current job was defined.	Yes	No
/myResource/...	Starts in the property sheet for the resource associated with the current job step.	No	Yes
/myResourcePool/...	Starts in the property sheet for the resource pool associated with the current job step.	No	Yes
/myResourcePool/...	Starts in the property sheet for the resource pool associated with the current job step.	No	Yes

Shortcuts	Descriptions	For jobs	For job steps
<code>/myStage/...</code>	Start in the property sheet for the pipeline stage in which the current job or job step was defined.	Yes	Yes
<code>/myState/...</code>	Starts in the property sheet for the state object so you can reference built-in and custom state properties or find parameter values passed to that state.	Yes	Yes
<code>/myStep/...</code>	Starts in the property sheet for the step associated with the current job step.	No	Yes
<code>/myTask/...</code>	Start in the property sheet for the pipeline task in which the current job or job step was defined.	Yes	Yes
<code>/myWorkflow/...</code>	Starts in the property sheet for the workflow object so you can reference built-in and custom workflow properties.	Yes	Yes
<code>/myWorkflowDefinition/...</code>	Starts in the property sheet for the workflow definition object so you can reference built-in and custom workflow properties.	Yes	Yes
<code>/myWorkspace/...</code>	Starts in the property sheet for the workspace associated with the current job step.	No	Yes

### Property name substitutions

Property names can contain references to other properties, which are then substituted into the property name before looking it up. For example, consider the following property name:

```
/myStep/${/myProcedure/name}
```

If the value of `/myProcedure/name` is "xyz", the property above is equivalent to `/myStep/xyz`.

### Expandable properties

Property values can contain property references using the `"${}"` notation.

For example:

1. Create a property named "foo" with a value of `hello ${bar}`.
2. Create a property named "bar" with a value of `world`.
3. Reference "foo" (either using `${foo}` or `ectool getProperty foo`). The value "hello world" is returned.

If you want just the literal value of "foo" (useful in the UI, for example), you can use the `expand` option in `ectool`:

```
ectool getProperty foo --expand false. The value "hello ${bar}" will be returned.
```

Properties are expanded by default when you use `getProperty` or `getProperties`.

If the value of a property contains "`$( )`" but you do not want it to be interpreted as a property reference, you can use the `expandable` option:

```
ectool setProperty symbols '$[!@]#' --expandable false.
```

This option can be toggled in the web UI as well. Properties are expandable by default.

Because you cannot control where your expandable property might be referenced (and therefore which context is used during expansion), we recommend using absolute paths when referencing a property from the value of another property.

In the example above, if you define both "foo" and "bar" as properties on a project "proj1", you might assume there is no problem with the value of "foo". However, if you later reference "foo" from a job under "proj1" (for example, `$/myProject/foo`), foo will be referenced with the job step as its context. Therefore, when the value of "foo" is expanded, you will get a `PROPERTY_REFERENCE_ERROR` because "bar" is not defined in the context of the job step.

## Custom property names and values

The following properties are used by the standard ElectricFlow UI, so you should use these property names whenever possible, and avoid using these names in ways that conflict with the definitions below.

- **compiles**—the number of files compiled during the job step
- **diagFile**—the filename in the top-level directory of the job's workspace, containing diagnostics extracted from the step's log file
- **errors**—the number of errors (compilation failures, test failures, application crashes, and so on) that occurred during the job step. When property errors are set by `postp`, the step outcome is set to error also.
- **tests**—the number of tests executed by the job step, including successes and failures
- **testsSkipped**—the number of tests skipped during the job step
- **warnings**—the number of warnings that occurred during the job step. When property warnings is set by `postp`, the step outcome is set to warning also.
- **preSummary**—if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears *before* whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **postSummary**—if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears *after* whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **summary**—if this property exists, its value is displayed in the "Status" field (in the job reports) for this step, replacing whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

## The property hierarchy

All ElectricFlow properties fall into a hierarchical structure, and you can reference any property using an absolute path from the root of the hierarchy. This includes properties you define and intrinsic properties defined by ElectricFlow.

For example, each step contains a property "resource" that provides the resource name to use for that step. All steps of a procedure exist as property sheets underneath the procedure. All procedures in a project exist as property sheets underneath the project, and so on.

The examples below illustrate some nesting relationships between objects.

For example, the notation "*project/procedures[procedureName]*" means each project object contains a property sheet named "procedures" holding all procedures defined within that project. Within the procedures property sheet, there is a nested property sheet for each procedure, named after the procedure. Thus, the name "*projects[a]/procedures[b]*" refers to a procedure named "b" contained in a project named "a."

- Each project contains procedures, schedules, credential definitions, workflow definitions, and workflows:

```
project/procedures[procedureName]
project/schedules[scheduleName]
project/credentials[credentialName]
project/workflowDefinitions[workflowName]
project/workflows[workflowName]
```

- Each procedure contains steps and parameters. The parameters are "formal parameters," meaning they specify parameter names the procedure will accept, whether each parameter is required, and so on:

```
procedure/steps[stepName]
procedure/formalParameters[paramenterName]
```

- Steps that invoke subprocedures contain parameter values for the subprocedure. These are called "actual parameters" because they provide actual values that will be passed into the subprocedure:

```
step/actualParameters[parameterName]
```

- Each job contains a collection of job step objects for steps in the outermost procedure, along with parameter values passed into the job when it was invoked:

```
job/jobSteps[stepName]
job/actualParameters[parameterName]
```

- If a job step invokes a nested subprocedure, its property sheet contains parameter values that were passed into the nested subprocedure, plus all job steps corresponding to that procedure:

```
jobStep/actualParameters[parameterName]
jobStep/jobSteps[stepName]
```

- Schedules contain parameter values for the procedures they invoke. These are called "actual parameters" because they provide actual values passed into the procedure:

```
schedule/actualParameters[parameterName]
```

- Workflow definitions contain state definitions:

```
workflowDefinition/stateDefinitions[stateDefinitionName]
```

- Transition definitions contain actual parameters:

```
transitionDefinition/actualParameters[parameterName]
```

- State definitions contain transition definitions, actual parameters, and formal parameters:  
*stateDefinition/actualParameters[parameterName]*  
*stateDefinition/formalParameters[parameterName]*  
*stateDefinition/transitionDefinitions[transitionDefinitionName]*
- Workflows contains states:  
*workflow/states[stateName]*
- Transitions contain actual parameters:  
*transition/actualParameters[parameterName]*
- States contain transitions, actual parameters, and formal parameters:  
*state/actualParameters[parameterName]*  
*state/formalParameters[parameterName]*  
*state/transitions[transitionName]*

### Special property references

ElectricFlow also supports several special property reference forms that are described in the following subsections.

#### increment

Use this form to increment the value of an integer property before returning its value. For example, suppose property xyz has the value 43. The property reference `$/increment xyz` first increments the value of property xyz to 44, then returns 44.

#### timestamp

Use this form to generate a formatted timestamp value. For example, the property reference `$/timestamp yyyy-MMM-d hh:mm` returns the current time in a form such as "2007-Jun-19 04:36". The pattern following `/timestamp` specifies how to format the time and defaults to "yyyyMMddHHmm". The pattern follows conventions for the Java class `SimpleDateFormat`, where various letters are substituted with various current time elements. For more information, go to <http://docs.oracle.com/javase/7/docs/api/java/text/SimpleDateFormat.html> for `SimpleDateFormat` class documentation.

Here are some of the supported substitutions:

- y—Year, such as "2007" or "07"
- M—Month, such as "April", "Apr", or "04"
- w—Week in year, such as "27"
- W—Week in month, such as "3"
- D—Day in year, such as "194"
- d—Day in month, such as "18"
- E—Day in the week, such as "Tuesday" or "Tue"
- a—am/pm marker, such as "PM"
- H—Hour in day (0-23), such as "7"

h—Hour in am/pm (1-12), such as "11"

m—Minute in hour, such as "30"

s—Second in minute, such as "15"

S—Millisecond, such as "908"

z—Time zone such as "Pacific Standard Time", "PST", or "GMT-08:00"

Z—Time zone such as "-0800"

Repeated letters cause longer forms to be substituted. For example, "yy" substitutes the last 2 digits of the current year, whereas "yyyy" substitutes the 4-digit year number. Single quotes can be used to substitute text directly without the above interpretations.

## javascript

This form executes a Javascript code fragment inside the ElectricFlow server and returns the result computed by that code.

For example, `$/javascript 4*2` returns "8.0". Javascript code can be arbitrarily long and include multiple statements. The value of the last statement is returned by the property reference.

Javascript code executes in an interpreter that provides access to ElectricFlow properties:

1. The normal way to access property values is through Javascript objects. Global Javascript objects named "server," "projects," and so on, exist and correspond to all top-level objects in an absolute property path.  
For example, there is a Javascript object named `server` that corresponds to the path `/server`, and a Javascript object named `myJob` that corresponds to the path `/myJob`. You can use either `"."` or `"["` notation to access properties within the object.  
For a more complete list of top-level objects, see the ["Absolute property paths"](#) section.

Examples:

```
$/javascript myJob.mightExist]
this is a safe way to refer to an optional parameter
```

```
$/javascript (myJobStep.errors > 0) ? "step failed" : "no errors"]
test a value and return another string based on the result
```

```
$/javascript server.settings.ipAddress]
refer to a property in a nested property sheet
```

```
$/javascript server["Electric Cloud"].installDirectory]
if the property name has a space, use [""] notation
```

```
$/javascript server["Electric Cloud"]["installDirectory"]]
do not use the "." in front of the "["
```



2. You can also call the function, "getProperty". It takes a property name as argument and returns the value of that property. The case where this is most useful is when you want to access another special property reference.

Examples:

```
$/javascript getProperty ("/timestamp yyyy-MMM-d hh:mm")]  
returns the current time
```

```
$/javascript getProperty ("/increment /myJob/jsCount")]  
this is the only way to change a property via javascript
```

For example, consider the following property reference:

```
$/javascript (getProperty("/myJobStep/errors") > 0) ? "step failed" : "no  
errors"]
```

This example returns "step failed" if the property "errors" on the current job step had a value greater than zero, and it returns "no errors" otherwise.

3. If calling the "setProperty" function, similar to `getProperty`, there are two variations on the function:
  - A *global* function variation that uses the current context object.  
The global function takes 2 or 3 arguments. The 3-argument version takes a context object, a path, and a value. The 2-argument version omits the context object and uses the current context object (for example, *job step*).

Example:

```
setProperty (myProject, "foo", "bar")  
would set the value of the "foo" property on the current project to "bar".
```

- An *object* function variation that can be called on objects, which uses that object as a context object. The object function takes two arguments: a "path" and a "value".

Example:

```
server.setproperty ("foo", "bar")  
would set the "foo" property on the server object to the value "var".
```

## Intrinsic properties listed by object type

### ElectricFlow Deploy intrinsic properties

For details about the intrinsic properties for each object in ElectricFlow Deploy, see the *Intrinsic Properties in ElectricFlow Deploy Objects* document at [http://docs.electric-cloud.com/eflow\\_doc/FlowIndex.html](http://docs.electric-cloud.com/eflow_doc/FlowIndex.html).

### Automation Platform intrinsic properties

This section describes the intrinsic properties for some (but not all) of the objects in the Automation Platform. For each object type in the following list, there is a link to a table that includes a list of intrinsic properties applicable to that object and provides the property type and description.

<a href="#">acl</a>	<a href="#">repository</a>
<a href="#">artifact</a>	<a href="#">resource</a>
<a href="#">artifactVersion</a>	<a href="#">resourcePool</a>
<a href="#">credential</a>	<a href="#">resourceUsage</a>
<a href="#">directoryProvider</a>	<a href="#">schedule</a>
<a href="#">emailConfig</a>	<a href="#">server</a>
<a href="#">emailNotifier</a>	<a href="#">state</a>
<a href="#">formalParameter</a>	<a href="#">stateDefinition</a>
<a href="#">gateways</a>	<a href="#">step</a>
<a href="#">group</a>	<a href="#">transition</a>
<a href="#">job</a>	<a href="#">transitionDefinition</a>
<a href="#">jobStep</a>	<a href="#">user</a>
<a href="#">logEntry</a>	<a href="#">workflow</a>
<a href="#">procedure</a>	<a href="#">workflowDefinition</a>
<a href="#">project</a>	<a href="#">workspace</a>
<a href="#">property</a>	<a href="#">zones</a>
<a href="#">propertySheet</a>	

### Property Type definitions in the Automation Platform

This table provides Property Type definitions for each property listed in the following tables. (A Property Type precedes each property description in the Description column.)

Type	Definition
boolean	One of two possible values—either <i>true</i> or <i>false</i> . These values are more frequently represented by the numbers "0" and "1", where "0" equals false and "1" equals true.
date	A millisecond precision UTC date in ISO 8601 form: [YYYY] - [MM] - [DD] T [hh] : [mm] Z For example, 2007-06-19T04:36:22.000Z
id	Each time an object is created, ElectricFlow generates a unique ID number for that object.
name	This is a unicode string value with a maximum of 255 characters.
number	This is a simple integer numeric value.
reference	This property refers to another object.
string	This is a unicode string value with a maximum CLOB size of the database, but only the first 450 characters are indexed, which means a defined search will not "see" beyond the first 450 characters.

In the following tables, the Description column displays the property type preceding the property description.

<b>Object Type: <code>acl</code></b>  <b>Description:</b> An <i>acl</i> is an Access Control List.	
Property Name	Description
<code>aclId</code>	<code>id</code> : The unique identifier for this <code>acl</code> object. Other objects can refer to this <code>acl</code> by its ID.
<code>inheriting</code>	<code>boolean</code> : If true, the ACL inherits ACEs from the ACL's parent.

<b>Object Type: <code>acl</code></b>  <b>Description:</b> An <i>acl</i> is an Access Control List.																													
Property Name	Description																												
<code>ownerType</code>	<p>This is any type of object the ACL controls and can be any of the objects listed below.</p> <table> <tr> <td><code>ace</code></td><td><code>project</code></td></tr> <tr> <td><code>acl</code></td><td><code>property</code></td></tr> <tr> <td><code>admin</code></td><td><code>propertySheet</code></td></tr> <tr> <td><code>artifact</code></td><td><code>repository</code></td></tr> <tr> <td><code>artifactVersion</code></td><td><code>resource</code></td></tr> <tr> <td><code>event</code></td><td><code>resourcePool</code></td></tr> <tr> <td><code>formalParameter</code></td><td><code>server</code></td></tr> <tr> <td><code>group</code></td><td><code>schedule</code></td></tr> <tr> <td><code>job</code></td><td><code>systemObject</code></td></tr> <tr> <td><code>jobStep</code></td><td><code>user</code></td></tr> <tr> <td><code>license</code></td><td><code>userSettings</code></td></tr> <tr> <td><code>notifier</code></td><td><code>workspace</code></td></tr> <tr> <td><code>procedure</code></td><td><code>plugin</code></td></tr> <tr> <td><code>procedureStep</code></td><td></td></tr> </table>	<code>ace</code>	<code>project</code>	<code>acl</code>	<code>property</code>	<code>admin</code>	<code>propertySheet</code>	<code>artifact</code>	<code>repository</code>	<code>artifactVersion</code>	<code>resource</code>	<code>event</code>	<code>resourcePool</code>	<code>formalParameter</code>	<code>server</code>	<code>group</code>	<code>schedule</code>	<code>job</code>	<code>systemObject</code>	<code>jobStep</code>	<code>user</code>	<code>license</code>	<code>userSettings</code>	<code>notifier</code>	<code>workspace</code>	<code>procedure</code>	<code>plugin</code>	<code>procedureStep</code>	
<code>ace</code>	<code>project</code>																												
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<code>group</code>	<code>schedule</code>																												
<code>job</code>	<code>systemObject</code>																												
<code>jobStep</code>	<code>user</code>																												
<code>license</code>	<code>userSettings</code>																												
<code>notifier</code>	<code>workspace</code>																												
<code>procedure</code>	<code>plugin</code>																												
<code>procedureStep</code>																													
<code>parentId</code>	<code>id</code> : The parent ACL.																												

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<b>Object Type: <code>artifact</code></b>  <b>Description:</b> An <i>artifact</i> is an object that contains zero or more artifact versions. An artifact has two purposes: <ol style="list-style-type: none"> <li>1. To group artifact versions and provide a template for naming the versions</li> <li>2. To restrict who can publish artifact versions, based on <code>groupId:artifactKey</code></li> </ol>	
Property Name	Description
<code>acl</code>	<code>reference:acl</code>
<code>artifactId</code>	<code>id</code> : The artifact's ID number.

**Object Type: artifact**

**Description:** An *artifact* is an object that contains zero or more artifact versions.

An artifact has two purposes:

1. To group artifact versions and provide a template for naming the versions
2. To restrict who can publish artifact versions, based on `groupId:artifactKey`

Property Name	Description
<code>artifactKey</code>	<code>string</code> : User-specified identifier for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.
<code>artifactName</code>	<code>name</code> : The name of this artifact.
<code>artifactVersionNameTemplate</code>	<code>name</code> : The template for artifact version names published to this artifact.
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>description</code>	<code>string</code> : A user-specified text description of the object.
<code>groupId</code>	<code>id</code> : A user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>propertySheet</code>	<code>reference</code> : <code>propertySheet</code>

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**Object Type: artifactVersion**

**Description:** An artifact version is an object that represents a user-defined unit of related files typically produced by one job and consumed by one or more other jobs.

Property Name	Description
acl	<code>reference: acl</code>
artifactKey	<code>string</code> : User-specified identifier for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.
artifactName	<code>name</code> : The name of the artifact.
artifactVersionId	<code>id</code> : The ElectricFlow-generated ID number for this artifact version.
artifactVersionName	<code>name</code> : The name of the artifact version.
artifactVersionState	<code>string</code> : Possible values are: <code>available publishing unavailable</code>
buildNumber	<code>number</code> : User-defined build number component of the version attribute for the artifact version.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
groupId	<code>id</code> : A user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
majorMinorPatch	<code>string</code> : <code>major.minor.patch</code> component of the version attribute for the artifact.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.

**Object Type: artifactVersion**

**Description:** An artifact version is an object that represents a user-defined unit of related files typically produced by one job and consumed by one or more other jobs.

Property Name	Description
propertySheet	<code>reference</code> : <code>propertySheet</code>
publisherJobId	<code>id</code> : The ElectricFlow-generated ID number for the job that published the artifact version.
publisherJobName	<code>string</code> : The name of the job that published the artifact version.
publisherJobStepId	<code>id</code> : The ElectricFlow-generated ID number for the job step that published the artifact version.
qualifier	<code>string</code> : User-defined qualifier component of the version attribute for the artifact.
repositoryName	<code>name</code> : The name of the artifact repository.
version	<code>string</code> : An artifact version specification uses the following form: <i>major.minor.patch.qualifier.buildNumber</i>

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**Object Type: credential**

**Description:** In ElectricFlow, a *credential* is an object that stores a username and password for later use.

Property Name	Description
acl	<code>reference</code> : <code>acl</code>
createTime	<code>date</code> : The time when this object was created.
credentialId	<code>id</code> : The credential's ID number.
credentialName	<code>name</code> : The name of this credential.

**Object Type: credential**

**Description:** In ElectricFlow, a *credential* is an object that stores a username and password for later use.

Property Name	Description
description	<code>string</code> : A user-specified text description of the object.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
password	<code>string</code> : The password corresponding to the username and this credential.
projectName	<code>name</code> : The name of the <a href="#">project</a> that contains this credential.
propertySheet	<code>reference</code> : <a href="#">propertySheet</a>
userName	<code>name</code> : A saved string that represents the name portion of a credential, typically a user account name.

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**Object Type: directoryProvider**

**Description:** A *directoryProvider* is an object containing information about an external directory service (LDAP or ActiveDirectory).

Property Name	Description
acl	<code>reference</code> : <a href="#">acl</a>
commonGroupNameAttribute	<code>string</code> : The attribute in a group record that contains the common group name. If specified, this name is used only when searching for groups from an external provider.



**Object Type: directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

Property Name	Description
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
directoryProviderId	<code>id</code> : The ID of the directory provider.
domainName	<code>string</code> : The domain name from which Active Directory servers are automatically discovered.
emailAttribute	<code>string</code> : The attribute in a user record that contains the user's email address. If the attribute was not specified, the account name and domain name are concatenated to form an email address.
enableGroups	<code>boolean</code> : Determines whether or not external groups are enabled for the directory provider. Defaults to "true".
fullUserNameAttribute	<code>name</code> : The attribute in a user record that contains the user's full name (first and last) for display in the UI.
groupBase	<code>string</code> : This string is prepended to the <code>basedn</code> to construct the directory DN that contains group records.
groupMemberAttributes	<code>string</code> : A comma-separated attribute name list that identifies a group member.
groupMemberFilter	<code>string</code> : Two common forms of group record in LDAP directories: POSIX style groups where members are identified by account name, and <code>groupOfNames</code> or <code>uniqueGroupOfNames</code> records where members are identified by the full user DN. Both forms are supported, so the query is passed to parameters: "{0}" is replaced with the full user record DN, and "{1}" is replaced with the user's account name.
groupNameAttribute	<code>name</code> : The group record that contains the name of the group.

**Object Type: directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

Property Name	Description
groupSearchFilter	<code>string</code> : This LDAP query is performed in the context of the groups directory to enumerate group records.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
managerDn	<code>name</code> : The DN of a user who has read-only access to LDAP user and group directories.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
propertySheet	<code>reference</code> : <code>propertySheet</code>
providerIndex	<code>number</code> : The index that specifies the search order across multiple directory providers. For example: 2 LDAP providers, one with index "0" and one with index "1" means the providers will be searched in that numerical order.
providerName	<code>name</code> : This human-readable name will be displayed in the user interface to identify users and groups that come from this provider.
providerType	<code>string</code> : <code>&lt;ldap activedirectory&gt;</code>
realm	<code>string</code> : An identifier (string) used for LDAP directory providers so users and groups (within LDAP) can be uniquely identified in "same name" collisions across multiple directory providers. The realm is appended to the user or group name when stored in the ElectricFlow server. For example, <code>&lt;user&gt;@dir</code> (where the realm is set to "dir").
url	<code>string</code> : The server URL is in the form <code>protocol://host:port/basedn</code> . Protocol is either <code>ldap</code> or <code>ldaps</code> (for secure LDAP).

**Object Type: directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

Property Name	Description
userBase	<b>string:</b> This string is prepended to the <code>basedn</code> to construct the directory DN that contains user records.
userNameAttribute	<b>name:</b> The attribute in a user record that contains the user's account name.
userSearchFilter	<b>string:</b> This LDAP query is performed in the context of the user directory to search for a user by account name. The string "{0}" is replaced with the user's login ID. Typically, the query compares a user record attribute with the substituted user login ID.
userSearchSubtree	<b>boolean:</b> If true, the subtree below the user base is searched recursively.
useSSL	<b>boolean:</b> This flag is used to specify SSL to communicate with your Active Directory servers.  <b>Note:</b> Transport Layer Security (TLS) has replaced Secure Sockets Layer version 3.0 (SSLv3) on the ElectricFlow web server and the ElectricFlow server.

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**Object Type: emailConfig**

**Description:** An *emailConfig* is an object that stores information created and used to communicate with the email server.

Property Name	Description
acl	<b>reference:</b> <code>acl</code>
configName	<b>string:</b> The name of the email configuration.

<b>Object Type: emailConfig</b>  <b>Description:</b> An <i>emailConfig</i> is an object that stores information created and used to communicate with the email server.	
Property Name	Description
createTime	<b>date:</b> The time when this object was created.
description	<b>string:</b> A user-specified text description of the object.
emailConfigId	<b>id:</b> The ElectricFlow-generated ID for the email configuration.
emailConfigName	<b>string:</b> The name of the email configuration.
lastModifiedBy	<b>name:</b> This shows who (generally, a username) last modified this object.
mailFrom	<b>string:</b> The email address used as the email sender address for notifications.
mailHost	<b>string:</b> The name of the email server host.
mailPort	<b>number:</b> The port number for the mail server. The protocol software determines the default value (25 for SMTP and 465 for SSMTP).
mailProtocol	<b>string:</b> This is either SSMTP or SMTP (not case sensitive). Default is SMTP.
mailUser	<b>name:</b> An individual or a generic name like "ElectricFlow" -- the name of the email user on whose behalf ElectricFlow sends email notifications.
modifyTime	<b>date:</b> The time when this object was last modified.
owner	<b>name:</b> The person (username) who created the object.
propertySheet	<b>reference:</b> <a href="#">propertySheet</a>

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**Object Type: emailNotifier**

**Description:** An *emailNotifier* is an object that stores information created and used to notify users about various types information, including status.

Property Name	Description
acl	<code>reference:</code> <code>acl</code>
condition	<code>string</code> : Only send mail if the condition evaluates to "true". The condition is a string subject to property expansion. The notification will NOT be sent if the expanded string is "false" or "0". If no condition is specified, the notification is ALWAYS sent.
configName	<code>string</code> : The name of the email configuration.
container	<code>id</code> : The object ID to which the email notifier is attached (for example: procedure-123).
containerType	<code>string</code> : The type of object that the notifier is attached to (procedure, step, job, jobstep).
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
destinations	<code>string</code> : A space-separated list of valid email addresses, email aliases, or ElectricFlow usernames, or a string subject to property expansion that expands into such a list.
emailNotifierId	<code>id</code> : The ElectricFlow-generated ID for the email notifier.
eventType	<code>string</code> : <code>&lt;onEnter onStart onCompletion&gt;</code> <code>onStart</code> triggers an email notification when the job or job step begins. <code>onCompletion</code> , default, triggers an email notification when the job finishes, no matter how it finishes.
formattingTemplate	<code>string</code> : The email address used as the email sender address for notifications.

**Object Type: emailNotifier**

**Description:** An *emailNotifier* is an object that stores information created and used to notify users about various types information, including status.

Property Name	Description
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
notifierName	<code>name</code> : The name of the email notifier.
owner	<code>name</code> : The person (username) who created the object.
propertySheet	<code>reference</code> : <code>propertySheet</code>

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**Object Type: formalParameter**

**Description:** A *formalParameter* is a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from "actual parameters"--- formal parameters define the type of parameters a procedure is expecting, and actual parameters provide values to use at run-time.

Property Name	Description
container	<code>string</code> : An object ID for a "container" that contains formal parameters.
containerType	<code>string</code> : The type of object containing the formal parameter.
createTime	<code>date</code> : The time when this object was created.
defaultValue	<code>string</code> : The <code>formalParameter</code> 's default value.

**Object Type: `formalParameter`**

**Description:** A *formalParameter* is a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from "actual parameters"--- formal parameters define the type of parameters a procedure is expecting, and actual parameters provide values to use at run-time.

Property Name	Description
<code>description</code>	<code>string</code> : A user-specified text description of the object.
<code>expansionDeferred</code>	<code>boolean</code> : Determines whether or not the property expansion is deferred.
<code>formalParameterId</code>	<code>id</code> : This is this formal parameter's ID.
<code>formalParameterName</code>	<code>name</code> : This is this formal parameter's name.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>required</code>	<code>boolean</code> : If true, a value for this parameter must be supplied when the procedure is called.
<code>type</code>	<code>name</code> : The custom type of <code>formalParameter</code> .

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**Object Type: gateway**

**Description:** To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source* zone and the other in the *target* zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

Property Name	Description
acl	<code>reference</code> : acl
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
gatewayDisabled	<code>boolean</code> : If set to 1 (true), the gateway is disabled.
gatewayId	<code>id</code> : The unique ElectricFlow-generated ID for this gateway.
gatewayName	<code>string</code> : The name of the gateway.
hostName1	<code>string</code> : The agent host name where <i>Resource1</i> resides. This host name is used by <i>Resource2</i> to communicate with <i>Resource1</i> . Do not specify this option if you want to use the host name from <i>Resource1</i> 's definition.
hostName2	<code>string</code> : The agent host name where <i>Resource2</i> resides. This host name is used by <i>Resource1</i> to communicate with <i>Resource2</i> . Do not specify this option if you want to use the host name from <i>Resource2</i> 's definition.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
port1	<code>number</code> : The port number used by <i>Resource1</i> —defaults to the port number used by the resource.



**Object Type: gateway**

**Description:** To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source* zone and the other in the *target* zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

Property Name	Description
port2	<code>number</code> : The port number used by <i>Resource2</i> —defaults to the port number used by the resource.
propertySheet	<code>reference</code> : <code>propertySheet</code>
resourceName1	<code>string</code> : The name of your choice for the first of two required gateway resources. Do <b>not</b> include "spaces" in a resource name.
resourceName2	<code>string</code> : The name of your choice for the second of two required gateway resources. Do <b>not</b> include "spaces" in a resource name.

[\[back to top\]](#)**Object Type: group**

**Description:** This is any *group* of users known to the ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP or ActiveDirectory.

Property Name	Description
acl	<code>reference</code> : <code>acl</code>
createTime	<code>date</code> : The time when this object was created.
groupId	<code>id</code> : The unique ElectricFlow-generated group ID.
groupName	<code>name</code> : This is this group's name.

**Object Type: group**

**Description:** This is any *group* of users known to the ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP or ActiveDirectory.

Property Name	Description
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>mutable</code>	<code>boolean</code> : If true, the member list of this group is editable within ElectricFlow via the web UI or the <code>modifyGroup</code> API.
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>propertySheet</code>	<code>reference</code> : <code>propertySheet</code>
<code>providerName</code>	<code>name</code> : The name of the <code>directory provider</code> that controls this group.

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**Object Type: job**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

Property Name	Description
<code>abortStatus</code>	<code>string</code> : If set, indicates the step was aborted. Values will be either <code>ABORT</code> or <code>FORCE_ABORT</code> —indicating how the step was aborted.
<code>abortedBy</code>	<code>name</code> : This is the user who issued the "abort."

**Object Type: `job`**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>actualParameter</code>	<code>reference</code> : <code>propertySheet</code> An <code>actualParameter</code> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
<code>callingState</code>	<code>string</code> : The full property path to the "calling state", which can appear on <code>subjobs</code> and <code>subworkflows</code> of a workflow.
<code>callingStateId</code>	<code>id</code> : The ElectricFlow-generated ID number for the calling state.
<code>combinedStatus</code>	Provides more inclusive step status output—the resulting query output may contain up to three sub-elements: <code>status message properties</code>
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>credentialName</code>	<code>name</code> : The name of the <code>credential</code> being used for impersonation when the job runs commands on a resource.
<code>deleted</code>	The object was marked for background deletion. Possible values are "0" or "1". Default is "0" (not set).
<code>directoryName</code>	<code>name</code> : The name of this job's directory within each workspace for this job.

**Object Type: `job`**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

Property Name	Description
<code>elapsedTime</code>	<code>number</code> : The number of milliseconds between the start and end times for the job.
<code>errorCode</code>	<code>errorCode</code> : When the outcome is <code>error</code> , this property displays the error code, identifying which error occurred.
<code>errorMessage</code>	<code>string</code> : When the outcome is <code>error</code> , this property displays the error description.
<code>external</code>	<code>boolean</code> : If <code>'true'</code> , the job is external.
<code>finish</code>	<code>date</code> : The time this job completed.
<code>jobId</code>	<code>id</code> : This is this job's ID number, which is a UUID.
<code>jobName</code>	<code>name</code> : This is this job's name.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>launchedByUser</code>	<code>name</code> : The name of the user or project principal that explicitly launched the job. This property is blank when the job is launched by a schedule.
<code>licenseWaitTime</code>	The sum of time all job steps had to wait for a license.
<code>liveProcedure</code>	<code>name</code> : The current procedure name from which this job was created – if the procedure was renamed since the job launched, this will be the procedure's new name, and if the procedure was deleted, this will be null.

**Object Type: `job`**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

Property Name	Description
<code>liveSchedule</code>	<code>name</code> : The current schedule name that launched this job – if the schedule was renamed since the job was launched, this will be the schedule's new name, and if the schedule was deleted, this will be null.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>outcome</code>	The overall result of the job: <code>success</code> , <code>warning</code> , <code>error</code> , or <code>skipped</code> .
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>priority</code>	Values can be <code>low</code> , <code>normal</code> (default), <code>high</code> , or <code>highest</code> .
<code>procedureName</code>	<code>name</code> : The name of the <code>procedure</code> that defines the job's steps.
<code>projectName</code>	<code>name</code> : The name of the <code>project</code> that contains this job.
<code>propertySheetId</code>	<code>reference</code> : <code>propertySheet</code>
<code>resourceWaitTime</code>	The sum of time all job steps had to wait for a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.
<code>runAsUser</code>	<code>name</code> : The name of the user being impersonated in this job.
<code>scheduleName</code>	<code>name</code> : The schedule name that launched this job – this field differs from <code>liveSchedule</code> in that it is written at job creation time only, and not changed, even if the schedule is renamed or deleted.
<code>start</code>	<code>date</code> : The time when this job began executing.

**Object Type: `job`**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

Property Name	Description
<code>status</code>	<p>Possible values are:</p> <p><code>pending</code>—the job was created, but it is waiting for prerequisite steps to complete</p> <p><code>runnable</code>—the job step is waiting for a resource</p> <p><code>scheduled</code>—the job was assigned a resource, but the command has not started running</p> <p><code>running</code>—the job/job step is running a command on the assigned resource</p> <p><code>completed</code>—the job/job step has completed</p>
<code>totalWaitTime</code>	The total sum of license, resource, a precondition, and workspace wait times job steps were restricted and had to wait to process.
<code>workspaceWaitTime</code>	The sum of time all job steps had to wait for a workspace.

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**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>abortStatus</code>	<code>string</code> : If set, indicates the step was aborted. Values will be either <code>ABORT</code> or <code>FORCE_ABORT</code> —indicating how the step was aborted.
<code>abortedBy</code>	<code>name</code> : The user who issued the "abort."

**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>acl</code>	<code>reference</code> : <a href="#">acl</a>
<code>actualParameter</code>	<code>reference</code> : <a href="#">propertySheet</a> An <code>actualParameter</code> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"—formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
<code>alwaysRun</code>	<code>boolean</code> : If true, this step runs even if the job is aborted before the step completes. Note that a "force abort" will abort an <code>alwaysRun</code> step.
<code>assignedResourceName</code>	<code>name</code> : The name of the resource assigned to this step by the resource scheduler.
<code>broadcast</code>	<code>boolean</code> : If true, this step runs on all resources in a pool.
<code>combinedStatus</code>	Provides more inclusive step status output—the resulting query output may contain up to three sub-elements: <code>status message properties</code>
<code>command</code>	<code>string</code> : This property specifies the command this step runs.
<code>condition</code>	<code>string</code> : If this element is not present, the event is ALWAYS triggered. If specified, the event is triggered only if the value of the condition argument is TRUE; if not true, a boolean value of "false" or "0" was used. Condition arguments can be a literal, a fixed value string, or a string subject to property expansion.
<code>conditionExpanded</code>	<code>boolean</code> : The result of the expansion on the step condition.
<code>createTime</code>	<code>date</code> : The time when this object was created.

<b>Object Type: <code>jobStep</code></b>	
<b>Description:</b> A <i>jobStep</i> is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a <a href="#">job</a> .	
Property Name	Description
<code>delayUntil</code>	For a step that was rescheduled due to a resource or workspace problem, this is the next time the step will be eligible to run.
<code>elapsedTime</code>	<a href="#">number</a> : The number of milliseconds between the start and end times for the <code>jobStep</code> .
<code>errorCode</code>	<a href="#">errorCode</a> : This property appears when the outcome is <code>error</code> and displays the error code, identifying which error occurred.
<code>errorHandling</code>	<p>This is the error handling policy copied from the procedure step and indicates how the step responds to errors:</p> <p><code>failProcedure</code> —The current procedure continues, but the overall status is <code>error</code> (default).</p> <p><code>abortProcedure</code> —Aborts the current procedure, but allows already-running steps in the current procedure to complete.</p> <p><code>abortProcedureNow</code> —Aborts the current procedure and terminates running steps in the current procedure.</p> <p><code>abortJob</code> —Aborts the entire job, terminates running steps, but allows <code>alwaysRun</code> steps to run.</p> <p><code>abortJobNow</code> —Aborts the entire job and terminates all running steps, including <code>alwaysRun</code> steps.</p> <p><code>failProcedure</code> — The current procedure continues, but the overall status is <code>error</code> (default).</p> <p><code>ignore</code> —Continues as if the step succeeded.</p>
<code>errorMessage</code>	<a href="#">string</a> : When the outcome is <code>error</code> , this property displays an error message description.
<code>exclusive</code>	<a href="#">boolean</a> : If true, this step acquires and retains its resource exclusively.



**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>exclusiveMode</code>	<code>string</code> : Possible values are: none, job, step, call
<code>exitCode</code>	<code>number</code> : This is this step's exit code.
<code>external</code>	<code>boolean</code> : If "true", the job is external.
<code>finish</code>	<code>date</code> : The time when this job step completed.
<code>hostName</code>	<code>name</code> : The name of the host where this step was invoked (copied from the <a href="#">resource</a> )
<code>job</code>	<code>id</code> : This is the ID number of the job that owns the job step.  The string representation of the job is its name, so <code>\${job}</code> evaluates to the job name, but <code>\${job/foo}</code> is also legal and refers to the foo property of the job.
<code>jobId</code>	<code>id</code> : This is this job's ID number, which is a UUID.
<code>jobName</code>	<code>name</code> : This is the name of this step's job.
<code>jobStepId</code>	<code>id</code> : This is this step's ID number.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>licenseWaitTime</code>	The length of time this job step had to wait to process because the license limit was reached or exceeded.
<code>liveProcedure</code>	<code>string</code> : The current procedure name for the procedure step from which the job or job step was created – if the procedure step was renamed since the job or job step was launched, this is the procedure step's new name, and if the procedure step was deleted, this will be null.

**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>liveProcedureStep</code>	<b>name:</b> This property shows the current procedure name for the procedure step from which this job step was created – if the procedure step was renamed since the job was launched, this will be the procedure step's new name, and if the procedure step was deleted, this will be null.
<code>logFileName</code>	<b>name:</b> The name of the log file produced by this step, relative to the job's workspace directory.
<code>modifyTime</code>	<b>date:</b> The time when this object was last modified.
<code>outcome</code>	<b>string:</b> The overall result of the job—possible values are: <code>success</code> , <code>warning</code> , <code>error</code> , or <code>skipped</code>
<code>owner</code>	<b>name:</b> The person (username) who created the object.
<code>parallel</code>	<b>boolean:</b> If true, this step runs in parallel with other adjacent steps also marked to run in parallel.
<code>postExitCode</code>	<b>number:</b> This is this step's post processor exit code.
<code>postLogFileName</code>	<b>name:</b> The log file name produced by this step's post processor.
<code>postProcessor</code>	<b>string:</b> The post processor name used to gather information about this step.
<code>precondition</code>	<b>string:</b> By default, if a step has no precondition, it will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a <i>precondition</i> is evaluated. A <i>precondition</i> is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a <code>"0"</code> or <code>"false"</code> is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.

**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>procedureName</code>	<code>name</code> : The name of the <a href="#">procedure</a> that contains this <code>jobStep</code> .
<code>projectName</code>	<code>name</code> : The name of the <a href="#">project</a> that contains this <code>jobStep</code> .
<code>propertySheet</code>	<code>reference</code> : <a href="#">propertySheet</a>
<code>releaseExclusive</code>	<code>boolean</code> : A Boolean value indicating whether this step should release its resource upon completion.
<code>releaseMode</code>	<code>string</code> : Possible values are: none, release, releaseToJob
<code>resourceName</code>	<code>name</code> : The name of the resource or pool this step should use to run on.
<code>resourceSource</code>	This property indicates whether the resource for the job step is explicitly specified by the step or was defaulted from the procedure: <a href="#">procedure</a> or <code>procedureStep</code> .
<code>resourceWaitTime</code>	The length of time this job step stalled because it could not get a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.
<code>retries</code>	<code>number</code> : This is a number—the number of retries before the request times out.
<code>runAsUser</code>	<code>name</code> : The name of the user being impersonated in this job step.
<code>runnable</code>	<code>date</code> : The time when the step became runnable.
<code>runTime</code>	<code>number</code> : The number of milliseconds the step command spent running on a resource.

**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>shell</code>	<a href="#">name</a> : The shell used to execute the step's commands on a resource. The script name is inserted into the command at the position of a " {0} " marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the <a href="#">Shell</a> definition in the Step Help topic.
<code>start</code>	<a href="#">date</a> : The time when this job step began executing.
<code>status</code>	<p>Possible values are:</p> <p><code>pending</code>—the job step was created, but it is waiting for prerequisite steps to complete</p> <p><code>runnable</code>—the job step is waiting for a resource</p> <p><code>scheduled</code>—the job step was assigned a resource, but the command has not started running</p> <p><code>running</code>—the job/job step is running a command on the assigned resource</p> <p><code>completed</code>—the job/job step has completed</p>
<code>stepName</code>	<a href="#">name</a> : This is this step's name.
<code>subprocedure</code>	<a href="#">name</a> : The nested procedure name to call when this step executes.
<code>subproject</code>	<a href="#">name</a> : This property appears if the subprocedure element is present and specifies the project to which the subprocedure belongs (by default, the current project is used.)
<code>timeLimit</code>	<a href="#">number</a> : The maximum length of time this step is allowed to run.
<code>timeout</code>	<a href="#">date</a> : The time when this job step will be automatically aborted if it has not yet completed.

**Object Type: `jobStep`**

**Description:** A *jobStep* is an instance of a step that ran—a single invocation of a command on a resource or a single call to a subprocedure within the context of a [job](#).

Property Name	Description
<code>totalWaitTime</code>	The sum of resource, workspace, and license wait times for this job step.
<code>waitTime</code>	<a href="#">number</a> : The number of milliseconds the step spent between runnable and running (for example, waiting for a resource).
<code>workingDirectory</code>	<a href="#">name</a> : The name of this step's working directory.
<code>workspaceName</code>	<a href="#">name</a> : The workspace name used by the <code>jobStep</code> object.
<code>workspaceWaitTime</code>	The time this job step had to wait because no workspace was found or available.

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**Object Type: logEntry**

**Description:** A *logEntry* is an object containing various types of information available in a log file generated from anywhere in the ElectricFlow system.

The *Event Log* can be configured for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries.

To change the default settings, go to Administration > Server > Settings and modify the Event log retain time and the Maximum background delete delay fields

**Note:** Setting the "retain" period to "0" disables the automatic deletion mechanism, allowing you to use an external cleanup script to implement a custom cleanup policy.

Property Name	Description
category	(currently not used)
container	<code>string</code> : Typically, this is the type and name of the workflow or job with a corresponding ID.
containerName	<code>name</code> : The name of the container.
containerType	<code>string</code> : The type of object the log entry pertains to (for example, procedure, job step, step).
deleted	<code>byte</code> : The object was marked for background deletion. Possible values are "0" or "1". Default is "0" (which means "deleted" is not set).
logEntryId	<code>id</code> : The log entry ElectricFlow-generated ID.
message	<code>string</code> : The message text will either be informational or display the warning or error message. The message may contain important information about a resource or workspace issue.
principal	<code>string</code> : The user or project principal from the session that was active when the event occurred.

**Object Type: logEntry**

**Description:** A *logEntry* is an object containing various types of information available in a log file generated from anywhere in the ElectricFlow system.

The *Event Log* can be configured for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries.

To change the default settings, go to Administration > Server > Settings and modify the Event log retain time and the Maximum background delete delay fields

**Note:** Setting the "retain" period to "0" disables the automatic deletion mechanism, allowing you to use an external cleanup script to implement a custom cleanup policy.

Property Name	Description
severity	<code>string</code> : Severity can be either TRACE, DEBUG, INFO, WARN, ERROR
subject	<code>string</code> : The object associated with the message.
subjectName	<code>name</code> : The name of the object associated with the message.
subjectType	<code>string</code> : (similar to <code>container</code> ) Refers to the object the event concerns. This may be the same as the container, or it may be a different object that is related to the event in some manner.
time	<code>string</code> : The time the event was logged.

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**Object Type: procedure**

**Description:** A *procedure* describes a series of actions to be performed on one or more resources. A procedure contains steps and properties and can define formal parameters.

Property Name	Description
acl	<code>reference: acl</code>
createTime	<code>date</code> : The time when this object was created.
credentialName	<code>name</code> : The name of the credential assigned to this job step.
description	<code>string</code> : A user-specified text description of the object.
jobNameTemplate	<code>name</code> : The template used to name jobs created from this procedure.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
procedureId	<code>id</code> : This is this procedure's ID number.
procedureName	<code>name</code> : This is this procedure's name.
projectName	<code>name</code> : The name of the <code>project</code> that contains this procedure.
propertySheet	<code>reference: propertySheet</code>
resourceName	<code>name</code> : The name of the resource or pool this procedure should use to run on.
workspaceName	<code>name</code> : The workspace name used by the procedure object.

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**Object Type: project**

**Description:** A *project* is an object used in ElectricFlow to organize information. A project contains procedures, schedules, credentials, and properties.

Property Name	Description
acl	<a href="#">reference: acl</a>
createTime	<a href="#">date</a> : The time when this object was created.
credentialName	<a href="#">name</a> : The name of the credential assigned to this project.
deleted	The object was marked for background deletion. Possible values are "0" or "1". Default is "0" (not set).
description	<a href="#">string</a> : A user-specified text description of the object.
lastModifiedBy	<a href="#">name</a> : This shows who (generally, a username) last modified this object.
modifyTime	<a href="#">date</a> : The time when this object was last modified.
owner	<a href="#">name</a> : The person (username) who created the object.
pluginName	<a href="#">name</a> : The name of the plugin associated with this project.
projectId	<a href="#">id</a> : This is this project's ID.
projectName	<a href="#">name</a> : The name of the project.
propertySheet	<a href="#">reference: propertySheet</a>
resourceName	<a href="#">name</a> : The name of the resource.
workspaceName	<a href="#">name</a> : This is the workspace name used by the project.

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**Object Type: property**

**Description:** A *property* is a string value with a name. Properties can have arbitrary names and values. You can attach properties to any object in the ElectricFlow system, such as a project, procedure, or job. After a property is created, it is stored in the ElectricFlow database. You can retrieve and/or modify the value later, and you can delete properties you no longer need. Properties provide a flexible and powerful mechanism to manage data about your builds.

**IMPORTANT: Note:** The names "properties" and "project" are not valid property names.

Property Name	Description
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
expandable	<code>boolean</code> : If set to true, the property value will undergo string expansion when it is retrieved.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
canonicalPath	<code>string</code> : The path that specifies the property object.
propertyId	<code>id</code> : This property's ID number.
propertyName	<code>name</code> : This property's name.
propertySheetId	<code>reference</code> : <code>propertySheet</code> —If the property is a nested property sheet, the <code>propertySheet</code> refers to the nested sheet.
value	<code>string</code> : The property or actual parameter's value—if this property is a string property.

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**Object Type: `propertySheet`**

**Description:** A property value can be a simple string or a nested *propertySheet* containing its own properties. Property sheets can be nested to any depth, which allows you to create hierarchical collections of information.

Most objects have an associated property sheet that contains "custom properties" created by user scripts.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>propertySheetId</code>	<code>id</code> : This property sheet's ID.

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**Object Type: `repository`**

**Description:** A *repository* is an object that stores artifact versions. This object primarily contains information on how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>description</code>	<code>string</code> : A user-specified text description for this object.

**Object Type: repository**

**Description:** A *repository* is an object that stores artifact versions. This object primarily contains information on how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found.

Property Name	Description
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
propertySheet	<code>reference</code> : <code>propertySheet</code>
repositoryDisabled	<code>boolean</code> : Determines whether the repository is disabled. Default is "false".
repositoryId	<code>id</code> : The ElectricFlow-generated ID number of the repository.
repositoryIndex	<code>number</code> : The order of the repository, within a list of repositories.
repositoryName	<code>name</code> : The name of the repository.
url	<code>string</code> : The server URL is in the form <code>protocol://host:port/</code> . Typically, the repository server is configured to listen on port 8200 for <code>https</code> requests, so a typical URL looks like <code>https://host:8200/</code> .
zoneName	<code>name</code> : The name of the zone where this repository is or will reside.

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**Object Type: resource**

**Description:** A *resource* is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server through an ElectricFlow agent proxy machine.

Property Name	Description
acl	<code>reference: acl</code>
agentState	<code>string</code> : Specific information about an agent, including the state of the agent. Possible values are: <code>unknown alive down</code>
artifactCacheDirectory	<code>string</code> : The directory on the agent host where retrieved artifacts are stored.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
exclusiveJobId	<code>id</code> : The ID number of the job that owns this resource, which occurs when one of the job's steps requests exclusive use of the resource for the duration of the job.
exclusiveJobName	<code>name</code> : The name of the job that owns this resource, which occurs when one of the job's steps requests exclusive use of the resource for the duration of the job.
exclusiveJobStepId	<code>id</code> : The ID number of the job step that owns this resource, which occurs when one of the steps request exclusive use of the resource for the duration of the job.
exclusiveJobStepName	<code>name</code> : The name of the job step that owns this resource, which occurs when one of the steps request exclusive use of the resource for the duration of the job.
gateways	The gateway names associated with this resource.

**Object Type: RESOURCE**

**Description:** A *resource* is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server through an ElectricFlow agent proxy machine.

Property Name	Description
hostName	<code>name</code> : The computer name or IP address for the machine containing the ElectricFlow agent for this resource.
hostOS	<code>string</code> : The full name of the host operating system, plus its version. However, if this host is a proxy, "proxied" appears as the host description/name.
hostPlatform	<code>string</code> : Examples for "platform" are: Windows, Linux, HPUX, and so on. However, if this host is a proxy, "proxied" appears as the hostPlatform name.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
lastRunTime	<code>date</code> : The most recent time a job step ran on the resource.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
pools	<code>string</code> : A space-separated list of one or more pool names where this resource is a member. Steps defined to run on a resource pool will run on any available member (resource) in the pool.
port	<code>number</code> : The port number for this resource.
propertySheet	<code>reference</code> : <code>propertySheet</code>
proxyCustomization	<code>string</code> : This property displays the customization of the ElectricFlow proxy agent.

**Object Type: resource**

**Description:** A *resource* is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server through an ElectricFlow agent proxy machine.

Property Name	Description
proxyHostName	<code>name</code> : The name of the ElectricFlow agent being used to proxy to another agent, the proxy target.
proxyPort	<code>number</code> : The port number of the ElectricFlow agent being used to proxy to another agent, the proxy target.
proxyProtocol	<code>name</code> : The name of the proxy agent protocol used for communication from the ElectricFlow proxy agent to the proxy target—default is SSH.
repositoryNames	A "new line" separated list of repository names.
resourceDisabled	<code>boolean</code> : A Boolean value indicating whether this resource was disabled.
resourceId	<code>id</code> : This is this resource's ID.
resourceName	<code>name</code> : The name of the resource or pool.
shell	<code>name</code> : The shell used to execute the step's commands on a resource. If no shell was defined on a step, the shell defined on the resource is used, or if no shell was defined on the resource, a default shell is used. For shells: The script name is inserted into the command at the position of a "{0}" marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the <a href="#">Shell</a> definition in the Step Help topic.
stepCount	<code>number</code> : The current number of executing steps on this resource.
stepLimit	<code>number</code> : This property specifies the maximum number of steps that can run on this resource at one time.

**Object Type: resource**

**Description:** A *resource* is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server through an ElectricFlow agent proxy machine.

Property Name	Description
trusted	<code>boolean</code> : If "true", this agent is trusted.
useSSL	<code>boolean</code> : A Boolean value indicating whether this resource uses SSL for communication.  Transport Layer Security (TLS) has replaced Secure Sockets Layer version 3.0 (SSLv3) on the ElectricFlow web server and the ElectricFlow server.
workspaceName	<code>name</code> : The workspace name used by this resource.
zoneName	<code>string</code> : The name of the zone where this resource resides.

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**Object Type: resourcePool**

**Description:** A *resource pool* is a container for a group of resources.

Property Name	Description
acl	<code>reference</code> : <code>acl</code>
autoDelete	<code>boolean</code> : If "true", the resource pool is deleted when the last resource is removed or deleted.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.



**Object Type: resourcePool**

**Description:** A *resource pool* is a container for a group of resources.

Property Name	Description
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
lastResourceUsed	<code>name</code> : The name of the most recently used resource from the pool.
modifyTime	<code>date</code> : The time when this object was last modified.
orderingFilter	<code>string</code> : A Javascript block invoked when scheduling resources for a pool. <b>Note:</b> A Javascript block is not required unless you need to override the default resource ordering behavior.
owner	<code>name</code> : The person (username) who created the object.
propertySheet	<code>reference</code> : <a href="#">propertySheet</a>
resourcePoolDisabled	<code>boolean</code> : A Boolean value indicating whether this resource pool was disabled.
resourcePoolId	<code>id</code> : This resource pool's ID number.
resourcePoolName	<code>name</code> : The name of the resource pool.

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**Object Type: resourceUsage**

**Description:** Provides usage information for all resources in the system.

For any job step running on a resource, there is a resource usage record that contains the ID and name of the job, job step, and resource.

Property Name	Description
jobId	<code>id</code> : This is this job's ID number, which is a UUID.

**Object Type: resourceUsage**

**Description:** Provides usage information for all resources in the system.

For any job step running on a resource, there is a resource usage record that contains the ID and name of the job, job step, and resource.

Property Name	Description
jobName	<code>name</code> : The name of the job.
jobStepId	<code>id</code> : The ID number of the job step.
jobStepName	<code>name</code> : The name of the job step.
licenseWaitTime	The time this job step had to wait because no license was found or available.
resourceId	<code>id</code> : The ElectricFlow-generated resource ID number.
resourceName	<code>name</code> : The name (or names) of the resource.
resourcePoolId	<code>id</code> : The ElectricFlow-generated resource pool's ID number.
resourcePoolName	<code>name</code> : The name of the resource pool.
resourceUsageId	<code>id</code> : The unique ID of the resource usage record.
resourceWaitTime	The time this job step had to wait because no resource was found or available. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.
waitReason	Possible values are: <code>license</code> , <code>resource</code> , or <code>workspace</code> .
workspaceWaitTime	The time this job step had to wait because no workspace was found or available.

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<b>Object Type: <code>schedule</code></b>  <b>Description:</b> <i>Schedules</i> are used to execute procedures and determine when specific procedures run.	
Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>actualParameter</code>	<code>reference</code> : <code>propertySheet</code> An <i>actualParameter</i> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
<code>beginDate</code>	<code>string</code> : The first day on which the schedule is active, in the form YYYY-MM-dd. For example, "2009-06-25"
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>credentialName</code>	<code>name</code> : The name of the <code>credential</code> being used for impersonation when the schedule launches a job.
<code>description</code>	<code>string</code> : A user-specified text description of the object.
<code>endDate</code>	<code>string</code> : The end of the range of dates the schedule is active, in the form: YYYY-MM-dd. The actual end date is not included in the range. For example, "2009-06-25"
<code>interval</code>	<code>string</code> : A floating point number that represents the time to wait between invocations of the schedule.
<code>intervalUnits</code>	<code>string</code> : These are the units to use when interpreting the <i>interval</i> value. The <i>units</i> can be <code>hours</code> , <code>minutes</code> , <code>seconds</code> , or <code>continuous</code> .
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>lastRunTime</code>	<code>date</code> : The last time a job was launched by a schedule.

<b>Object Type: <code>schedule</code></b>  <b>Description:</b> <i>Schedules</i> are used to execute procedures and determine when specific procedures run.	
Property Name	Description
<code>misfirePolicy</code>	<b>string:</b> The policy the schedule uses when it is unable to launch a job at the scheduled time: <code>ignore</code> —wait until the next scheduled time to run <code>runOnce</code> —run immediately, then resume normal scheduling
<code>modifyTime</code>	<b>date:</b> The time when this object was last modified.
<code>monthDays</code>	<b>string:</b> This property specifies which days of the month this schedule should run—shown as a space-separated list of numbers (1-31).
<code>owner</code>	<b>name:</b> The person (username) who created the object.
<code>priority</code>	<b>string:</b> Values can be <code>low</code> , <code>normal</code> (default), <code>high</code> , or <code>highest</code>
<code>procedureName</code>	<b>name:</b> The name of the <a href="#">procedure</a> that contains this schedule.
<code>projectName</code>	<b>name:</b> The name of the <a href="#">project</a> that contains this schedule.
<code>propertySheet</code>	<b>reference:</b> <a href="#">propertySheet</a>
<code>scheduleDisabled</code>	<b>boolean:</b> A Boolean value indicating whether this schedule was disabled.
<code>scheduleId</code>	<b>id:</b> This schedule's ID number.
<code>scheduleName</code>	<b>name:</b> This property displays this schedule's name and differs from the <code>liveSchedule</code> property found under a job in that the <code>liveSchedule</code> property is written at job creation time only, and not changed, even if the schedule is renamed or deleted.
<code>startTime</code>	<b>string:</b> The time of day when this schedule should start running, in the form: <code>HH:mm:ss</code>

**Object Type: `schedule`**

**Description:** *Schedules* are used to execute procedures and determine when specific procedures run.

Property Name	Description
<code>stopTime</code>	<code>string</code> : The time of day when this schedule should stop running, in the form: <code>HH:mm:ss</code>
<code>timeZone</code>	<code>string</code> : A Java-compatible time zone string.
<code>weekDays</code>	<code>string</code> : This property specifies which days of the week this schedule should run. This is a space-separated list of <code>MONDAY</code> <code>TUESDAY</code> <code>WEDNESDAY</code> <code>THURSDAY</code> <code>FRIDAY</code> <code>SATURDAY</code> <code>SUNDAY</code> . (Note: These are not localized strings.)

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**Object Type: `Server`**

**Description:** This is the ElectricFlow server. There is only one such object in your database.

**Read-only server properties**

Two read-only server properties are available for use in a step, a script, or an email notifier, which can be used to identify the ElectricFlow server location.

`/server/hostname` —returns the ElectricFlow server name

`/server/hostIP` —returns the ElectricFlow server IP address

These properties are especially useful for building a URL link to an ElectricFlow web page. For example, a link in an email notifier that links back to a Job Details page.

A sample link: `https://$[/server/hostname]/commander/jobDetails.php?jobId=$[jobId]`

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>hostIP</code>	<code>string</code> : The server's IP address.

**Object Type: Server**

**Description:** This is the ElectricFlow server. There is only one such object in your database.

**Read-only server properties**

Two read-only server properties are available for use in a step, a script, or an email notifier, which can be used to identify the ElectricFlow server location.

`/server/hostname` —returns the ElectricFlow server name

`/server/hostIP` —returns the ElectricFlow server IP address

These properties are especially useful for building a URL link to an ElectricFlow web page. For example, a link in an email notifier that links back to a Job Details page.

A sample link: `https://$[/server/hostname]/commander/jobDetails.php?jobId=$[jobId]`

Property Name	Description
hostname	<b>name:</b> Generally refers to the computer name or IP address for the machine containing the ElectricFlow server.
lastModifiedBy	<b>name:</b> This shows who (generally, a username) last modified this object.
modifyTime	<b>date:</b> The time when this object was last modified.
owner	<b>name:</b> The person (username) who created the object.
propertySheet	<b>reference:</b> <code>propertySheet</code>
serverId	<b>id:</b> The server's ID number.
serverName	<b>string:</b> The ElectricFlow server's name—defaults to "server".

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**Object Type: state**

**Description:** A *state* object belongs to a workflow and corresponds to the state definition, including a pointer to the workflow, formal parameters (cloned from definition), expanded actual parameters (from the last time a transition was taken to this state), and the "process" which includes the procedure or workflow (cloned from definition), unexpanded actual parameters (cloned from definition, expanded and passed to the process on entry), and the "last run" entity reference.

Property Name	Description
acl	<code>reference</code> : <code>acl</code>
active	<code>boolean</code> : If "true", the state of the workflow is active.
actualParameter	<code>reference</code> : <code>propertySheet</code> An <code>actualParameter</code> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
errorMessage	<code>string</code> : When the outcome is <code>error</code> , this property displays an error message description.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <code>project</code> that contains this state.
propertySheet	<code>reference</code> : <code>propertySheet</code>
stateId	<code>id</code> : The ElectricFlow-generated ID number for the state.

**Object Type: state**

**Description:** A *state* object belongs to a workflow and corresponds to the state definition, including a pointer to the workflow, formal parameters (cloned from definition), expanded actual parameters (from the last time a transition was taken to this state), and the "process" which includes the procedure or workflow (cloned from definition), unexpanded actual parameters (cloned from definition, expanded and passed to the process on entry), and the "last run" entity reference.

Property Name	Description
stateName	<a href="#">name</a> : The name of the state.
subjob	<a href="#">name</a> : The name of the subjob.
subparameters	<a href="#">reference</a> : <a href="#">propertySheet</a>
subprocedure	<a href="#">name</a> : The name of the nested procedure called when a step runs.
subproject	<a href="#">string</a> : If a subprocedure argument was used, this is the name of the project where that subprocedure is found. By default, the current project is used.
substartingState	<a href="#">name</a> : Name of the starting state for the workflow launched when the state is entered.
subworkflow	<a href="#">name</a> : The name of the subworkflow—a workflow called by another workflow.
subworkflowDefinition	<a href="#">name</a> : The name of the subworkflow definition.
workflow	<a href="#">name</a> : The name of the workflow.

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**Object Type: stateDefinition**

**Description:** A *stateDefinition* is a named object that belongs to a workflow definition, which includes specifications for whether or not the state is "startable", formal parameters, notifications, and the process. A process includes a procedure or workflow, the starting state (for workflows only), and actual parameters.

Property Name	Description
acl	<code>reference: acl</code>
actualParameter	<code>reference: propertySheet</code> An <i>actualParameter</i> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <a href="#">project</a> that contains this state definition.
propertySheet	<code>reference: propertySheet</code>
startable	<code>boolean</code> : "True" means this state definition can be the initial state of an instantiated workflow.
stateDefinitionId	<code>id</code> : The ElectricFlow-generated ID number for the state definition.
stateDefinitionName	<code>name</code> : The name of the state definition.

**Object Type: stateDefinition**

**Description:** A *stateDefinition* is a named object that belongs to a workflow definition, which includes specifications for whether or not the state is "startable", formal parameters, notifications, and the process. A process includes a procedure or workflow, the starting state (for workflows only), and actual parameters.

Property Name	Description
subprocedure	<code>name</code> : The name of the nested procedure called when a step runs.
subproject	<code>string</code> : If a subprocedure argument was used, this is the name of the project where that subprocedure is found. By default, the current project is used.
substartingState	<code>name</code> : Name of the starting state for the workflow launched when the state is entered.
subworkflowDefinition	<code>name</code> : The name of the subworkflow definition.
workflowDefinitionName	<code>name</code> : The name of the workflow definition.

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**Object Type: step**

**Description:** A *step* includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>actualParameter</code>	<code>reference</code> : <code>propertySheet</code> An <code>actualParameter</code> is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters"- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.
<code>alwaysRun</code>	<code>boolean</code> : If true, this step runs even if the job is aborted before the step completes. Note that a force abort will abort an <code>alwaysRun</code> step.
<code>broadcast</code>	<code>boolean</code> : If true, this step will run on all resources in a pool.
<code>command</code>	<code>string</code> : This property specifies the command this step runs.
<code>condition</code>	<code>string</code> : If this element is not present, the event is ALWAYS triggered. If specified, the event is triggered only if the value of the condition argument is TRUE; if not true, a boolean value of "false" or "0" was used. Condition arguments can be a literal, a fixed value string, or a string subject to property expansion.
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>credentialName</code>	<code>name</code> : The credential name assigned to this step.

**Object Type: step**

**Description:** A *step* includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

Property Name	Description
description	<code>string</code> : A user-specified text description of the object.
errorHandling	<p>This is the error handling policy copied from the procedure step and indicates how the step responds to errors:</p> <p><code>failProcedure</code> —The current procedure continues, but the overall status is error (default).</p> <p><code>abortProcedure</code> —Aborts the current procedure, but allows already-running steps in the current procedure to complete.</p> <p><code>abortProcedureNow</code> —Aborts the current procedure and terminates running steps in the current procedure.</p> <p><code>abortJob</code> —Aborts the entire job, terminates running steps, but allows alwaysRun steps to run.</p> <p><code>abortJobNow</code> —Aborts the entire job and terminates all running steps, including alwaysRun steps.</p> <p><code>ignore</code> —Continues as if the step succeeded.</p>
exclusive	<code>boolean</code> : If true, this step acquires and retains its resource exclusively.
exclusiveMode	<code>string</code> : Possible values are: none, job, step, call
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.

**Object Type: step**

**Description:** A *step* includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

Property Name	Description
logFileName	<code>name</code> : The name of the log file produced by this step, relative to the job's workspace directory.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
parallel	<code>boolean</code> : If true, this step runs in parallel with other adjacent steps also marked to run in parallel.
postLogFileName	<code>name</code> : This property displays the log file name produced by this step's post processor.
postProcessor	<code>string</code> : This property displays the post processor name that is used to gather information about this step. Typically, this is either <code>postp</code> or <code>postp &lt;options&gt;</code> , or an appropriate command or path including options to a postprocessor available on the ElectricFlow server.

**Object Type: step**

**Description:** A *step* includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

Property Name	Description
precondition	<p><b>string:</b> By default, if a step has no precondition, it will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a <i>precondition</i> is evaluated.</p> <p>A <i>precondition</i> is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a \"0\" or \"false\" is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.</p>
procedureName	<b>name:</b> The name of the <a href="#">procedure</a> that contains this <i>step</i> .
projectName	<b>name:</b> The name of the <a href="#">project</a> that contains this step.
propertySheet	<b>reference:</b> <a href="#">propertySheet</a>
releaseExclusive	<b>boolean:</b> A Boolean value indicating whether this step should release its resource upon completion.
releaseMode	<b>string:</b> Possible values are: none, release, releaseToJob
resourceName	<b>name:</b> The resource's name this step should use to run on.

**Object Type: step**

**Description:** A *step* includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a *pool* of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

Property Name	Description
shell	<code>name</code> : The shell used to execute the step's commands on a resource. The script name is inserted into the command at the position of a "{0}" marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the <a href="#">Shell</a> definition in the Step Help topic.
stepId	<code>id</code> : The step's ID number.
stepName	<code>name</code> : The step's name.
subprocedure	<code>name</code> : The nested procedure name to call when this step executes.
subproject	<code>name</code> : This property is displayed if the subprocedure element is present and specifies the project to which the subprocedure belongs (by default, the current project is used.)
timeLimit	<code>number</code> : A floating point number that specifies the maximum length of time this step is allowed to run.
timeLimitUnits	The units to use when interpreting the time limit. Units can be <code>hours</code> , <code>minutes</code> , or <code>seconds</code> .
workingDirectory	<code>name</code> : The name of the step's working directory.
workspaceName	<code>name</code> : The workspace name used by this step.

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**Object Type: transition**

**Description:** A *transition* object belongs to a state and corresponds to the transition definition, and includes the target state (unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry), the Javascript condition, and the trigger (onEnter|onStart|onCompletion|manual).

Property Name	Description
acl	<code>reference: acl</code>
actualParameter	<code>reference: propertySheet</code> An <i>actualParameter</i> is an object that provides the value for a parameter that is passed to the target state when the transition is taken.
condition	<code>string</code> : If empty or non-zero, the transition is allowed to trigger. If set to "0", the transition is ignored.
createTime	<code>date</code> : The time when this object was created.
description	<code>string</code> : A user-specified text description of the object.
index	The numeric index of a transition that indicates the transition order in the state definition's transition list.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <a href="#">project</a> that contains this transition.
propertySheet	<code>reference: propertySheet</code>
stateName	<code>name</code> : The name of the state.
targetState	<code>string</code> : The target state for the transition definition.
transitionId	<code>id</code> : The ElectricFlow-generated ID for the transition.



**Object Type: transition**

**Description:** A *transition* object belongs to a state and corresponds to the transition definition, and includes the target state (unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry), the Javascript condition, and the trigger (`onEnter|onStart|onCompletion|manual`).

Property Name	Description
transitionName	<code>name</code> : The name of the transition.
trigger	<code>string</code> : Possible values are: <code>onEnter</code> –before any actions <code>onStart</code> –after a subjob or workflow is created <code>onCompletion</code> –after a subjob or workflow completes <code>manual</code> –when a user manually requests a transition
workflowName	<code>name</code> : The name of the workflow.

[\[back to top\]](#)**Object Type: transitionDefinition**

**Description:** A *transitionDefinition* is a named object that belongs to a state definition, which includes the target state definition (with actual parameters to the target state, the Javascript condition, and the trigger (`onEnter|onStart|onCompletion|manual`)).

Property Name	Description
acl	<code>reference</code> : <code>acl</code>
actualParameter	<code>reference</code> : <code>propertySheet</code> An <i>actualParameter</i> is an object that provides the value for a parameter passed to the target state.
condition	<code>string</code> : If empty or non-zero, the transition is allowed to trigger. If set to "0", the transition is ignored.
createTime	<code>date</code> : The time when this object was created.

**Object Type: transitionDefinition**

**Description:** A *transitionDefinition* is a named object that belongs to a state definition, which includes the target state definition (with actual parameters to the target state, the Javascript condition, and the trigger (onEnter|onStart|onCompletion|manual)).

Property Name	Description
description	<code>string</code> : A user-specified text description of the object.
index	The numeric index of a transition that indicates the transition order in the state definition's transition list.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <a href="#">project</a> that contains this transition definition.
propertySheet	<code>reference</code> : <a href="#">propertySheet</a>
stateDefinitionName	<code>name</code> : The name of the state definition.
targetState	<code>string</code> : The target state for the transition definition.
transitionDefinitionId	<code>id</code> : The ElectricFlow-generated ID for the transition definition.
transitionDefinitionName	<code>name</code> : The name of the transition definition.
trigger	<code>string</code> : Possible values are: onEnter –before any actions onStart –after a subjob or workflow is created onCompletion –after a subjob or workflow completes manual –when a user manually requests a transition
workflowDefinitionName	<code>name</code> : The name of the workflow definition.

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**Object Type: `User`**

**Description:** *User* refers to any user currently logged into the ElectricFlow system or any user who may use ElectricFlow, but may not be currently logged in.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>email</code>	<code>name</code> : Displays this user's email address.
<code>fullUserName</code>	<code>name</code> : The user's real name.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>modifyTime</code>	<code>date</code> : The time when this object was last modified.
<code>mutable</code>	<code>boolean</code> : If true, the user is editable within ElectricFlow via the web UI or the <code>modifyUser</code> API.
<code>owner</code>	<code>name</code> : The person (username) who created the object.
<code>propertySheet</code>	<code>reference</code> : <code>propertySheet</code>
<code>providerName</code>	<code>name</code> : The name of the <code>directory provider</code> that controls this user.
<code>userId</code>	<code>id</code> : A unique ID number for a user object.
<code>userName</code>	<code>name</code> : Displays this user's name and also appears in a group object and displays the name of a user who belongs to this group.

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**Object Type: Workflow**

**Description:** A *workflow* object includes a pointer to the workflow definition, sets of states, the active state, the starting state, parameters to the initial state, "complete"—a boolean value determining whether or not the workflow is complete, and a log containing the transactions taken and user events.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>
<code>activeState</code>	<code>string</code> : The name of the active state on the workflow object.
<code>actualParameter</code>	<code>reference</code> : <code>propertySheet</code> An <i>actualParameter</i> is an object that provides the value for a parameter that is passed to the target state when the transition is taken.
<code>callingState</code>	<code>string</code> : The full property path to the state that created this workflow.
<code>callingStateId</code>	<code>id</code> : The ID number for the full property path to the state that created this workflow.
<code>completed</code>	<code>boolean</code> : If "true", the workflow is completed and no additional transactions will be evaluated.
<code>createTime</code>	<code>date</code> : The time when this object was created.
<code>deleted</code>	<code>boolean</code> : The object was marked for background deletion. Possible values are "0" or "1". Default is "0" (not set).
<code>elapsedTime</code>	The time this object ran from start to finish.
<code>finish</code>	<code>date</code> : The date/time when this object finished.
<code>lastModifiedBy</code>	<code>name</code> : This shows who (generally, a username) last modified this object.
<code>launchedByUser</code>	<code>string</code> : The name of the user or project principal that explicitly launched the workflow.
<code>liveWorkflowDefinition</code>	<code>name</code> : The current workflow definition name for the workflow definition from which the workflow was created.

**Object Type: Workflow**

**Description:** A *workflow* object includes a pointer to the workflow definition, sets of states, the active state, the starting state, parameters to the initial state, "complete"—a boolean value determining whether or not the workflow is complete, and a log containing the transactions taken and user events.

Property Name	Description
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <a href="#">project</a> that contains this workflow.
propertySheet	<code>reference</code> : <a href="#">propertySheet</a>
start	<code>date</code> : The date/time when this workflow began to run.
startingState	<code>string</code> : The initial state of the workflow.
workflowDefinitionName	<code>name</code> : The name of the workflow definition.
workflowId	<code>id</code> : The ElectricFlow-generated ID for the workflow.
workflowName	<code>name</code> : The name of the workflow.

[\[back to top\]](#)**Object Type: workflowDefinition**

**Description:** A *workflowDefinition* object contains state and transition definitions, including the workflow name template (analogous to a job name template on a procedure), and ordered sets of state and transition definitions.

Property Name	Description
acl	<code>reference</code> : <a href="#">acl</a>
createTime	<code>date</code> : The time when this object was created.

**Object Type: workflowDefinition**

**Description:** A *workflowDefinition* object contains state and transition definitions, including the workflow name template (analogous to a job name template on a procedure), and ordered sets of state and transition definitions.

Property Name	Description
description	<code>string</code> : A user-specified text description of the object.
lastModifiedBy	<code>name</code> : This shows who (generally, a username) last modified this object.
modifyTime	<code>date</code> : The time when this object was last modified.
owner	<code>name</code> : The person (username) who created the object.
projectName	<code>name</code> : The name of the <code>project</code> that contains this workflow definition.
propertySheet	<code>reference</code> : <code>propertySheet</code>
workflowDefinitionId	<code>id</code> : The ElectricFlow-generated ID for the workflow definition.
workflowDefinitionName	<code>name</code> : The name of the workflow definition.
workflowNameTemplate	<code>string</code> : Template used to determine the default names for workflows launched from a workflow definition.

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**Object Type: workspace**

**Description:** ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a job *workspace*. (The job workspace defaults to a directory under the workspace directory.) A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files such as step logs in the workspace.

Normally, a single workspace is shared by all steps in a job, but different steps within a job could use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.

Property Name	Description
acl	<code>reference:</code> <a href="#">acl</a>
agentDrivePath	<code>name:</code> The drive-letter based mount point for this workspace on Windows agents.
agentUncPath	<code>name:</code> The UNC path for this workspace on Windows agents.
agentUnixPath	<code>name:</code> The UNIX path for this workspace on UNIX agents.
createTime	<code>date:</code> The time when this object was created.
credentialName	<code>name:</code> The name of the <a href="#">credential</a> being used when a resource connects to a network share while setting up the workspace.
description	<code>string:</code> A user-specified text description of the object.
lastModifiedBy	<code>name:</code> This shows who (generally, a username) last modified this object.
local	<code>boolean:</code> If "true", this workspace is local.
modifyTime	<code>date:</code> The time when this object was last modified.
owner	<code>name:</code> The person (username) who created the object.
propertySheet	<code>reference:</code> <a href="#">propertySheet</a>

**Object Type: workspace**

**Description:** ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a job *workspace*. (The job workspace defaults to a directory under the workspace directory.) A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files such as step logs in the workspace.

Normally, a single workspace is shared by all steps in a job, but different steps within a job could use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.

Property Name	Description
<code>workspaceDisabled</code>	<code>boolean</code> : A Boolean value that indicates whether this workspace was disabled.
<code>workspaceId</code>	<code>id</code> : The workspace's ID number.
<code>workspaceName</code>	<code>name</code> : The workspace's name.
<code>zoneName</code>	<code>name</code> : The name of the zone where this workspace resides.

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**Object Type: Zone**

**Description:** ElectricFlow provides the ability to create zones—often used to enhance security.

- A zone is a way to partition a collection of agents to secure them from use by other groups. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.
- A *default* zone is created during ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).
- Each zone can have one or more "gateway agents", which you define. Gateway agents are used for communication from one zone to another zone. For more information, see the [Gateways](#) Help topic.

Property Name	Description
<code>acl</code>	<code>reference</code> : <code>acl</code>



**Object Type: Zone**

**Description:** ElectricFlow provides the ability to create zones—often used to enhance security.

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- Each zone can have one or more "gateway agents", which you define. Gateway agents are used for communication from one zone to another zone. For more information, see the [Gateways](#) Help topic.

Property Name	Description
createTime	<a href="#">date</a> : The time when this object was created.
description	<a href="#">string</a> : A user-specified text description for the object.
lastModifiedBy	<a href="#">name</a> : This person (generally, a username) last modified this object.
modifyTime	<a href="#">date</a> : The time when this object was last modified.
owner	<a href="#">name</a> : The person (username) who created the object.
propertySheet	<a href="#">reference</a> : <a href="#">propertySheet</a>
resources	<a href="#">string</a> : A space-separated list of resources contained in this zone.
zoneId	<a href="#">id</a> : The ElectricFlow-generated ID for this zone.
zoneName	<a href="#">string</a> : The name of the zone.

**Property error codes**

The following list provides error codes that may appear as a value within an `errorCode` property.

ABORTED

ACCESS\_DENIED

AGENT\_BAD\_WORKINGDIR

AGENT\_FAILED\_CONNECT\_BROKER

AGENT\_FAILED\_CREATE\_FILE  
AGENT\_FAILED\_CREATE\_WORKSPACE  
AGENT\_FAILED\_IMPERSONATION  
AGENT\_FAILED\_MAP\_DRIVE  
AGENT\_FAILED\_PROXYTARGET\_PING  
AGENT\_INCOMPATIBLE\_VERSION  
AGENT\_INTERNAL\_ERROR  
AGENT\_INVALID\_CWD  
AGENT\_INVALID\_MESSAGE  
AGENT\_INVALID\_PING\_TOKEN  
AGENT\_INVALID\_WORKSPACE  
AGENT\_IO\_CONNECTION\_REFUSED  
AGENT\_IO\_CONNECTION\_RESET  
AGENT\_IO\_ERROR  
AGENT\_IO\_NO\_ROUTE\_TO\_HOST  
AGENT\_IO\_PORT\_UNREACHABLE  
AGENT\_MALFORMED\_XML  
AGENT\_NONABSOLUTE\_PATH  
AGENT\_NONEXISTENT\_DIR  
AGENT\_NONEXISTENT\_FILE  
AGENT\_PING\_FAILED  
AGENT\_STREAM\_STOPPED  
AGENT\_TIMEOUT  
AGENT\_UNKNOWN\_CMDID  
AGENT\_UNKNOWN\_COMMAND  
AGENT\_WRONG\_FILE\_TYPE  
BAD\_AGENT\_RESPONSE  
BAD\_LOGFILE\_PATH  
CANCELED  
CIRCULAR\_PROCEDURE\_REFERENCE  
CORRUPT\_CREDENTIAL

DUPLICATE\_JOB\_NAME  
EMPTY\_SUBPROCEDURE  
FAILED\_JOB\_RENAME  
FORMAL\_PARAMETER\_ERROR  
INTERNAL\_ERROR  
INVALID\_EMAIL\_HEADER  
MY\_EVENT\_EXPANSION\_ERROR  
NO\_EMAIL\_HEADERS\_SEPARATOR  
NONEXISTENT\_EMAIL\_CONFIG  
NONEXISTENT\_PROCEDURE  
NONEXISTENT\_RESOURCE  
NONEXISTENT\_WORKSPACE  
NOTIFIER\_EXPANSION\_ERROR  
POST\_PROCESSOR\_ERROR  
POST\_PROCESSOR\_OUTPUT\_FAILURE  
PROPERTY\_REFERENCE\_ERROR  
RESOURCE\_WITHOUT\_HOSTNAME  
SERVER\_SHUTDOWN  
TIMEOUT  
UNKNOWN\_HOST

## Postprocessors: Collecting Data for Reports

[Postp](#)

[Extending postp: matchers](#)

[Postp functions](#)

[Integration with the ElectricFlow user interface](#)

[Postp integration with Java Tools](#)

## Overview

In ElectricFlow, reporting is divided into two phases.

- The first phase is data collection: interesting information is extracted from job step logs and saved in the ElectricFlow database.
- The second phase is report generation: data collected previously is retrieved and organized into reports.

The report phases are separated so data is gathered once but then available to use in a variety of different reports either immediately or later. For example, one report might summarize errors within a particular job, and another report might display error trends from all jobs over the past month.

ElectricFlow implements data collection with a *postprocessor*.

- A postprocessor is a command associated with a particular procedure step. If a postprocessor is specified for a step, it executes concurrently with the main step command.
- The postprocessor runs on the same machine as the main command and in the same working directory, and it retrieves the log file from the step as its standard input.

ElectricFlow includes a standard postprocessor called *postp* that you can use and extend.

*postp* scans the step's log file looking for interesting output such as error messages and then sets properties on the job step to describe what it found. For example, *postp* might create a property named "errors" whose value is a count of the number of error messages in the log file, or a property named "tests" that counts the number of tests executed by the step. Also, *postp* can extract portions of the step log that contain useful diagnostic information and save this information for reporting.

Standard ElectricFlow reports, such as those on the Job Details page, display information collected by *postp* such as properties named "errors" and diagnostic log extracts. This information is available immediately, even before the step completes execution, so you can view it via ElectricFlow's web interface to monitor step execution. Also, you can create additional report generators of your own, which can use the same information displayed by ElectricFlow and/or any other additional information of your choice.

## Postp

ElectricFlow's general-purpose postprocessor, *postp*, uses regular expression patterns to detect interesting lines in a step log.

- *postp* is already configured with patterns to handle many common cases such as error messages and warnings from *gcc*, *gmake*, *cl*, *junit*, and *cppunit*, or any error message containing the string "error." You can use the empty matcher group named "none" if just want to run a *postpEndHook*.
- *postp* is easy to use by simply setting the postprocessor for a step to "postp."
- *postp* also supports several useful command-line options.

To explore these options, invoke "*postp --help*" from your command-line.

## Extending *postp*: matchers

If you find useful patterns in your log files undetected by *postp*, you can extend *postp* with additional patterns. This feature is easily implemented, but the extension interface currently involves writing simple Perl scripts and you need to look at the Perl source file for *postp* as you do this. The *postp* source code is installed during ElectricFlow installation and located in the `src/postp.pl` file in the distribution directory.

Postp is driven by a collection of *matchers*, which are regular expression patterns that select certain lines from step logs, and by a collection of Perl functions the matchers invoke to handle lines of interest. A matcher is a Perl hash with three values similar to the following example:

```
{
  id      => "error",
  pattern => q{ERROR:|[Ee]rror:},
  action  => q{
    incValue("errors"); diagnostic("", "error", -4)
  },
}
```

Explanation of the values in the Perl hash example above:

- **id**—A unique name for the matcher—used to identify the matcher in command-line arguments and a few other places.
- **pattern**—A regular expression tested against each line of the step log file. This particular pattern matches lines containing any of the strings "ERROR:", "Error:" or "error:"
- **action**—A Perl script that executes whenever a log line matches the pattern for this matcher. The script in this example increments a variable named "errors" that is copied automatically to a job step property with the same name. The script also saves a portion of the step log beginning 4 lines prior and extending through the current line and associates those lines with this error so it can be displayed in the web interface. See below for more information on the `incValue` and `diagnostic` functions.

To extend postp with patterns of your own, write a Perl script to add new patterns to the `@::gMatchers` array. Here is a simple example:

```
my @newMatchers = (
  {
    id      => "coreDump",
    pattern => "core dumped",
    action  => q{
      incValue("coreDumps")
    },
  },
  {
    id      => "segFault",
    pattern => "segmentation fault",
    action  => q{
      incValue("segFaults")
    },
  },
);
push @::gMatchers, @newMatchers;
```

These matchers detect lines containing the strings "core dumped" or "segmentation fault" and increment separate variables for each line type.

After writing extension code, you must ask postp to execute the code when it starts up. You can execute extension code in one of two ways:

- Place the code into a file and invoke postp with the `--load` option.  
For example, `postp --load fileName`
- Copy the code into a property in ElectricFlow and use the `--loadProperty` option to postp.  
For example, `postp --loadProperty /myProject/extraMatchers`

Postp extensions can contain arbitrary Perl code, which means you can use this mechanism to define additional functions to invoke in matcher actions if existing functions do not provide what you need.

**Note:** Additional postp matchers are available for your convenience. The matcher sample directory was installed during ElectricFlow installation. Go to `src/samples/postp`.

## Postp functions

*Postp* contains several built-in functions to invoke in your matchers. The most useful functions are summarized below. Also, you can scan postp code for additional functions.

### **debugLog(format, arg, arg, ...)**

Outputs information to the debug log, if the `--debugLog` command-line switch is set. Format provides a format string similar to `printf`, and each argument provides a value to substitute into the format string.

### **backTo(pattern, start)**

This function searches backward to find the first line in the step log matching "pattern" (a regular expression) and returns the offset of that line relative to the current line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to -1).

### **backWhile(pattern, start)**

This function searches backward to find the first line in the step log that does not match "pattern" (a regular expression) and returns the offset relative to the current line of the line just after the first non-matching line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to -1).

### **currentModule()**

Returns the name of the current module (as determined by previous calls to `pushModule` and `popModule`), or an empty string if there is no current module.

### **diagnostic(name, type, first, last)**

This function extracts a group of contiguous lines from the log file and saves them along with additional information for reports such as the log extracts, which appear at the bottom of the Job Details web page. The range of lines to extract is indicated by "first" and "last," each of which is an offset relative to the current line. For example, if "first" is -3 and "last" is 2, then 6 lines will be recorded: 3 lines before the current line, the current line, and 2 lines after the current line. In many cases, the values for "first" and "last" are computed by calling functions such as "forwardTo" or "backWhile." "Name" provides an identifier for this particular diagnostic, such as the name of a test that failed or a file that did not compile. "Type" specifies which kind of information this is, and must be "error," "warning," or "info." In addition to log lines, this function records "name," "type," the current module, if any, and the name of the current matcher.

### **forwardTo(pattern, start)**

This function searches forward to find the first line in the step log matching "pattern" (a regular expression) and returns the offset of that line relative to the current line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to 1).

**forwardWhile(pattern, start)**

This function searches forward to find the first line in the step log that does not match "pattern" (a regular expression) and returns the offset relative to the current line of the line just before the first non-matching line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to 1).

**incValue(name, increment)**

Adds "increment" to a value named "name" and arranges for that value to be written eventually to a property by the same name on the current job step. If this is the first call for "name," its value is initialized to 0.

"Increment" is optional and defaults to 1.

**Note:** postp does not check the job step for a pre-existing property with the same name; it simply overwrites it.

**logLine(lineNumber)**

Returns the line from the step log given by lineNumber. 1 corresponds to the first line in the step log and the Perl variable `$_:gCurrentLine` holds the number of the current line. This function caches a sliding window of lines in the file, allowing you to go back to retrieve lines preceding the current line (as long as they do not precede it by too many lines). If the requested line is off the end of the file then `undef` is returned. If the requested line is before the beginning window of cached lines, an empty string is returned.

**popModule()**

Cancels the effect of the most recent call to `pushModule`, resetting the current module name to whatever it was before the corresponding call to `pushModule`.

**postpEndHook()**

If you define a function with this name, it invokes after `postp` has finished processing the log file, but before it makes its final properties update on the job step. Use this function to perform your own operations such as generating an error if the log file did not contain a particular line you were expecting.

**pushModule(name)**

In some situations it is possible to divide the log file into parts corresponding to different modules. For example, with recursive make invocations, there are typically notifications in the log output before and after each recursive make. This function is invoked to indicate a new module is being entered, where "name" is the name of the module. After this function is called, the "diagnostic" function will include "name" with error or warning messages to provide additional information in job reports. The previous module name, if any, is saved; you can return to it by calling `popModule`.

**setProperty**

This function sets a property in the ElectricFlow server. If the named parameter is a relative path, like `moduleCount`, the property is set or created on the current job step. You can use an absolute path, like `/myJob/fileLocation` also. Calling `setProperty` does not result in an immediate call to the ElectricFlow server. The property is added to an update list for updating at the next "update interval", typically every 30 seconds.

## Integration with the ElectricFlow user interface

`postp` interacts with the ElectricFlowUI using two methods. The first method: Create custom properties with special names that are recognized by the UI itself. The second method: Create a file that contains "diagnostics",

which are used to display errors or warnings, and link them to specific sections in the step's log file.

### Custom property names and values

`postp` can be used to create properties in ElectricFlow, on the job step or anywhere else in ElectricFlow. However, the following properties are used by the standard ElectricFlow UI, so you should use these property names whenever possible, and avoid using these names in ways that conflict with the definitions below.

- **compiles**—the number of files compiled during the job step
- **diagFile**—the filename in the top-level directory of the job's workspace, containing diagnostics extracted from the step's log file
- **errors**—the number of errors (compilation failures, test failures, application crashes, and so on) that occurred during the job step. When property errors are set by `postp`, the step outcome is set to error also.
- **tests**—the number of tests executed by the job step, including successes and failures
- **testsSkipped**—the number of tests skipped during the job step
- **warnings**—the number of warnings that occurred during the job step. When property warnings is set by `postp`, the step outcome is set to warning also.
- **preSummary**—if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears *before* whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **postSummary**—if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears *after* whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **summary**—if this property exists, its value is displayed in the "Status" field (in the job reports) for this step, replacing whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

### Diagnostic information

The second form of postprocessor generated output contains diagnostic extracts from the step's log file, typically providing additional information about problems. The postprocessor stores diagnostic information in an XML file in the top-level directory of the job workspace, then sets the step's **diagFile** property with the name of the file.

Diagnostic files must have a format like the following example:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<diagnostics>
  <diagnostic>
    <matcher>compileError</matcher>
    <name>testa.c</name>
    <type>error</type>
    <module>util/timeLib</module>
    <firstLine>2</firstLine>
    <numLines>7</numLines>
    <message>testa.c: In function 'procl':
      testa.c:12: error: parse error before ';' token
      testa.c:13: error: 'for' loop initial declaration used outside C99 mode
      testa.c:14: error: parse error before ';' token
```



```
        testa.c:16: error: too few arguments to function 'exit'
        testa.c:18:2: warning: no newline at end of file
        testa.c:18: error: parse error at end of input
    </message>
</diagnostic>
<diagnostic>
    <name>testa.o</name>
    <type>error</type>
    <module>util/timeLib</module>
    <firstLine>9</firstLine>
    <numLines>1</numLines>
    <message>make: *** [testa.o] Error 1 </message>
</diagnostic>
</diagnostics>
```

XML elements in the diagnostic file are as follows:

- **diagnostics**—Overall container; its children consist of all of the diagnostic elements.
- **diagnostic**—Describes one diagnostic extract; the elements described below are all children of this element.
- **matcher**—(optional) Identifier for the matcher that triggered this diagnostic; used primarily for debugging.
- **name**—(optional) Identifier that indicates the problem or situation that resulted in this diagnostic, such as the name of a failed test or the name of a file that did not compile.
- **type**—Type of message: must be "error," "warning," or "info."
- **module**—(optional) Name of the module in which the issue occurred, such as the name of a source code module being compiled at the time of a compile error.
- **firstLine**—Line number in the log file for the first line of the diagnostic extract (1 means the first line of the file). This element is used to provide a link from the diagnostic extract to the full log file.
- **numLines**—Total number of lines included in the diagnostic extract.
- **message**—The actual lines from the log file.

## Postp integration with Java Tools

ElectricFlow integrates with three standard Java tools through postp matchers. These Java tools are:

- **EMMA**—an open source toolkit for measuring and reporting Java code coverage (Emma v2.0)
- **JUnit**—a framework for writing and running automated tests (tested with Ant v1.7)
- **Clover**—Atlassian's Java code coverage (generated by system, functional, or unit tests) analysis tool (Clover v2.4)

**Note:** If one of these Java tools is invoked in an ElectricFlow job step, ElectricFlow automatically detects the invocation [if you are using Postp] and adds any reports generated by these tools to the list of links at the top of the Job Details page.

### The process...

Postp parses output from the invoked JAVA tool to match paths to reports it has already created. Then, postp copies all files that comprise the report to a unique location in the "Artifacts" Directory. Next, postp generates a

link to the location in the Artifacts Directory to make the report available in the Links section on the Job Details page.

The following example of generated output from Emma illustrates this process:

```
emma:

init:
[mkdir] Created dir: C:\Documents and Settings\ptharani\Desktop\emma\emma-2.0.5312\examples\out

compile:
[javac] Compiling 4 source files to C:\Documents and Settings\ptharani\Desktop\emma\emma-2.0.5312\examples\out

run:
[emmajava] EMMA: processing classpath ...
[emmajava] EMMA: [3 class(es) processed in 47 ms]
[emmajava] main(): running doSearch()...
[emmajava] main(): done
[emmajava] EMMA: writing [txt] report to [C:\Documents and Settings\ptharani\Desktop\emma\emma-2.0.5312\examples\coverage\coverage.txt] ...
[emmajava] EMMA: writing [html] report to [C:\Documents and Settings\ptharani\Desktop\emma\emma-2.0.5312\examples\coverage\coverage.html] ...

all:

BUILD SUCCESSFUL
Total time: 1 second
```

#### From this output

The actual link may reside here:

```
/home/commanderWorkspace/job_112_
200901081732/artifacts/javaTools/238/emmaCoverage/2/coverage.html
```

While the link name may be:

```
Step Id 238 ant-on-the-fly-emma report# 2
```

And the value of the link may be:

```
jobSteps/238//javaTools/238/emmaCoverage/2/coverage.html
```

#### Java Tool matcher examples

Two examples of postp Emma matchers:

```
{
  id      => "emmaReport1",
  pattern => q{EMMA: writing},
  action  => q{emmaExtractReport()},
},
{
  id      => "emmaReport2",
  pattern => q{\\[report\\] writing},
  action  => q{emmaValidateOutput()},
},
```

**An example of postp JUnit matchers:**

```
{
  id      => "junitReportCapture",
  pattern => q{\\[junitreport\\] Processing},
  action  => q{junitExtractReport ()},
},
```

These matchers correspond to the following output:

```
junit.report:
[junitreport] Processing
/net/WinStor2home/ptharani/junitDemo1/sample/testreport/TESTS-TestSuites.xml to
/tmp/null11214791178
[junitreport] Loading stylesheet jar:[file:/usr/local/tools/common/apache-ant-
1.7.0/lib/ant-junit.jar!/org/apache/tools/ant/taskdefs/optional/junit/xsl/junit-
frames.xsl
[junitreport] [file:/usr/local/tools/common/apache-ant-1.7.0/lib/ant-
junit.jar!/org/apache/tools/ant/taskdefs/optional/junit/xsl/junit-frames.xsl
[junitreport]] Transform time: 622ms
[junitreport] Deleting: /tmp/null11214791178
```

**An example of postp Clover matchers:**

```
{
  id      => "cloverHtmlReportAntTask",
  pattern => q{\\[clover-html-report\\] Writing HTML report to},
  action  => q{cloverExtractReport ()},
},
```

These matchers correspond to the following output:

```
clover.report:
[clover-html-report] Clover Version 2.4.0, built on November 05 2008 (build-747)
[clover-html-report] Loaded from: /home/cloverDemo/clover-ant-2.4.0/lib/clover.jar
[clover-html-report] Clover: Evaluation License registered to electric cloud.
[clover-html-report] You have 27 day(s) before your license expires.
[clover-html-report] Loading coverage database from: '/home/cloverDemo/clover-ant-
2.4.0/tutorial/.clover/clover2_4_0.db'
[clover-html-report] Writing HTML report to '/home/cloverDemo/clover-ant-
2.4.0/tutorial/clover_html'
[clover-html-report] Done. Processed 1 packages in 2559ms (2559ms per package).
```

**Artifacts directory**

The value of the artifacts directory determines the scope of what is visible in the ElectricFlow UI from a job's workspace. By default, the Artifacts Directory is set to "artifacts", so the artifacts directory would have the form:

```
<path to job workspace>/artifacts
```

The value of the artifacts directory can be set in any of the following properties:

```
/myJob/artifactsDirectory
/myProject/artifactsDirectory
/server/settings/artifactsDirectory
```

*Postp* queries these properties [in the order listed] to determine the location of the Artifacts Directory. If no value is found (because the property was never set), the default "artifacts" is used.

*Postp* has a feature where it recognizes that data belongs to some standard tool (such as Junit), copies the logs produced by that tool to the artifacts directory, and then creates the report-url properties. These actions are done with the `junitReportCapture` matcher.

If you want to disable this matcher in your *postp* invocation in the step that runs junit tests, do the following:

```
postp --dontCheck junitReportCapture
```

It is possible that the artifacts directory will still be created even if nothing is put in it. If that occurs, set the `artifactsDirectory` property on your job (or the owning project) to empty-string.

## Reports

ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.

- Real-time reports—filtered view of your workload in real-time
- Build reports—summary reports produced at the end of a build and attached to the job
- Batch reports—summaries of your build environment with trends over time, two types:
  - Default Batch reports—automatically installed during ElectricFlow installation and scheduled to run daily  
(Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)
  - Optional Batch reports—you can configure, rename, and schedule these reports to fit your requirements  
(Category Report, Procedure Usage Report, Count Over Time Report, Multiple Series Reports)
- Custom reports—your choice to create and add at any time

You can use also StatsD and Graphite to generate custom reports. For more information, go to [System Health Monitoring](#) on page 1213.

**Note:** Batch and Custom reports must be run on the ElectricFlow server's agent (local agent) only. These reports need the BIRT report engine, which is installed on the ElectricFlow server.

### Run reports on a non-local resource

If you want to configure reports to run on a non-local resource, do the following:

1. In the web interface, go to Projects > Electric Cloud > runReports > runEcprtdata.
2. Change the Parameter Resource from the default value "local" to the name of a different resource. the resource must have access to the plugins directory.

## Real-time reports

### Home page

The Home page is a user-customizable dashboard that can be configured to show you just the ElectricFlow jobs you care about.

The Jobs Quick View section (on the right-side of the Home page) shows jobs you define using filters on job properties. You can create multiple categories filtered on specific project names, procedure names, users, or any other job property. Summary details for the job "pop-up" if you hover your mouse over one of the jobs.

### Jobs

Unlike the Home page, which allows you to see specific subsets of work, the Jobs page shows all jobs that are running and all jobs that have completed. This is a good report to view when you need to see a list of all jobs run by any user or schedule. System administrators and managers can use this page to monitor overall system throughput.

### Job details / Step details

After a job starts, you can get execution details from the Job Details page. To view job details, click on the job from the Home page or the Jobs tab. From within the Job Details page you can drill down to see details for an individual step. This is the finest grain of reporting, showing the detailed results of a specific job.

### Resources

The Resources page reports the current state of your defined resources. This page also shows the current state of the agent (connected or not) and any steps currently running on that resource. Use this report to monitor your resources in near real time.

## Build reports using *ecreport*

ElectricFlow includes a utility, *ecreport*, that summarizes build results and sends that summary through email. This customizable utility allows you to create a simple matrix based on results stored in properties and log files. Details such as SCM change logs and errors can be included.

In addition, you can attach your own reports to any job and have them show up as attachments to the Job Details Report. To attach custom reports, put them in the top-level workspace directory in a file that ends with ".html" and contains the string "report" or "Report." Names of all matching files are displayed in the Summary section in the upper right corner of the page. Click on a report name to view the report.

The following is an example of *ecreport* output:

thunder-main.4315-200706261344 is good!

[View Online](#)

	Windows	Linux
Compile	1183 compiles	1121 compiles
Build installer	ok	ok
Agent unit tests	748 tests	642 tests
Server unit tests	1875 tests	1860 tests
Web unit tests	1556 tests	1557 tests
Tool unit tests	410 tests	338 tests
Install	ok	ok
System tests	22 tests	22 tests

General Information

Start Time	6/26/2007 13:44:19
Elapsed Time	1 hour, 27 minutes, 6.0 seconds
Workspace	//f2/scratch/buildserver3build/thunder-main.4315-200706261344

Recent Updates

----- chris -----

Change 24248 by chris@chris-thunder on 2007/06/26 13:24:31

Adding "index-redirect.php", which will be used to redirect web browsers to the "thunder" sub-directory when users only type in the host name for the web server. At install time, this file should be moved to the apache/htdocs directory, and renamed "index.php".

This will resolve the issue of https redirection not working when using the httpd.conf "Redirect" directive.

Jobs fixed ...

NMB-2761 on 2007/06/26 by tom \*closed\*

<https://buildserver2:443> redirects to <http://www.thunder.com/>

Affected files ...

.. //depot/thunder/main/web/docroot/index-redirect.php#1 add

**ecreport** extracts information about a particular job from the ElectricFlow server and writes an HTML report to standard output. The report is organized as a 2-dimensional table summarizing the results of steps in the job. The table layout can be customized by defining its format using the `ectool` (or `ec-perl`) `--load` option. Invoke the program in the top-level directory of the job's workspace so it can access log file extracts in that workspace (or, use the `--dir` option).

The following options are available for use with the *ecreport* utility:

Option	Description
<code>--culprit</code>	If specified and the job failed, the report will be emailed to each user mentioned in the updates file. The value of this option provides the subject line for the message (%s will be replaced with the job name).
<code>--data</code>	Name of file containing job data for the report. If specified, this data is used in place of querying the ElectricFlow server. Used primarily for testing.
<code>--dir</code>	Change to this working directory before doing anything else.
<code>--help</code>	Print this message and exit without doing anything.
<code>--jobId</code>	Identifier for the ElectricFlow job to report on (required unless <code>--data</code> is supplied). This is a UUID.
<code>--load</code>	Name of a file containing Perl code to evaluate after option processing. Used primarily for debugging. There can be multiple <code>--load</code> options.
<code>--emailConfig</code>	The name of the Email Configuration to use when emailing the report. Defaults to "default".
<code>--mailto</code>	Email the report to this addresses.
<code>--replyto</code>	Value for the "Reply-To" field in emailed reports.
<code>--server</code>	Location of the ElectricFlow server (hostname or hostname:port), to retrieve job data. Defaults to the <code>COMMANDER_SERVER</code> environment variable.
<code>--subject</code>	Value for the "Subject" field in emailed reports. If the value contains a %s, a string summarizing the job replaces the %s.
<code>--updates</code>	Name of a file containing information about recent updates reflected in the job. If specified, the contents of this file are included in the report.
<code>--version</code>	Print ecreport version number.
<code>--webRoot</code>	Base URL for the ElectricFlow Web server where the job was run, such as <code>http://myServer</code> . URLs in the report will refer to ElectricFlow Web pages relative to this URL.

### Example 1

```
ecreport --jobId $[/myjob/jobId] --load ./rptformat.pl --updates update.log --
webRoot

http://myServer/commander > ecreport.html
```

This example writes a report to the file `ecreport.html`. Because this file has an `.html` extension, it will be displayed in the Reports section at the top of the Job Details page. The format of the table for this report is specified in `rptformat.pl`. An example of the contents from this file would be:

```
@:gTableRows = (
    [ "",
      "Windows",
        "Linux",
        "Solaris"],
    ["Extract",
      "span",
      "span",
      "update.log"],
    ["Compile",
      "windows-compile.log",
      "linux-compile.log",
      "solaris-compile.log"],
    ["Unit test",
      "windows-unittest.log",
      "linux-unittest.log",
      "solaris-unittest.log"],
    ["System test",
      "windows-systemtest.log",
      "linux-systemtest.log",
      "solaris-systemtest.log"]
);
```

The “Recent Updates” report section is specified in `update.log`. The `--webRoot` argument defines the root for any URL that appears in the report.

## Example 2

```
ecreport --jobId $[/myJob/jobName] --load ./ecreportConfig.pl --mailto
user1@company.com --replyto user2@company.com
--subject 'Build Report' --updates updates.log
--webRoot http://myServer/commander
```

This report will be sent as the body of an email message to `user1@company.com` with subject “Build Report”.

## Default Batch Reports (Run Reports)

These reports are installed during the ElectricFlow installation and automatically scheduled to run daily.

To access these reports: Select the Projects tab, then select the Electric Cloud project, then click the Reports subtab. This report collection graphs trends over time, including success/failure, build times, and resource



consumption. These reports allow you to customize two levels of grouping into "variants." These variants may represent products, branches, locations, architectures, or any other descriptors you would like to use to group your workload.

**Note:** After a Default Batch Report runs, a link for each report appears on the Job Details page in the Links section. When you select a report from the Links section, it will be displayed in full-screen view.

## Report types

**Cross Project Summary**—This report shows the status of multiple variants over the past 30 days. This high-level summary of each of the 30 days shows green, yellow, or red depending on the result of the best build of the day. The summary also shows average times, total invocations, and other data.

**Variant Trend**—This report shows more details about a particular variant such as build outcome over time, build quantity over time, elapsed build times over time, and a list of actual jobs that ran during the period.

**Daily Summary**—This report shows the most recent results of each variant, including the last successful build.

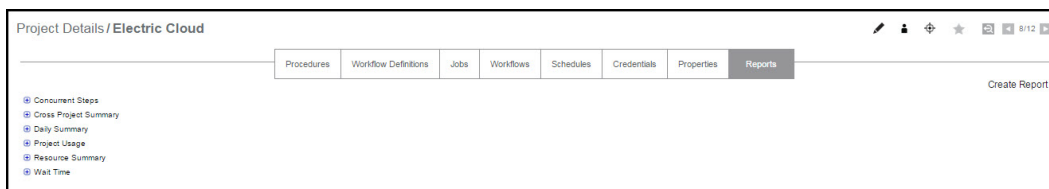
**Resource Summary**—This report shows resource utilization over the last 24 hours. You can see which resources are idle and which resources are busy. ElectricFlow has advanced features that allow you to select resources for your job at runtime, using late binding of property names. This feature provides unparalleled flexibility and control over your environment, but could make it difficult to find out which resources were used. This report provides the visibility you need into resource loading.

**Resource Detail**—This report shows the utilization of a particular resource over the course of one day.

**Wait Time**—This report shows cumulative wait time due to license, resource, and workspace waits. It also shows the number of steps that were delayed for any of those reasons.

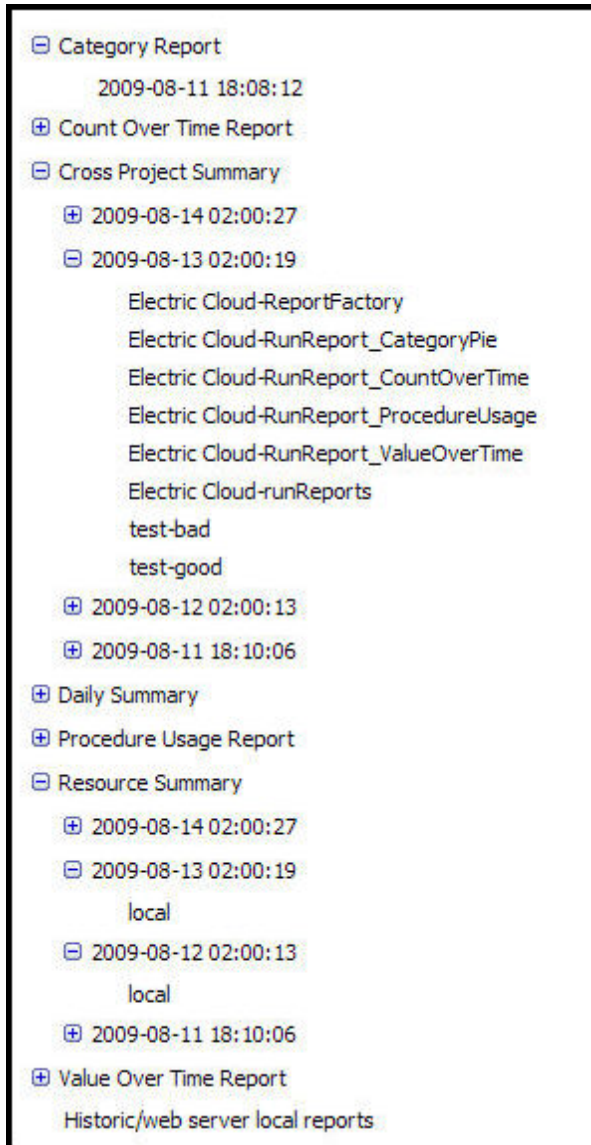
## Default Batch Reports

- Cross Project Summary
  - Variant Trend
- Daily Summary
- Resource Summary
  - Resource Detail



The navigation tree on the left-side of the screen allows you choose the report and date of interest. These reports, which show long term trends over all projects and resources, are run from the `runReports` procedure in the Electric Cloud project.

The following example shows the Default Batch Reports, the historical reports link, and Optional Batch Reports (described below). Notice that you can expand a selected report to three levels. The third level represents drill-down links available within that report. In addition, if you click on a report name, the most current report is displayed.



### Tip

You may change the number of reports displayed under each report type. Locate the `propertySheet` named `ec_reportConfiguration` on the project or server (project overrides server) and find the "groupings" section. Next, you can create nested property sheets under `ec_reportConfiguration` with the properties `groupName`, `sortDirection`, and `limit`. If you set this information using `ectool`, you will also see it on ElectricFlow's web interface .

If the `ec_reportConfiguration` propertySheet does not exist, you will need to create it, then copy the example below into the propertySheet.

Example:

```
ectool setProperty ec_reportConfiguration/reportDaysLimit --value 90 --projectName foo

ectool setProperty ec_reportConfiguration/groupings/1/groupingName --value reportType
--projectName foo
ectool setProperty ec_reportConfiguration/groupings/1/sortDirection --value ascending
--projectName foo
ectool setProperty ec_reportConfiguration/groupings/1/limit --value 100 --projectName
foo

ectool setProperty ec_reportConfiguration/groupings/2/groupingName --value reportDate
--projectName foo
ectool setProperty ec_reportConfiguration/groupings/2/sortDirection --value descending
--projectName foo
ectool setProperty ec_reportConfiguration/groupings/2/limit --value 5 --projectName
foo

ectool setProperty ec_reportConfiguration/groupings/3/groupingName --value
reportResource --projectName foo
ectool setProperty ec_reportConfiguration/groupings/3/sortDirection --value ascending
--projectName foo
ectool setProperty ec_reportConfiguration/groupings/3/limit --value 100 --projectName
foo
```

This example explicitly defines the default behavior for project foo's reports.

The 1, 2 and 3 propertySheets define the order of the groupings. The actual names 1, 2, 3, could be anything as long as they are listed alphanumerically in the order you need.

Additionally, any groupings that do not exist will be skipped during output. For example, if you added a `reportRunByUser` grouping #4 and added it to some reports that define `reportType="User Builds"`, `reportDate`, and `reportRunByUser` properties (but not `reportResource`), you would get something similar to a resource usage report structure with users rather than resources at the deepest level.

**Note:** If you choose to display 500 or more reports at one time, you may experience some performance degradation.

## Advanced reporting information—ecrptdata

### How are default batch reports generated?

Reports are scheduled as part of a special procedure, `runReports`, in the Electric Cloud project. This procedure has one step, `runEcrptdata`, that runs the `ecrptdata` program. This program reads data from ElectricFlow, summarizes it for reports, and generates HTML reports using the BIRT reporting engine. The program takes input parameters. During installation, reporting is configured as follows:

```
ecrptdata --end yesterday --grain 300 --debug 2 --reports all
```

By default, all reports are run every day at 2am. The Cross Project Summary and Variant Trend shows data from the previous 30 days. The Daily Summary, Resource Summary, and Resource Detail reports show data from the last full day (yesterday). You can adjust the schedule to run more often or at different times by altering the "Report Schedule" schedule in the Electric Cloud project.

## Changing the report time period

If you would like to alter the report time period, you must change the input parameters to the `ecrptdata` program within the procedure step "Electric Cloud:runReports:runEcrptdata". Select the `Ecrptdata` step name to go to the Edit Step page. Make the changes you need in the Parameters section. If the `--end` option is omitted, the end of the reporting period is the time when the report runs (now). If the keyword "yesterday" is provided, reports will include full data for yesterday. Otherwise, a specific date and time can be given in the format "YYYY-MM-DDTHH:MM:SS".

## Changing the report grouping

You can tell ElectricFlow how to group the Cross Project Summary and Variant Trend reports. By default, the outer grouping is "Project Name" and the inner grouping is "Procedure Name." To change these groupings, use the following `ecrptdata` options:

<code>--group1Name xxxx</code>	Set the column header for the first column of the Cross Project Summary report to "xxxx".
<code>--group1Property yyyy</code>	Use property "yyyy" as the name to group on in the first column of the Cross Project Summary report.

All lookups are done with respect to an individual job and will be converted to absolute property paths. The values `projectName`, `procedureName`, and `jobId` are set in context for the job being examined.

Examples:

`/myProject/foo` will be converted into the API call `"ectool getProperty /projects/projectName/foo"`

`/myProcedure/foo` will be converted into the API call `"ectool getProperty /projects/projectName/procedures/procedureName/foo"`

`/myJob/foo` will be converted into the API call `>"ectool getProperty /jobs/jobId/foo"`

`/myParameter/foo` will be converted into the API call `"ectool getActualParameter foo -jobId jobId"`

To show the value of the procedure name as the outer grouping and the value of the parameter "branch" as the inner grouping,

use the following `ecrptdata` options:

```
--group1Name Procedure --group1Property "/myProcedure/procedureName"
--group2Name Branch --group2Property /myParameter/branch
```

**Note:** The `/myParameter` "shortcut" to the property path was created specifically for `ecrptdata` only—it cannot be used as other `/my` property shortcuts are used. For more information on property shortcuts, see the [Properties](#) Help topic. In addition, when working with `ecrptdata`, any `/my` value is case-insensitive. For example, you can use `/myParameter` or `/myparameter`.

## Filtering

`ecrptdata` supports "findObjects" type filters when searching for jobs and job steps.

This feature is implemented with two new command line switches: "--jobFilter <property, operator, operand>" and "--stepFilter <property, operator, operand>". The jobFilter option filters the CrossProjectSummary, DailySummary, and VariantTrend reports. The stepFilter option filters the ResourceSummary and ResourceDetail reports.

Examples:

```
--jobFilter "branch,isNotNull,1"
--jobFilter "jobName,like,my-procedure%"
--stepFilter "outcome,notEquals,aborted"
```

### Adding additional data columns to the report

You can add custom data columns to each report. These columns are specified by providing a comma separated list of property references in the following ecrptdata options:

--crossProjectProperties	sets extra columns for the Cross Project Summary Report
--variantTrendProperties	sets extra columns for the Variant Trend Report
--dailySummaryProperties	sets extra columns for the Daily Summary Report
--resourceSummaryProperties	sets extra columns for the Resource Summary Report
--resourceDetailProperties	sets extra columns for the Resource Detail Report

You must choose properties appropriate for the type of report and grouping you have chosen. For example, if you choose Project Name and Procedure Name for your groupings in the Cross Project Summary report, each line of the report will be in the context of a project or procedure. You can add extra columns to show properties on the project or procedure, but it would not make sense to show properties on a resource, job, or job step. For resource reports, the properties must be in the context of a resource.

The column header is the name of the property.

Examples:

```
--crossProjectProperties "/myproject/QA_State,/myprocedure/PartNumber"
--resourceSummaryProperties "/myresource/OS,/myresource/Architecture"
```

### Secure login

ecrptdata provides options for secure login to the ElectricFlow server.

Currently, there are three ways to login:

1. Use both the "--user <user>" and "--pass <password>" options.  
This method is not secure... the password will be in plain text and visible to others.
2. If you omit the "--pass <password>" option, the password will be read from `stdin`. You can then read the password from a secure file or from a stored credential.  
For example:  

```
cat mySafePasswordFile.txt | ecrpdata --user <user> ...
ectool getFullCredential myCred --value password | ecrpdata --user <user> ...
```
3. Another option, "--credential <credentialName>", allows you to specify a credential name. If you use this option, "--user <user>" and "--pass <password>" are ignored. Note that the credential must be attached to the `runReports` job step. Both the user and password are retrieved from the credential.

Logic:

1. If `--credential` is used, attempt to lookup credential and extract user and password
2. If user is not set, return error
3. If password is not set, read from `stdin`
4. Attempt to login to server specified in `--server <server>` option using user and password

## Optional Batch Reports

Additional reports are available, but these reports are not scheduled to run by default. You can schedule these reports to suit your purpose.

**Note:** When you run an Optional Batch Report, a link for each report appears on the Job Details page in the Links section. When you select a report from the Links section, it is displayed in full-screen view. The following optional reports are available:

- Category Report
- Procedure Usage Report
- Count Over Time Report
- Multiple Series Report  
(formerly known as the "Value Over Time" report)

These reports are available from the Reports tab on the Project Details page for your Project.

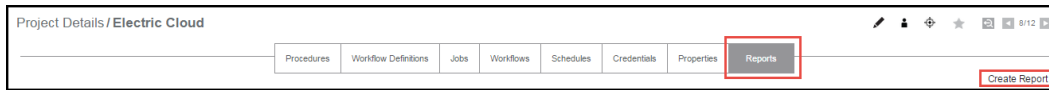
**Note:** For the Category, Count Over Time, and Multiple Series reports, a **View Search Results** link is available at the bottom of the report if a Saved Filter was used to generate the report.

## Creating a Report Job

ElectricFlow runs reports as a job, so reports can be managed like any other job.

To create a report for your project:

1. Go to the Project Details page for your selected project.
2. Select the Reports subtab.
3. Click the **Create Report** link.



After clicking **Create Report**, the next screen is displayed with the default values for the selected tab ( Multiple Series) in this example.

Multiple Series | Category | Count Over Time | Procedure Usage

Report Title: Multiple Series Report

Saved Filter: Project: ==Select Project==

Filter: [-None-]

Time Period: Yesterday

Create thumbnail? ☐

Object Type: Job

Chart Type	Function	Property Name	Display Name	Stacked
Line	Average	elapsedTime	Elapsed Time	<input type="checkbox"/>

Add Series

► Chart Options

► Table Options

► Advanced

Run Report | Create Schedule | Cancel

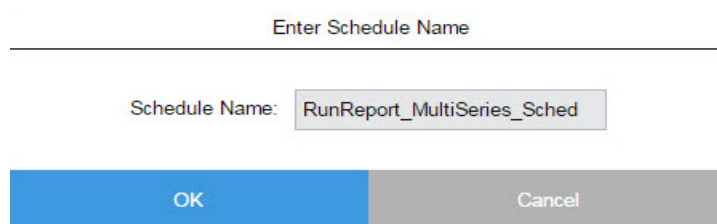
Enter information in the fields or select the appropriate values as follows:

- Report Title—Your report title. Type over the default report name, choosing any unique name for your report. We supplied Basic Build Report for our report name.
- Saved Filter:
  - Project—Click your mouse inside this field to see a list of projects from which to make a selection. We select our FirstNewProject project name.
  - Filter—Use the BasicBuildFilter we created earlier.
- Time Period—Use the drop-down menu to select the time period.
- Create thumbnail?—Check this box so you can view this report on your Home page. (We will create a “thumbnail” report view on your Home page at the end of this scenario.)
- Object Type—Use the drop-down menu to select Job for this example.

- Table column choices:
  - Chart Type—Use the drop-down menu to choose the chart type.
  - Function—Use the drop-down menu to choose the function you need.
  - Property Name—Use the default property value or delete the text and click your mouse in the blank field to see a list of possible properties. We chose "outcome" for this example.
  - Display Name—You can choose a different unique Display Name if you prefer to do so.
  - Stacked—Select this check box to see your report results "stacked" versus overlaid.
  - The "X" icon—Click this icon to delete any row you no longer need.
- Select the **Add Series** button if you would like to create additional table entries for additional report information.
- Chart Options—Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.

Buttons at the bottom of the page:

- Run Report button—this button takes you to the Job Details page to run the report immediately—one time only.
- Click the **Create Schedule** button—this button displays a box with a default schedule name you can change.



- Enter a name for the schedule, **Basic Build Report Schedule**—again, we tied the schedule name to the procedure name for which we want the report.

## Viewing the report

After the report job runs, view the report by selecting the Reports subtab within the project. **Note:** All reports are viewed from within a project context. If you have reports that span multiple projects, run them from the Electric Cloud project or create a project to store summary reports.

After selecting the Reports subtab, see the navigation tree on the left-side of the page. This tree allows you to select the report you want to view. The report tree contains three levels.

- Report Title—Click the "+" icon next to the report type to see available report versions.
- Report Date—Click this link to see report details.

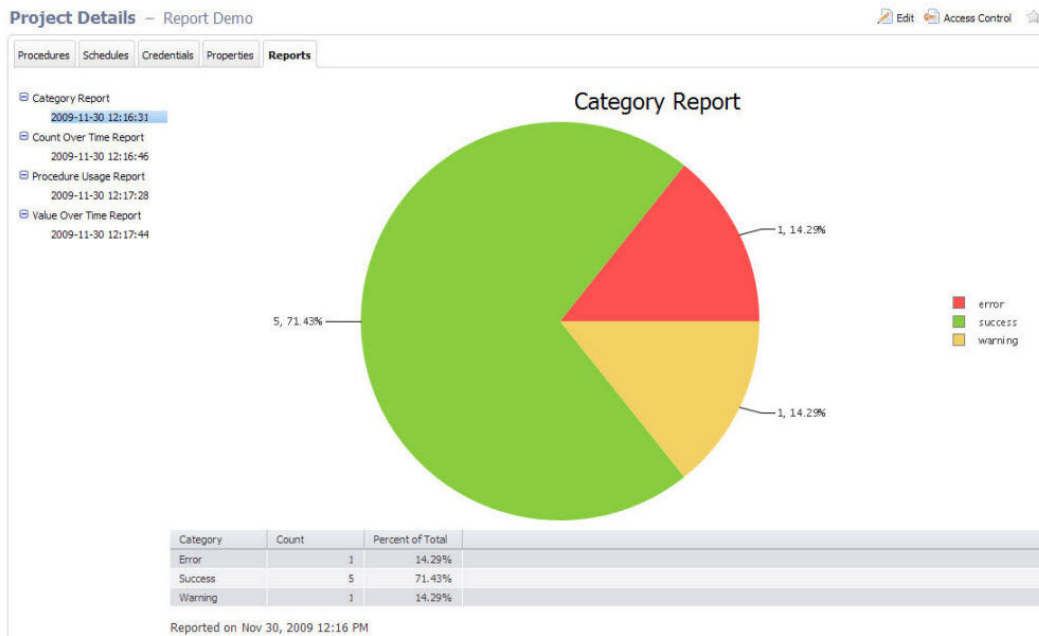
**Note:** Click the report type to display the most recent report version.



## Optional Batch report examples

### Category sample report

This report shows the distribution of property values in a pie chart.



Creating this report on the Run Procedure page:

Run Procedure – RunReport\_CategoryPie

Parameters

Credential: Username:  Password:

Locales:

Object Type:

Property:  Default: "outcome"

Report Title:  Default: "Category Report"

Saved Filter Project: ☒ Current ☐  Browse

Saved Filter Name:  Browse

Time Period:

Advanced

Priority:

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

Run Cancel

Field descriptions:

- **Credential**—these are credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- **Locales** -a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: `en`, `zh`, `ja`, or `ko`, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. Note: Currently, ElectricFlow supports four locales only.
- **Object Type**—the type of object to search (default job)
- **Property**—the property of interest (default outcome) and must be a valid property for the object type selected
- **Report Title**—your report title (default Category Report)
- **Saved Filter Project**—select "Current" or Browse to find the project where you want to save this filter.
- **Saved Filter Name**—the name of a saved filter to use when filtering collected data.

Use the Search tab to create the filter. After entering your search criteria, click **OK**.

If the preview displays the data you want, click **Save Filter** and provide a Project Name and Filter Name to specify where the filter is saved.

On the Run Report parameters page, select the filter. If you leave the Filter Name blank, no filtering is performed.

**Note:** "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select a time period of "Yesterday" and a filter of Start=less than Jan 1, 1900. To avoid this problem, we recommend you do NOT include dates or times in your filter.

- **Time Period**—these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  - Today—midnight until now
  - Yesterday—previous full day
  - This week—from the start of the previous Sunday until now
  - Last week—from Sunday to Sunday of the last complete week
  - This month—from the start of the first of this month until now
  - Last month—from the last complete calendar month, which means on January 3rd the last full month is all of December
  - This year—from January 1st until now
  - Last year—all of last year (Jan 1 to December 31)
  - All—all dates until now

### Procedure Usage Sample Report

For a specific procedure, this report shows procedures called by the procedure and which procedures it called.

**Project Details** – Report Demo

Edit Access Control Job Notes Access Control

Procedures Schedules Credentials Properties **Reports**

Category Report  
2009-01-12 08:04:57.6

Count Over Time Report  
2009-01-12 08:06:17.7

**Procedure Usage Report**  
2009-01-12 08:17:05.0

Value Over Time Report  
2009-01-12 08:07:14.9

Reported on Jan 12, 2009 8:16 AM

Project	Procedure	Calls/Called By	Project	Procedure
My Library	LibProc-Bar	called by	My Library	LibProc-Foo
My Library	LibProc-Foo	calls	My Library	LibProc-Bar
My Library	LibProc-Foo	called by	Sample Project	Do Work

Creating this report on the Run Procedure page:

**Run Procedure** – RunReport\_ProcedureUsage

Parameters

Credential: Username:  Password:

Locales:

Project:  Browse

Project Procedure:  Required; Default: "%"

Report Title:  Default: "Procedure Usage Report"

Advanced

Priority:

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

Run Cancel

Field descriptions:

- **Credential**—these are the credentials to use for collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- **Locales**—a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en , zh , ja , or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. **Note:** Currently, ElectricFlow supports four locales only.
- **Project**—this is the name of the project where you want to install the report.
- **Project Procedure**—enter a project procedure. "called" and "called by" data is shown for that project/procedure combination. You can use "wildcards." For example, to see data for ALL projects and procedures, enter the % character in each field.
- **Report Title**—this is the title of the report

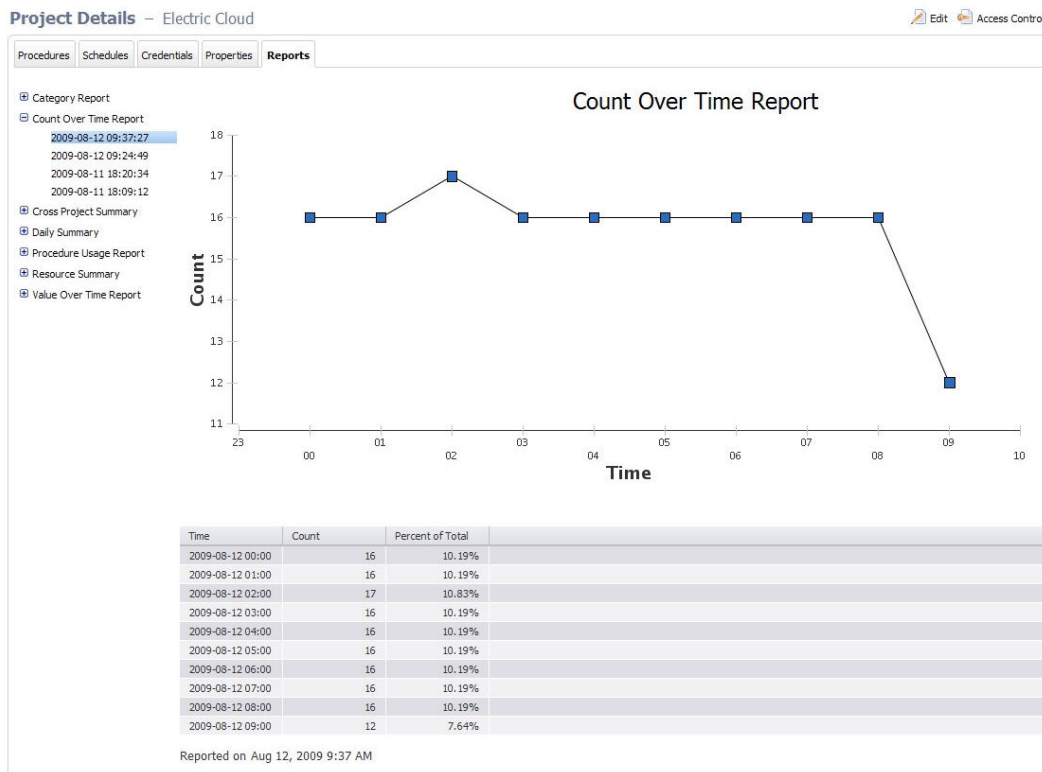
### Count Over Time Sample Report

This report shows search results from counting multiple job, job step, or resource objects within the selected time range.

For example, this report counts the number of occurrences for the specified object-type over the selected time range--if a filter exists, it will be applied. This report does not aggregate the value (use ValueOverTime if you want aggregation), each occurrence counts as one.

Use this report when the property contains string values. The ValueOverTime report can be used only for numeric properties.

**Note:** Generating large numbers of datapoints can exceed BIRT's charting capability.



Creating this report on the Run Procedure page.

**Run Procedure** – RunReport\_CountOverTime

**Parameters**

Chart Time Grouping:  Default: "Time"

Chart Type:  Default: "Count"

Chart X-Axis Label:  Default: "Time"

Chart Y-Axis Label:  Default: "Count"

Credential: Username:  Password:

Locales:

Object Type:  Default: "Count Over Time Report"

Report Title:  Default: "Count Over Time Report"

Saved Filter Project: ☒ Current ☐  Browse

Saved Filter Name:  Browse

Table Column Heading Property:  Default: "Count"

Table Column Heading Time:  Default: "Time"

Table Time Grouping:

Time Period:

**Advanced**

Priority:

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

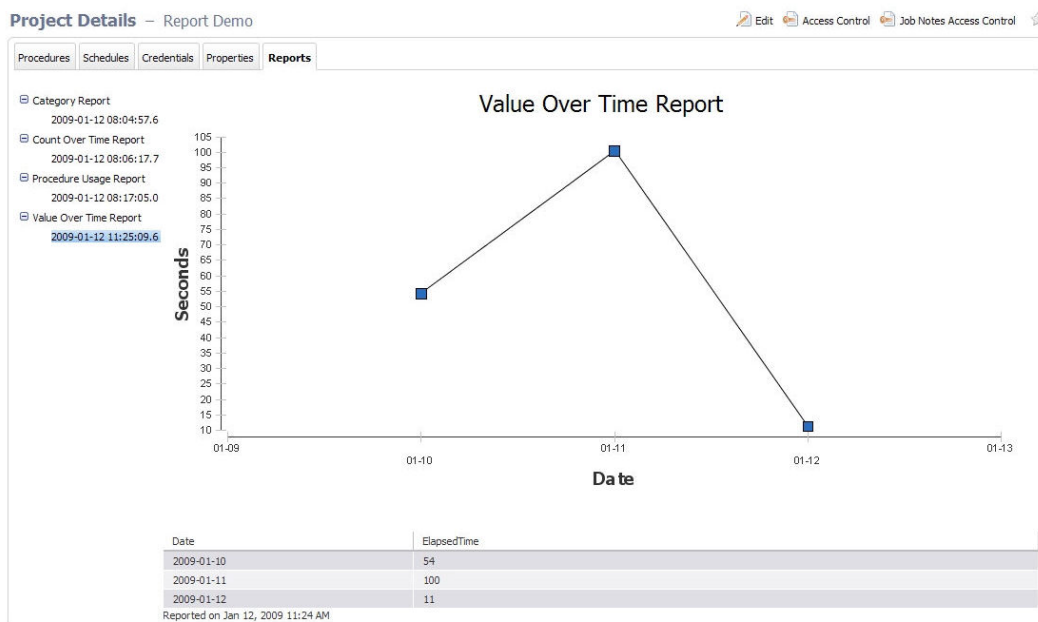
#### Field descriptions:

- Chart Time Grouping—these are: Auto (default), Minute, Hour, Day, Week, Month, or Year
- Chart Type—these are: Line (default), Bar, Cone, Tube, Triangle, or Area
- Chart X-Axis Label—the text to display on chart x-axis (default Date)
- Chart Y-Axis Label—the text to display on chart y-axis (default Count)
- Credential—credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- Locales—a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. Currently, ElectricFlow supports four locales only.
- Object Type—the type of object to search (default job)
- Report Title—your report title (default Count Over Time Report)
- Saved Filter Project—select "Current" or Browse to find the project where you want to save this filter.
- Saved Filter Name—the name of a saved filter to use when filtering collected data.//Use the Search tab to create the filter. After entering your search criteria, click **OK**.//If the preview displays the data you want, click **Save Filter** and provide a Project Name and Filter Name to specify where the filter is saved.// On the Run Report parameters page, select the filter. If you leave the Filter Name blank, no filtering is performed.//**Note:** "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select Time Period of "Yesterday" and a filter of Start=less than Jan 1, 1900. To avoid this problem, Electric Cloud recommends you do NOT include dates or times in your filter.

- Table Column Heading Property—the table heading for the right column (default Count)
- Table Column Heading Time—the table heading for the left column (default Date)
- Table Time Grouping—these are: Auto (default), Minute, Hour, Day, Week, Month, Year
- Time Period—these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  - Today—midnight until now
  - Yesterday—previous full day
  - This week—from the start of the previous Sunday until now
  - Last week—from Sunday to Sunday of the last complete week
  - This month—from the start of the first of this month until now
  - Last month—from the last complete calendar month, which means on January 3rd the last full month is all of December
  - This year—from January 1st until now
  - Last year—all of last year (Jan 1 to December 31)
  - All—all dates until now

### Multiple Series Report

This reports shows the cumulative value of a property over time. This report should be run against properties that contain numbers. (Use the Count Over Time report if your property contains string values.) You can specify the function to use for aggregating values (sum, count, average). For example: Assume a property that contains the number of failed unit tests is stored on each job. Using the Multiple Series report, you can see the failure trend over time.



Creating this report on the Run Procedure page:

**Run Procedure** – RunReport\_ValueOverTime

**Parameters**

Chart Time Grouping:  Default: "Auto"

Chart Type:  Default: "Line"

Chart X-Axis Label:  Default: "Date"

Chart Y-Axis Label:  Default: "Seconds"

Credential: Username:  Password:

Locales:

Object Type:  Default: "Job"

Property:  Default: "elapsedTime"

Property Expression:

Property Function:  Default: "Average"

Report Title:  Default: "Value Over Time Report"

Saved Filter Project: ☒ Current ☐  Browse

Saved Filter Name:  Browse

Table Column Heading Property:

Table Column Heading Time:  Default: "Date"

Table Time Grouping:

Time Period:

**Advanced**

Priority:

Impersonation: ☒ Use pre-defined credential ☐ Use specific credential ☐ Use a specific user

Field descriptions:

- Chart Time Grouping—these are: Auto (default), Minute, Hour, Day, Week, Month, or Year
- Chart Type—these are: Line (default), Bar, Cone, Tube, Triangle, or Area
- Chart X-Axis Label—the text to display on chart x-axis (default Date)
- Chart Y-Axis Label—the text to display on chart y-axis (default Count)
- Credential—these are credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- Locales—a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. **Note:** Currently, ElectricFlow supports four locales only.
- Object Type—the type of object to search (default job)
- Property—the property of interest (default outcome) and must be a valid property for the object type selected
- Property Expression—an optional mathematical function to apply to your data. For example, elapsed time is recorded in milliseconds. To make a useful report with elapsed times, you may want to show seconds, so this field would be entered as "/1000".

- **Property Function**—the following list contains the aggregation functions to use for data in the chart and table.

Count	Median
Count Distinct	Mode
First	Std Deviation
Last	Sum
Min	

- **Report Title**—your report title (default Value Over Time Report)
- **Saved Filter Project**—select "Current" or Browse to find the project where you want to save this filter.
- **Saved Filter Name**—the name of a saved filter to use when filtering collected data.

Use the Search tab to create the filter. After entering your search criteria, click **OK**.

If the preview displays the data you want, click **Save Filter** and provide a Project Name and Filter Name to specify where the filter is saved.

On the Run Report parameters page, select the filter. If you leave the Filter Name no filtering is performed.

**Note:** "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select Time Period of "Yesterday" and a filter of Start=less than Jan 1, 1900. To avoid this problem, Electric Cloud recommends you do NOT include dates or times in your filter.

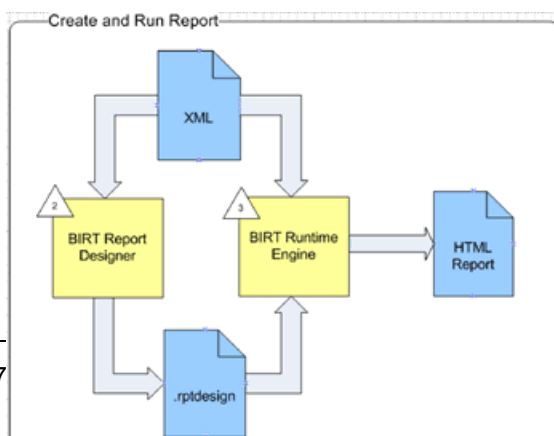
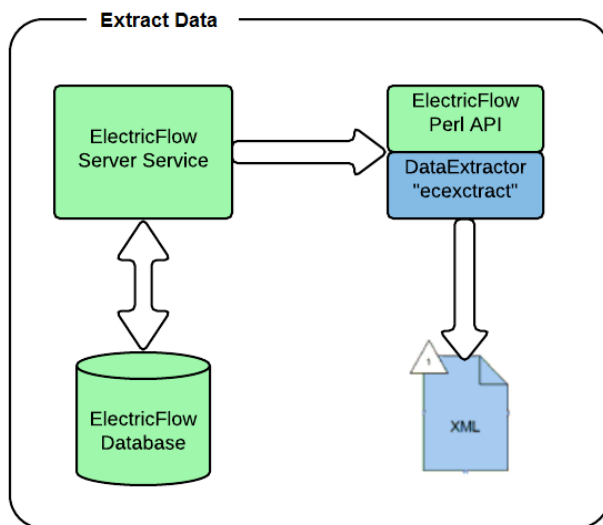
- **Table Column Heading Property**—the table heading for the right column (default Count)
- **Table Column Heading Time**—the table heading for the left column (default Date)
- **Table Time Grouping**—these are: Auto (default), Minute, Hour, Day, Week, Month, Year



- Time Period—these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  - Today—midnight until now
  - Yesterday—previous full day
  - This week—from the start of the previous Sunday until now
  - Last week—from Sunday to Sunday of the last complete week
  - This month—from the start of the first of this month until now
  - Last month—from the last complete calendar month, which means on January 3rd the last full month is all of December
  - This year—from January 1st until now
  - Last year—all of last year (Jan 1 to December 31)
  - All—all dates until now

## Creating Custom reports

The ElectricFlow batch mode reports which, by default, run once each night and are accessed through the Reports tab [in the Electric Cloud project] in the web UI. These reports are built using a combination of the ElectricFlow API and the BIRT Report Designer tool. BIRT is an open source Eclipse-based reporting system you can use to create your own custom reports, or modify existing ElectricFlow reports. This section describes how to write your own custom report and integrate it into ElectricFlow.



There are several steps to using BIRT to create reports:

- Create an XML file with data using the ElectricFlow Perl API
- Design a report using BIRT RCP Report Designer
- Run the report with the BIRT Report Engine
- View the report from within ElectricFlow

## Data extraction

To begin creating a custom report, you must first extract report data from ElectricFlow and move it into a standalone XML file. The recommended way to create the XML file is to use the ElectricFlow `ecextract` utility program, which is derived from the Perl API. The benefits of using `ecextract` to create XML files are:

- **Security**—`ecextract` enforces all ElectricFlow security and ACLs. (Direct DB access does not honor ACLs.)
- **Maintainability**—`ecextract` is supported by Electric Cloud, including backward compatibility and insulates you from database schema changes.
- **Simplicity**—`ecextract` provides easy-to-use search and filtering options. Because of the complex nature of our schema, particularly for properties, it may be difficult to create custom SQL statements.
- **Reuse**—You may find that XML files created by built-in reports already contain all the data you need. If you simply want to present data differently or "slice" the data in a different way, you can reuse the XML from the existing built-in reports.

**Note:** If you already use `ectool` or Perl for data extraction, and have already created the scripts you need for custom reports, you may continue to use those scripts. However, we recommend using `ecextract` if you are new to creating custom reports.

## Using `ecextract.pl` for data extraction

A Perl program, `ecextract.pl`, is provided so you do not have to write Perl code—or you can use it as a starter for your own Perl API calls. This script allows you to specify the most common query types on a command line and generates an XML file. The following table lists currently available `ecextract` arguments:

**Usage:** `ecextract [options]`

**Data Extract Options:**

<code>--type job jobStep resource</code>	The object type to query.
--	---------------------------

<code>--property [label=]property</code>	Add a property to the output. If label is specified, it is used as the XML tag name instead of the property name.
--	---

<pre>--filter property, operator, operand1 [,operand2]</pre>	Add a property filter to the query.
--	-------------------------------------

<code>--savedfilter filterName</code>	Use a saved filter (ignores --filter)
---------------------------------------	---------------------------------------

<code>--period period</code>	<p>The time period. One of: today, yesterday, thisweek, lastweek, thismonth, lastmonth, thisyear, lastyear, all, window, &lt;number of days&gt;, or range,&lt;start-time&gt;,&lt;end-time&gt;</p> <p>Range start, end time is date in ISO 8601 format: YYYY-MM-DDTHH:MM:SS[Z]If the date ends with 'Z', it is considered to be GMT time, otherwise the local timezone is used.</p>
------------------------------	--



<code>--sort property, order</code>	Add a sort to the query. Order is either 'ascending' or 'descending'.
-------------------------------------	---

<code>--outputPath</code>	Path and name of output file. Default is <code>out.xml</code> .
---------------------------	--

--max	Maximum number of objects to return.
-------	--------------------------------------

**Server Communication Options:**

<code>--server server</code>	Address for the ElectricFlow server. Defaults to the value of the <code>COMMANDER_SERVER</code> environment variable. If it does not exist, defaults to localhost.
------------------------------	--

<code>--port port</code>	HTTP listener port on the server. Defaults to 8000.
<code>--securePort port</code>	HTTPS listener port on the server. Defaults to 8443.
<code>--secure 0 1</code>	If set to true, HTTPS is used to communicate with the server. Defaults to true.
<code>--timeout seconds</code>	Set the number of seconds for the timeout. Defaults to 280.
<b>Login Options:</b>	
<code>--user user</code>	ElectricFlow login user.
<code>--pass password</code>	Password for login user.
<code>--credentialName</code>	Credential name (valid only when running inside a job step).
<b>Global Options:</b>	
<code>--help</code>	Print this message and exit without doing anything.
<code>--version</code>	Debug level. 0—errors only 1—0 + System progress 2—1 + Property Warnings 3 and higher give detailed diagnostics
<b>Plugin File Options:</b>	
<code>--load loadFile</code>	Plugin perl program to execute
<code>--</code>	Stop processing ectract options. Allows plugins to process their own options following this option.

ecextract.pl is part of the EC-Reports plugin—this script is located in the "agent/bin" directory of the EC-Reports plugin.

**Notes:**

--property

Properties can be specified as high-level values (--property propertyName), properties in a sheet ( --property sheet1/sheet2/propertyName), or as relative paths (--property /myProject/propertyName).

--filter

Each entry consists of a property name to test and an operator to use for comparison. The property can be an intrinsic property defined by ElectricFlow or a custom property added by the user. Each operator takes zero or one operand to compare against the desired property.

The operators are:

contains, equals, greaterOrEqual, greaterThan, in, lessOrEqual, lessThan, like, notEqual, notLike, isNotNull, isNull

Example: --filter jobName,equals,Hello

**Examples**

The following 3 examples contain the script input and the output.

***Example 1: Find properties on job steps for one day in April***

```
ec-perl ecextract.pl ^
--user report ^
--pass report ^
--server localhost ^
--outputPath jobStepOut.xml ^
--type jobStep ^
--max 1000 ^
--property jobId ^
--property finish ^
--property jobStepId ^
--property stepName ^
--property status ^
--property outcome ^
--property runTime ^
--property waitTime ^
--filter jobName,like,commander-2.2%% ^
--filter createTime,greaterOrEqual,2008-04-01T00:00:00.000Z ^
--filter createTime,lessOrEqual,2008-04-02T00:00:00.000Z ^
--sort jobId,descending
```

**Output from example 1**

```

<?xml version="1.0" encoding="utf-8"?>
<response>
  <object objectType="jobStep" objectId="jobStep-3511785">
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <finish name="finish">2009-04-01T23:54:45.424Z</finish>
    <jobStepId name="jobStepId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobStepId>
    <stepName name="stepName">Setup</stepName>
    <status name="status">completed</status>
    <outcome name="outcome">success</outcome>
    <runTime name="runTime">0</runTime>
    <waitTime name="waitTime">922</waitTime>
  </object>
  <object objectType="jobStep" objectId="jobStep-3511915">
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <finish name="finish">2009-04-01T23:59:26.844Z</finish>
    <jobStepId name="jobStepId">5da765dd-73f1-11e3-b67e-b0a420524153</jobStepId>
    <stepName name="stepName">Drop</stepName>
    <status name="status">completed</status>
    <outcome name="outcome">success</outcome>
    <runTime name="runTime">0</runTime>
    <waitTime name="waitTime">266</waitTime>
  </object>
  .....
</response>

```

### ***Example 2: Find all jobs that were created in April 2008***

```

ec-perl ecextract.pl ^
--user report ^
--pass report ^
--server localhost ^
--outputPath jobOut.xml ^
--type job ^
--max 100 ^
--property jobName ^
--property jobId ^
--property projectName ^

```



```
--property procedureName ^
--property branch ^
--filter createTime,greaterOrEqual,2009-04-01T00:00:00.000Z ^
--filter createTime,lessOrEqual,2009-04-30T00:00:00.000Z ^
--sort projectName,ascending ^
--sort procedureName,ascending ^
--sort createTime,descending
```

### Output from example 2

```
<?xml version="1.0" encoding="utf-8"?>
<response>
  <object objectType="job" objectId="job-158461">
    <jobName name="jobName">commander-3.2.23916-200904011650</jobName>
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <projectName name="projectName">Commander</projectName>
    <procedureName name="procedureName">Master</procedureName>
    <branch name="branch">3.2</branch>
  </object>
  <object objectType="job" objectId="job-158455">
    <jobName name="jobName">commander-anders-main-ad.23915-200904011627</jobName>
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <projectName name="projectName">Commander</projectName>
    <procedureName name="procedureName">Master</procedureName>
    <branch name="branch">main</branch>
  </object>
  .....
</response>
```

### **Example 3: Find all resources**

```
ec-perl ecextract.pl ^
--user report ^
--pass report ^
--server localhost^
--outputPath resourceOut.xml ^
--type resource ^
--max 100 ^
```

```
--property resourceName ^
--property stepCount ^
--property stepLimit ^
--property hostName ^
--filter stepCount,greaterThan,0 ^
--sort resourceName,ascending
```

### Output from example 3

```
<?xml version="1.0" encoding="utf-8"?>
<response>
  <object objectType="resource" objectId="resource-106">
    <resourceName name="resourceName">ecbuild-lin1</resourceName>
    <stepCount name="stepCount">2</stepCount>
    <stepLimit name="stepLimit">0</stepLimit>
    <hostName name="hostName">ecbuild-lin1</hostName>
  </object>
  <object objectType="resource" objectId="resource-108">
    <resourceName name="resourceName">ecbuild-win1</resourceName>
    <stepCount name="stepCount">1</stepCount>
    <stepLimit name="stepLimit">0</stepLimit>
    <hostName name="hostName">ecbuild-win1</hostName>
  </object>
  .....
</response>
```

## BIRT Report Designer

Now that you have a dataset, you can create a BIRT report. You need an XML file to use while designing the report. If you did not create an XML data file yet, now is the time to do so. After you have sample data, you are ready to start designing a report.

Report definitions are created with the BIRT Report Designer, currently version 2.5.2. These definitions are then stored in `.rptdesign` files. You have several options for installing the designer tool:

- Use a BIRT Report Designer bundled and already installed with Eclipse, or
- download BIRT Report Designer to use with your existing Eclipse installation, or
- because Eclipse is not required, you can download only the BIRT Report Designer (this is the easiest and preferred method).

We recommend downloading the BIRT RCP Report Designer only, which is the standalone design tool. The url for downloading the Report Designer is:

[http://www.eclipse.org/downloads/download.php?file=/birt/downloads/drops/R-R1-2\\_5\\_2-201002221500/birt-rcp-report-designer-2\\_5\\_2.zip](http://www.eclipse.org/downloads/download.php?file=/birt/downloads/drops/R-R1-2_5_2-201002221500/birt-rcp-report-designer-2_5_2.zip)

The general download page for BIRT 2.5.2 with the other options discussed is

[http://download.eclipse.org/birt/downloads/build.php?build=R-R1-2\\_5\\_2-201002221500](http://download.eclipse.org/birt/downloads/build.php?build=R-R1-2_5_2-201002221500)

Using the BIRT Report Designer is beyond the scope of this Help topic. Documentation and tutorials can be found on the BIRT website: <http://www.eclipse.org/birt>. You may find it helpful to view the report designs for built-in ElectricFlow. These designs can be found in the `agent/reports/<report name>` directory in the EC-Reports plugin.

### Understanding additional report components

In addition to the XML dataset and report design, there are optional report components you may wish to include in your report.

- **External style sheet**  
BIRT supports external style sheets for reports. If you use these style sheets, they need to be located with your report design. For example, built-in ElectricFlow reports use an external style sheet file `"styles_birt.css"`.
- **Externalized string properties**  
String literals (used in your report design) can be externalized into property files to support localization. These property files need to be located with your report design also. The properties file for the default locale will have the same name as your report and a `".properties"` file extension, for example, `CategoryPie.properties`. Text for additional locales are stored in files named `<report name>_<locale>.properties`, for example, `CategoryPie_ja.properties` contains text localized for the Japanese language.

You may review examples of these additional components for built-in ElectricFlow reports. These files are located in the EC-Reports plugin, in the `agent/reports/<report name>` directory.

### Packaging reports for ElectricFlow

After you have an XML dataset (using `ecextract.pl`), a BIRT report design (using BIRT Report Designer), and any additional optional report components completed, you are ready to integrate your report into ElectricFlow. To do this:

- Store all the report components in a location accessible to your ElectricFlow agent—you can use the ElectricFlow plugins directory. For example, for your report files, you could create a directory called "MyReport" in the ElectricFlow plugins directory.

- Create an ElectricFlow procedure to perform the necessary steps to generate a report, including: extracting data, running the report design, and registering report output to appear on the Report tab on the Project Details page. You may want to copy one of the procedures from the built-in ElectricFlow reports to use as a template. The following command creates a copy of the RunReport\_CategoryPie procedure called RunReport\_MyReport in the project of your choice. Substitute your project name for <my-project-name> in the following command.

```
ectool clone --cloneName/projects/<my-project-name>/procedures/RunReport_
MyReport
--projectName/plugins/EC-Reports/project --procedureName RunReport_
CategoryPie
```

### **Example: customizing the command body**

The following is an example of customizing the procedure contents for the RunReport\_MyReport procedure, cloned from the RunReport\_CategoryPie procedure above.

One customization is required and two are optional. The remainder of the command body does not need to be changed.

- Customizing the location of the BIRT report design file  
Required: update the location of the BIRT report design file.
  - **Original value:** our \$reportDesignFile =  
"\$pluginDir/agent/reports/CategoryPie/CategoryPie.rptdesign";
  - **New value:** our \$reportDesignFile = "\$ENV{'COMMANDER\_PLUGINS'}  
/MyReport/MyReport.rptdesign";
- Customizing data extraction  
To customize data extraction using `ecextract.pl`, modify the following section of the command body:

```
#-----
# extractReportData
#
#       Extract report data from Commander using ecextract utility
#-----

sub extractReportData()
{
    # Time property varies based on object type
    my $timeprop = "modifyTime";
    if (
        $timeprop = "finish";
    )
    my $command = "ec-perl \"$pluginDir/agent/bin/ecextract.pl\" "
        . " --debug 3"
        . " --outputPath \"$ ecextractXmlFile\""
        . " --credential \"$[Credential]\""
```

```
        . " --type \"${Object Type}\"\"
        . " --property time=$timeprop"
        . " --property series1=\"${Property}\"";
    if ("${Saved Filter}" ne "") {
        command = $command . " --savedFilter \"${Saved Filter}\"
    }

    $command = $command . " --period \"${Time Period}\"";
    print "data extract [$command]\n";
    my $result = ` $command `;
    print "extract result:\n$result";
    if ($?) {
        exit (1);
    }
}
```

- Customizing report parameters

To customize the parameters passed to your report design, modify the following section of the command body:

```
#-----
# getReportArgs
#
#      Get report arguments
#-----

sub getReportArgs() {
    # args for creating report
    my $categoryHeading = ucfirst("${Property}");
    my @args = (
        "-f", "$reportFormat",
        "-o", "$reportName",
        "-i", "images/",
        "-p", " xmlfile=../$extractXmlFile",
        "-p", "ReportTitle=$reportTitle",
        "-p", "TableColHeadingTime=$categoryHeading",
        "-p", "TableColHeadingSeries1=Count" ,
        "-p", " SearchURL=" . getSearchUrl(),
        "$reportDesignFile",
```

```

);

# add locale args
foreach my $locale (@locales) {
    if ($locale ne "") {
        unshift @args, "-l $locale";
    }
}

return @args;
}

```

### Helper functions provided in `ElectricCommander::ReportUtils.pm`

**ecgenReport**—runs the BIRT report, using the BIRT Report Designer

- **installationDirectory**—this is the directory where ElectricFlow is installed and where you will find JAVA and BIRT
- **artifactDirectory**—this is the directory where reports, images, and other artifacts should be stored. To display using the Reports subtab, these items must be in a directory named "artifacts" at the top of the job's workspace
- **args**—an array of arguments to the BIRT run-time engine, which specifies parameters, design templates, and so on.

**registerReport**—marks the report so it will be displayed when you select the Reports subtab

- **commander**—an `ElectricCommander()` object used to make ElectricFlow calls. If you need to use a specific user context, call the login method before calling `registerReport`
- **jobId**—this is the report job ID, which is used to set properties on the job
- **url**—this is the URL to register and it takes the form workspace name/html file name
- **title**—this is the text string for the report navigation tree
- **treeGroupings**—a hash grouped `name/values` set as properties to define the report tree groupings—report tree groupings are defined on a propertySheet named `ec_reportConfiguration` on the project or on the server
  - **hash key**—this is a property name that will be created on job's `ec_reportData/$title/` property sheet and used for report tree grouping
  - **hash value**—property value

**registerArtifactsDirectory**—creates the property required to set the artifacts directory

- **commander**—an `ElectricCommander()` object used to make ElectricFlow calls
- **jobId**—this is the report job ID, which is used to set properties on the job
- **artifactsDir**—this is a directory path relative to the workspace where job artifacts will be stored

**extractFile**—this function pulls content from the report definition (stored in properties) and creates files from them

- **commander**—an `ElectricCommander()` object used to make ElectricFlow calls. If you need to use a specific user context, make sure to call the `login` method before calling `registerReport`
- **jobId**—this is the report job ID, which is used to set properties on the job
- **reportType**—this is used to lookup report attributes
- **files**—an array of hashes that specify which properties should be loaded into which files
  - **prop**—the property name from the installed report type
  - **dest**—the destination file name (relative to the current working directory)
  - **expand**—this is "1" if you want ElectricFlow to expand property references in the property, "0" if not

**getReportTimestamp**—return hires timestamp formatted in a specified time zone

- **TimeZone**—(optional) a time zone specifier, default is "local"
- **FormatString**—(optional) a format specifier for the timestamp string

## Custom Report Examples

This Help topic contains two examples illustrating how you might use the BIRT Report Designer to modify a built-in ElectricFlow report to create a custom report more meaningful for your purposes.

### Example 1: modifying an existing report—adding a "banner" heading

The easiest way to customize a report is to take an existing report and modify it. ElectricFlow provides a set of built-in reports you can modify.

Process overview for modifying an ElectricFlow built-in report

- Make a copy of an existing report
- Make changes to the report
- Test your new custom report

#### To copy an existing ElectricFlow report

For this example, we will make a copy of the built-in Value Over Time report. The process to copy a report is:

- Make a copy of the file system report components of the Value Over Time report located in the ElectricFlow plugins directory.

Rename the copied directory to MyReport.

The default location of the ElectricFlow plugins directory is:

On Linux: `/opt/electriccloud/electriccommander/plugins`

On Windows: `C:\Documents and Settings\All Users\Application Data\Electric Cloud\ElectricCommander\plugins`

Linux example—The following commands will make a copy of the Value Over Time report file components and then rename the files:

```
$ cd /opt/electriccloud/electriccommander/plugins
$ cp -r EC-Reports-1.0.0.* /agent/reports/ValueOverTime/ MyReport
$ cd MyReport
$ rename ValueOverTime MyReport ValueOverTime*
```

The contents of the MyReport directory should be:

```
$ ls -l
MyReport_en.properties
MyReport_ja.properties
MyReport_ko.properties
MyReport.properties
MyReport.rptdesign
MyReport_zh.properties
styles_birt.css
```

- Make a copy of the RunReport\_ValueOverTime procedure from the EC-Reports plugin that performs the steps to generate a report, including extracting data, running the report design, and registering the report output to appear on the Report tab of the Project Details page. In this example, we will create a Project called “MyReportProject” and the procedure we copy will be called “RunReport\_MyReport”.

```
$ ectool createProject MyReportProject
$ ectool clone --cloneName /projects/MyReportProject /procedures/RunReport_
MyReport
--projectName /plugins/EC-Reports/project --procedureName RunReport_
ValueOverTime
response requestId="1"
<cloneName>RunReport_MyReport</cloneName>
</response>
```

- Edit the “RunReport\_MyReport” procedure in “MyReportProject” to reference the report design file copied earlier.
- Navigate to project MyReportProject, procedure RunReport\_MyReport and select the RunCustomReport step to edit the Command block:

Find the following line:

```
our $reportDesignFile =
"$pluginDir/agent/reports/ValueOverTime/ValueOverTime.rptdesign";
```

and change this line to:

```
our $reportDesignFile = "$ENV{'COMMANDER_PLUGINS'}/ MyReport/MyReport.rptdesign";
```



Edit Step / RunCustomReport1

General

Name: RunCustomReport1

Description:

Command

```

Command(s):
our $reportType = "${Report_Type}";
if ($reportType eq "") { $reportType = $reportTitle; }
our $reportFormat = "html", $html, pdf, doc, xls
our $reportName = $safeFileName("$reportTitle.$reportFormat");
our $artifactsDir = "artifacts";
our $agentInstallDir = getAgentInstallDir();
our $pluginsDir = "$ENV{'COMANDER_PLUGINS'}/$([plugins/EC-Reports/pluginName]);"
our $reportDesignFile = "$ENV{'COMANDER_PLUGINS'}/MyReport/MyReport.rptdesign";
our $birtInstallDir = "$ENV{'COMANDER_PLUGINS'}/$([plugins/EC-ReportEngine/agent]";
our $executeXmlFile = $safeFileName("$execute-$reportType-${[increment /myJob/xmlCounter].xml}");

```

Click **OK** to save the change.

### To modify the copied report design

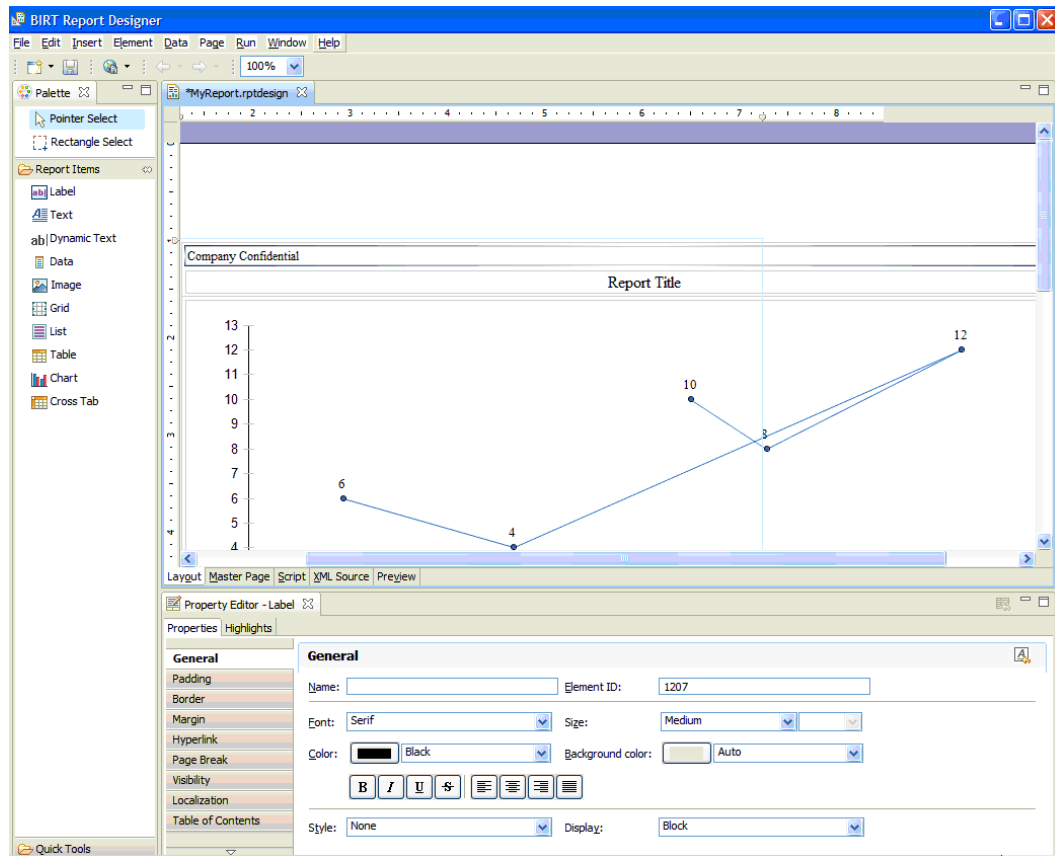
Start the BIRT Report Designer and open the report design file (`MyReport.rptdesign`) located in the `MyReport` directory previously created in the ElectricFlow plugins directory.

**At this point** You are now ready to begin editing an existing report to create a custom report.

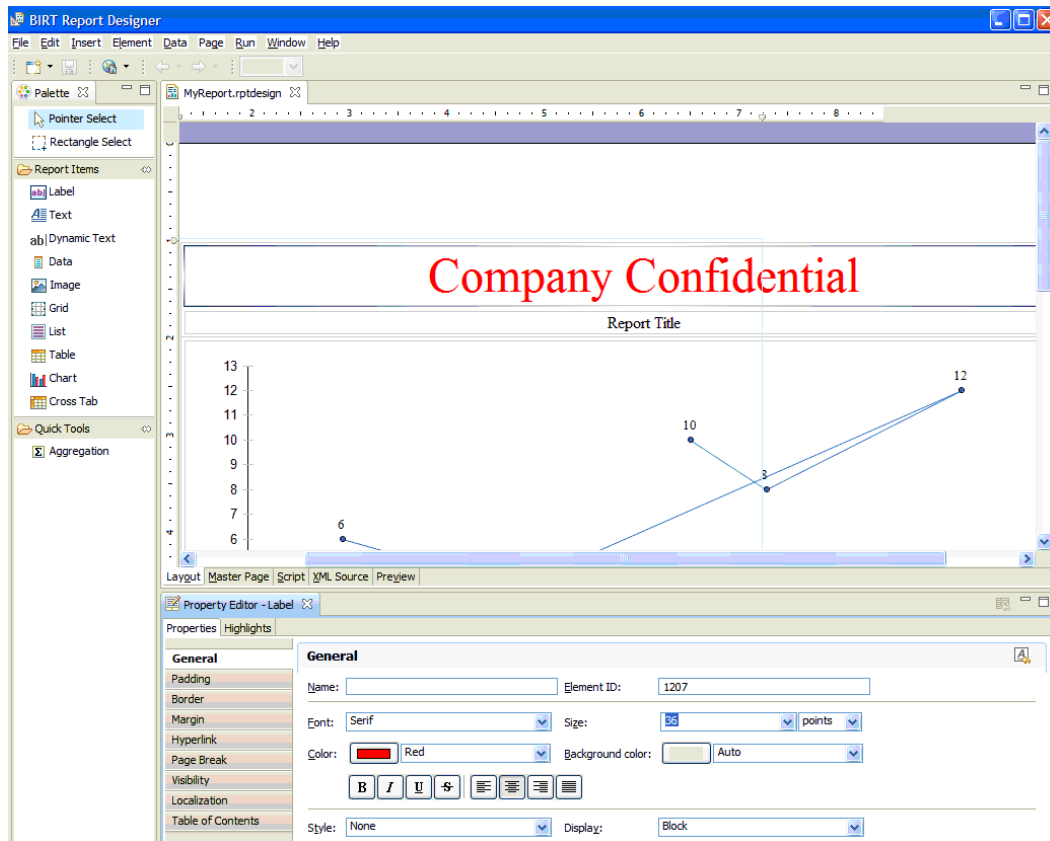
For our example, we are adding a new heading, "Company Confidential," (in large red letters) to the top of the existing report.

1. On the BIRT screen, select the Layout tab.
2. Drag a "Label" from the Palette window into the top of the report and type "Company Confidential" (or whatever text you would like to use for your test report) into the Label box.

See the next BIRT screen example.



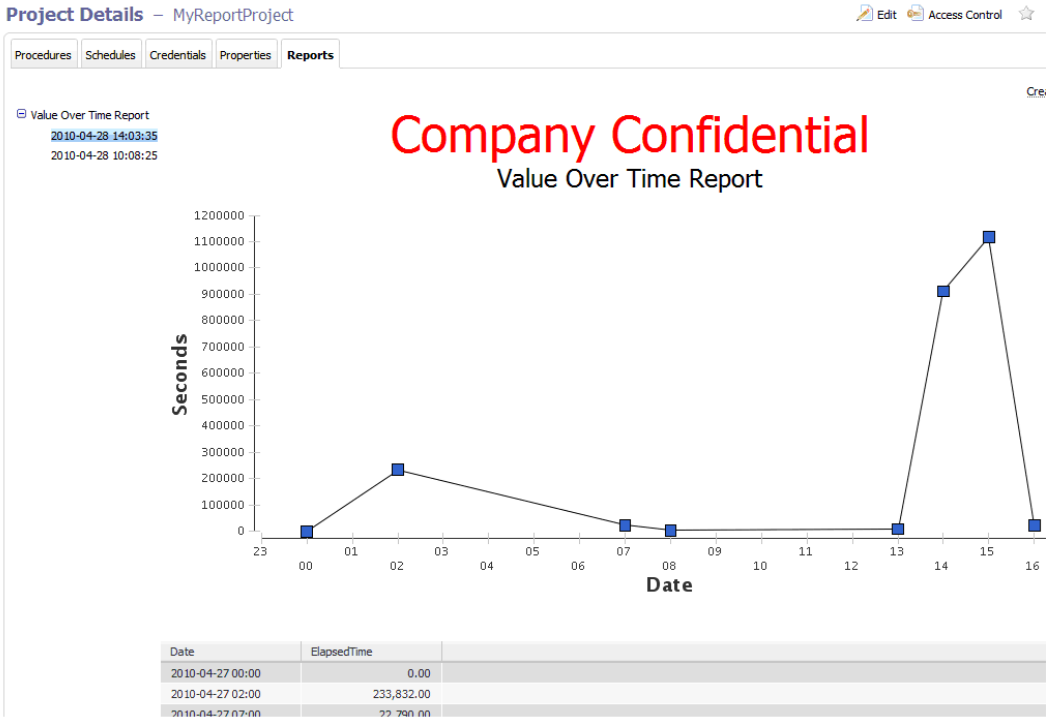
3. Now you can change the font size and color to create a banner appearance. Select the Property Editor window to customize your text—see the next screen example.
4. After customizing your text, Save your report.



***Congratulations! You have just created a custom report.***

### Test your new report

Run the report by running the RunReport\_MyReport procedure in the MyReportProject project. When the job completes, your new report will be available in the Links section on the Job Details page and from the Reports tab if the MyReportProject project. You will see the new header in the report output.



**Example 2: complete end-to-end example**

Using BIRT and some scripting expertise, you can create almost any kind of report you can imagine. This example creates a new report that shows the run-time trend of all job steps. Tasks for creating this report can be grouped into the following steps:

- Plan your report
- Create a new BIRT rptdesign file
- Deploy your custom report
- Test your new report

**Planning this report example**

We decided our report will be a single-series type report that will show job steps runtime. The report will include a line chart at the top of the page whose X and Y axis represent the number of seconds and the job step ID respectively. We also want a table with two columns—column names will be "Job Step Name" and "Run Time".

Next, we need to gather all materials:

Generate sample data to test in the report.

You can use data from a previous run of a Value Over Time report—this file is located in the workspace of a previous reporting job and has the name eextract.xml.

Also from the copy of an ElectricFlow Value Over Time report, we will "copy and paste" a few values from it to save some typing.

**Note:** This example briefly describes items we are working with, but for more information about BIRT, you may need to consult BIRT documentation.

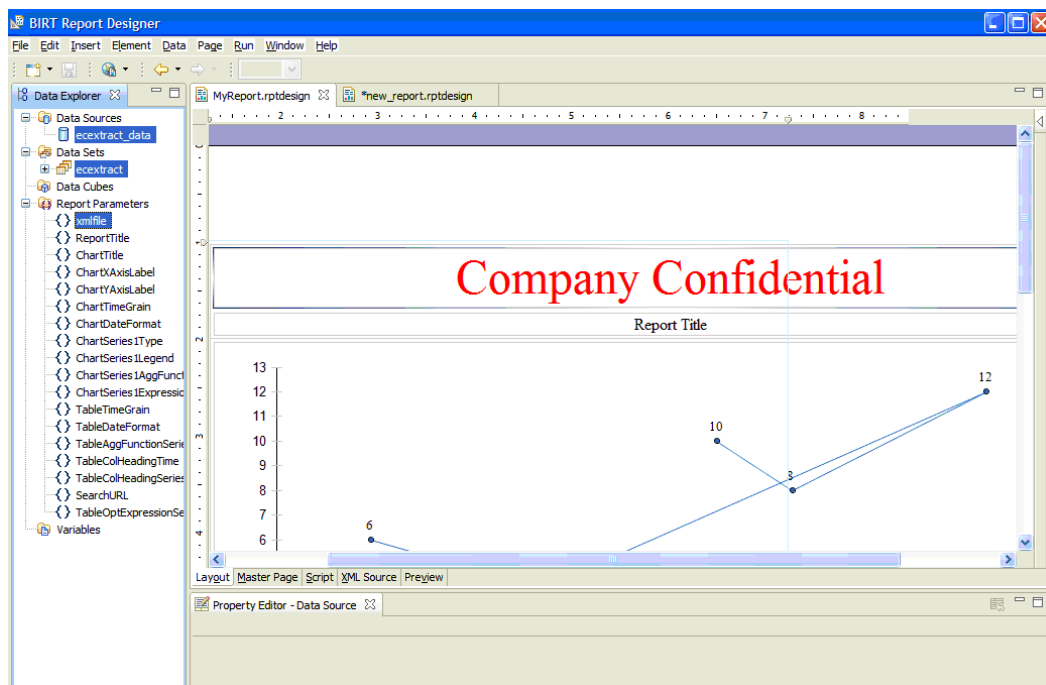
### Creating a new BIRT rptdesign file

In BIRT Report Designer, create a new rptdesign file. Open the report file you created in "Example 1: modifying an existing report—adding a banner heading" so you can use the previous example report to copy some items into your new report.

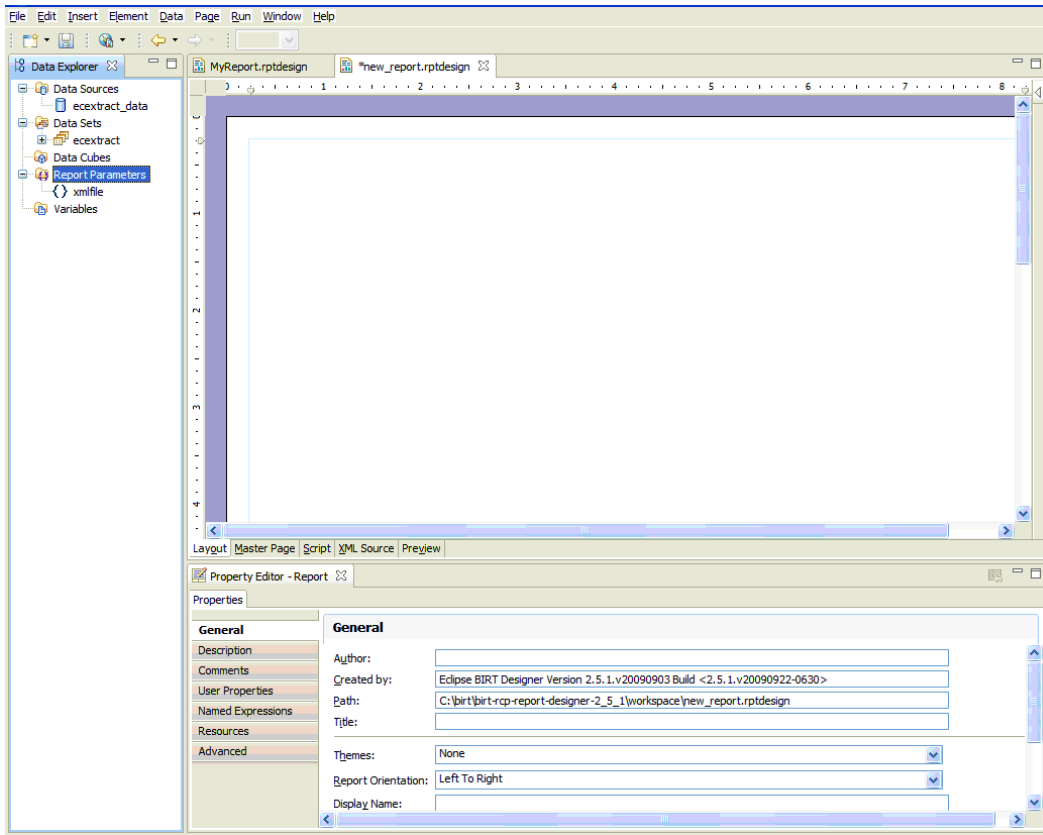
Items to copy into the new report:

- From Data Sources, copy ecextract\_data
- From Data Sets, copy ecextract
- From Report Parameters, copy xmlfile

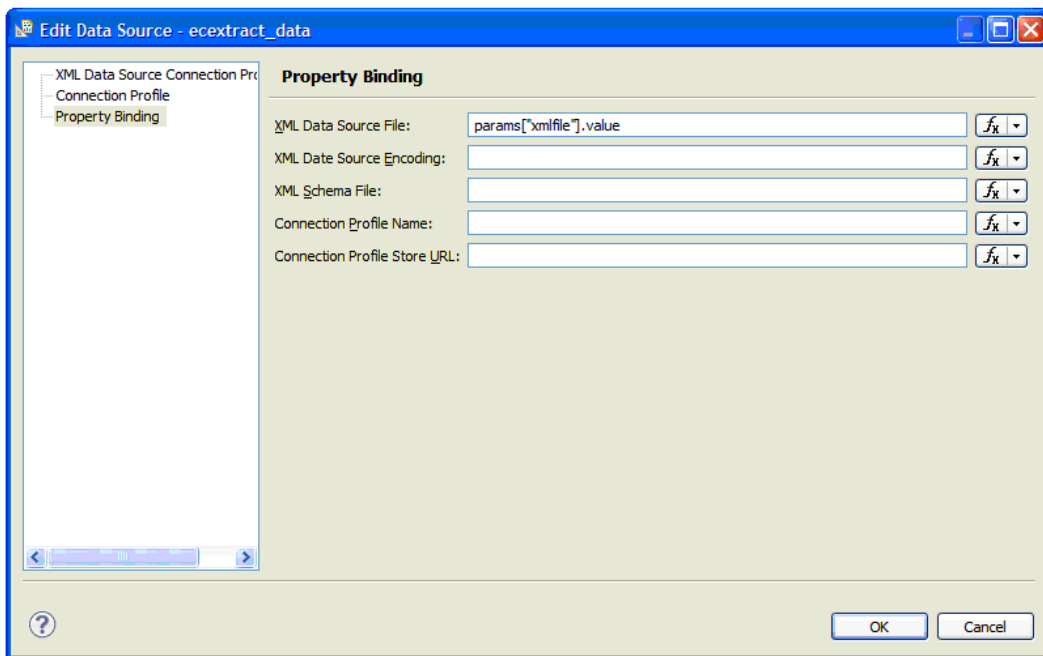
See the next screen example to help find these items.



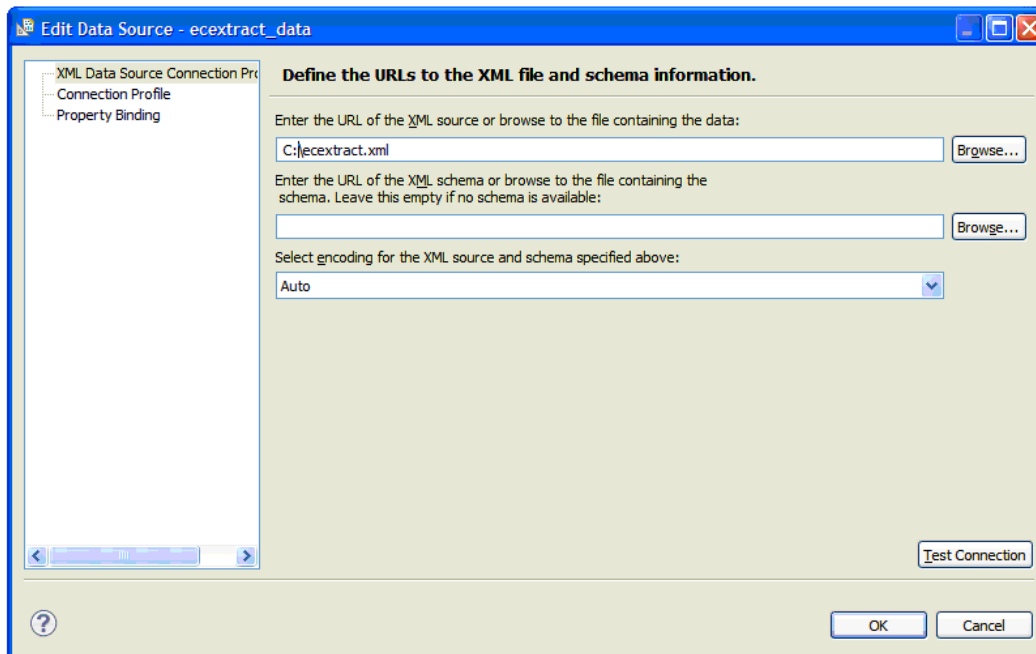
After copying these items, your new report design will look like the following example:



Double-click the Data Sources > ecextract\_data file to ensure the XML file is referenced as a parameter. If it is not, type in the value as shown below.

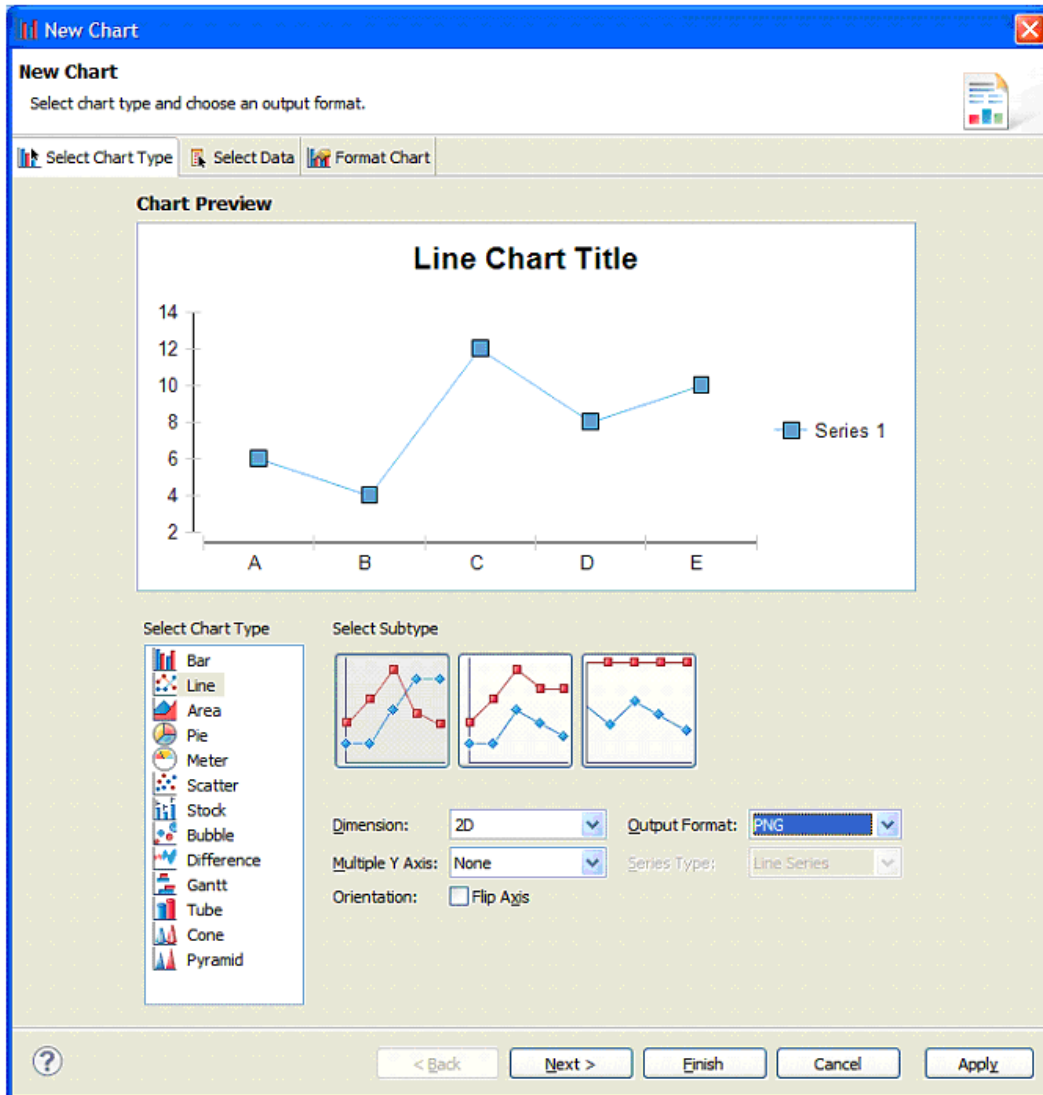


Double-click Data Sources > `ecextract_data` to ensure the XML Data Source Connection refers to the data file you downloaded earlier. In this example the file is `C:\ecextract.xml`.



From the Palette window, drag a Chart object into your report. Your view will be similar to the following:

In the New Chart dialog, select Line under Select Chart Type and browse to select PNG for the Output Format.

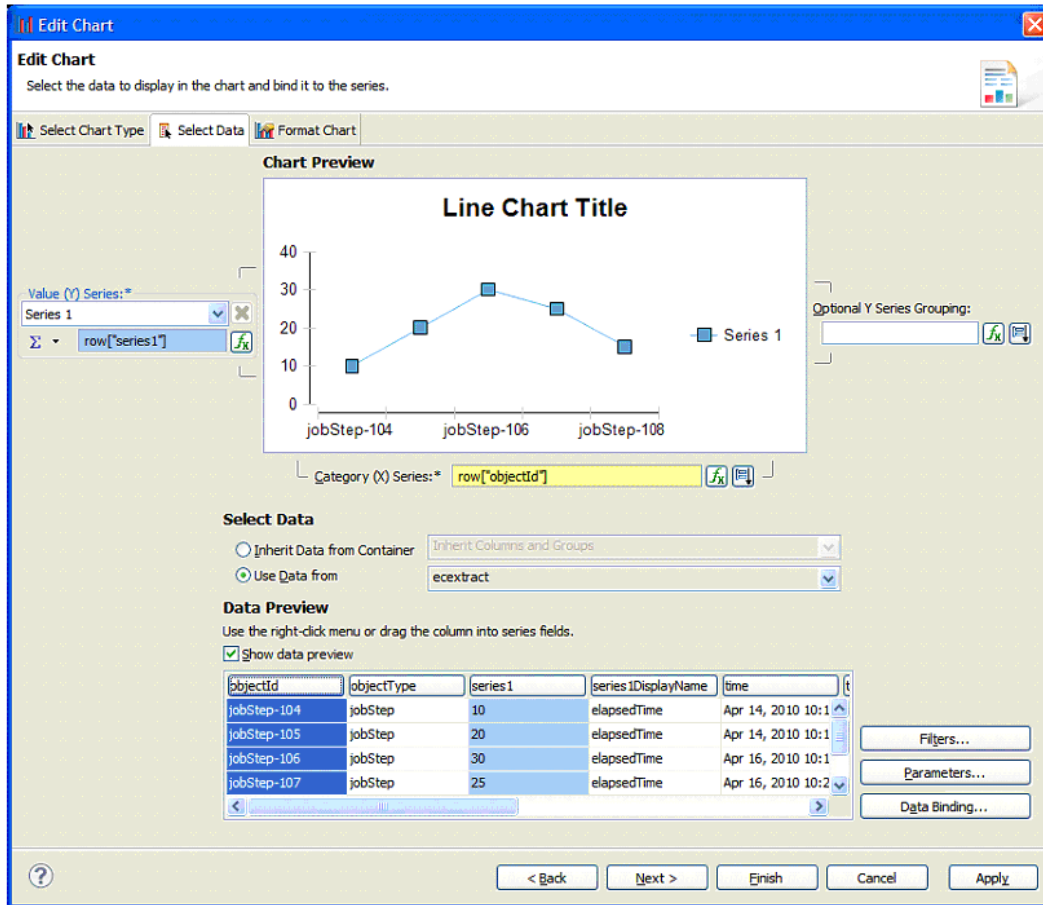


Click **Next**.

On the next screen:

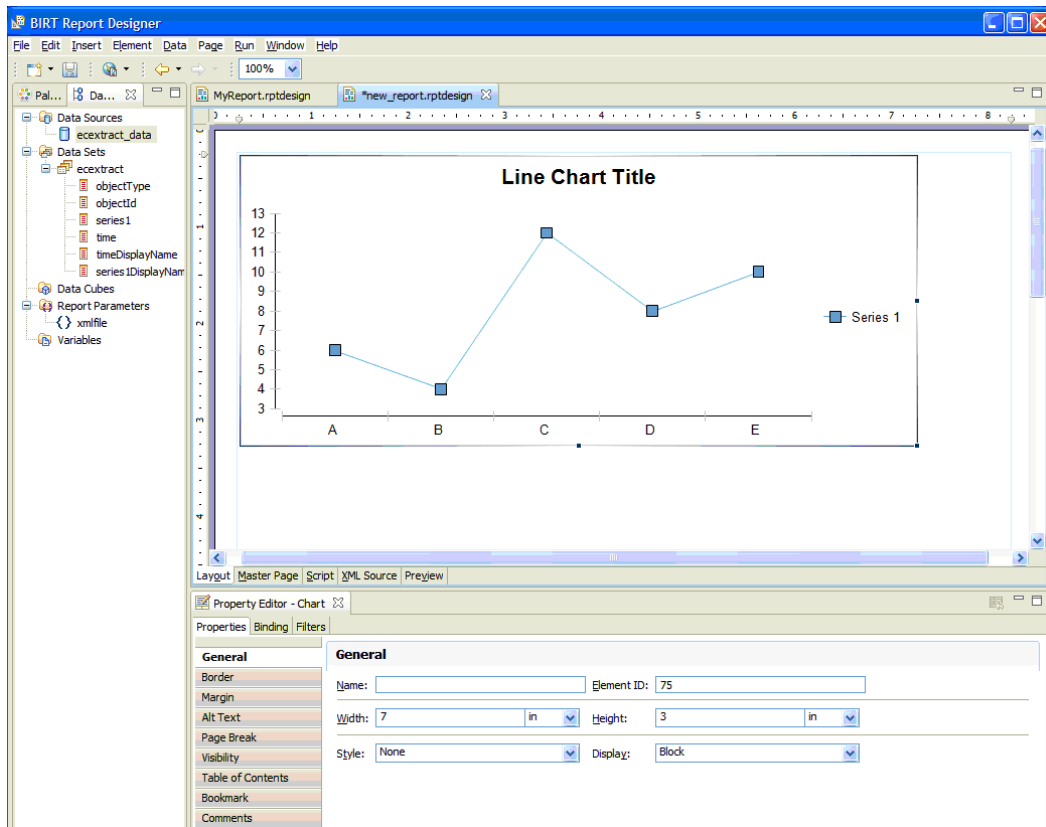
- Under Select Data, browse to select ecextract.
- Make sure the Use Data From radio button is selected.
- Drag the "series1" header to the Value (Y) Series field.
- Drag the "objectId" header to the Category (X) Series field.





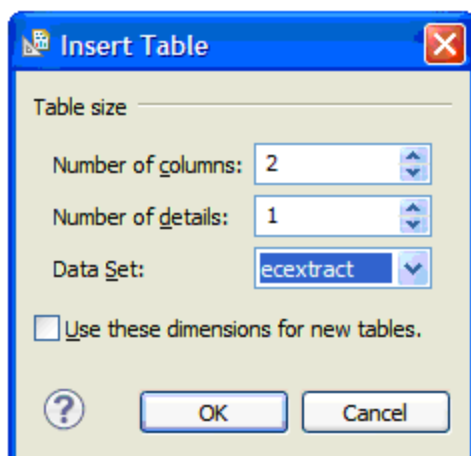
Click **Next** to apply any other formatting changes you choose, then click **Finish**.

On the next screen, after clicking Finish, you have to option to resize the chart as you wish.

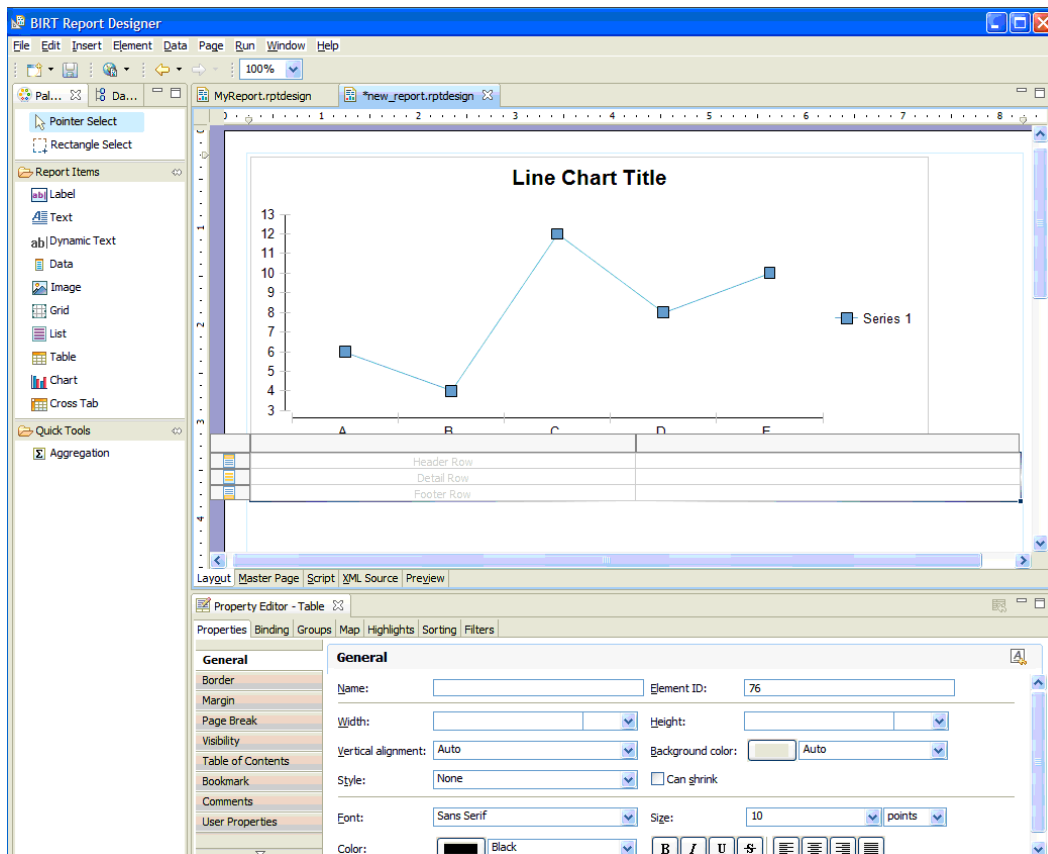


You are now ready to drag a Table item from the Palette to the report layout below the chart.

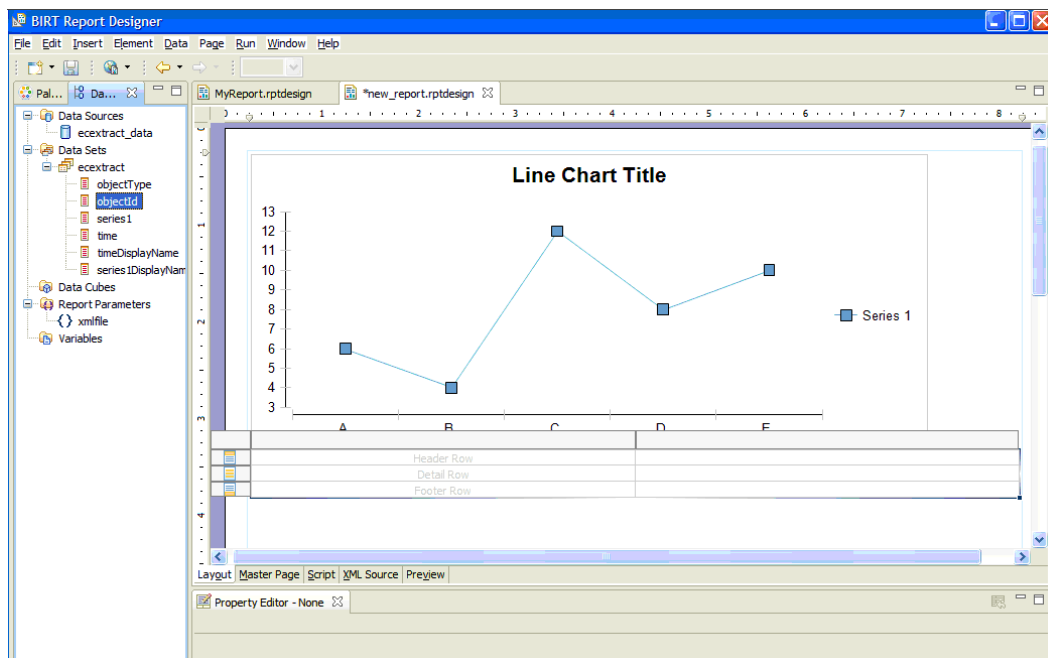
Select "2" columns and the ecextract dataset.



Click **OK**.



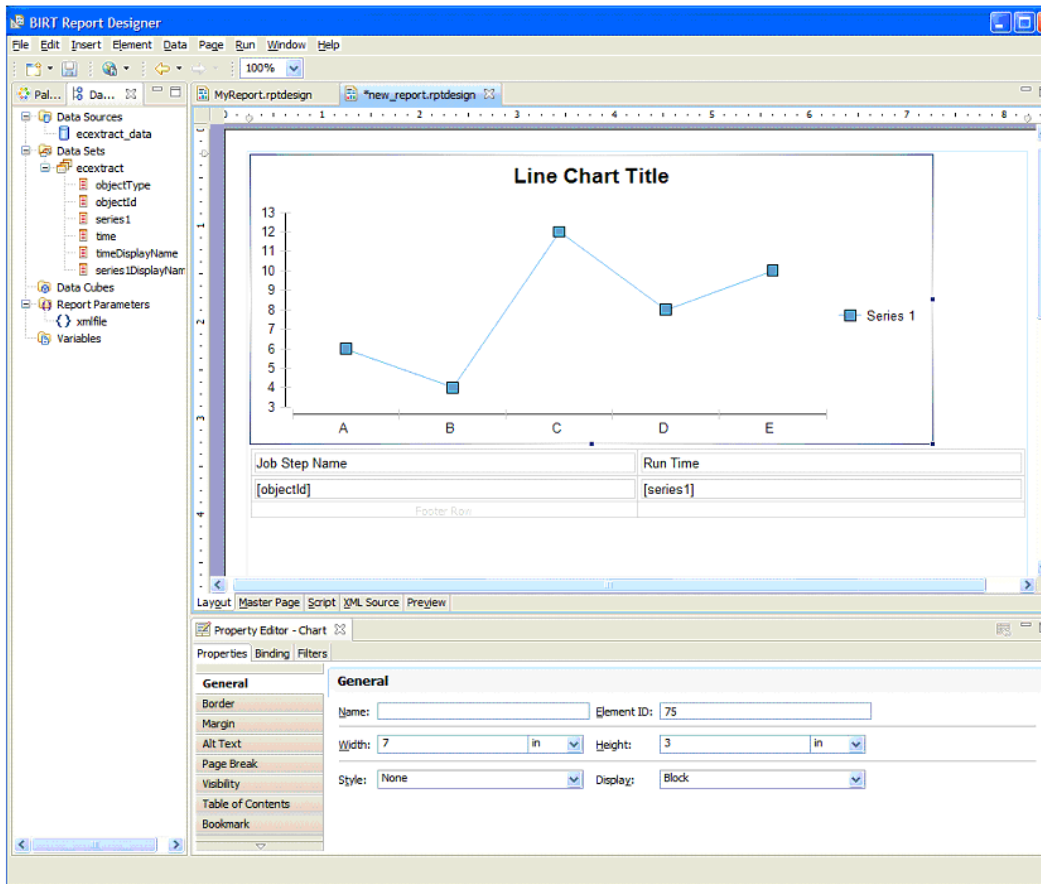
Select the Data Explorer tab and expand Data Sets > ecextract. See the next screen.



Now you are ready to:

- Drag "objectId" to the left Detail Row.
- Drag "series1" to the right Detail Row.
- Replace the Header Row for "objectId" and "series1" with Job Step Name and Run Time, respectively.

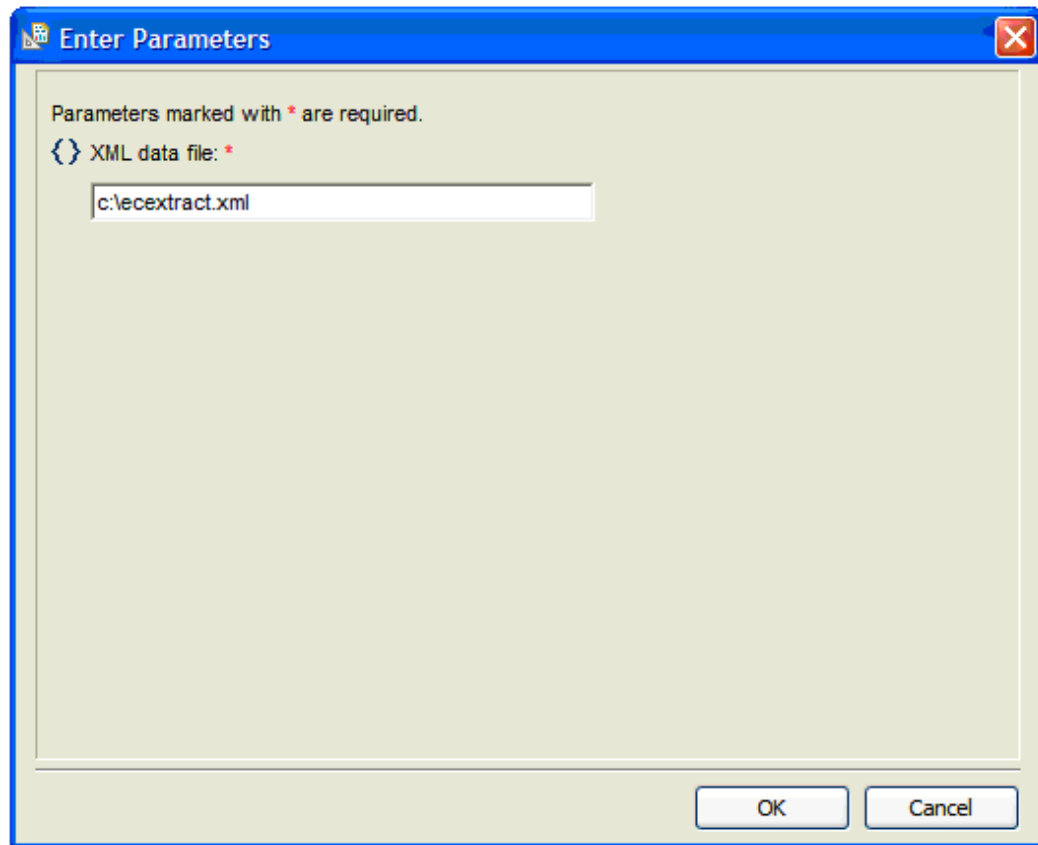
See the next screen example.

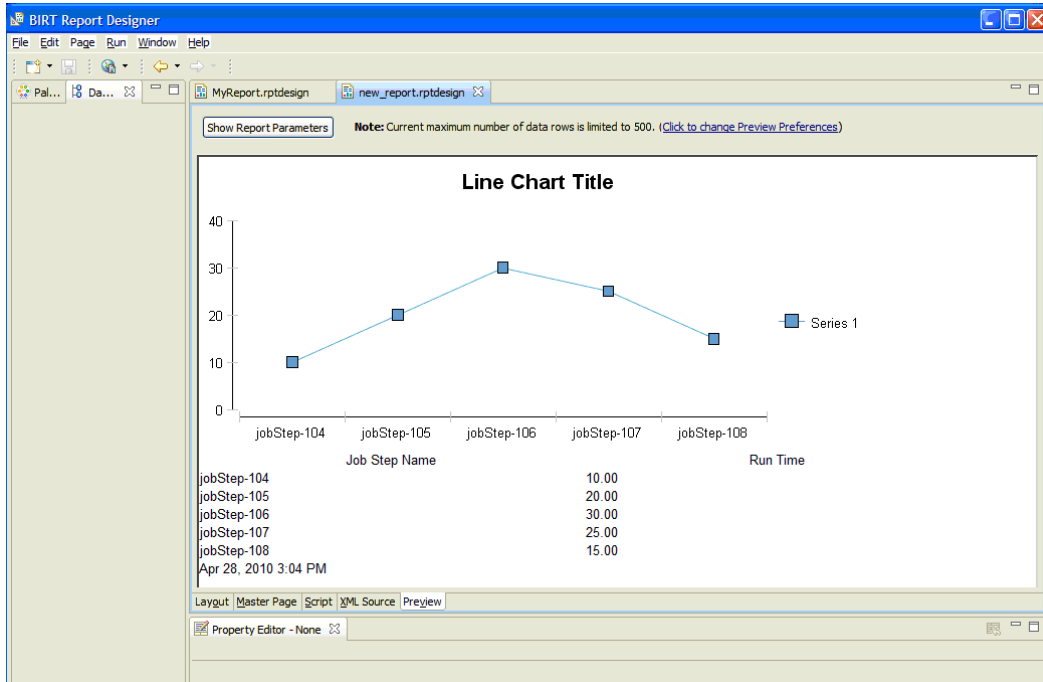


Select Preview to see your report.

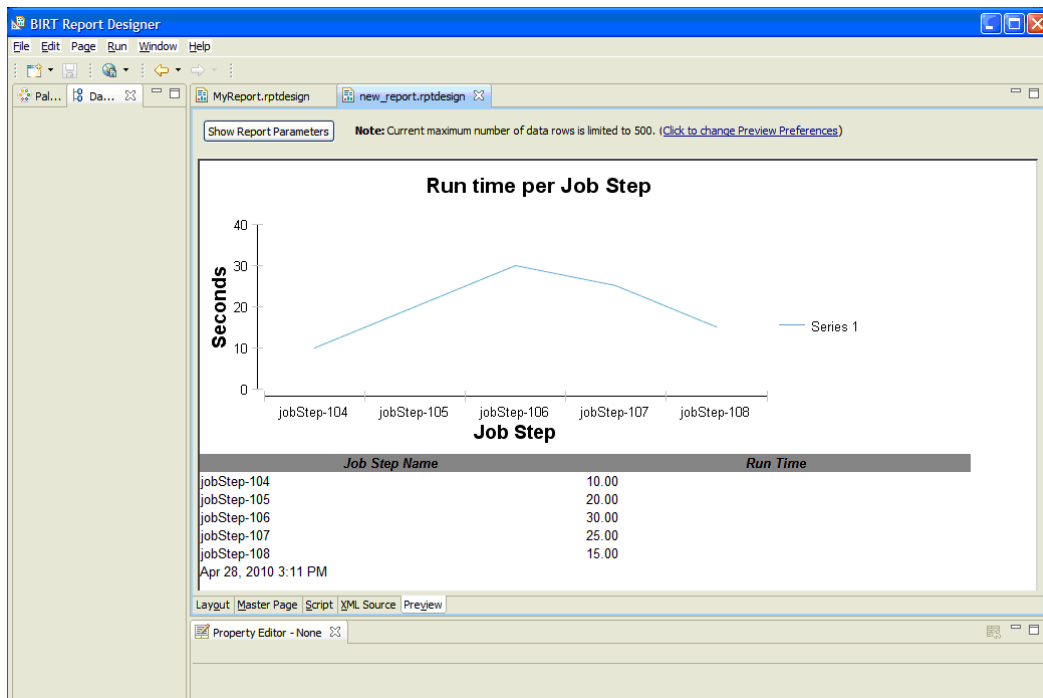
In the "Enter Parameters" dialog, type the location of your ecextract.xml data file.

Click **OK**.





At this point, you can continue to make formatting changes to make your custom report look exactly how you want it to look. Our example report, when finished, looked like the following example::



## Deploy your custom report

If you have not already done so, save your new report design now. We have named our report design "JobStepRunTime.rptdesign".

The new report design needs to be stored in a location accessible to the ElectricFlow Agent that will run the report. As in the previous example, we will use the ElectricFlow plugins directory for this purpose.

- Save the JobStepRunTime.rptdesign file to a new JobStepRunTimeReport directory in the ElectricFlow plugins directory.

The default location of the ElectricFlow plugins directory is:

On Linux: /opt/electriccloud/electriccommander/plugins

On Windows: C:\Documents and Settings\All Users\Application Data\Electric Cloud\ElectricCommander\plugins

Linux example—The following commands will make a copy of the Value Over Time report file components and then rename the files:

```
$ cd /opt/electriccloud/electriccommander/plugins
$ mkdir JobStepRunTimeReport
```

- Now copy the previously saved JobStepRunTime.rptdesign file to the JobStepRunTimeReport directory.
- Make a copy of the RunReport\_ValueOverTime procedure from the EC-Reports plugin that performs the steps to generate a report, including extracting data, running the report design, and registering the report output to appear on the Report tab of the Project Details page. In this example, we will create a Project called "JobStepRunTime" and the procedure we copy will be called "RunReport\_JobStepRunTime".

```
$ ectool createProject JobStepRunTime

$ ectool clone --cloneName /projects/JobStepRunTime/procedures/RunReport_
JobStepRunTime

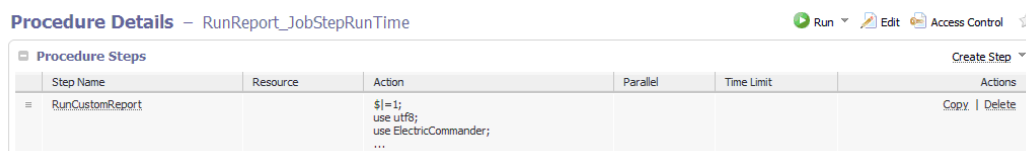
--projectName /plugins/EC-Reports/project --procedureName RunReport_
ValueOverTime

<response requestId="1"

    <cloneName>RunReport_JobStepRunTime</cloneName>

</response>
```

- Edit the "RunReport\_JobStepRunTime" procedure in project "JobStepRunTime" to reference the report design file copied earlier.
- Navigate to project JobStepRunTime, procedure RunReport\_JobStepRunTime and select the RunCustomReport step to edit the Command block:



Find the following line:

```
our $reportDesignFile =
"$pluginDir/agent/reports/ValueOverTime/ValueOverTime.rptdesign";
```

and change it to:

```
our $reportDesignFile = "$ENV{'COMMANDER_PLUGINS'}/
JobStepRunTime/JobStepRunTime.rptdesign";
```

#### Edit Step – RunCustomReport

General	
Name:	RunCustomReport
Description:	
Command	
Command(s):	<pre>our \$reportType = "[%Report Type]"; if (\$reportType eq "") { \$reportType = \$reportTitle; } our \$reportFormat = "html"; #html,sdf,doc,xls our \$reportName = safeFileName("\$reportTitle.\$reportFormat"); our \$artifactsDir = "artifacts"; our \$agentInstallDir = getAgentInstallDir(); our \$pluginDir = "\$ENV{'COMMANDER_PLUGINS'}/[%plugins/EC-Reports/pluginName]"; our \$reportDesignFile = "\$ENV{'COMMANDER_PLUGINS'}/JobStepRunTime/JobStepRunTime.rptdesign"; our \$shrtInstallDir = "\$ENV{'COMMANDER_PLUGINS'}/[%plugins/EC-ReportEngine]/agent"; our \$ecextractXmlFile = safeFileName("ecextract-\$reportType-[%increment /myJob/xmlCounter].xml"); our \$locales = getLocales();</pre>

Click **OK** to save the change.

#### Test your new report

Run the report by running the RunReport\_JobStepRunTime procedure in the JobStepRunTime project. On the Run Procedure page, change the values of the following parameters:

- Object Type => Job Step
- Property Expression => /1000
- Report Title => Job Step Run Time



## Run Procedure – RunReport\_JobStepRunTime

## Parameters

Chart Time Grouping:	Auto
Chart Type:	Line
Chart X-Axis Label:	Date
Chart Y-Axis Label:	Seconds
Credential:	Username: Password:
Locales:	
Object Type:	Job Step
Property:	elapsedTime
Property Expression:	/1000
Property Function:	Average
Report Title:	Job Step Run Time
Report Type:	
Resource:	local
Saved Filter Project:	<input checked="" type="radio"/> Current <input type="radio"/> Browse
Saved Filter Name:	Browse
Table Column Heading Property:	
Table Column Heading Time:	Date
Table Time Grouping:	Auto
Time Period:	Yesterday

Click **Run**.

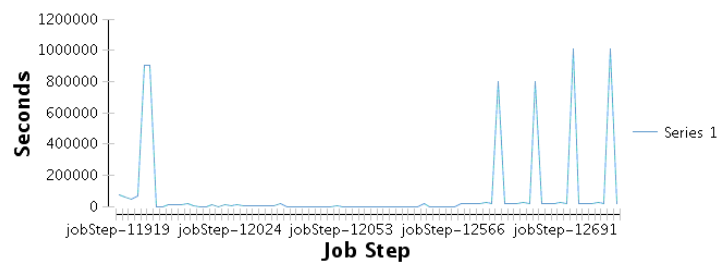
When the job completes, your new report will be available in the Links section of the Job Details page and from the Reports tab in the JobStepRunTime project.

## Project Details – JobStepRunTime

Procedures Schedules Credentials Properties **Reports**

Job Step Run Time

## Run time per Job Step



Job Step Name	Run Time
jobStep-11919	73,519.00
jobStep-11920	63,770.00
jobStep-11922	48,951.00
jobStep-11924	67,912.00
jobStep-11925	906,155.00
jobStep-11926	906,445.00
jobStep-12012	1,770.00
jobStep-12013	684.00
jobStep-12014	12,970.00
jobStep-12015	13,620.00
jobStep-12016	13,831.00
jobStep-12017	19,626.00
jobStep-12018	5,180.00
jobStep-12019	1,236.00
jobStep-12020	1,657.00

## System Health Monitoring

You can also use StatsD and Graphite to generate custom reports for system health monitoring in ElectricFlow. After StatsD and Graphite are enabled, reports about a predefined list of items are generated.

This Help topic does not include instructions to set up StatsD and Graphite. Go to the following sites for documentation and tutorials:

- <https://github.com/etsy/statsd/>
- <http://graphite.readthedocs.org/en/latest/index.html#>
- <https://www.digitalocean.com/community/tutorials/an-introduction-to-tracking-statistics-with-graphite-statsd-and-collectd>
- <https://www.digitalocean.com/community/tutorials/installing-and-configuring-graphite-and-statsd-on-an-ubuntu-12-04-vps>

## Workflow Overview

[Workflow objects](#)

[Access Control](#)

[Property Search Paths](#)

[Parameters](#)

[Sending Notifications](#)

[Workflow logs](#)

[A Workflow Tutorial](#)

Use a Workflow to design and manage processes at a higher level than individual jobs. Workflows allow you to combine procedures into processes to create build-test-deploy lifecycles (for example). A workflow contains *states* and *transitions* you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small lifecycle combinations to meet your needs.

**Some benefits of defining a workflow include**

- **Manual intervention** - workflows make it easy to introduce manual decision points into your process. With workflows, you can enable specific users or groups to choose how the workflow should proceed. Using an email notification, you can notify one or more users about the workflow status. If the workflow is waiting for someone to manually intervene, an email (including a screen link) can provide immediate attention and access to choices for how the workflow should proceed.
- **Aggregation**—Workflows allow you to collect information from a set of related jobs into a single location. A workflow can act as a central place to monitor the full lifecycle of your build, test, and deploy process.

- **Looping**—Workflows provide the native ability to run a job more than once. You have full control over the loop condition—you can re-run the job any number of times, only re-run the job if it did not succeed, or make this decision based on a custom job property.
- **Branching**—Workflows allow you to run multiple jobs in parallel and wait for them to complete before moving to the next state in the workflow. If you combine branching with looping, you can re-run these jobs based on a condition you defined (for example, only re-run jobs that failed).
- **Multipathed**—Design a workflow to take multiple paths automatically, depending on the outcome of each state's action, and the pre- and post-triggers you defined for each state.

### Basic workflow concepts

Workflows contain states—one or more states can be designated as "starting" states to provide multiple entry points into the workflow. When a workflow is launched, a starting state is specified. You may prefer to design a complex or multi-purpose workflow so you can start the workflow at a different state to complete only a portion of the workflow for a particular outcome. For example, you might choose to run only the test suite workflow section.

As each state in a workflow becomes active, it performs an *action*. The state's action can be to create a job from a procedure or to start a workflow from a workflow definition. When the job or called workflow completes, "On Completion" transitions are evaluated to see if the workflow should change to a different state, possibly based on the outcome of the action.

You can create as many state definitions as you need. For example, you might have a small workflow definition with only 5 states, calling 5 procedures, or you might create 50-100 or more states to process a like-number of procedures from multiple projects.

A state can send email notifications before or after an action to notify interested users about workflow progress or to request manual user intervention to move the workflow to the next state.

Transitions are used to move workflow progress from one state to another state. Four types of transitions are available to move a workflow to the next state:

**On Enter** —Evaluates before sending email notifiers or starting the action

**On Start** —Evaluates immediately after starting the action. These transitions are ignored if no action is specified for the source state.

**On Completion** —Evaluates when the action completes. These transitions are ignored if no action is specified for the source state.

On Completion transitions are taken only if the state is still active when the action completes. These transitions are ignored if the workflow has transitioned to another state.

**Manual** —Evaluates when a user selects the transition in the UI and specifies parameters. The same action can occur using ectool or the Perl API by calling `transitionWorkflow`. Only users who have "execute" permission on the transition are allowed to use the manual transition.

Similar to other objects in the ElectricFlow system, workflow objects can contain access control privileges, properties, and parameters.

## Workflow objects

Workflow objects are split into two types: **Definition** objects and **Instance** objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.

When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.

**Note:** We omit the "Instance" qualifier for brevity in the API and the UI.

## Workflow Definition

This is the top-level workflow object, which is a container for states, and transitions, and other information defining your workflow. In the same way a procedure defines the behavior of a job, the workflow definition defines the behavior of a workflow.

Create a project to get started:

1. Select the Projects tab, then click the **Create Project** link. After creating a project, its name will appear in the table on the Projects page.
2. Select your project name to go to its Project Details page, select the Workflow Definitions subtab, then select the **Create Workflow Definition** link.
3. On the New Workflow Definition page, name your workflow definition. Access the **Help** link on that page if you need help creating the Workflow Name Template (similar to the Job Name Template). Click **Save**.
4. Now, on the Workflow Definition Details page (Graph view), you are ready to create the first state for your workflow.

For an example of how this page might look as you add states and transitions to your workflow definition, see [Workflow Definition Details](#) for details about the Workflow Definition Details page. Notice also that you can add properties to the workflow definition at this point.

## State Definition

Each workflow can contain one or more states. Defining states for a workflow is analogous to defining steps for a procedure.

You might choose to name your states for their intended purpose (for example: waiting for user, building, testing, or test1, test2, and so on) just as you might name steps for your procedure. You can define multiple states as "startable" so you can choose different starting points when you begin using the workflow. By default, the first defined state is always "startable".

As you create states, they will be displayed in the graph on the Workflow Definition Details page. Selecting a state in the Graph view opens the State Definition panel to define:

- Action to perform
- Parameters required by the action
- Transitions
- Parameters

- Email notifiers
- Properties that you want to assign

## Transition Definition

Each state can contain one or more transitions. The transition definition requires a name for the transition. This transition name will appear on the Workflow Definition Details graph and the Workflow Definition Details List view.

You can define one or more transitions for each state. When defining a transition, you can:

- Add a text description for your reference
- Select the "target" state
- Select the type of transition trigger you want to use (On Enter, On Start, On Completion, or Manual)  
See the [Workflow Definition Details](#) Help topic for trigger type definitions and other information for defining a transition
- Select (or enter) a Condition to specify when the transition is allowed to trigger
- Assign parameters to a transition. These parameters are passed to the target state

## Workflow

While we generically refer to or think of a "workflow" as an automated process to perform multiple tasks, it is actually the end result of running a Workflow Definition. Running a Workflow Definition produces a Workflow, which is analogous to running a Procedure, which produces a Job.

After you start running Workflow Definitions, select the main Workflow tab to see all workflows that ran (or are still running) listed in a table, each linked to its own Workflow Details page. The Workflow Details page main view is a graphical representation of the workflow, and also provides links to stop the workflow process, run the workflow again, see the workflow log, and so on.

A Workflow contains a pointer to:

- Its workflow definition
- Sets of states and their transitions
- The current and initial state
- Parameters to the initial state
- A "complete" value to specify whether or not the workflow is complete
- A log containing transitions taken and user events

## State

The run-time instance of a State Definition is a State. The state is part of a workflow and contains information about actual parameter values specified by the user when the workflow was run or from transitions taken to enter the state.

If the state has an *action*, then the state contains information about the most recently created job or workflow. Because a state may be entered multiple times, the state contains a copy of the state definition properties needed to launch the action again.

**Note:** After the state is created, it no longer depends on the state definition, so any changes made to the definition will not affect workflows already running. Changes do not take effect until the next time the workflow runs.

## Transition

The run-time instance of a Transition Definition is a Transition. The transition is part of a state and contains a copy of information from the transition definition. Each transition object corresponds to a transition definition, but once defined, each transition is recognized by its unique name. A transition contains unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry, the Javascript condition, and the trigger type instructing the transition when to occur.

**Note:** After the transition is created, it no longer depends on the transition definition, so any changes made to the definition will not affect workflows already running. Changes do not take effect until the next time the workflow runs.

A transition moves the workflow from its state to a *target* state.

## Access Control

Setting access control privileges for those persons who can or cannot run a workflow or execute a manual transition may relate to security policies in your organization.

Specific workflow access control notes:

- All workflow, state, and transition ACLs are copied from the definition object to their corresponding instance when the workflow is run initially.
- To run a workflow, you must have execute permission on the state definition you are using to start the workflow.
- To take a manual transition, you need execute permission on that transition.
- To strictly control who can take a manual transition:  
Grant read and modify privileges to anyone who can view or edit the workflow, but only give execute permission to those users or groups who can take the manual transition.
- You can control who can start each of the startable states by setting ACLs on state definitions accordingly.

For more information about access control, including examples you might use, see the [Access Control](#) Help topic.

## Property Search Paths

A workflow serves as a hub of information that can be shared between states, transitions, jobs, and other workflows. Depending on the context, an implicit search path is used to reference a property by name. Using a simple property name like `$(someCustomProperty)` “walks” down the following paths until it finds a property by that name. If the search fails to find a property, an error is produced.

The search path followed to resolve a simple property name depends on where the reference occurs.

### Transition context

1. Transition property sheet
2. State property sheet—Includes parameter values passed to that state and any custom properties. Because a state can be entered multiple times, parameter values are available for the most recent entry only.
3. Starting state property sheet—Used to get to parameter values for the initial entry into the workflow.
4. Workflow property sheet—Used to access information shared across the workflow.

### State context

1. State property sheet—Includes parameter values passed to that state and any custom properties. Because a state can be entered multiple times, parameter values are available only for the most recent entry.
2. Starting state property sheet—Used to get to parameter values for the initial entry into the workflow.
3. Workflow property sheet—Used to access information shared across the workflow.

For information on context-relative property path shortcuts that allow passing information from one object to another or accessing a property from different parts of the workflow, review the [Properties](#) Help topic. The Properties Help topic also includes all intrinsic workflow-related properties.

## Parameters

States may use formal parameters to determine what information to provide when the workflow enters that state. Parameter values can come from the initial run workflow call or from a subsequent transition into the state.

An automatic transition must specify all values required by the target state. A manual transition may omit some values to be passed to its target state. If a manual transition does not specify all values needed by the target state, then any missing values are collected from the user when the transition is taken.

Parameters to the starting state for the workflow are collected when the workflow is launched. These parameters are accessible throughout the workflow and act like global workflow parameters. See the [Property Search Paths](#) section above.

It is important to distinguish between formal parameters on a state and formal parameters on the action the state calls (procedure or workflow starting state). The procedure (or workflow) may have its own parameters, so the state is responsible for entering required actual parameter values. In some cases, values may be static values, in other cases the values may come from the state's parameters or those of the starting state (for example, global workflow parameters).

Parameters on the calling state do not need to be the same as the parameters on the action:

- A state parameter value can be passed as the value for an action's parameter by specifying a property reference in the value field on the Action tab for the state definition.
- All parameters on workflow current and starting states are accessible with a simple property reference (for example, '\$[param1]')
- Parameters on a workflow starting state act like global workflow parameters because they are available everywhere within the workflow.

## Sending Notifications

A state can be defined to send email notifications when it is entered, when it starts its action, and/or when the action completes. Notifiers are created by visiting the Notifications tab on the State Definition panel. See the [Email Notifier](#) Help topic for details on defining email notifiers. Sample notifier templates are provided also.

## Workflow Logs

Each workflow keeps a log of events that relate to the workflow. The log contains information about the evaluation of transition conditions, transitions taken, actions started, and other information that might prove useful when debugging a workflow. Access the log by clicking the **View Log** link on the Workflow Details page.

**For more information**, click [here](#) to go to the Workflow Log Help topic, which contains a screen example of the Workflow Log page.

## Visualizing a Workflow

Two Workflow web pages, Workflow Definition Details and Workflow Details, open to the Graph view.

- Workflow Definition Details page—As you build your workflow, you can see a visual representation of state and transition definitions you define.
- Workflow Details page—Displays a graph, updated in real-time, for your running or completed workflow.

Your workflow Graph (on either page) contains context-sensitive links to various options. Options are different depending on whether or not you are building or running your workflow. Workflow Definition Details and Workflow Details Help topics include information about the context-sensitive link options provided within the workflow graph.

The next section, "Building a Workflow—Tutorial," begins with a "sketched" representation of the workflow the tutorial will create. At the end of the tutorial, see the actual workflow graph created by the ElectricFlow workflow process.

## Building a Workflow—a Tutorial

This overview tutorial is an example of how to create a "build-test-approve" workflow, building each state and transition we want the workflow to include, and building the workflow in the order we need to use to achieve our purpose. The diagram below outlines our workflow process.

You can read through the tutorial or actually recreate this example workflow on your machine. If you want to use this tutorial as a real, working example, you must do some initial setup first:

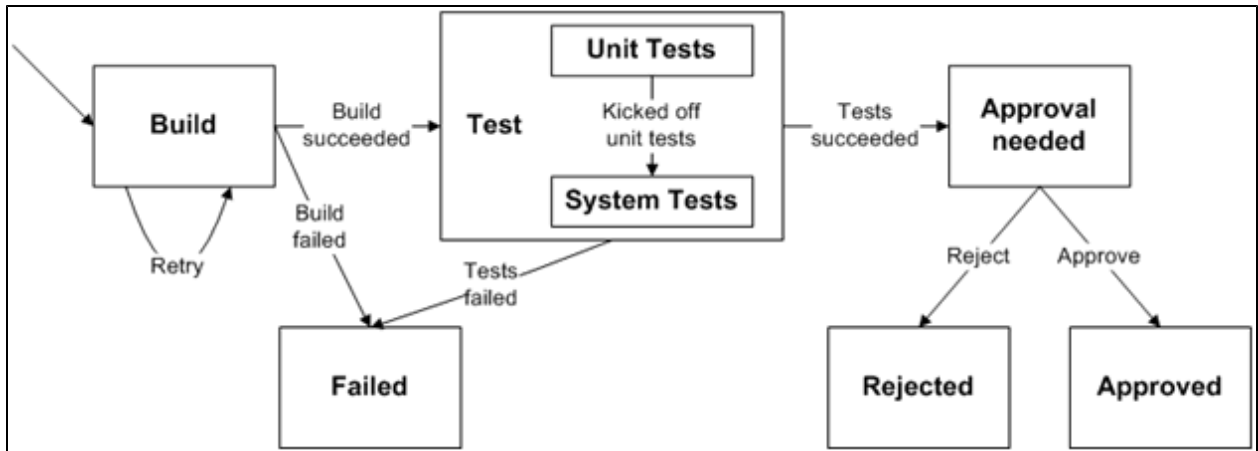
1. Create a project named "Sample"
2. Create a procedure name "BuildProduct"
3. On the "BuildProduct" procedure, add a parameter named "branch"

The following diagram shows the workflow that you will build:

- The starting state is *Build*, which could transition to the *Test* state or the *Failed* state
- Two test states—*Unit Tests* and *System Tests*, which could transition to a *Failed* state or an *Approval needed* state
- The *Approval needed* state could transition to one of two states—*Rejected* or *Approved*



- All transitions are represented by the lines between the states, which include "arrows" to show the possible workflow directions (depending on the outcome of each state's action)

**Best Practice tip**

Designing your workflow on paper or whiteboard, creating your own state and transition diagram, is a great way to organize your thoughts and map your workflow process.

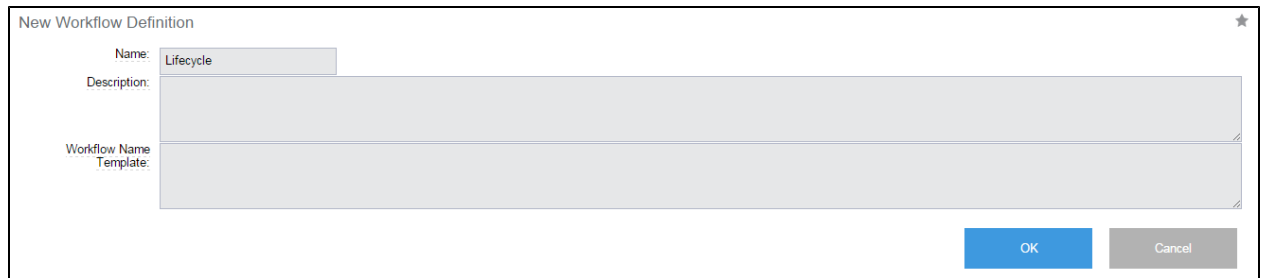
**A summary of the component sections to build our workflow:**

- [Calling a job from within a workflow](#)
- [Collecting a parameter when a workflow is launched and passing its value to a job](#)
- [Retrying a state](#)
- [Automatically transitioning to different states based on the outcome of a job](#)
- [Invoking another subworkflow](#)
- [Running jobs in parallel](#)
- [Automatically transitioning to different states based on the outcome of jobs in a workflow](#)
- [Waiting for manual intervention](#)
- [Restricting who can take a manual transition](#)
- [Sending email notifiers](#)
- [Adding a global parameter to use later in the workflow](#)
- [Setting the name of your workflow](#)
- [Workflow list](#)

**To begin calling a job from within a workflow**

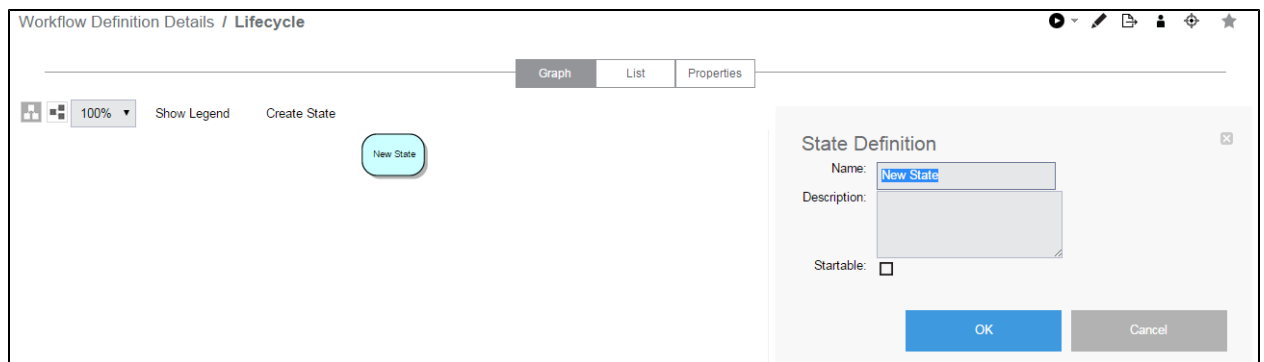
Or, running a job by calling its procedure from a workflow state.

1. Select the Projects tab, select the Sample project to go to the Project Details page, then select the Workflow Definitions subtab.
2. Click the **Create Workflow Definition** link to go to the New Workflow Definition page.
3. Create a new Workflow Definition named *Lifecycle*.



The 'New Workflow Definition' form is shown. It has a title bar with a star icon. The form contains three input fields: 'Name' with the value 'Lifecycle', 'Description' (empty), and 'Workflow Name Template' (empty). At the bottom right, there are 'OK' and 'Cancel' buttons.

Because the workflow definition, *Lifecycle*, is a new definition and does not have any state or transition definitions, the State Definition panel opens, ready for you to create a new state definition for your workflow.



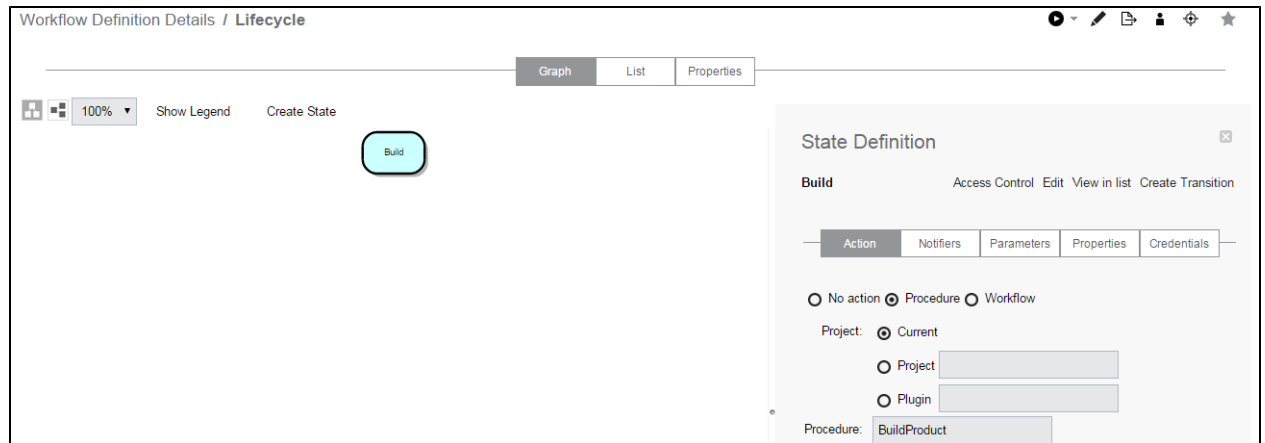
The 'Workflow Definition Details / Lifecycle' page is shown. It has a title bar with a star icon. The page has a tabbed interface with 'Graph', 'List', and 'Properties' tabs. The 'Graph' tab is active. On the left, there is a '100%' zoom dropdown, 'Show Legend', and 'Create State' buttons. A 'New State' button is visible. On the right, the 'State Definition' panel is open, showing a form with 'Name' (New State), 'Description' (empty), and 'Startable' (checkbox). At the bottom right of the panel are 'OK' and 'Cancel' buttons.



You can use the DSL Export ( ) button to download the objects as a DSL file.

4. Change the system-generated state Name to *Build* and click **OK**.

The State Definition panel is displayed.



5. Specify the Action for this state, which is Procedure.  
In this example, the procedure *BuildProduct* already exists with a single parameter named *branch*.
6. Set the value of this parameter to "3.0".

The *Build* state now has an Action associated with it.

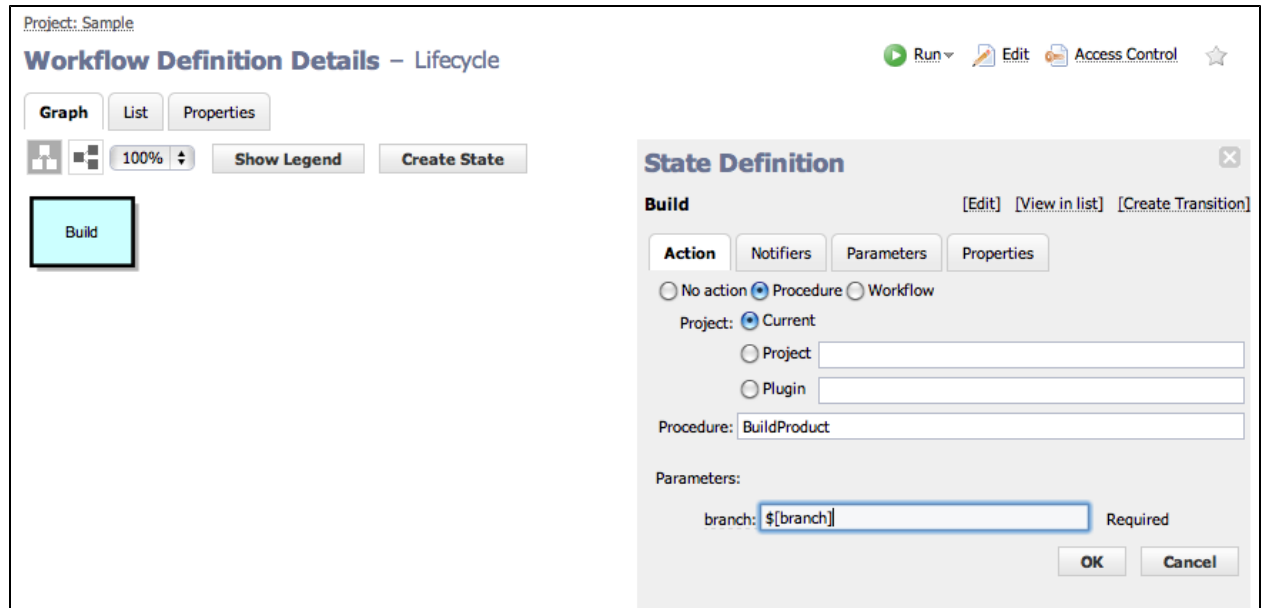
7. Click **OK**.  
Note the shape of this state in the graph. The state shape will be different depending on the state Action selected.
8. Click **Run** to launch the workflow.
  - Running the workflow shows a Job was launched by the *Build* state. The workflow job completed successfully, indicated by the "check mark" on the state.
  - You can get more details about the job by clicking on the *Build* state, which opens the State Details panel, and clicking on the Job link displays the Job Details page.
  - Alternately, clicking on the Show History button opens the History panel to show what ran and the workflow outcome.

### Collecting a parameter when a workflow is launched and passing its value to a job

Or, "prompting" for a parameter value when a workflow is launched and passing its value to a procedure.

1. Return to the Workflow Definition page for the **Lifecycle** workflow.
2. Click the *Build* state (from the graph) to open the State Definition panel, then select the Parameters tab.
3. Click the **Create Parameter** link to display the New Parameter page.
4. Create a parameter called "branch".
5. Add a description and make sure the Required? box is "checked" and click **OK**.

- On the Workflow Definition Details page again, change the value passed to the job from 3.0 to `${branch}`.



- Now, when the workflow is launched, you will be prompted for the value of *branch* and you can specify a different value if necessary.

For example, a "3.5" value is now specified in the screen below. The value is passed to the job when the workflow is launched.

### Retrying a state

If a State fails (technically, the job started by the workflow state), you may choose to retry it a few times before giving up.

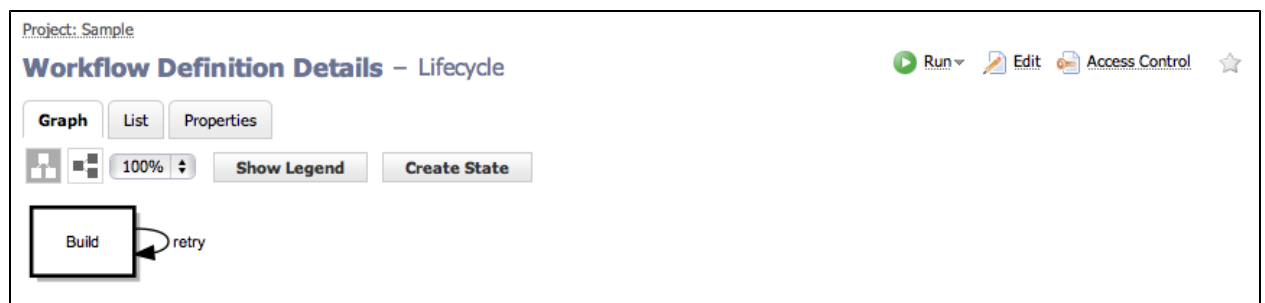
- Right-click on the *Build* state and select the **Create Transition** link to create a new transition from the *Build* state back to itself.
- Create a new On Completion transition named "retry" from the *Build* state that returns to the same state when the job fails.

3. Add a limit of 3 retries by using the following JavaScript condition:

```
$[/javascript mySubjob.outcome == "error" && myState.getProperty('/increment  
numberOfRetries') < 3; ]
```

The screenshot shows the 'Workflow Definition Details - Lifecycle' page. On the left, the 'Graph' tab is active, displaying a single state named 'Build'. On the right, the 'Transition Definition' dialog is open. The dialog fields are: Name: 'retry', Description: 'Retry if the Build state fails', Target State: 'Build', Trigger: 'On Completion', and Condition: 'Custom'. The custom condition is set to the JavaScript code: `$[/javascript mySubjob.outcome == "error" && myState.getProperty("/increment numberOfRetries") < 3; ]`. The 'OK' button is highlighted.

The new transition is displayed on the Workflow Definition Details page.



4. When we run the workflow, we see only the last job that was run.

Project: Sample

### Workflow Details – workflow\_82\_201204251214

Run Again Delete View Log Access Control

**Final State**  
**Build**  
Subjob: job\_14211\_201204251214

**General Information**  
Project: Sample  
Workflow Definition: Lifecycle

Graph States Parameters Properties

100% Show Legend Show History

5. Clicking the States tab and then the **Show All** link displays all jobs that were invoked by the *Build* state.

Project: Sample

### Workflow Details – workflow\_82\_201204251214

Run Again Delete View Log Access Control

**Final State**  
**Build**  
Subjob: job\_14211\_201204251214

**General Information**  
Project: Sample  
Workflow Definition: Lifecycle

Graph **States** Parameters Properties

State Name	Action
Build	job_14211_201204251214 <a href="#">[Show All]</a>

On this screen, you can see the build was attempted 3 times because that was the limit we specified in the JavaScript condition for the "retry" transition.

### Job Search Results

3 Results for "callingStateId" equals "282"

New Search | Save Filter | Edit Search | Refresh Search

Job	Status	Priority	Procedure	Launched By	Elapsed Time	Start Time	Actions
job_14211_201204251214	Error	normal	Sample:BuildProduct	workflow_82_201204251214: Build	00:00:00.453	2012-04-25 12:14:18 PDT	Delete
job_14210_201204251214	Error	normal	Sample:BuildProduct	workflow_82_201204251214: Build	00:00:00.613	2012-04-25 12:14:17 PDT	Delete
job_14209_201204251214	Error	normal	Sample:BuildProduct	workflow_82_201204251214: Build	00:00:00.539	2012-04-25 12:14:17 PDT	Delete

Records per page: 20 1 thru 3 of 3

Also, you can see the number of times a state was visited and which transitions were taken by clicking the **Show History** button.

## Automatically transitioning to different states based on the outcome of a job

If the *Build* job fails, we might want to end the workflow. If the job succeeds, we might want to continue to the next stages of the workflow. In this section, you add new states to transition to, depending on the outcome of the job.

1. Create the *Test* state where the workflow will transition to when the build state succeeds.
2. Create a *Failed* state.

The screenshot shows the 'Workflow Definition Details - Lifecycle' interface. On the left, a graph shows three states: 'Build' (a rectangle), 'Test' (an oval), and 'Failed' (a light blue oval). A 'retry' arrow points from 'Build' back to itself. On the right, the 'State Definition' dialog is open for the 'Failed' state. It has a 'Name' field with 'Failed', a 'Description' field with 'An error occurred while the workflow was running', and a 'Startable' checkbox which is unchecked. 'OK' and 'Cancel' buttons are at the bottom.

3. Create an On Completion transition from *Build* to *Test* when the job succeeds.

Notice that the Condition dropdown menu provides a template condition called *Job success* that can be used here.

The screenshot shows the 'Workflow Definition Details - Lifecycle' interface. On the left, the graph shows the 'Build' state highlighted in pink. On the right, the 'Transition Definition' dialog is open. It has a 'Name' field with 'Build succeeded', an empty 'Description' field, a 'Target State' dropdown set to 'Test', a 'Trigger' dropdown set to 'On Completion', and a 'Condition' dropdown set to 'Job success'. Below the dropdown is a text area containing the JavaScript condition: `$/javascript mySubjob.outcome == "success";`. 'OK' and 'Cancel' buttons are at the bottom.

4. Create an On Completion transition from *Build* to *Failed* when the job fails.

Notice that the Condition field remains blank. Because transitions are evaluated in order, if the workflow gets to this transition, we will know that the "success" case will be false. Leaving the Condition field "Always" allows us to handle all "non-successful" outcomes (error or warning).

The screenshot shows the 'Workflow Definition Details - Lifecycle' interface for 'Project: Sample'. The 'Graph' tab is active, displaying a workflow diagram with a 'Build' state (rectangle) and two outgoing transitions: 'Build succeeded' leading to a 'Test' state (rounded rectangle) and 'Build failed' leading to a 'Failed' state (rounded rectangle). A 'retry' arrow loops back from the 'Failed' state to the 'Build' state. On the right, the 'Transition Definition' panel for 'Build failed' is open, showing: Source: Build, Target: Failed, Trigger: On Completion, and Condition: Always. The 'Parameters' tab is also visible, indicating 'This object has no formal parameters.' Buttons for 'Run', 'Edit', 'Access Control', and 'Show Legend' are at the top.

When you run the workflow, if the build succeeds the workflow will end up in the *Test* state, as in the example below.

The screenshot shows the 'Workflow Details - workflow\_86\_201204251226' interface for 'Project: Sample'. The 'Final State' is 'Test', indicated by a blue checkmark icon. The 'General Information' section shows 'Project: Sample' and 'Workflow Definition: Lifecycle'. The 'Graph' tab is active, displaying the same workflow diagram as before, but the 'Build' state is now highlighted with a green checkmark, indicating it has completed successfully. The 'Test' state is also highlighted with a green background. Buttons for 'Run Again', 'Delete', 'View Log', and 'Access Control' are at the top.


The workflow will end up in the *Failed* state if the build fails after trying three times. (In this example, we show the Workflow History panel open.)



Project: Sample

## Workflow Details – workflow\_87

[Run Again](#) [Delete](#) [View Log](#) [Access Control](#)

**Final State**

**Failed**

**General Information**



Project: Sample  
Workflow Definition: [Lifecycle](#)

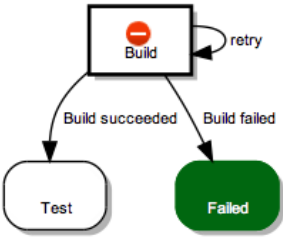
Graph

States

Parameters











Properties

 100% [Show Legend](#) [Hide History](#)



```
graph TD; Build[Build] -- retry --> Build; Build -- "Build succeeded" --> Test[Test]; Build -- "Build failed" --> Failed[Failed];
```

### History

	Build	 <a href="#">job_14240_201204251227</a>
	retry	
	Build	 <a href="#">job_14241_201204251227</a>
	retry	
	Build	 <a href="#">job_14242_201204251228</a>
	Build failed	
	Failed	

### Invoking another workflow

Just as a state can invoke a job as its “Action”, it can invoke another workflow, which then becomes its subworkflow.

1. From the Workflow Definition Details page for *Lifecycle*, click on the *Test* state in the graph.

2. Specify the “Action” for the Test state, which is a Workflow.

In this example, the workflow *AutomaticTests* already exists and so does a state called *UnitTests*, which has a single required parameter called *buildName*. We can get the name of the build from the *Build* state by using the property path

```
$/myWorkflow/states/Build/subjob/jobName].
```

The screenshot displays the 'Workflow Definition Details - Lifecycle' interface. On the left, a state graph shows a 'Build' state (rectangle) with a 'retry' loop. Transitions from 'Build' lead to 'Test' (light blue rectangle) labeled 'Build succeeded' and to 'Failed' (oval) labeled 'Build failed'. On the right, the 'State Definition' dialog for the 'Test' state is open. It shows the 'Action' tab with 'Workflow' selected. The 'Project' is 'Current', the 'Workflow' is 'Automatic Tests', and the 'Starting State' is 'UnitTests'. The 'Parameters' section shows 'buildName' with the value '\$/myWorkflow/states/Build/subjob/jobName'.

The *Test* state now has an Action associated with it. Because the *Test* state Action is Workflow, the object shape in the graph has changed.

Project: Sample

## Workflow Details – workflow\_95\_

Run Again ▾ Delete View Log Access Control

**Final State**

**Test**

Subworkflow: [workflow\\_96\\_201204251240 : System tests](#)

**General Information**

Project: Sample

Workflow Definition: [Lifecycle](#)

Graph States Parameters Properties

100% ▾ Show Legend Hide History

```

graph TD
    Build[Build] -- retry --> Build
    Build -- "Build succeeded" --> Test[Test]
    Build -- "Build failed" --> Failed[Failed]
  
```

**History**

Build	job_14276_201204251240
Build succeeded	
Test	workflow_96_201204251240 : System tests

Running the workflow shows another workflow was launched by the *Test* state.

- Click on the workflow link in the History panel to see more details about that workflow.

### Running jobs in parallel

Run multiple jobs at the same time.

- Look at the *AutomaticTests* workflow that was invoked (in the previous example) by the *Test* state in our main *Lifecycle* workflow. The first state in this workflow runs unit tests, and when the tests complete, the state automatically transitions to the second state that runs system tests.

Project: Sample

## Workflow Definition Details – Automatic Tests

Run ▾ Edit Access Control

Graph List Properties

100% ▾ Show Legend Create State

```

graph TD
    UnitTests[UnitTests] -- "Done unit testing" --> SystemTests[System tests]
  
```

**Transition Definition**

**Done unit testing** [Edit] [View in list]

No Description

Source: [UnitTests](#)

Target: [System tests](#)

Trigger: On Completion

Condition: Always

**Parameters** Properties

This object has no formal parameters.

OK Cancel

Now we will change the behavior of the transition to move from the *Unit tests* state to the *System tests* state as soon as the first job is launched.

2. Edit the existing transition by renaming it to *Kicked off unit tests* and changing it to an On Start trigger type.

Project: Sample

### Workflow Definition Details – Automatic Tests

Run Edit Access Control

Graph List Properties

100% Show Legend Create State

UnitTests

Done unit testing

System tests

#### Transition Definition

Name: Kicked off unit tests

Description:

Target State: System tests

Trigger: On Start

Condition: Always

OK Cancel

Now, when the *AutomaticTests* workflow is launched, both jobs will run in parallel. The workflow completes automatically when both jobs complete, as in the example below.

Project: Sample

### Workflow Details – workflow\_93\_

Run Again Stop Workflow Delete View Log Access Control Stop Refresh

#### Active State

System tests

Subjob: system-test-14267

#### General Information

Project: Sample

Workflow Definition: Automatic Tests

Graph States Parameters Properties

100% Show Legend Hide History

UnitTests

Kicked off unit tests

System tests

#### History

UnitTests	unit-test-14266
Kicked off unit tests	
System tests	system-test-14267

### Automatically transitioning to different states based on the outcome of jobs in another workflow

If the jobs in the *Test* workflow fail, we will want the workflow to end. If the jobs succeed, we will want to continue to the next stages of a calling workflow.

1. Click the **Create State** link.
2. Create the *Approval needed* state that the workflow will transition to when tests succeed.

3. Create a transition named "Tests succeeded" from *Test* to *Approval needed* when all jobs in the workflow succeed.  
(Right-click on the *Test* state to create the transition.)

The following JavaScript condition checks the outcome of all subjobs for a subworkflow and evaluates to "true"

only if they all succeeded:

```
$/javascript
    var success = "1";

    for (var stateName in mySubworkflow.states) {

        var subjob = mySubworkflow.states[stateName].subjob;

        if (subjob !=null && subjob.outcome != "success") {

            success = "0";

            break;

        }

    }

    success;

}
```

The screenshot shows the 'Workflow Definition Details - Lifecycle' interface. On the left, a state transition diagram shows a 'Build' state with a 'retry' loop, leading to 'Test' (labeled 'Build succeeded') and 'Failed' (labeled 'Build failed'). From 'Test', a transition labeled 'Tests succeeded' leads to 'Approval needed'. On the right, the 'Transition Definition' dialog is open for the 'Tests succeeded' transition. It shows the target state as 'Approval needed', the trigger as 'On Completion', and a custom JavaScript condition that checks if all subjobs in the subworkflow have succeeded.

**Workflow Definition Details - Lifecycle**

Graph | List | Properties

100% | Show Legend | Create State

**Transition Definition**

Name: Tests succeeded

Description: Tests from the sub-workflow have completed with success

Target State: Approval needed

Trigger: On Completion

Condition: Custom

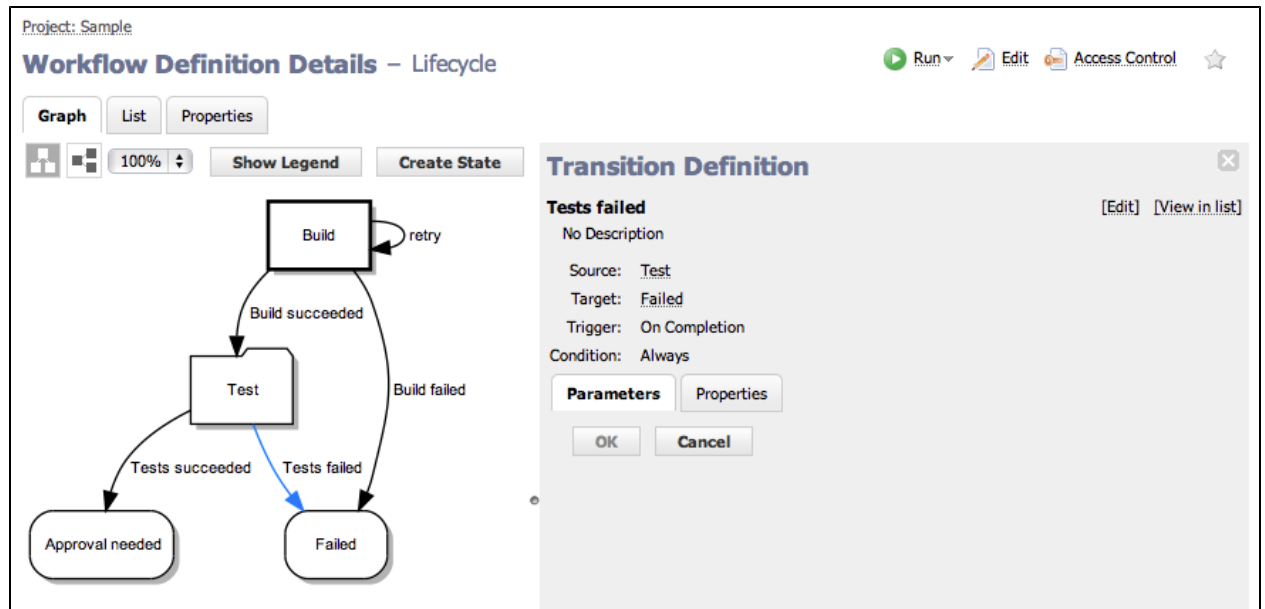
```
$/javascript
var success = "1";
for (var stateName in mySubworkflow.states) {
    var subjob = mySubworkflow.states[stateName].subjob;
    if (subjob !=null && subjob.outcome != "success") {
        success = "0";
        break;
    }
}
success;
}
```

OK Cancel

Note that we created the *Approval needed* state first, then we created the *Tests succeeded* transition to connect the two states.

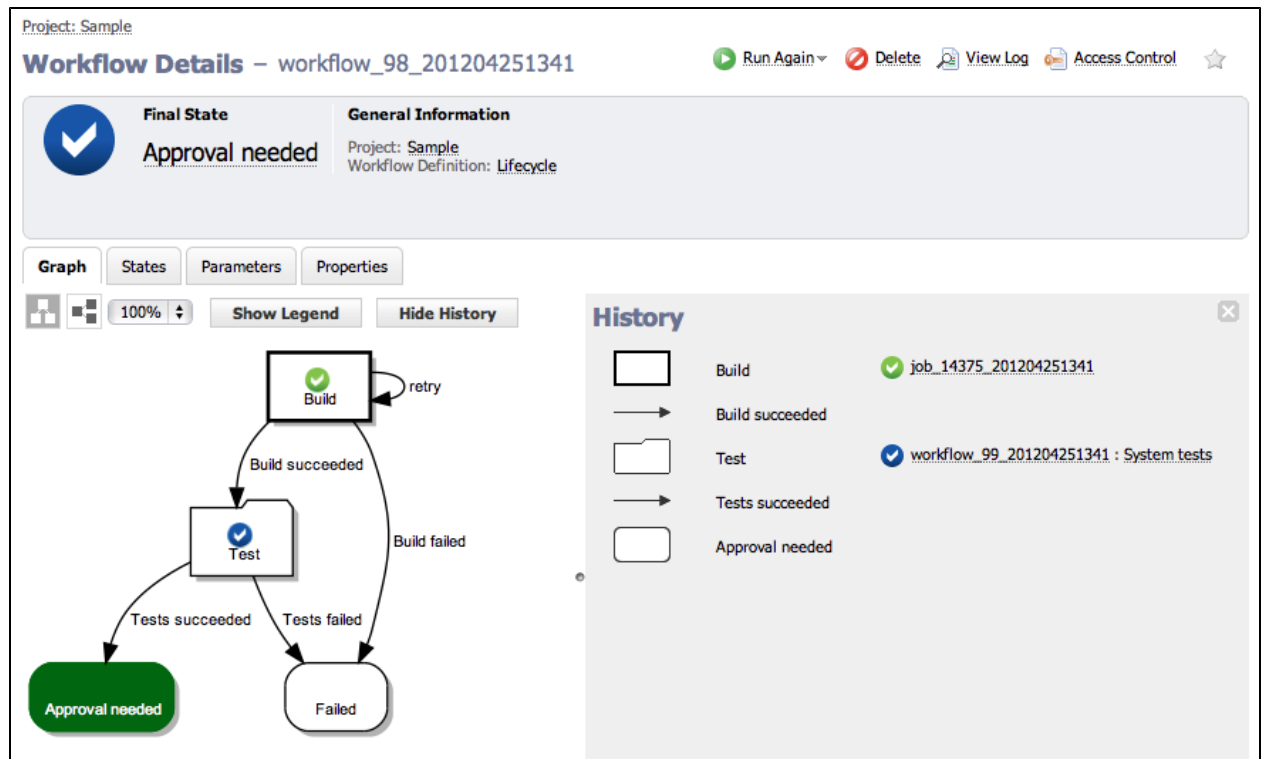
4. Create a transition from the *Test* to the *Failed* state when either of the jobs in the workflow fails.

Notice the Condition field remains blank. Because transitions are evaluated in order, if the workflow gets to this transition we know the success case was "false".



When you run the workflow, if the test jobs succeed, the workflow will end up in the *Approval needed* state.





In the following example, one of the tests in the *Test* workflow encountered an error, so the workflow will end up in the *Failed* state if either of the test jobs fail.

Project: Sample

## Workflow Details – workflow\_100\_201204251344

Run Again Delete View Log Access Control

**Final State**  
**Failed**

**General Information**  
 Project: Sample  
 Workflow Definition: Lifecycle

Graph States Parameters Properties

100% Show Legend Hide History

History

Step	Status	Job ID
Build	Build succeeded	job_14378_201204251344
Test	Tests failed	workflow_101_201204251344 : System tests
Failed	Failed	

The "blue checkmark" indicates the workflow (or subworkflow) has completed, which means it is no longer running. This icon does *not* indicate the workflow outcome (completed successfully or with warnings or errors).

To see exactly what happened in the workflow, you can "drill-down" by clicking on the workflow link shown in the History panel.

Project: Sample

## Workflow Details – workflow\_101\_201204251344

Run Again Delete View Log Access Control

**Final State**  
**System tests**

**General Information**  
 Project: Sample  
 Workflow Definition: Automatic Tests

Subjob: system-test-14380  
Calling State: workflow\_100\_201204251344 : Test

Graph States Parameters Properties

100% Show Legend Hide History

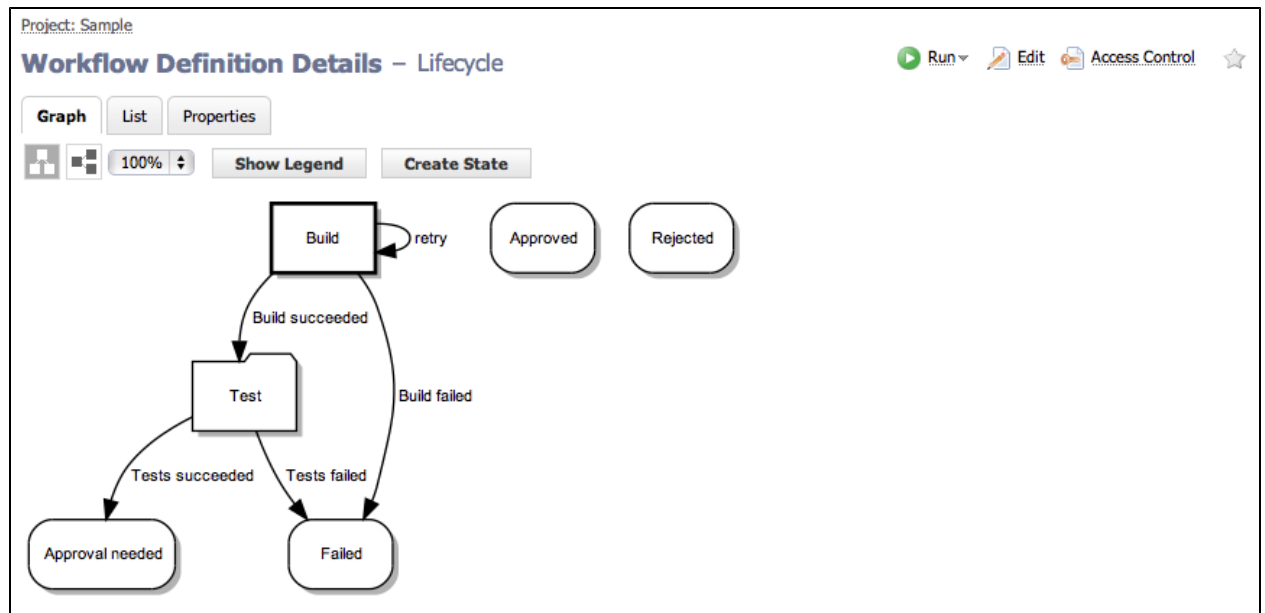
History

Step	Status	Job ID
UnitTests	Kicked off unit tests	unit-test-14379
System tests	System tests	system-test-14380

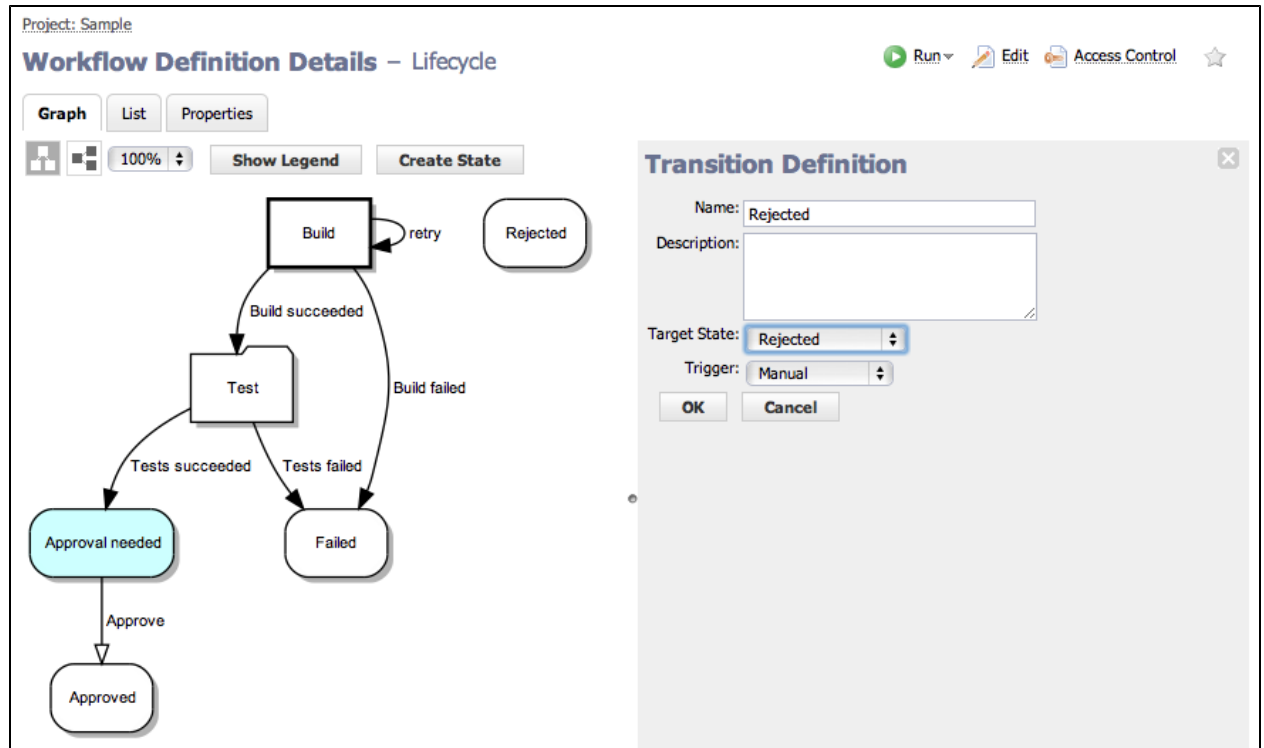
## Waiting for manual intervention

Allow users to choose how to progress the workflow.

1. From the Workflow Definition Details page for *Lifecycle*, create an *Approved* state and a *Rejected* state for the workflow to transition to when a user approves or rejects the build.

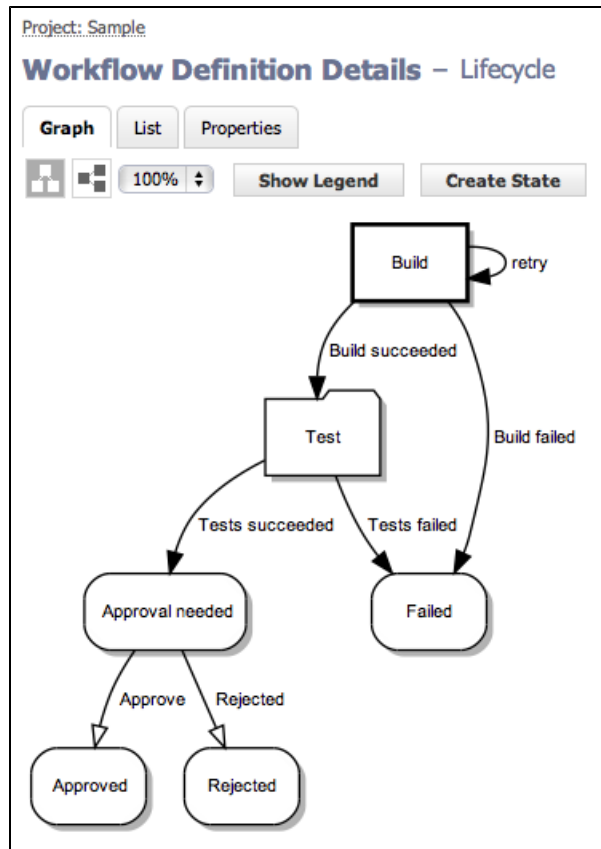


- For the *Approval needed* state, we create a manual transition called *Approve* that the user can select to progress the workflow to the *Approved* state.



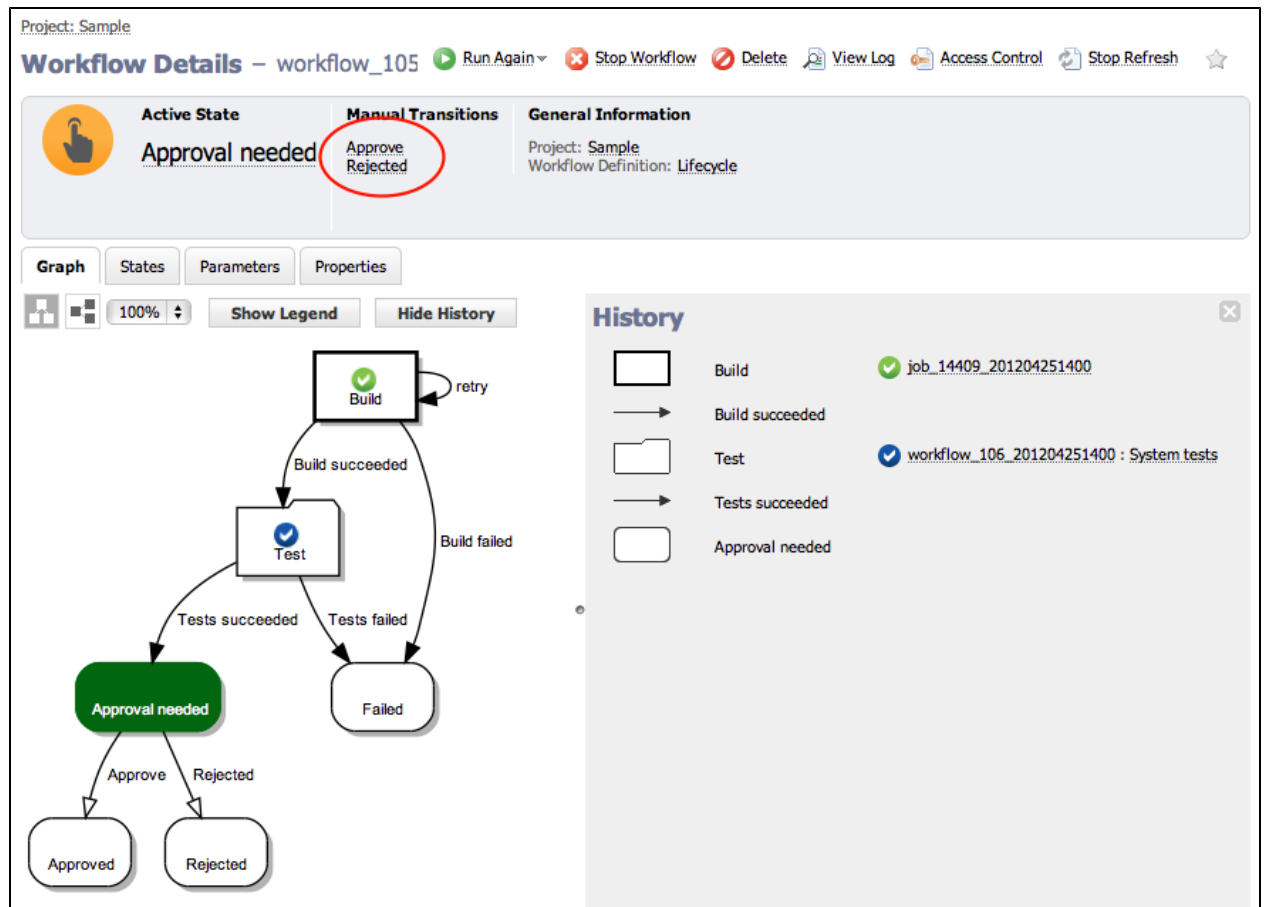
- Next, we create a manual transition called *Reject* that the user can select to progress the workflow to the *Rejected* state.

At this point, our workflow now looks like the following example.

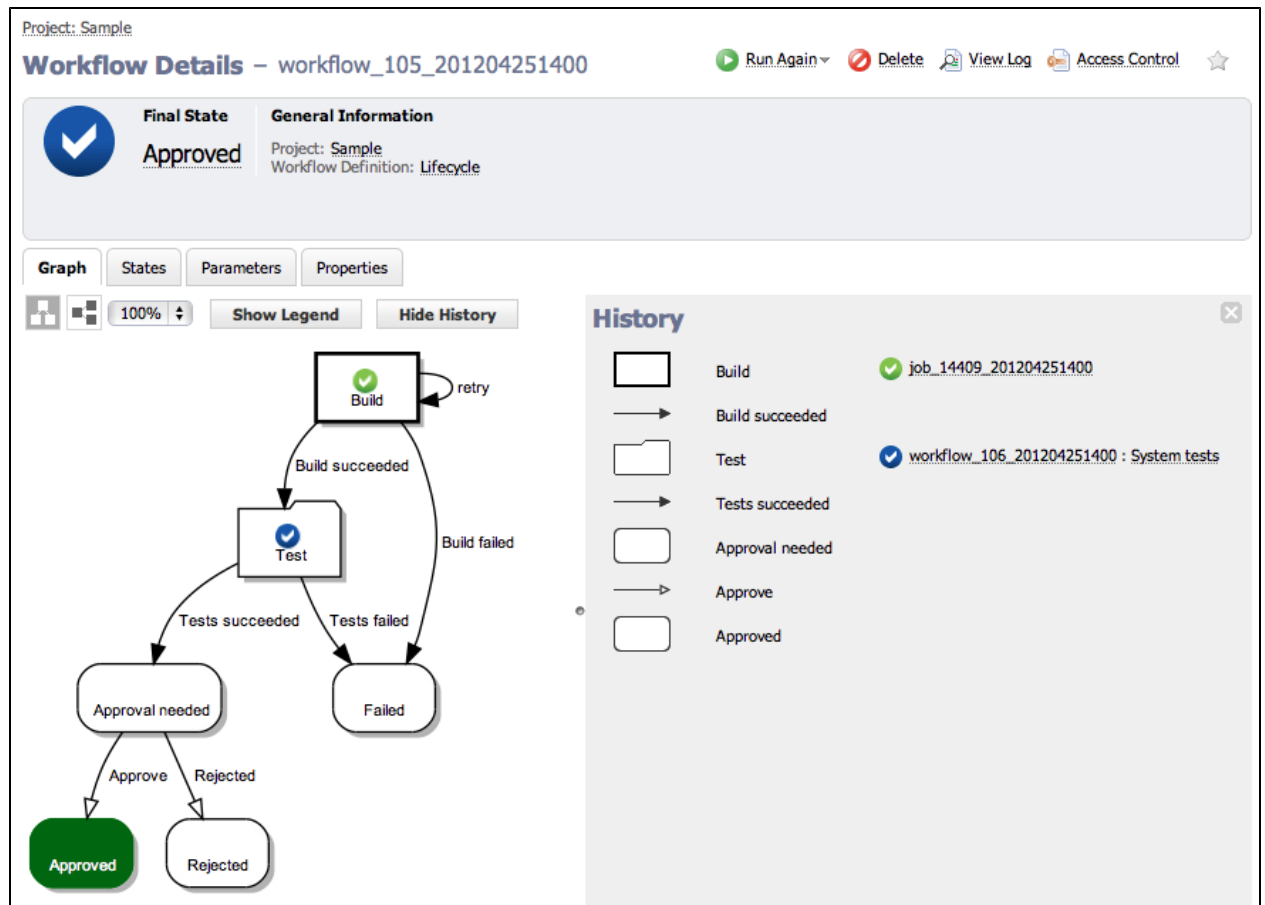


When you run the workflow and the build and test phases succeed, the new manual transitions are made available to users on the Workflow Details page.

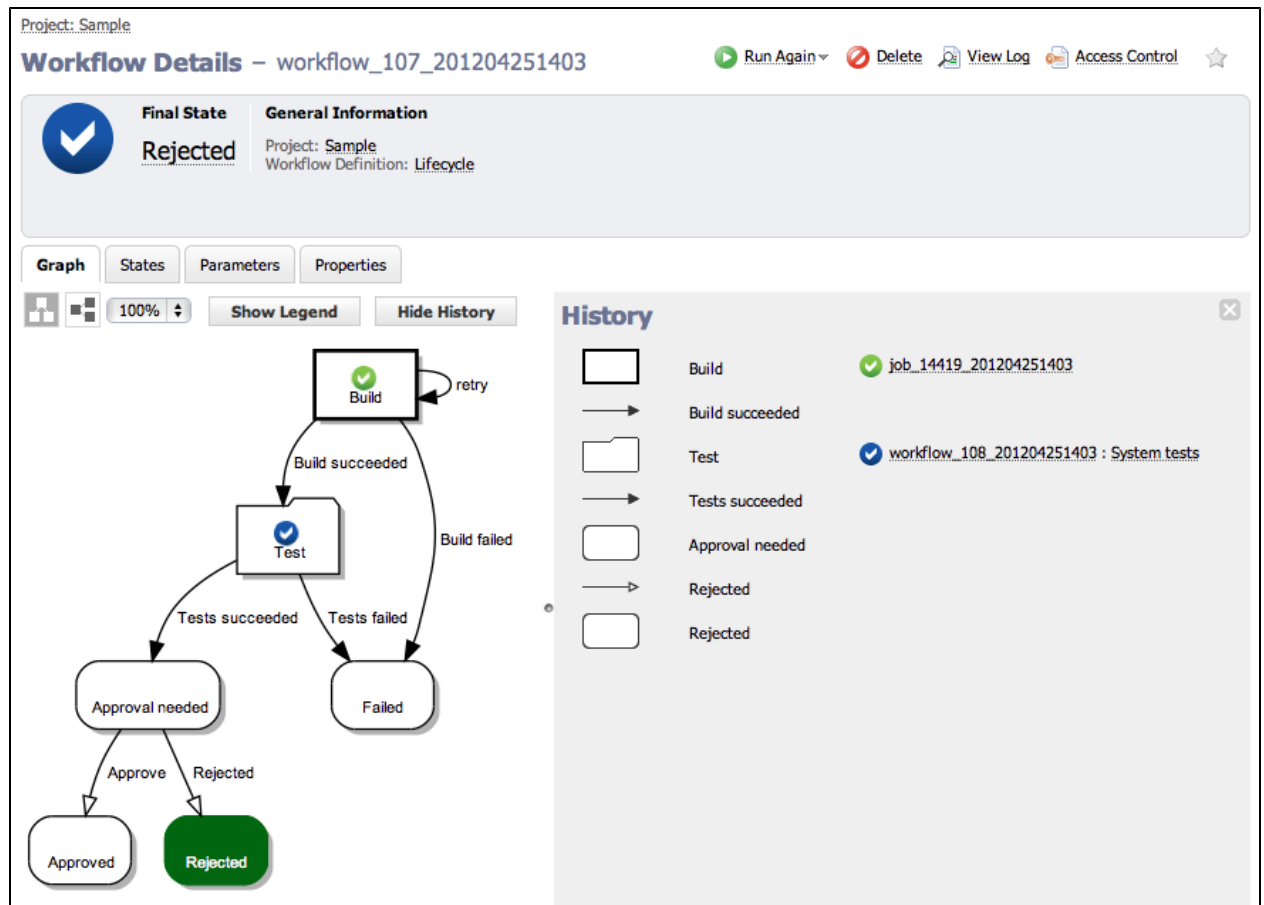
**Note:** If a user does not have execute permission for manual transitions, the Manual Transitions section will not be included in the summary section at the top of the Workflow Details page.



If you choose the *Approve* transition, the workflow will end up in the *Approved* state.



If you choose the *Reject* transition, the workflow will end up in the *Rejected* state.



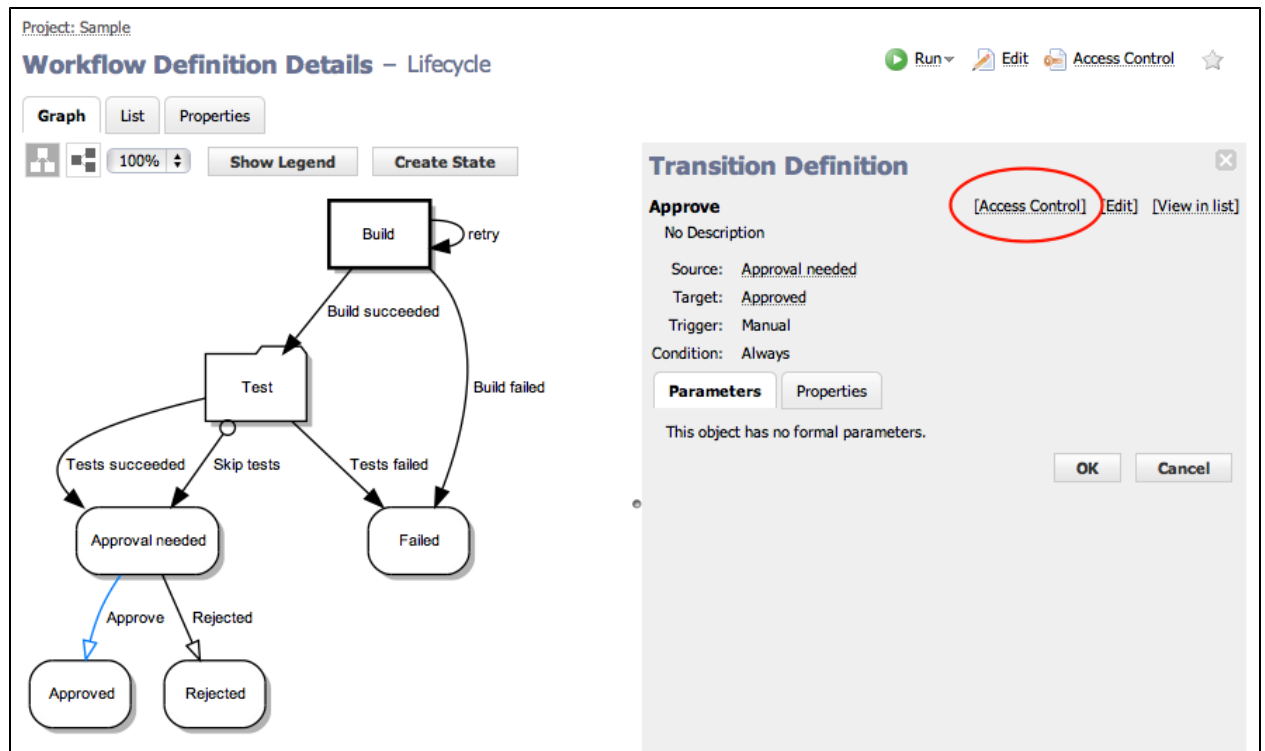
### Restricting who can take a manual transition

Only allow certain users to take manual transitions. From the Workflow Definition Details page for *Lifecycle*:

- When the workflow is created, access control entries from the Transition Definition are copied to the corresponding transition.  
These are the access control entries for the *Approve* transition before we edit them (see below).
- To add access control to a transition, select the transition or transition name.



- When the Transition Definition panel opens, click the **Access Control** link.



- When the Access Control page is displayed, click the **Add Group** link to add privileges for a group that can take this transition.

Project: [Sample](#) / Workflow Definition: [Lifecycle](#) / State Definition: [Approval needed](#) / Transition Definition: [Approve](#)

### Access Control – Transition Definition: Approve

☐ **Privileges for Transition Definition : [Approve](#)**

[Add User](#) | [Add Group](#) | [Add Project](#) | [Break Inheritance](#)

Currently, there are no records to display in this list.

☐ **Privileges inherited from State Definition : [Approval needed](#)**

Currently, there are no records to display in this list.

☐ **Privileges inherited from Workflow Definition : [Lifecycle](#)**

Currently, there are no records to display in this list.

☐ **Privileges inherited from Project : [Sample](#)**

Type	Name	Location	Read	Modify	Execute	Change Permissions
project	Sample		allow	allow	allow	allow

☐ **Privileges inherited from Projects**

☐ **Privileges inherited from Server**

Type	Name	Location	Read	Modify	Execute	Change Permissions
group	Everyone		allow	inherit	allow	inherit

**Note:** If you already have groups created, you can use them here or create two groups now: *Lifecycle Approvers* and *Lifecycle Modifiers*.

- Allow read and execute access for a group named *Lifecycle Approvers*. These users can see and take a manual transition in a workflow.
- Allow read, modify, and change permission access for a group named *Lifecycle Modifiers*. These users can edit the Transition Definition, but will not have access to take a manual transition in a workflow.
- "Break the inheritance" so only specified groups have access to this transition.

8. Duplicate this access control configuration for the *Reject* transition.

Project: Sample / Workflow Definition: Lifecycle / State Definition: Approval needed / Transition Definition: Approve

Access Control – Transition Definition: Approve

Privileges for Transition Definition : Approve

Add User

Add Group

Add Project

Restore Inheritance

Type	Name	Location	Read	Modify	Execute	Change Permissions	Actions
group	Lifecycle Approvers		allow	inherit	allow	inherit	Edit   Delete
group	Lifecycle Modifiers		allow	allow	inherit	allow	Edit   Delete

Transition Definition "Approve" disallows further inheritance.

When a workflow is launched and reaches the *Approval needed* state, a user who is not a member of the *Lifecycle Approvers* group will not be allowed to execute any manual transitions. A user who is a member of the Lifecycle Approvers group can execute manual transitions.

The Workflow Details page updates in real-time, which means you will see changes at the top of the page pertaining to the current state in the running workflow, and current changes in the graph also. For example, if the previous state had a manual transition, but the current state now processing does not have a manual transition, the Manual Transition section will not be displayed.

The screenshot displays the electriccommander interface. At the top, the user is logged in as 'Manager'. The main navigation bar includes Home, Projects, Jobs, Workflows, Cloud, Artifacts, Search, and Administration. The current view is 'Workflow Details - lifecycle-3.5-workflow-8'. The 'Final State' is 'Approved'. The 'General Information' section shows 'Project: Sample' and 'Workflow Definition: Lifecycle'. The 'Graph' tab shows a flowchart with nodes for Build, Test, Approval needed, and Failed. The 'History' tab shows a list of events, with 'Approve' highlighted by a red circle.

**Workflow Details - lifecycle-3.5-workflow-8**

**Final State** Approved

**General Information**  
Project: Sample  
Workflow Definition: Lifecycle

**Graph** States Parameters Properties

100% Show Legend Hide History

**History**

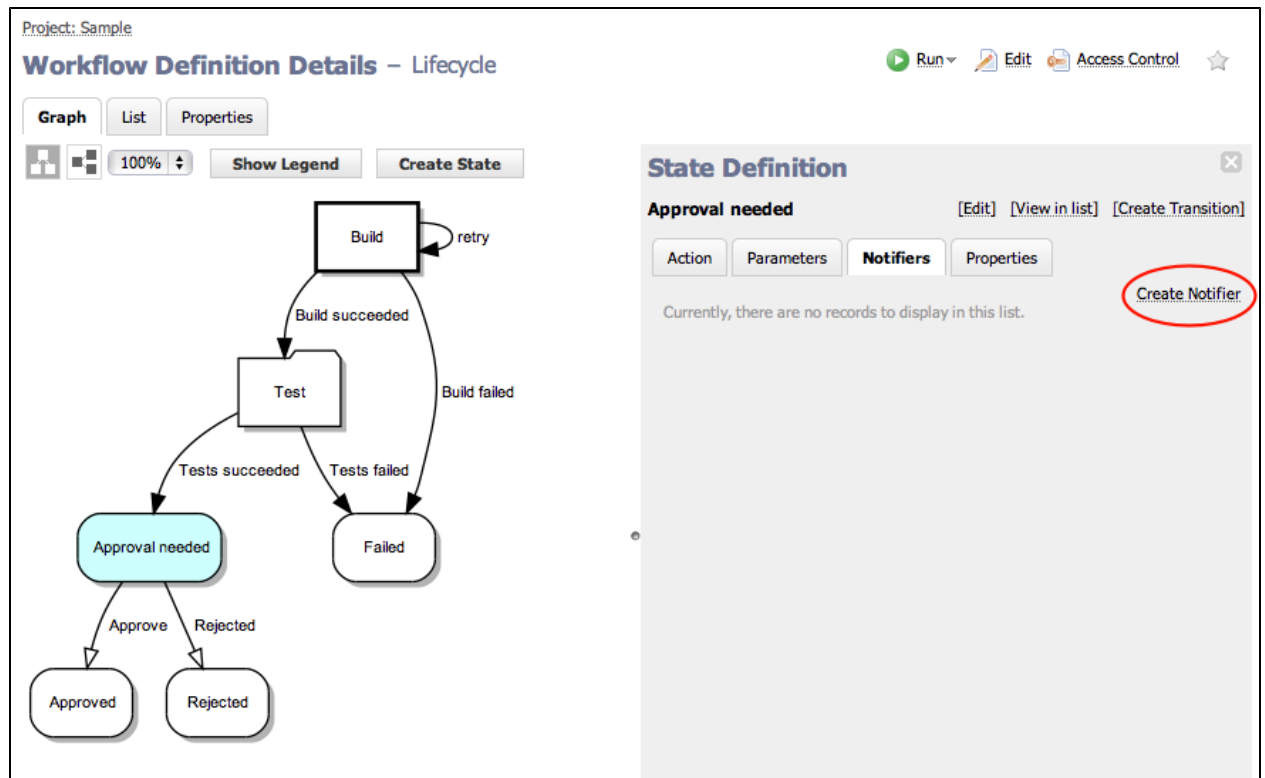
- Build job\_19937\_201204292333
- Build succeeded
- Test workflow\_146\_201204292333 : System tests
- Tests succeeded
- Approval needed
- Approve**
- Approved

## Sending email notifiers

Send email notifications so a user or group knows they need to take an action on a workflow.

1. From the Notifications tab for the *Approval needed* state definition, click the Notifiers tab.

2. Click the **Create Notifier** link.



We want to create an On Enter email notifier. When a workflow enters the *Approval needed* state, this email notifier will be sent out.

Project: Sample

## Workflow Definition Details – Lifecycle

Graph List Properties

100% Show Legend Create State

```
graph TD; Build[Build] -- "retry" --> Build; Build -- "Build succeeded" --> Test[Test]; Build -- "Build failed" --> Failed[Failed]; Test -- "Tests succeeded" --> Approval[Approval needed]; Test -- "Tests failed" --> Failed; Approval -- "Approve" --> Approved[Approved]; Approval -- "Rejected" --> Rejected[Rejected];
```

### Email Notifier

Name:  Required

Description:

Type:

Condition:

Template:

Subject:  Required

<html>  
<body>  
<h2>Workflow Approval Required</h2>  
<a  
href="http://\$[/server/hostname]/commander/link/workflowData  
ils/projects/\$[/myProject]/workflows/  
\$[/myWorkflow/workflowName]/s=Projects">View Workflow

Email Config:

Destination:  Required

OK Cancel

In this example, we want to send an email notification to the "approvers". The email will contain a link to the Workflow Details page and links to all available transitions.

3. Use the following formatting template for the email notifier. It includes a link to the ElectricFlow workflow, embeds a block of JavaScript that cycles through all the manual transitions from the active state, and has a link to go directly to those transitions. To ensure that the script works properly, use the script as is and make sure there are no white spaces before `<!DOCTYPE...>`, `<html>`, and `</html>`.

Subject: Workflow `$(workflowName)` is ready for approval

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd"><html>
<body>
    <h2>Workflow Approval Required</h2>
    <a href="http://$[/server/hostname]/commander/link/workflowDetails/project
s/$(myProject)/workflows/$(myWorkflow/workflowName)/s=Projects">View Workflow
$(workflowName)</a>
    <br /><br />
    $[/javascript
        var links = new String("");
        for (var tName in myWorkflow.activeState.transitions) {
            var transition = myWorkflow.activeState.transitions[tName];
            if (transition.trigger == "manual") {
                links += "<a href=\"http://$[/server/hostname]/commander/link/trans
itionWorkflow/projects/$(myProject)/workflows/$(myWorkflow/workflowName)/trans
itions/" + tName + "\">" + tName + "</a><br />";
            }
        }
        links;
    ]
</body></html>
```

This script is a sample of the type of script you can insert into the Formatting Template field illustrated in the

following screen example. When a workflow is run and it reaches the *Approval needed* state, an email similar to the following example can be sent to specified destinations. Only users who have execute permission on these transitions will be able to approve them by clicking the link.



### Adding a global parameter to use later in the workflow

Prompt for a parameter when the workflow is launched, and use its value later in the workflow.

1. Currently, there is one parameter for the starting state *Build*.
2. Click on the *Build* state in the graph and select the Parameters tab.



3. Click the **Create Parameter** link to create a second parameter.

Project: Sample

## Workflow Definition Details – Lifecycle

Run Edit Access Control

Graph List Properties

Show Legend Create State

```
graph TD; Build[Build] -- retry --> Build; Build -- "Build succeeded" --> Test[Test]; Build -- "Build failed" --> Failed[Failed]; Test -- "Tests succeeded" --> Approval[Approval needed]; Test -- "Tests failed" --> Failed; Approval -- Approve --> Approved[Approved]; Approval -- Rejected --> Rejected[Rejected];
```

### State Definition

Build [Edit] [View in list] [Create Transition]

Action Parameters Notifiers Properties

Create Parameter

Name	Default Value	Type	Req?	Description	Actions
branch		entry	✓	The branch of the product to build	Delete

4. Add a checkbox-type parameter named *skipTests* which, if selected, should skip the test suite after the build is completed.

Project: Sample / Workflow Definition: Lifecycle / State Definition: Build

### New Parameter

Name:

Description:

Type:

Value when unchecked:

Value when checked:

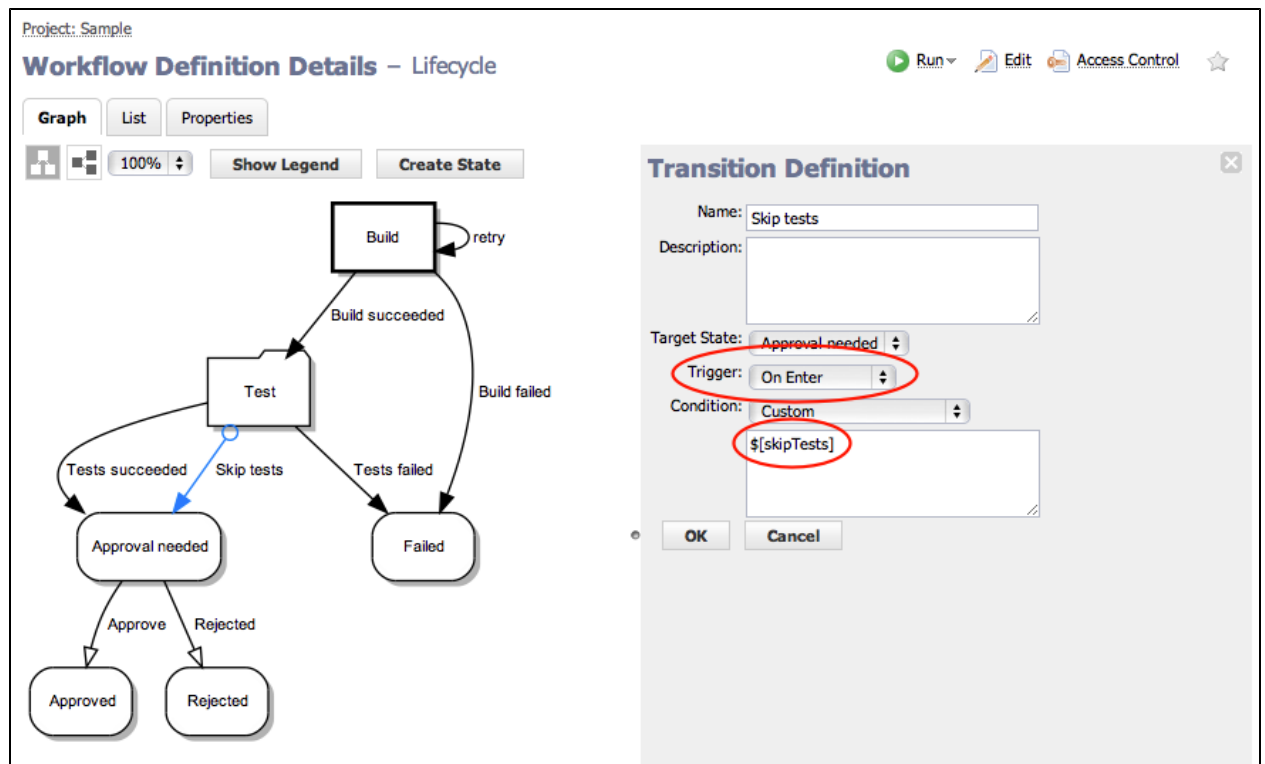
Initially checked? ☐

Default Value:

Required? ☐

Defer Expansion? ☐

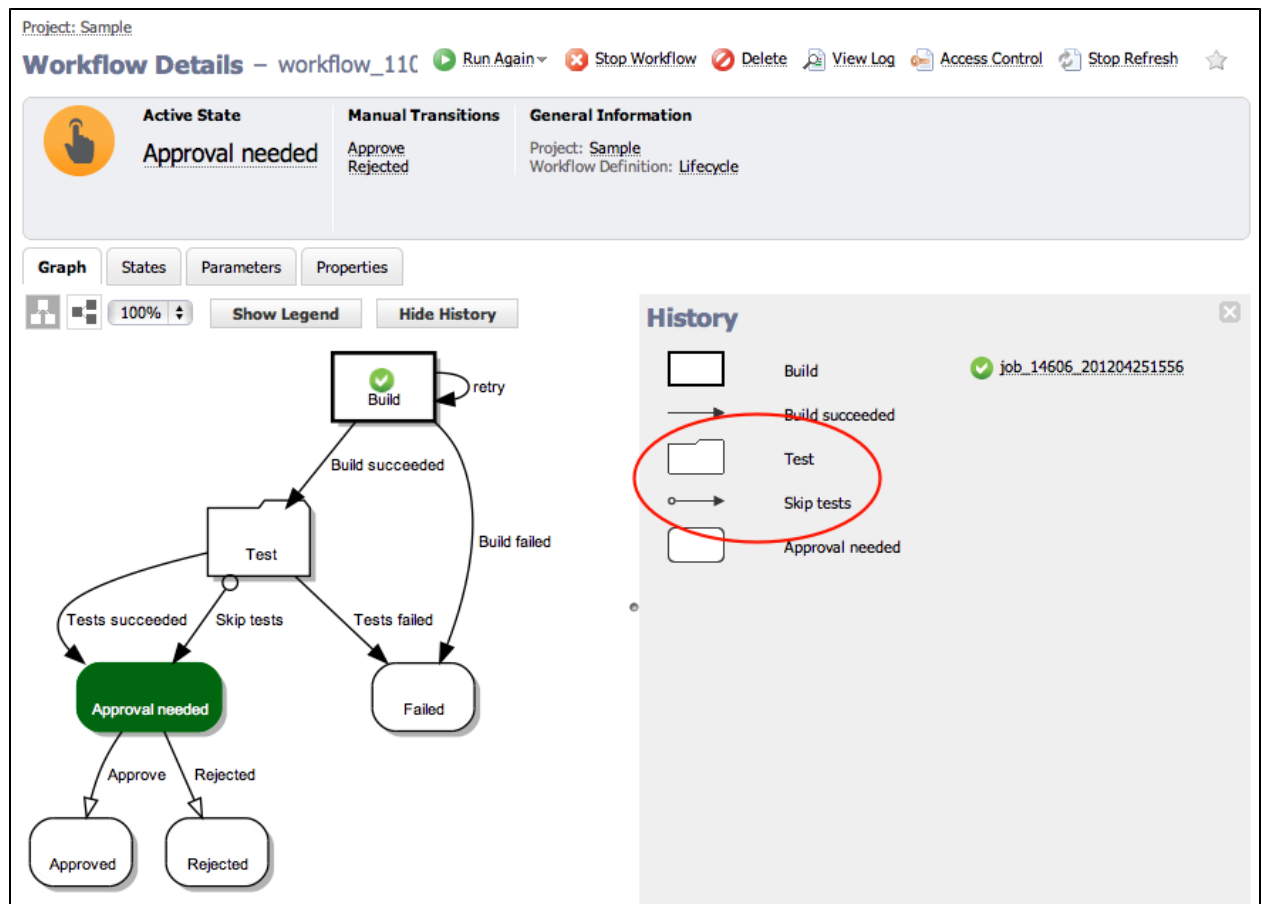
5. Create an On Enter transition from *Test* to *Approval needed* if the *skipTests* parameter evaluates to "true".  
Because this is an On Enter transition, it will be taken before the automated tests workflow is started.



6. When the workflow is launched, you will see the *skipTests* checkbox.

The screenshot shows the 'Run Workflow - Lifecycle' interface. It displays the 'Starting State: Build' and 'Parameters: branch: 3.5 Required'. Below the parameters, the 'skipTests' checkbox is checked and circled in red. The 'OK' and 'Cancel' buttons are at the bottom right.

- If the parameter is checked, and after the *Build* state is completed, the workflow will immediately transition from *Test* to *Approval needed*, without starting the subworkflow. Looking at the workflow History, we see the *Test* state was entered, but the subworkflow (and subjobs) was not executed.

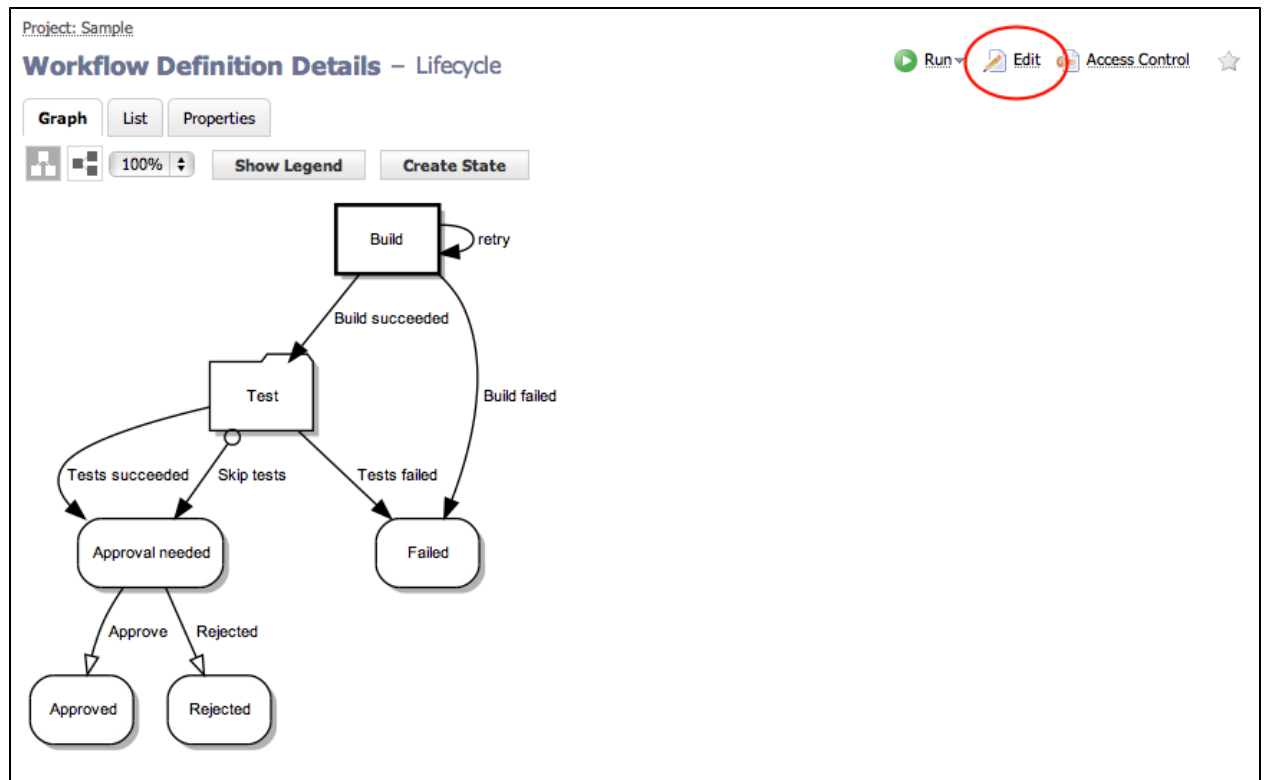


## Setting the name of your workflow

Choose appropriate names for workflows so they are easy to identify.

- If the Workflow Name Template was not set, workflows are created with a default name (workflow <jobId> <timestamp> or workflow\_239\_201012091208, for example). However, because you may have many different workflow definitions, you might want to create a distinguishing name for workflows launched from each definition.

- From the Workflow Definition page for *Lifecycle*, click the **Edit** link at the top of the page.



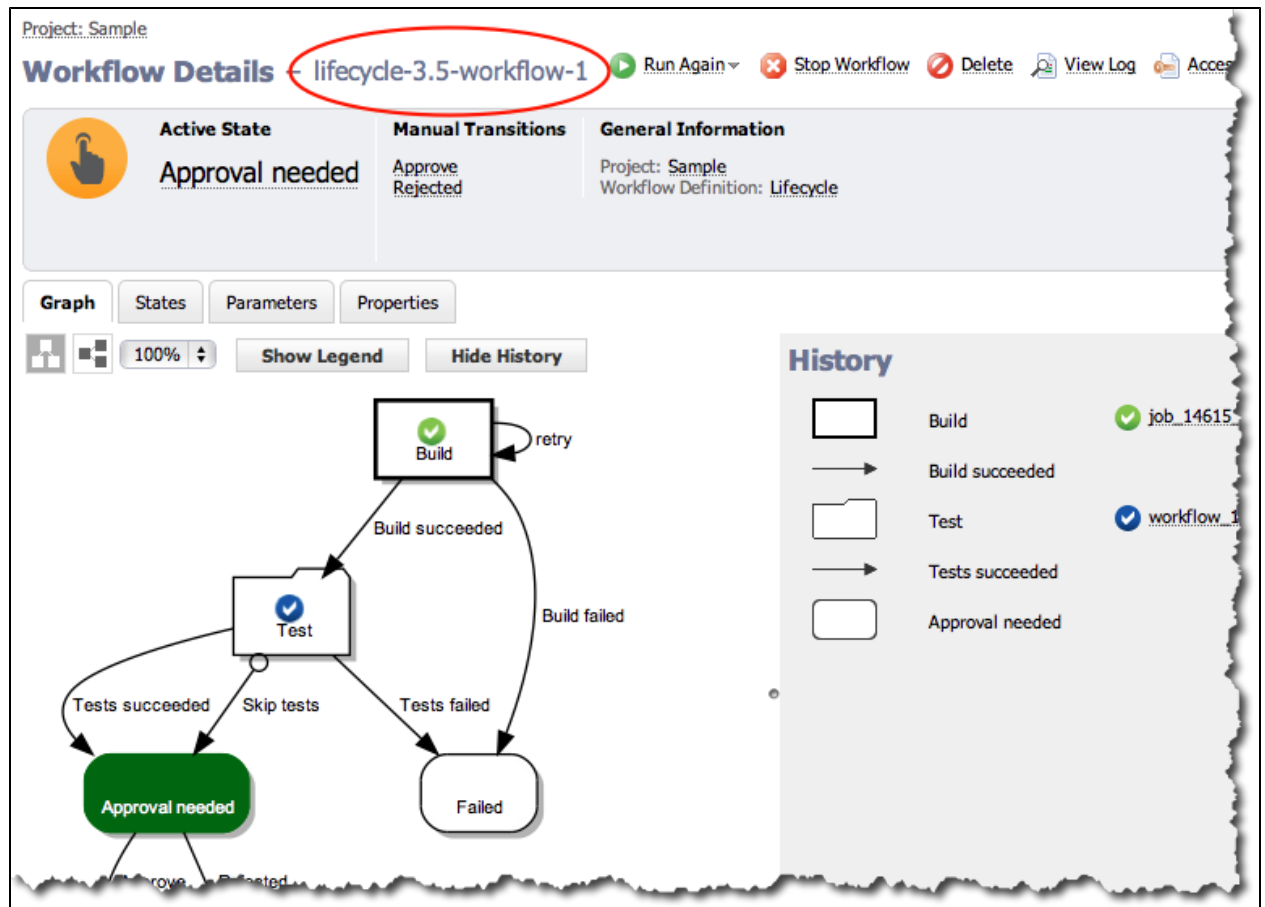
- Setting the Workflow Name Template to `lifecycle- $\$$ [branch]-workflow- $\$$ [/increment /myProject/lifecycle-counter]` (as shown in the sample below) achieves this goal.
  - `$\$$ [branch]` refers to the value of the branch parameter as specified when the workflow is launched.
  - `$\$$ [/increment /myProject/lifecycle-counter]` creates a property called `lifecycle-counter` on the project and increments the property every time a new workflow is launched so the names are unique.

The screenshot shows the 'Edit Workflow Definition - Lifecycle' form. It includes fields for 'Name' (set to 'Lifecycle') and 'Description'. The 'Workflow Name Template' field is circled in red and contains the following text:

```
lifecycle- $\$$ [branch]-workflow- $\$$ [/increment /myProject/lifecycle-counter]
```

At the bottom right, there are 'OK' and 'Cancel' buttons.

4. Now, when the workflow is launched, its name is much more descriptive than the default workflow name.



## Workflow List

Most of the time, you will want to interact with your workflow from the default Graph view. However, if you want to see your workflow in a list or table view, click the List button. See the [Workflow Definition Details](#) Help topic for detailed information about this page.

Project: Sample

## Workflow Definition Details – Lifecycle

Run Edit Access Control

Graph **List** Properties

Create State Definition

Name	Type	Action	Startable	Description	Actions
Build	Subjob	Sample : BuildProduct	✓		Create Transition   Copy   Move   Delete
retry	On Completion	Target: Build		Retry if the Build state fails	Access Control   Copy   Move   Delete
Build succeeded	On Completion	Target: Test			Access Control   Copy   Move   Delete
Build failed	On Completion	Target: Failed			Access Control   Copy   Move   Delete
Test	Subworkflow	Sample : Automatic Tests			Create Transition   Copy   Move   Delete
Tests succeeded	On Completion	Target: Approval needed		Tests from the sub-workflow have completed with success	Access Control   Copy   Move   Delete
Tests failed	On Completion	Target: Failed			Access Control   Copy   Move   Delete
Skip tests	On Enter	Target: Approval needed			Access Control   Copy   Move   Delete
Failed	No action			An error occurred while the workflow was running	Create Transition   Copy   Move   Delete
Approval needed	No action				Create Transition   Copy   Move   Delete
Approve	Manual	Target: Approved			Access Control   Copy   Move   Delete
Rejected	Manual	Target: Rejected			Access Control   Copy   Move   Delete
Approved	No action				Create Transition   Copy   Move   Delete
Rejected	No action				Create Transition   Copy   Move   Delete

The transition order is important because transitions are evaluated in order and the first one with a condition that evaluates to 'true' is taken. In the next screen example, the *Test* state has two On Completion transitions. When the state completes, it evaluates the *Tests succeeded* transition first. If a third transition was added for the *Test* state, you could use this List view and Move the transition to the correct order for evaluation.

Project: Sample

## Workflow Definition Details – Lifecycle

[Edit](#) [Access Control](#) [☆](#)

[Graph](#) **List** [Properties](#)

[Create State Definition](#)

Name	Type	Action	State	Actions
Build	Subjob	Sample : BuildProduct	Build	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
retry	On Completion	Target: Build	Build	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Build succeeded	On Completion	Target: Test	Build	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Build failed	On Completion	Target: Failed	Build	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Test	Subworkflow	Sample : Automatic Tests	Test	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Tests succeeded	On Completion	Target: Approval needed	Test	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Tests failed	On Completion	Target: Failed	Test	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Skip tests	On Enter	Target: Approval needed	Test	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Failed	No action		Test	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Approval needed	No action		Test	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Approve	Manual	Target: Approved	Test	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Rejected	Manual	Target: Rejected	Test	<a href="#">Access Control</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Approved	No action		Test	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>
Rejected	No action		Test	<a href="#">View Transition</a>   <a href="#">Copy</a>   <a href="#">Move</a>   <a href="#">Delete</a>

## Another workflow example

An advanced sample Workflow Definition is pre-defined for you in the EC-Examples project. This is a "working" example, also modeling the workflow process, with which you can interact. To navigate to this example: Select the Projects tab > EC-Examples > Workflow Definitions subtab > then select Build Workflow With Approvals.

## Workspaces and Disk Space Management

[Defining workspaces](#)

[Using workspaces](#)

[Workspace directory names](#)

[Working directories](#)

[Workspace accessibility](#)

[Local workspaces](#)

[Access control](#)



[Impersonation and workspaces](#)

[ElectricFlow managed files](#)

[Disk space management](#)

[ecremotefilecopy](#)

## Overview

ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a **job workspace**. (The job workspace defaults to a directory under the workspace directory.)

- A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files in the workspace, such as step logs. Normally, a single workspace is shared by all steps in a job, but it is possible for different steps within a job to use different workspaces.
- The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.
- Workspaces are grouped together, with workspaces for different jobs allocated as children of the same *workspace root*. When you define procedures, you can specify which workspace roots to use, then ElectricFlow creates a child directory within that workspace root for the job's steps to use.
- The term "workspace" is used at different times to refer to either a job workspace or a workspace root. Depending on the context, it should be easy to discern which "workspace" is being discussed or referenced.

## Defining Workspaces

ElectricFlow can handle any number of workspace roots, which are defined by selecting the Cloud > Workspaces tabs on the web interface. To create a workspace root, provide a workspace name and three file paths for jobs to access the workspace:

### Workspace name

The workspace name must not have trailing spaces.

When two workspaces have similar names, such as "Server1" and "Server1 " (with an extra space at the end), the database records them as two entries, one without trailing spaces and one with trailing spaces.

If you run a job against one of these workspaces, it may hang and not proceed because ElectricFlow is waiting for a resource, an available workspace, or a step to complete.

### UNC path

A UNC path that Windows machines can use to access the workspace via the network, such as

`//server/share/x/y/z.`

You must ensure this path is accessible on any resource where the workspace is used.

### Drive path

A Windows path, using a drive letter that refers to the same directory as the UNC path. Before running a job step using the workspace, the ElectricFlow agent creates a drive mapping for this path to match the UNC path.

For example, if the UNC path is `//server/share/x/y/z` and the drive path is `N:`, the agent will map `N:` to `//server/share/x/y/z`. If the drive path is `N:/y/z` then the agent will map `N:` to `//server/share/x`.

The directories in the drive path after the drive letter (`y/z` in the preceding example) must match the last directories in the UNC path.

### **UNIX path**

A path used on UNIX machines to access the workspace via the network, typically using an NFS mount. You must ensure appropriate mounts exist on all resources where the workspace is used.

If your environment contains Windows machines only, you can omit the UNIX path, and if your environment contains UNIX machines only, you can omit the UNC and Drive paths.

During the ElectricFlow installation, you had the option of defining a workspace. If you defined a workspace, it was named "default" and will be the default workspace for all jobs, as described below.

By default, remote workspaces are accessed with the agent user's credentials. For Windows resources, you can override that user's credential by attaching a credential to the workspace. Using a credential attached to a workspace is useful if the agent machine is not a member of the domain, but the workspace is located on a machine in the domain. An attached credential for a domain user allows the agent to manipulate the workspace as that domain user.

## **Using Workspaces**

The simplest way to use workspaces is to define a single workspace named "default" that is readable and writable on all resources, and never specify any other workspace information. With this approach the default workspace will be used for all steps in all jobs.

However, you can also arrange for different jobs to use different workspaces, or even for different steps within a single job to use different workspaces.

You can specify a workspace name in any of the following ElectricFlow objects:

- If you specify a workspace in the definition of a procedure step, it applies to that step.
- If you specify a workspace in the definition of a procedure, it applies to all steps in the procedure.
- If you specify a workspace in the definition of a project, it applies to all steps in all procedures defined in that project.
- If you specify a workspace in the definition of a resource, it applies to all steps assigned to that resource.

If workspaces are defined in several of these places, the workspace for a particular step is chosen in priority order corresponding to the list above: a workspace specified in a step takes priority over all others, followed by a workspace in the procedure, project, and finally resource. If no workspace is specified in any of these locations, the workspace named "default" is used.

### **Workspace Directory Names**

A job workspace directory name, within its workspace root, is derived from the name of the job.

For example, if a job named "job\_63" uses a workspace whose root directory is `//ec/workspaces`, the job workspace directory will be `//ec/workspaces/job_63`. Changing the name of a job has no impact on workspace names: the initial name of the job is always used for workspace directory names.

A job is allocated a single job workspace only within a particular workspace root, which will be shared by all steps that specify that root.

For example, suppose a job has 5 steps: 3 steps specify workspace A and 2 steps specify workspace B. The 3 steps that specify A will all share a single directory under A, and the other 2 steps will share a single directory under B.

## Working Directories

By default, each job step begins execution with its current working directory set to the top-level directory in the job's workspace. A job step can override this location by specifying an explicit working directory. If a job step specifies a relative path for its working directory, the path is relative to the top-level workspace directory.

## Workspace Accessibility

The simplest way to set up ElectricFlow is to make every workspace root accessible on every resource. This accessibility mode provides the most flexibility and simplifies ElectricFlow system management.

Unfortunately, some environments cannot allow such universal access.

For example, some sites do not provide file sharing between UNIX and Windows machines. In large enterprise environments where ElectricFlow is shared among multiple groups, you may want to partition resources among the groups and limit access by each group to the other groups' resources. In the most extreme case, you may not have network file sharing at all. ElectricFlow can handle all of these cases.

If a workspace root is not accessible on a particular resource, you should not use that workspace in any step that runs on the resource. If you do, the resource will not be able to create the job workspace directory and the step will stall until the issue is resolved. A workspace root (on a resource) must be both readable and writable to be used for job steps.

## Local Workspaces (Disconnected Workspaces)

Normally, workspaces are shared, which means if the same workspace is used on different resources, they see the same set of files. However, it is possible to define a *local* workspace (also referred to as a disconnected workspace), which means it will refer to a different local directory on each resource where it is used.

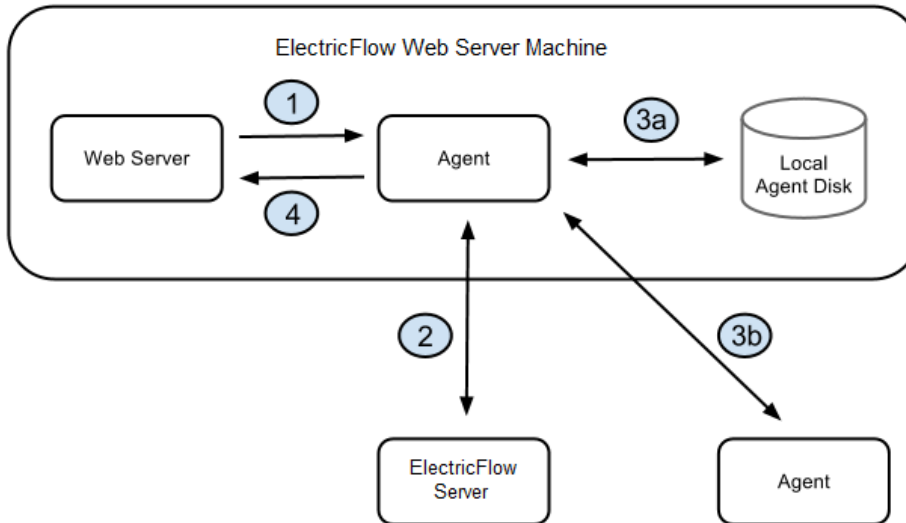
To define a local workspace on Windows, specify a local path such as `C:/Windows/Temp/ecworkspace` for the drive path.

For UNIX, specify a local UNIX path such as `/usr/tmp/ecworkspace`. Local workspaces are advantageous because they do not require remote network access and access may be faster in some cases.

However, you cannot share workspace information among job steps running on different resources.

**Note:** Web servers "ask" the relevant agent for access to log files in workspaces. The agent streams the file back to the web server, which then streams the log file to your browser. However, this mechanism works only for Windows and Linux 4.2 (or later) agents. Solaris, MacOS, and HP-UX agents must transfer log files to a

workspace proactively so a Linux or Windows agent can access them for the web server—this task can be made easier, using the `ecremotefilecopy` tool. See the `ecremotefilecopy` section in [ElectricFlow Installed Tools](#) on page 638 for details.



The diagram illustrates the architecture when the web server requests a log file and you have defined a local workspace.

1. The web server asks the local agent to retrieve the file from a workspace.
2. The agent (local to the web server) asks the ElectricFlow server how to find the workspace, and the ElectricFlow server replies with a route to an agent and validates the session ID.
3. The route to the agent that has the file could be: (a) the local agent itself or (b) a different agent that ran the step that produced the file.
  - a. The agent (local to the web server) gets the file from its local disk.
- or**
- b. The agent gets the file from some other agent.
4. The agent (local to the web server) sends the file to the web server.

### Access control

You can restrict access to workspaces using the ElectricFlow access control mechanism. Before a step can use a workspace, it must have the "execute" privilege on the workspace, where "it" means the ElectricFlow user ID under which the step executes (the project principal). You can set permissions on a workspace to enable or disable access as you choose.

### Impersonation and workspaces

Before a job step can use a particular workspace, three access limitations must be satisfied:

The job step must have execute access to the workspace object.

If not, ElectricFlow aborts the step with an access control violation. See the [Access Control](#) Help topic for details.

The workspace must be accessible on the resource where the step runs.

If not, the ElectricFlow agent is unable to create the step's log file and the step's execution will fail. See [Workspace Accessibility](#) (above) for more information.

The Windows or UNIX agent account and/or job step must have read/write access to workspace files.

If not, the step's execution will fail in one of several ways. This issue is the topic of this section.

Potentially, two system accounts can impact each job step execution:

The first account is the one used by the ElectricFlow agent—you selected this account when ElectricFlow was installed. The agent account must have the ability to write the workspace root directory (to create the job workspace directory), and it must have the ability to write the job workspace directory to create log files.

The second account is the one under which the step executes. If the step does not use user impersonation (in other words, no credential has been specified for it), the step runs under the same account as the agent so there are no additional issues. However, if the step is running with credentials, the credentialed account must also have read/write access to the workspace area.

Because of these requirements, you may end up with a configuration where any job step running in a workspace can read or write any file under that workspace root, including files from other jobs that share the same workspace root. In many environments this solution works, but in some situations you may want to prevent one job from accessing files from a different job.

To create job privacy, run all of the job's steps with credentials for a separate account. In addition, run a job step at the beginning of the job that creates a subdirectory within the job workspace and change the protection on that directory to permit access to the credentialed account only. Next, place all private files for the build in the protected subdirectory. These files will not be accessible to other jobs or the agent. The top-level directory in the job workspace still needs to be accessible to the agent so it can read and write log files, but everything in the lower-level directory will be private.

## ElectricFlow managed files

ElectricFlow automatically places certain files in the top-level job step workspace directory:

### Step logs

When a step's command executes, its standard output is redirected to a log file unique to that step. The log filename is derived from the step name and its unique identifier within ElectricFlow.

For example, a step named "step1" will have a log file with a name like "step1.2770.log", where 2770 is a unique identifier assigned by ElectricFlow. A unique identifier is needed in situations where the same step name occurs multiple times in a job such as multiple invocations of a single nested procedure.

### Postprocessor logs

If a step specifies a postprocessor, standard postprocessor output is redirected to a file in the workspace. The postprocessor output file will have a name similar to the step log. For example, "step1.2770-postp.log".

### **Diagnostic extracts**

If a postprocessor extracts diagnostic information from a step's log file, it usually places that information in an XML file in the top-level job workspace directory, and then it sets a property that contains the filename. The ElectricFlow *postp* postprocessor uses filenames like diag-2770.xml, where 2770 is the unique identifier for the step. Other postprocessors may use different filenames.

## **Disk space management**

The current ElectricFlow version does not provide a facility for automatically deleting old workspaces. You are responsible for deleting obsolete job workspaces yourself. If you delete a job, ElectricFlow does not automatically delete its workspace. (A future ElectricFlow version may provide automated facilities for identifying and deleting obsolete workspaces—until then, you may wish to create a procedure that runs on a regular schedule and deletes old job workspaces.)

# **Tutorials**

The ElectricFlow Help topics in this directory help you learn more about ElectricFlow and specific ElectricFlow tasks.

You can directly access these Help topics from the Help system Table of Contents.

You can also access these Help topics while using the automation platform. Click **Help** at the top-right corner on any web page in the automation platform.

## **Adding a Link to a Job**

ElectricFlow provides an easy method for adding links to the Job Details page to view files and reports for any job where you need to access additional information quickly. Adding direct links eliminates logging into where these files may be stored.

**Note:** The Workflow Details page and several other ElectricFlow web pages also allow adding links .

This tutorial shows how to add links to a job and have them immediately available on the Job Details page.

To view an example procedure for this tutorial , go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### **An explanation of what you see:**

- The Procedure Details page for the "Adding a link to a job" procedure contains two steps: Create File and Create Job Link

- The Action column displays a code fragment of the script used to create the `readme.txt` file and a reference for the Create Job Link step. For this example, we want to link to a "readme" file. (You can click on the **Create File** step name to go to the Edit Step page to see the full ec-perl script shown partially in the Action column.)

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page, where the new link to the `readme.txt` file is displayed under the Links heading in the summary section at the top of the page.

## Implementation

Use the following instructions if you would like to practice creating a link on the Job Details page now.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow. These instructions only coach you through the process you would use to create links on your Job Details pages.

1. In the automation platform UI, click **Projects > EC-Tutorials-<version> > Adding a link to a job**.  
The Procedure Details page opens.
2. In the Procedure Steps section, click **Subprocedure** to create a new step based on a subprocedure.  
The Choose Subprocedure Step dialog box opens.
3. To select a project:
  - a. Select **Project**. In the text box, start typing **EC-Utilities**.  
As you type, possible matches appear in a drop-down list.
  - b. When you see **EC-Utilities**, select it.
4. To select a procedure:
  - a. Select **Project**. In the text box, start typing **Create Job Link**.  
As you type, possible matches appear in a drop-down list.
  - b. When you see **Create Job Link**, select it.
5. Click **OK**.  
The New Step page opens.
6. In the General section, Google search in the **Name** field.
7. In the Parameters section:
  - a. In the **Link Label** field, enter `Google Search`.  
(This is any name you choose for the name of your link.)
  - b. In the **Link Location** field, enter `http://www.google.com`  
(This is the URL to your link location, or it can be a relative path to where you want to create a link.)
  - c. Click **OK** to save your entries and return to the Procedure Details page.
8. On the Procedure Details page, click **Run**.
9. On the Job Details page, as soon as the links are processed you will see the new "Google Search" link in addition to the "readme.txt" link.

Clicking on the new Google Search link will take to you to the Google website.

## Related Information

[Job Details](#)—See this Help topic for more detailed information about creating links and complete information on other aspects for using the Job Details page.

## Calling a Subprocedure

The ability to create *reusable components* is a major ElectricFlow strength. Procedures in any project or plugin can be called as a subprocedure in a step for another procedure. Creating a subprocedure is one way of reusing existing functionality already implemented in ElectricFlow.

This tutorial shows how to use the step configuration process to call an existing procedure to use as a subprocedure.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects > EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

- The Procedure Details page for the Calling a subprocedure procedure contains a step named Execute a procedure from this project.  
(Clicking on this step takes you to the Edit Step page.)
- The Action column displays a plugin (or project) name, EC-Tutorials, and a procedure name, Working with properties in a stored procedure.  
(Clicking on the plugin/project name takes you to the Project Details page for that project, and clicking on the procedure name takes you to the Procedure Details page for that procedure.)

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

## Implementation

Use the following instructions if you would like to practice creating another subprocedure for this "Calling a subprocedure" procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow and cannot be transferred to your procedures. These instructions only provide a clearer explanation for how you can call subprocedures in your projects.

To create a step that executes a subprocedure:

1. On the Procedure Details page, click the **Create Step** link to see the Choose Step Type dialog.
  - Select the Subprocedure tab.
  - Select Plugin and place your cursor in the text field and start typing EC-Tutorials.
  - For Procedure, click inside the text box and select Reserving a Resource for job step duration procedure or whichever procedure you would like to choose.
  - Click **Create** to go to the New Step page to create the step to call an existing procedure to use as a subprocedure.
2. On the New Step page, enter any new step name of your choice.  
Notice that no parameters are required for this step.



3. Click **OK** to return to the Procedure Details page to see your new step in the table, then click **Run**.
4. When the Job Details page is displayed, you can see your new step and the procedures it is calling.

### Related Information

[Procedure—create new or edit existing procedure](#)—Help topic

[Step—create new or edit existing step](#)—Help topic

## Checking the Outcome of Preceding Steps

ElectricFlow steps can have a *success*, *warning*, *error*, or *skipped* outcome. Sometimes it is useful to execute or skip subsequent steps based on the outcome of a previous step. Used with error handling behavior available at the step level, sophisticated flow control can be achieved easily.

This tutorial demonstrates how to see the outcome of a preceding step and use run conditions to execute steps based on that outcome.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

The Procedure Details page for the procedure, "Checking outcome of preceding step", contains 3 steps:

- `step 1-force an error`—This step forces an error by attempting to run on a resource that does not exist.  
This action was achieved by hard-coding the step named `"step 1 - force an error"` to run on a resource called `"this-does-not-exist"`.
- `step 2-execute if step 1 failed`—This step uses JavaScript to check the outcome of the first step and executes if the first step failed.  
You can view the JavaScript for the run condition by clicking on the step name to take you to the Edit Step page—see the Run Condition field in the Advanced section.  
This statement checks the result of "step 1" for an error. If there is an error, "step 2" will execute.
- `step 3-execute if step 1 succeeded`—This step also uses embedded JavaScript to check the outcome of the first step and executes if the first step succeeded.  
This is a slight variation of "step 2". Instead of looking at "step 1" for an error, this step checks for success and executes only if "step 1" succeeds.  
You can view the JavaScript for the run condition by clicking on the step name to take you to the Edit Step page—see the Run Condition field in the Advanced section.

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

### Implementation

Use the following instructions if you would like to practice creating steps to check the outcome of a preceding step.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow and you cannot transfer any steps from this tutorial to your projects. These instruction are provided only to give you a clearer definition for how to recreate this process in your own projects.

- Click the **Create Step** link.
  - In the Choose Step Type dialog, choose **Command** step to go to the New Step page.
  - Enter a Name for your step.
  - In the Command(s) text box, you can use the information in the above section. "Copy and paste" the provided JavaScript, changing the step name (between the brackets) to the new step name you supplied.
- Repeat this process to create 3 steps, clicking **OK** to save each step.
- When your 3 new steps are displayed on the Procedure Details page, click **Run** to see your steps running on the Job Details page.

## Related information

[Step —create new or edit existing step](#)—Help topic

## Conditional Execution

Process automation frequently contains actions to be executed only if certain conditions are met. Conditional execution can be applied directly to your procedures rather than having to maintain larger scripts to handle these actions. For example, you may need to control whether or not to build on different operating system types.

This tutorial shows you how to implement simple conditional execution in a step.

To view an example procedure for this tutorial , go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

This procedure defines one parameter and then uses a run condition to check the parameter value to decide whether or not to execute a step.

- The Procedure Details page for the Conditional execution procedure contains a step named step 1. (Clicking on this step takes you to the Edit Step page.)
- The Action column displays the command to be executed.
- The Parameters section displays a parameter with values.  
The parameter named "Execute step 1" was created as a checkbox.

If checked, the parameter equates to "true".

In the run condition for "step 1", the parameter is read using the following property reference notation:

```
$[Execute step 1].
```

(Clicking on the Parameter Name takes you to the Edit Parameter page to make modifications you may need.)

Click **Run** (at the top of the page) to run this sample procedure, which then takes you to the Run Procedure page where you could cause `step 1` to execute by selecting the Execute step 1 checkbox.

- Click **Run** again to go to the Job Details page to see the job created by running this procedure.

## Implementation

Review the following instructions if you would like to see how to reproduce a conditional execution step.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow. These step-by-step instructions are provided only for more detailed information so you can easily see how to create your own "conditional execution" solutions within your procedures.

- Click the **Create Parameter** link to go to the New Parameter page.
  - Enter a new parameter name.
  - Click the Type down-arrow and select Checkbox.
  - Select Initially checked?
  - For Default Value, type "true".
  - Select Required?
  - Click **OK** to save your parameter and return to the Procedure Details page.
- Click the step name to go to the Edit Step page.
  - Change the Run Condition text to check the new parameter name you supplied above.
  - Click **OK** to return to the Procedure Details page.
  - Click **Run** to go to the Run Procedure page to see 2 parameters where you can now decide if both are required or not.
  - Click **Run** to go to the Job Details page.
    - If only 1 parameter was "checked" as required, you will see the "skipped" notation in the Status column.

### Related information

More complex run conditions can be implemented using inline JavaScript.

See the tutorial, "Checking outcome of preceding step" for a more complex run condition example.

## Custom parameter layouts

By default, parameters for procedures are displayed in alphabetical order based on the parameter name. Using the `ec_parameterForm` property allows parameters to be displayed in a specified order, different from the default, alphabetized order by name.

This tutorial shows how to create a custom parameter layout for procedures.

To view an example procedure for this tutorial , go to the automation platform UI > **Projects** > **EC-Tutorials-*<version>***, and click the procedure name.

### An explanation of what you see:

- This procedure implements two parameters.
- The Action column contains the command to execute. In this case, the action shows the `ec_parameterForm` property which was attached to the procedure.
- Notice the checkmarks in the Req? column, which indicates both parameters are "required" each time this procedure runs.

- In the Custom Procedure Properties table, notice the "formElement" values supplied to determine the new parameter order.
  - If the procedure is run **without** the `ec_parameterForm` property, the parameter input form displays parameters in default, alphabetical order:

**Parameters**

first parameter:

second parameter:

Click **Run**.

On the Run Procedure page, notice you are presented with a Parameter section that shows the parameters in reverse order because values supplied for the `ec_parameterForm` property were called to create this new order.

**Parameters**

this is the label for "second parameter"

this is the label for first parameter

The following XML creates the new order for these parameters:

```
<editor>
  <formElement>
    <property>second parameter</property>
    <label>this is the label for "second parameter"</label>
    <type>entry</type>
    <required>1</required>
  </formElement>
  <formElement>
    <property>first parameter</property>
    <label>this is the label for first parameter</label>
    <type>entry</type>
    <required>1</required>
  </formElement>
</editor>
```

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

## Implementation

**Note:** This tutorial is intended for viewing, but not modifications within its procedure, and any changes you might make will not be saved when you upgrade ElectricFlow.

However, in your own projects, you can use the sample XML above to change the parameter order in any of your procedures.

If you copy and paste the code samples we provided, using the `ec_parameterForm` property in one or more of your procedures, make sure you replace our example values with your parameter names, labels, and so on. If you have more than two parameters to reorder, create any number of additional `<formElement>` sections you need.

## Related information

[Customizing the ElectricFlow UI /Customizing Parameters—Help topic](#)

[Step—create new or edit existing step—Help topic](#)

[Parameter —create new or edit existing parameter—Help topic](#)

## Email Notifications

Use email notifiers to send information to people who need or want ElectricFlow notifications, whether or not they actually use ElectricFlow. For example, you might want to set up an email notifier to send log file error excerpts matched by *postp* to a team or individual responsible for investigating the error.

This tutorial illustrates how email notifiers can be attached to steps to automatically send an email when jobs, steps, or workflows execute.

**Prerequisite:** If you do not have an Email Configuration, you must create one before you can set up an email notification. An Email Configuration tells the ElectricFlow server which host to use for mail delivery. Remember the email configuration name you choose because you will need it later.

To view an example procedure for this tutorial , go to the automation platform UI > **Projects > EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

- A step named "do something" that puts a short message in the log file
- A parameter that defines the email address for where you want to send the notification. This parameter is used as the destination value for the notifier named "start notifier". This notifier sends an email when the procedure runs.
- An email notifier named "start notifier" with its Type specified as "onStart".
  - Click on the notifier name to view the notifier details.
  - Make sure the value in the Email Configuration field matches the email configuration name from the "Prerequisite" section above.
  - Click **OK** to save any changes and return to the Procedure Details page.

Click **Run**.

On the Run Procedure page, in the Parameters section, enter an email address, an address list, or email group name.

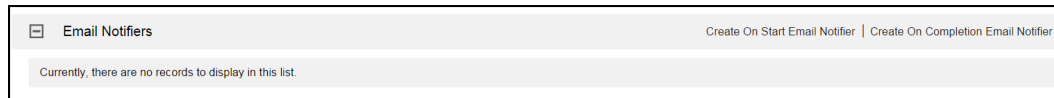
Click **Run** again to run this sample procedure and see the resulting job status on the Job Details page.

## Implementation

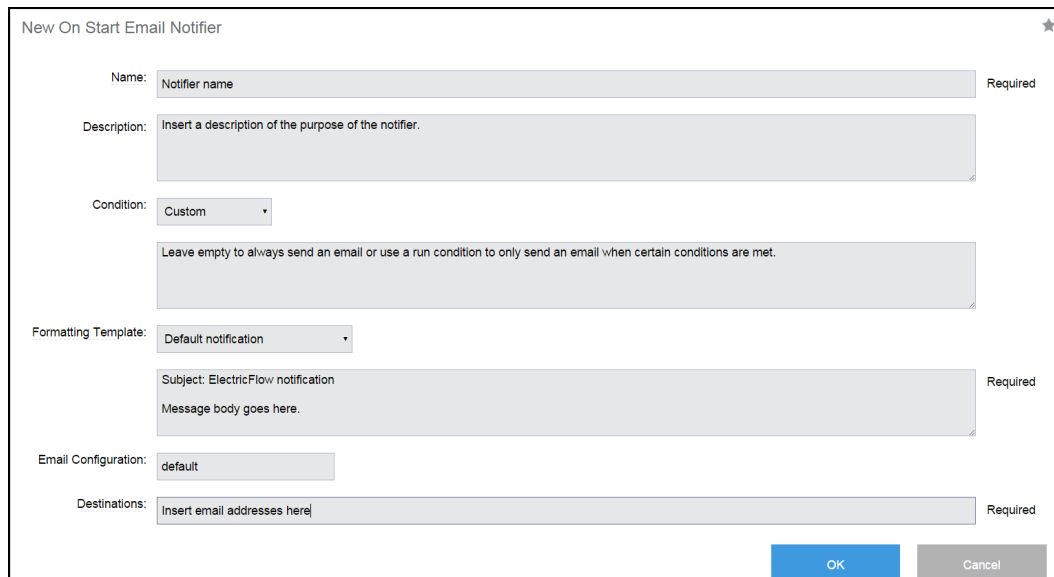
**Note:** Use the following information to create an email notifier in your own project, assuming you have already setup an email configuration. Any changes you might make within this tutorial will not be saved when you upgrade ElectricFlow.

Using the ElectricFlow automation platform UI to add an email notifier:

1. On the Procedure Details page, go to the Email Notifiers section, and click **Create On Start Email Notifier**.



2. Enter information in the fields on the New On Start Email Notifier page. See the example below.



**Note:** If the Email Configuration field is left blank, the system uses the email configuration with the name "default".

Click **OK** to save the notifier.

When the procedure is run, an email notification is sent to the email addresses specified in the Destinations field. In this tutorial example, the Destinations field refers to the parameter value passed in to the procedure when it is run.

The value is referenced using the following notation:

```
${myJob/Send notification email to}
```

## Related information

[Email Configuration—create new or edit existing email configuration](#)—Help topic

[Email Notifier—create new or edit existing email notifier](#)—Help topic

## Executing Tasks on All Resources in a Pool

Creating resource pools (grouping resources) means you can reference many resources using one name, the pool name. When configuring a step, you can "broadcast" the step to all resources in a pool. For example, you might want to start an application deployment at the same time on all resources in a pool.

This tutorial shows how to group resources into a resource "pool".

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

This procedure implements three steps:

1. The first step, `Setup environment`, creates a pool for resources.

Clicking on the step name takes you to the Edit Step page to see the full command text supplied to create this step—a partial section is displayed in the Action column.

**Note:** Functionality to create this step is beyond the scope of this tutorial. For more information, see the link to "Using ectool and the ElectricFlow API" below.

The following resources were created and added to a pool named EC-Tutorial-pool:

EC-Tutorials-resource1

EC-Tutorials-resource2

EC-Tutorials-resource3

2. The second step, `Execute command on all resources in pool`, executes an echo statement on the resource EC-Tutorial-pool and has the "broadcast" option selected, which results in the step executing on all resources in the pool simultaneously.
3. The third step, `Cleanup`, deletes the resources created in the `Setup environment` step.

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

## Implementation

**Note:** This tutorial is intended for viewing only and/or clicking on the available links to see more information. Any modifications you might make within this tutorial cannot be transferred to your projects and will not be saved when ElectricFlow is upgraded.

Before you can create the steps illustrated in this tutorial procedure for your own purpose, you must have already defined your resources and created resource pools.

See the following list of related links for more help with creating and using resource pools.

## Related information

[Resources](#)—Help topic

[Resource Pool—create new or edit existing pool](#)—Help topic

[Resource Pool Details](#)—Help topic

[Step —create new or edit existing step](#)—Help topic

## Factory Procedures

*Factory* procedures allow dynamic behavior in process automation. To implement a factory procedure, you must first create a procedure that other procedures can use as a template. A procedure uses the template to construct new procedures at runtime. Instead of creating steps or complex scripts to account for all possible scenarios, procedures can be created "on the fly" based on user input, resulting in a very dynamic system.

This tutorial shows how to create factory (dynamic) procedures, which are procedures that modify themselves at runtime based on parameters passed into them.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### An explanation for what you see and what is actually happening:

This tutorial contains 2 procedures and creates a third procedure "on the fly":

- "Factory procedures"—this procedure uses the procedure template (Utility Procedure—Factory Template).  
This procedure has a parameter called "number of steps". This parameter takes an integer and is used to specify how many new steps should be generated.  
**Note:** For this tutorial example, only one procedure is constructed to use the template procedure, but you may have multiple procedures that use the factory template procedure.
- "Utility Procedure—Factory Template"—you do not see this procedure on this Procedure Details page, but it is included in the EC-Tutorials project. This is the factory procedure template used when generating new steps in the main procedure. This procedure implements a single step that writes some text to the log file.  
This procedure is designed to do a repetitive task, repeating the task a variable number of times. For example, you might need to run a test framework "n" number of times.  
**Note:** You can view this procedure in the EC-Tutorials project.

The main procedure, "Factory procedures", implements these steps:

- The first step: "create dynamic procedure" is a Perl script that uses the Perl API to create a new procedure.  
The following script creates a new procedure containing the number of steps specified by the parameter:

```
my $procedureName = "Dynamically Created Procedure ${jobId}";
Sec->createProcedure("${myProject/projectName}", $procedureName);
for(my $i=0;$i<${number of steps};$i++)
{
```



```

$ec->createStep("$[/myProject/projectName]", $procedureName, "Generated step
$i", {subprocedure => "Utility Procedure-Factory Template",

  actualParameter => {actualParameterName => 'text', value => "Executing
generated step $i"}});

}

```

```

$ec->setProperty("/myJob/dynamicProcedure", $procedureName);

```

1. First, the procedure generates a unique name for the new procedure to be created. The name is created by appending the value of the `$[jobId]` property string.
  2. A new procedure is created in the current project.
  3. Based on the number of steps to be created that were passed in as a parameter, a number of subprocedure steps are created in the procedure. The subprocedure steps call the utility procedure associated with this tutorial.
  4. The name of the newly created procedure is stored in `/myJob/dynamicProcedure`
- The second step: "Run dynamically created procedure" calls the procedure that was created in Step 1. Step 2 appears to call nothing, but in fact it is calling a procedure referred by `$[/myJob/dynamicProcedure]`.

Click **Run** to run this sample procedure and go to the Job Details page.

Running the procedure and specifying the number of steps to be generated as 3, results in the following job being executed:

Job Details / Factory procedures-4

Completed with Success

Start Time: 2015-07-12 16:45:34 PDT

Elapsed Time: 00:00:02.960

Project: EC-Tutorials-1 0.0.69904

Procedure: Factory procedures

Launched by: admin

Priority: normal

View: All

StepsDiagnosticsParametersPropertiesNotifiersPublished Artifact VersionsRetrieved Artifact Versions

Expand AllCollapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
create dynamic procedure		Completed with Success	00:00:00.893	local	<div><div></div><div></div></div>
<div>Run dynamically created procedure</div>		Completed with Success	00:00:00.720		<div><div></div><div></div></div>
<div>Generated step 0</div>		Completed with Success	00:00:00.067		<div><div></div><div></div></div>
display text	<div></div>	Completed with Success	00:00:00.075	local	<div><div></div><div></div></div>
<div>Generated step 1</div>		Completed with Success	00:00:00.060		<div><div></div><div></div></div>
display text	<div></div>	Completed with Success	00:00:00.062	local	<div><div></div><div></div></div>
<div>Generated step 2</div>		Completed with Success	00:00:00.056		<div><div></div><div></div></div>
display text	<div></div>	Completed with Success	00:00:00.068	local	<div><div></div><div></div></div>
Delete dynamically created procedure		Completed with Success	00:00:00.361	local	<div><div></div><div></div></div>

Notice the steps that execute in parallel in the dynamically created procedure:  
Generated step 0, Generated step 1, and Generated step 2

## Implementation

To create a "factory procedure" process in your project:

1. Create a utility procedure—this procedure performs a task.
  - Create the steps you need for your task.
2. Create a second procedure—the "factory procedure," providing a name of your choice for this procedure.
  - Create a minimum of 3 steps in this procedure.
    - step 1—create a new procedure that contains steps, each calling the utility template procedure.
    - step 2—this step executes the procedure created in step 1.
    - step 3—this step deletes the procedure created in step 1.

Each time you run the "factory procedure," it creates a temporary procedure to run the utility procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Postp extension

*postp* is a powerful ElectricFlow feature (postprocessor) you can use to monitor step output in real-time and take action. Frequently, the *action* is to extract information from step output, store it in the ElectricFlow database, and set properties for reporting. In addition, *postp* can be used to execute functionality depending on whether or not a pattern is found. *Postp*, an essential part of the ElectricFlow toolbox, provides fast feedback to users about job step status.

**Note:** *Postp* matchers are written in Perl. *Postp* extensions are either loaded from a file located on the ElectricFlow server or from a stored property.

This tutorial demonstrates how to construct a simple custom *postp* matcher to extend *postp* capabilities, and loads the *postp* extension from a property.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

### An explanation of what you see:

- This procedure implements a single step, "get directory listing", that retrieves a directory listing using a simple Perl script. Perl is used for the example to ensure the same output no matter which operating system is used for this tutorial. Understanding the Perl code used to generate the tutorial listing is not required for this tutorial.
- A property was created. This procedure has a *postp* extension attached in a property named `matcher` and contains the following Perl code:

```
use ElectricCommander;
push (@::gMatchers,
{
  id => "fileCountMatcher",
  pattern => q{(\d+ File\s\)},
  action => q{
    setProperty("summary", "Matcher $matcher->{id} found the following
    output\n\n$1");
  }
});
```

The `postp` matcher has an identifier ("`id`"), a regular expression ("`pattern`") that matches text and an "`action`" to be performed when text matching the regular expression is found. In this case, the regular expression "`id`" is `fileCountMatcher`, and an example of the output being matched is "`2 File(s)`". When the pattern is matched, the action to perform is to set the summary property to the text matched by the regular expression.

The custom `postp` matcher is loaded using the following command in the Postprocessor field when creating the step:

```
postp -loadProperty /myProcedure/matcher
```

Click on the step name to go to the Edit Step page to see how this step was created—note the text in the Command box and the Postprocessor field.

Click **Run** to run this sample procedure and see the resulting job on the Job Details page.

See the Status column. The number of files in the file system root where the workspace is located is displayed.

Job Details / Postp extension-5

**Completed with Success**  
 Start Time: 2015-07-12 16:48:34 PDT  
 Elapsed Time: 00:00:00.906

Project: EC-Tutorials-1 0.0.69904  
 Procedure: Postp extension  
 Launched by: admin  
 Priority: normal

View: All ▾

Steps | Diagnostics | Parameters | Properties | Notifiers | Published Artifact Versions | Retrieved Artifact Versions

Expand All | Collapse All

Step Name	Log	Status	Elapsed Time	Resource	Actions
get directory listing					
Matcher fileCountMatcher found the following output 8 File(s)		✓	00:00:00.641	local	

## Implementation

To try using `postp` functionality in your own project:

- Edit an existing procedure or create a new one with a "matcher" as a property.  
For your practice example, you can "copy and paste" the matcher example provided in this tutorial (above).
- Create a new Command step for this procedure—filling in the Postprocessor field on the New Steps page.  
Again, for practice, you can use the `postp` string provide above in this tutorial.

When you run your new procedure, you will see results similar to those you saw after running the tutorial example procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Related information

[Postprocessors](#)—Help topic

[Step—create new or edit existing step](#)—Help topic

## Publishing and Retrieving an Artifact

To ensure traceability in processes, output needs to be versioned and tracked as it is handed from one process stage to another. With ElectricFlow Artifact Management, implementing your processes is auditable and secure.

This tutorial shows how to produce and consume artifacts as part of an ElectricFlow process.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see—the following concepts are illustrated in this procedure:**

- The first five steps are simple ec-perl scripts that create files and directories as use as an artifact.

The first step, "Create myartifact.txt file", creates a text file in a workspace that can be added as an artifact. Click this step to go to the Edit Step page to see the full "dummy" script used to set up the artifact in the Command(s) field. This script creates a file named `myartifact.txt`.

**Note:** There is no code specific to ElectricFlow in this step, so understanding the Perl code used to generate the text file is not necessary.

The next four steps create a directory, a subdirectory and the second text file in it.

- The "Publish artifact" step calls the EC-Artifact:Publish procedure. This step is configured to place the file `myartifact.txt`, created in the Setup step, into an artifact.

To do this, the EC-Artifact: Publish procedure requires the following information:

- The artifact where you want to publish. This is in the format `Artifact Group:Artifact Key`.  
In this case, the name of the artifact (where you want to publish) is `EC-Tutorials:MyArtifact`.
- The artifact version being published. The version is in the form of `major.minor.patch-qualifier-buildnumber` or `major.minor.patch.buildnumber-qualifier`. For this tutorial, the version is set to `1.0.${jobId}-tutorial`.  
Using the `${jobId}` property expansion results in a new artifact being created every time the procedure is run.
- The repository server from which you need to retrieve the artifact. This tutorial uses a repository named `default` that was created when ElectricFlow was installed.

**Note:** To see how this information is specified in this step, click the "Publish artifact" step name to go to the Edit Step page.

- The "Retrieve artifact" step calls the EC-Artifact: Retrieve procedure. This step takes two required parameters and several optional parameters (see the Edit Step page/Parameter section for this step). The required parameters are:

- **Artifact** – EC-Tutorials:MyArtifact (this is the name of the artifact to retrieve).
- **Version** – 1.0.\${jobId}-tutorial (this is the artifact version to be retrieved—either an exact version or a version range). This tutorial uses an exact version.

The optional parameters are:

- **Retrieve to directory** – the location where the artifact files are downloaded when they are retrieved. This is where the retrieved artifact versions are stored.
- **Overwrite** – the default is **update** where the artifact files are updated when they are retrieved. The other values are **true** (the files for the retrieved artifact versions are overwritten) or **false** (the files for the the retrieved artifact versions are not overwritten).

The **Retrieved Artifact Location Property** parameter is the name or property sheet path that the step uses to create a property sheet. The default value is

`/myJob/retrievedArtifactVersions/${assignedResourceName}`.

This property sheet has information about the retrieved artifact versions, including their location in the file system. It displays the location from where the artifact is to be retrieved and retrieves the property value in the `/myJob/retrievedArtifactVersions/${assignedResourceName}`.

For the **Filter(s)** parameter, enter search filters, one per line, applicable to querying the ElectricFlow database for the artifact version to retrieve.

For more information about these parameters, go to [Retrieve Artifact Version Step](#).

- The "Output location that artifact was retrieved to" step prints the message "Artifact extracted to: <directory where the retrieved artifact will be located>".
- Click **Run** to run this sample procedure and see the resulting job on the Job Details page.

## Implementation

To publish and retrieve artifacts, apply these concepts to your artifact projects, creating the steps as required to your procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Related information

[Artifact Management](#)—Help topic

[Artifact Details](#)—Help topic

[Job Details](#)—Help topic

[Publish Artifact Version step](#)—Help topic

[Retrieve Artifact Version step](#)—Help topic

## Reserving a Resource for Job Step Duration

Sometimes you may want a resource to perform work for only one job at a time. Because a ElectricFlow agent is capable of executing steps for many jobs on a resource, this can produce undesirable performance results. For example, you might want a dedicated resource to stress test an application after you have ElectricFlow initiate a load testing task.

This tutorial shows how to reserve a resource for one job step only while that job step is running.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

- This procedure locks the resource for the step and executes the tasks.
- To demonstrate this functionality, two steps are implemented.
  - Notice that both steps are set to run in parallel on the local resource.
  - Both steps request a lock of the resource for the duration of the step execution.

The functionality implemented in each step:

- A simple Perl sleep statement to force a lock over a period of time when the procedure is run
- Select "Step" in the Retain Exclusive field in the Advanced section on the New/Edit Step page

Click a name in the Step Name column (to go to the Edit Step page for that step). You will see the Perl sleep statement added to the Command text box, and "Step" selected on the Retain Exclusive field.

Instead of running the steps in parallel as you may have previously requested, the steps will now execute serially. The second step must wait for the resource to become available because it was reserved by the first step.

Click **Run** to run this sample procedure and see the resulting job on the Job Details page.

## Implementation

Create or edit Command Steps for your procedures if you need this functionality.

- Go to the Procedure Details page for the procedure where you want a step to reserve a resource.
- Add a Command Step to your procedure (use the step creation link at the top of the table), or edit an existing step.
- In the Command text box, enter a script if you want to specify any time constraints.
- On the New/edit Steps page, in the Advanced section, choose "Step" in the Retain Exclusive field.

The next time you run this procedure, your job step will have exclusive use of the resource you specified.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Related information

[Step—create new or edit existing step](#)—Help topic

## Running Steps in Parallel

The main advantage to running steps in parallel is increased performance. You can set a step to run serially as a synchronization point and then execute more steps in parallel. For example, running steps to execute tests on different platforms concurrently would mean numerous tests could complete in the same time period.

This tutorial demonstrates how to run steps in parallel.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

This procedure contains 5 steps:

- Step 1 and 2 run in parallel.
- The third step (sync) is a sync point where the procedure waits until steps 1 and 2 finish executing.
- Steps 4 and 5 execute in parallel after the sync point.
- Steps 1, 2, 4, and 5 execute simple Perl scripts that print a message and "sleep" for a period of time.

**Note:** Using "sleep" is not required, but used here to make sure each parallel step runs long enough to be visible while running this tutorial.

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

**Implementation**

**Note:** Use the following information to create steps to run in parallel in your procedures. Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

Steps will run in parallel if you select the Run in Parallel option in the Advanced section on the Step—create new or edit existing step page.

**Advanced**

Precondition

Run Condition:

Error Handling:

Procedure continues, but overall status will be error ▾

Time Limit:

minutes ▾

Run in Parallel:

☒

Always Run Step:

☐

Broadcast:

☐

Retain Exclusive:

None ▾

Release Exclusive:

None ▾

Shell

ec-perl

Workspace

Working Directory:

Log File:

## Related Information

[Step—create new or edit existing step](#)—Help topic

## Step Timeouts and Steps that Always Run

Complex processes can be brittle so ElectricFlow provides a way to account for different errors in your procedures. You can specify timeouts, error handling methods, and steps that always run no matter what errors have occurred in preceding steps in the procedure. These facilities can make sure your build does not "hang" in a situation where you would prefer the build to continue.



This tutorial shows how to construct a procedure so processes are terminated after a set time period and how to implement a step that always runs in the event of an error (to perform cleanup).

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

This procedure implements 2 steps:

(Clicking on the step name takes you to the Edit Step page to see how the step was created.)

- The "force timeout" step has a 10-second timeout and is set to abort the procedure and terminate running steps in the event of a timeout or error.

This step executes a sleep command using ec-perl, which makes the step execute for 15 seconds. Step error handling is set to "Abort procedure and terminate running steps". This step will always fail because the 15-second sleep time is longer than the 10-second timeout.

- The "always run" step set to run no matter what the error handling behavior is for any preceding steps.

This step uses an echo statement to output some text. The step property, `Always Run Step`, is set to "true" so this step runs regardless of the result for the preceding step.

Click **Run** to run this sample procedure and see the resulting job on the Job Details page.

On the Job Details page: Notice that the "always run" step completed with Success while the "force timeout" step completed with a TIMEOUT error.

## Implementation

**Note:** This tutorial is intended for viewing only. Any changes you might make within this tutorial cannot be transferred to your projects will not be saved when you upgrade ElectricFlow.

As you create steps for your projects, you can duplicate these tutorial concepts. On the New Steps page, review the Advanced section. Notice the Error Handling and Always Run Steps options.

- For Error Handling, choose the option that best suits your purpose.
- For the Always Run Step option, select the checkbox to ensure this step will always run.

## Storing and Retrieving Properties in a Job

When a job is running, it is often necessary to share data between steps. Because the data being shared is specific to the running procedure instance, the job, the data is more appropriately stored at the job level rather than the procedure level. Use the techniques illustrated in this tutorial to safely pass data between steps in a job.

This tutorial shows you how to create, set, and retrieve properties stored on a job.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

This procedure implements two steps.

- Write data to a property attached to the running job:  
"Step 1—Create a property attached to the job" calls ectool to create a property name `property1`.
  - The path to the property being set is `/jobs/${myJob}/property1`.
  - `${myJob}` is a shortcut to the running job name and can be used while the job is running.  
If the job number was 1000, the path `/jobs/${myJob}/property1` might expand to `/jobs/job-1000/property1`.
- Read data from the property created in Step 1:  
"Step 2—Read the property attached to the job by Step 1"—this step could read step values stored on a job, running as part of the job, or could be executed using a simple property expansion.
  - In this case, `property1` was set in Step 1 and is referenced in Step 2 using the `${property1}` notation.
  - Two other ways to reference a property (shown by example in the Action column):
    - Using `${myJob/property1}`
    - Using inline JavaScript with the notation `[/javascript myJob.property1]`

Click **Run** to run this sample procedure and see the resulting job on the Job Details page.

- After the job completes, click the icon in the Log column for Step 2 to view three lines each showing the data (the property value) that was stored in the property that was retrieved.

## Implementation

If you need to retrieve properties, adapt these step concepts to your procedures.

- For help getting started, click on a step name in the tutorial procedure to go to the corresponding Edit Step page.
- You can reuse the text supplied in the Command(s) box, changing the "property1" name and other values to those more meaningful to your project/procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Related information

[Procedure—create new or edit existing procedure](#)—Help topic

[Step—create new or edit existing step](#)—Help topic

## Working with Properties Stored in a Procedure

Using ElectricFlow properties is one of the keys to robust yet flexible process automation. Configuration and historical data persistence are common tasks in process automation.

This tutorial shows common ways to read and write properties on a procedure.

**Note:** For this tutorial, familiarity with creating procedures and steps is assumed. See the "Related Information" links below if you would like to review these topics.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see—this procedure implements the following functionality:**

- This procedure implements five steps. Each step name is a description of its action.
  - Click on a step name to go to the corresponding Edit Step page to see how the step was created. This page also contains text in the Description text box to describe what you see in the Action column on the Procedure Details page. The full text of what appears in the Action column is provided in the Command text box.
  - In the Custom Procedure Properties table, notice two properties were created: `property1` and `property2`
- There are numerous ways to work with stored properties. ***Each of the 5 steps described below illustrates a different method.***
  - Read data from `property1` using the *property substitution* notation (syntax):  
The property value is read in this step using the property substitution reference `$/myProcedure/property1`.
  - Read data from `property1` using inline JavaScript:  
The property name `property1` is read from the procedure level using this JavaScript notation: `$/javascript myProcedure.property1`.
  - Perform a calculation using data from `property 2` and inline JavaScript:  
In this example, the value of `property2` is multiplied by 5 using this JavaScript notation: `$/javascript myProcedure.property2 * 5`.
  - Read data from a `property1` using the ElectricFlow Perl API:  
Perl code is used to call the ElectricFlow API to retrieve the value of `property1`.  
The `getProperty` API returns an object so the property value must be retrieved after the `getProperty` call, using the `findnodes` method for the returned object.

```
#read the property
my $property1node = $ec->getProperty("/myProcedure/property1");
#retrieve the property value from the object returned to $property1node
my $property1 = $property1node->findnodes("//value")->string_value();
```

- Read data from `property1` using `ectool`:  
`ectool` code is used to retrieve the value of `property1`:

```
ectool getProperty "/projects/$[/myProject/projectName]/procedures/Working
with properties stored in a procedure/property1"
```

Click **Run** to run this sample procedure and see the results on the Job Details page.

On the Job Details page, click the icon in the Log column to see the value read from the property.

**Implementation**

If you need to retrieve properties stored in a procedure, adapt any one of these step concepts to your procedures.

You can reuse the text supplied in the Command(s) box (from any Edit Step page in this tutorial), changing names and other values to those more meaningful to your project/procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

## Related Information

[Procedure—create new or edit existing procedure](#)—Help topic

[Step—create new or edit existing step](#)—Help topic

[Properties](#)—Help topic

## Glossary

This glossary is a reference topic containing short descriptions for ElectricFlow objects, terms, and concepts.

Term	Description
access control	<p>An access control list (ACL) determines if a particular user can perform a particular operation on a specified object. The list contains <i>access control entries</i> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use.</p> <p>See the <b>Access Control</b> topic for more information.</p>

Term	Description
ACE (Access Control Entry)	<p>An ACL determines if a particular user can perform a particular operation on a specified object. The list contains <i>access control entries</i> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use.</p> <p>See the <b>Access Control</b> topic for more information.</p>

Term	Description
ACL (Access Control List)	<p>An ACL determines if a particular user can perform a particular operation on a specified object. The list contains <i>access control entries</i> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use.</p> <p>See the <b>Access Control</b> topic for more information.</p>

Term	Description
actual parameter	<p>An actual parameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from "formal parameters": formal parameters define parameters a procedure is expecting, and actual parameters provide values to use at run-time.</p>



Term	Description
admin	"admin" is a special built-in user that has universal ElectricFlow access. If you log in as admin, you can perform any operation in the system, regardless of access control limitations.

Term	Description
agent	<p>An agent is an ElectricFlow component that runs on each machine where job steps can execute. The agent works under the ElectricFlow server's control to execute job steps, monitor their progress, and record information about their completion. A single agent process can manage multiple job steps executing concurrently on a single machine.</p> <p>See the <b>Web Interface Help &gt; Resources</b> topic for more information.</p>

Term	Description
artifact	An artifact is a top-level object containing artifact versions, a name template for published artifact versions, artifact specific properties, and access control entries to specify privileges.

Term	Description
artifact key	An artifact key is an identifier for an artifact and the "key" component of the artifact name.

Term	Description
artifact repository	See the <b>Artifact Management &gt; Artifact objects &gt; Repository</b> topic for more information.

Term	Description
artifact version	An artifact version is a collection of 0 to N files that were published to an artifact repository.

Term	Description
backing store	The backing store is the directory on the repository server where artifact versions are stored. By default, the backing store is the <datadir>/repository-data directory in the repository installation—this default setting can be changed.

Term	Description
child step	<p>A nested step that appears as a substep in the Job Details page when a step is either of the following:</p> <ul style="list-style-type: none"><li>• A subprocedure step</li><li>• A step that dynamically creates subordinate (“child”) steps using the <code>createJobStep</code> API command</li></ul> <p>For details about the <code>createJobStep</code> API command, see the ElectricFlow API Guide at <a href="http://docs.electric-cloud.com/eflow_doc/FlowIndex.html">http://docs.electric-cloud.com/eflow_doc/FlowIndex.html</a>).</p>



Term	Description
compression	Compression reduces transfer time when publishing an artifact. However, compression also adds overhead when computing the compressed data. If files included in the artifact version are primarily text files or are another highly compressible file format, the benefit of reduced transfer time outweighs the cost of computing compressed data.

Term	Description
continuous integration	<p>Using continuous integration means a build is launched every time code changes are checked into a Source Control Management (SCM) system.</p> <p>The ElectricFlow ElectricSentry component is the engine for continuous integration, while the CI Continuous Integration Dashboard is the front-end user interface for ElectricSentry.</p>

Term	Description
credential	A credential is an object that stores a user name and password for later use. You can use credentials for user <a href="#">impersonation</a> and saving passwords for use inside steps. Two credential types are available: <i>stored</i> or <i>dynamic</i> .

Term	Description
custom property	<p>Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner and behave in every way like an intrinsic object-level property with one exception: they are not created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution.</p> <p>Custom properties in a property sheet can be one of two types: <i>string</i> property or a <i>property sheet</i> property. String properties hold simple text values. Property sheet properties hold nested properties. Nested properties are accessed by way of the property sheet property of their containing sheet.</p>

Term	Description
description	<p>A description is an optional plain text or HTML description for an object.</p> <p>Description text is for your use, ElectricFlow does not use this information. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code> <code>&lt;b&gt;</code> <code>&lt;br&gt;</code> <code>&lt;div&gt;</code> <code>&lt;dl&gt;</code> <code>&lt;font&gt;</code> <code>&lt;i&gt;</code> <code>&lt;li&gt;</code> <code>&lt;ol&gt;</code> <code>&lt;p&gt;</code> <code>&lt;pre&gt;</code> <code>&lt;span&gt;</code> <code>&lt;style&gt;</code> <code>&lt;table&gt;</code> <code>&lt;tc&gt;</code> <code>&lt;td&gt;</code> <code>&lt;th&gt;</code> <code>&lt;tr&gt;</code> <code>&lt;ul&gt;</code></p>

Term	Description
diagnostic extract	<p>A diagnostic extract is a log file portion from a job step, typically describing an error or interesting condition, extracted by a postprocessor and saved for reporting. The postprocessor usually places this information in an XML file in the top-level job workspace directory, and then sets a property that contains the filename.</p> <p>The ElectricFlow <i>postp</i> postprocessor uses filenames like <code>diag-2770.xml</code>, where "2770" is the unique identifier for the step. Other postprocessors you may use can have a different filename configuration.</p>

Term	Description
dynamic credential	Dynamic credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

Term	Description
ec-perl	<i>ec-perl</i> is a small wrapper program installed as part of ElectricFlow. When the ec-perl wrapper runs, it sets up the environment, finds, and calls ElectricFlow's copy of Perl, passing all of its parameters to Perl.



Term	Description
ectool	<i>ectool</i> is the ElectricFlow command-line application that provides control over the ElectricFlow system if you prefer using a command-line interface rather than the ElectricFlow web interface. Most functions that can be invoked through the ElectricFlow web interface can be invoked using <i>ectool</i> .

Term	Description
ElectricAccelerator	ElectricAccelerator is a software build accelerator that dramatically reduces software build times by distributing the build over a large cluster of inexpensive servers. Using a patented dependency management system, ElectricAccelerator identifies and fixes problems in real time that would break traditional parallel builds. ElectricAccelerator plugs into existing Make-based infrastructures seamlessly and includes web-based management and reporting tools.

Term	Description
ElectricSentry	<p>ElectricSentry is the ElectricFlow engine for continuous integration, integrating with numerous Source Control Management (SCM) systems. ElectricSentry is installed automatically with ElectricFlow and is contained in a plugin named ECSCM and in the Electric Cloud project.</p> <p><b>Note:</b> The CI Continuous Integration Dashboard is the front-end user interface for ElectricSentry.</p>

Term	Description
email configuration	Before you can send an email notifier, you must set up an email configuration, which establishes communication between the ElectricFlow server and your mail server.

Term	Description
email notifier	After setting up the ElectricFlow server and your mail server to communicate, you can send email notifications (notifiers). You can attach email notifiers to procedures, procedure steps, and state definitions.

Term	Description
Event log	See log.

Term	Description
Everyone	A special intrinsic <a href="#">access control</a> on page 1288group that includes <b>all</b> users.

Term	Description
filter	<p>Two filter categories:</p> <ul style="list-style-type: none"><li>• Intrinsic filters—these filters provide a convenient way to access certain well-defined fields for jobs.</li><li>• Custom filters—these filters allow you to access a much broader range of values, including custom properties. Any values accessible through an intrinsic filter can be checked using a custom filter also (though not as conveniently).</li></ul>



Term	Description
formal parameter	A formal parameter is an object that defines a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from "actual parameters": formal parameters define the kinds of parameters a procedure is expecting, and actual parameters provide values to use at run-time.

Term	Description
gateway	<p>To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created.</p> <p>A gateway object contains two resource (agent) machines. For example, GatewayResource1 and GatewayResource2 are each configured to communicate with the other. One gateway resource resides in the <i>source</i> zone and the other in the <i>target</i> zone.</p> <p>A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).</p>

Term	Description
group	<p>A group defines a collection of users for access control purposes. A group can be defined externally in an LDAP or Active Directory repository, or <i>locally</i> in the ElectricFlow server.</p> <p>See the <b>ElectricFlow Help &gt; Web Interface Help &gt; Users and Groups &gt; Groups</b> topic for more information.</p>

Term	Description
impersonation	Impersonation is a mechanism that allows a job step to execute under a particular login account (the ElectricFlow agent "impersonates" a particular user during the execution of that step). Impersonation is implemented using credentials. See the <i>ElectricFlow User Guide</i> for more information.

Term	Description
inheritance	A feature of the ElectricFlow access control mechanism where access to a particular object is determined by the access control list for that object, and also by the access control lists of the object's parent and other ancestors. Each object can be configured to enable or disable inheritance from its ancestors.

Term	Description
intrinsic property	<p>Intrinsic properties represent attributes that describe the object to which they are attached. ElectricFlow automatically provides intrinsic properties for each similar type object within ElectricFlow.</p> <p>For example:</p> <p>Every project has a <code>description</code> property that can be referenced with a non-local property path such as <code>/projects/Examples/description</code>.</p>

Term	Description
job	A job is the output associated with invoking a ElectricFlow procedure. A new job is created each time you <b>run</b> (execute) a procedure.

Term	Description
job configuration	<p>A job configuration is an object containing all parameter and credential information needed to run a procedure. A Job Configuration section is provided as part of the ElectricFlow Home page to make it easy for you to invoke your favorite configurations with a single mouse click. You can create job configurations in three ways:</p> <ul style="list-style-type: none"><li>• From the Job Details page for a previously invoked job, click the <b>Save Configuration</b> link at the top of the page. Your saved job configuration will be displayed on your Home page.</li><li>• Create a job configuration from "scratch" by clicking the <b>Create</b> link in the Job Configurations section (on the Home page). In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.</li><li>• On the page for editing a schedule, click the <b>Save Configuration</b> link at the top of the page. Your saved configuration will be displayed on your Home page.</li></ul>



Term	Description
job name template	<p>This is the template used to determine the default name for jobs launched from the procedure. You can create a Job Name Template when you create a procedure.</p> <p>For example:</p> <p>In the Job Name Template field, you might enter:</p> <pre><code>\${projectName}_\${/increment /myproject/jobCounter}_\${timestamp}</code></pre> <p>which produces a name like:</p> <pre><code>projectFoo_1234_20140102130321</code></pre> <p>You can enter any combination of elements to create procedure names more meaningful to you. For example, you could choose to include the build number and procedure name.</p>

Term	Description
jobs quick view	A Jobs Quick View section is one of the facilities provided on the ElectricFlow Home page. This section allows you to define a category of jobs interesting to you (such as all running jobs or all jobs for a particular product version). Your Home page can display the last several jobs in each category you define.

Term	Description
job step	After a procedure is executed, the resulting job contains one job step for each step in the original procedure. The job step records information about the procedure step execution, such as the command executed, the resource where it executed, execution time, and error information.

Term	Description
job workspace	<p>A directory (containing all files and subdirectories) allocated by ElectricFlow for a particular job. Each job workspace is allocated as the child of a workspace root directory.</p> <p>See <a href="#">workspace</a> on page 1369.</p>

Term	Description
local group	<p>A group defined <i>inside</i> ElectricFlow, as opposed to a group defined in an external repository. A local group can refer to both local and remote users, whereas a group in an external repository refers to users in that repository only.</p> <p>See <a href="#">group</a>.</p>

Term	Description
local user	<p>A user defined <i>inside</i> ElectricFlow, as opposed to a user defined in an external repository. If a user defined in an external repository has the same name as a local user, the external user is not accessible. Local users are not visible outside ElectricFlow. We recommend using external accounts whenever available, but you may need to create local users if you do not have a shared directory service or if you need special accounts to use for ElectricFlow only.</p> <p>See <a href="#">user</a>.</p>

Term	Description
log	<p>ElectricFlow provides a log for events generated anywhere in the system, including jobs and workflows.</p> <p><b>Note:</b> From the Administration tab, the default view for the Event Log page is the warning (WARN) level. For workflow and job event logs, the default view from their respective pages is the information (INFO) level.</p> <ul style="list-style-type: none"><li>• To see <i>only</i> events for a single workflow, select the Workflows tab, then a workflow Name to go to the Workflow Details page and click the View Log link at the top of the page.</li><li>• To see <i>only</i> events for a single job, select the Jobs tab, then the Job name to go to the Job Details page and click the View Log link at the top of the page.</li><li>• To see <i>only</i> events for a specific object, select the Search tab to go to the Define Search page. For example: You can select the Object Type, "Log Entry", then click the <b>Add Intrinsic Filter</b> link. Select the down-arrow where you see "Container" auto-populated and select "Container Type. Use the "equals" operator, then select the next down-arrow to choose an object. Click <b>OK</b> to start the search. See the <b>ElectricFlow Help &gt; Web Interface Help &gt; Event Log</b> topic for more information.</li></ul>

Term	Description
matcher	<p>A <i>matcher</i> controls the <a href="#">postp</a> postprocessor. Use matchers to extend postp with additional patterns if you find useful patterns in your log files undetected by postp. A matcher contains a pattern that matches lines in a step's log and actions to carry out if/when the pattern matches.</p>



Term	Description
misfire policy	<p>A misfire policy allows you to manage how a schedule resumes in cases where the normal scheduled time is interrupted.</p> <p>Available options are:</p> <p><code>skip</code> (all misfires are ignored and the job runs at the next scheduled time) and <code>run once</code> (after one or more misfires, the job runs at the soonest time that occurs within an active region).</p> <p>See <a href="#">schedule</a> on page 1354 .</p>

Term	Description
parameter	A property value passed into a procedure when it is invoked (at <i>run</i> time), and used by the procedure to change its behavior. Two types of parameters: <a href="#">actual</a> and <a href="#">formal</a> .

Term	Description
plugin	<p>A plugin is a collection of one or more features, or a third-party integration or tool that can be added to ElectricFlow. Plugins are delivered as a JAR file containing the functional implementation. When a plugin is installed, the ElectricFlow server extracts the JAR contents to disk into a configurable plugins directory.</p> <p>A plugin has an associated project that can contain procedures and properties required by the implementation. A plugin can provide one or more new pages for the web interface and may also provide a configuration page so you can provide additional information that may be necessary to implement the plugin.</p>

Term	Description
polling frequency	The <i>polling frequency</i> is how often the ElectricSentry continuous integration engine is set to look for new code check-ins. The default is set to every 5 minutes, but this number can be adjusted.

Term	Description
pool	Also known as "resource pool". A pool is a collection of resources. If a step specifies a pool name as its resource, ElectricFlow can choose any available resource within that pool.

Term	Description
postp	<p><i>postp</i> is a postprocessor included with ElectricFlow. <i>postp</i> uses regular expression patterns to detect interesting lines in a step log. <i>postp</i> is already configured with patterns to handle many common cases such as error messages and warnings from <i>gcc</i>, <i>gmake</i>, <i>cl</i>, <i>junit</i>, and <i>cppunit</i>, or any error message containing the string "error."</p> <p><i>postp</i> also supports several useful command-line options, and it can be extended using "matchers" to handle environment-specific errors.</p> <p>See <a href="#">matcher</a>.</p>

Term	Description
postprocessor	<p>A postprocessor is a command associated with a particular procedure step. After a step executes, the postprocessor runs to analyze its results. Typically, a postprocessor scans the step log file to check for errors and warnings. Also, it records useful metrics such as the number of errors in properties on the job step, and extracts step log portions that provide useful information for reporting. ElectricFlow includes a standard postprocessor called <i>postp</i> for your use and you can "extend" <i>postp</i>.</p> <p>See <a href="#">matcher</a>.</p>

Term	Description
preflight build	<p>A preflight build provides a way to build and test a developer's changes before those changes are committed. A "post-commit" source tree is simulated by creating a clean source snapshot and overlaying the developer's changes on top of it. These sources are then passed through the production build procedure to validate the changes work successfully. Developers are allowed to commit their changes only if the preflight build is successful. Because developer changes are built and tested in isolation, many common reasons for broken production builds are eliminated.</p>



Term	Description
privileges	<p>ElectricFlow supports four privilege types (for access control and security) for each object:</p> <ul style="list-style-type: none"><li>• Read—Allows object contents to be viewed.</li><li>• Modify—Allows object contents (but not its permissions) to be changed.</li><li>• Execute—If an object is a procedure or it contains procedures (for example, a <i>project</i>), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.</li><li>• Change Permissions—Allows object permissions to be modified.</li></ul>

Term	Description
procedure	<p>A procedure defines a process to automate one or more steps. A procedure is the ElectricFlow unit you execute (<i>run</i>) to carry out a process. A step in one procedure can call another procedure (in the same or different project), and this procedure then becomes known as a "subprocedure" (also known as a "nested" procedure). The step can pass arguments to the subprocedure.</p>

Term	Description
project	<p>A project is a top-level container for related procedures, workflows, schedules, jobs, and properties, which is used to isolate different user groups or functions, and also encapsulate shared facilities.</p> <p>Projects have two purposes:</p> <ul style="list-style-type: none"><li>• Projects allow you to create separate work areas for different purposes or groups of people so they do not interfere with each other. In a small organization, you might choose to keep all work within a single project, but in a large organization, you may want to use projects to organize information and simplify management.</li><li>• Projects simplify sharing. You can create library projects containing shared procedures and invoke these procedures from other projects. After creating a library project, you can easily copy it to other ElectricFlow servers to create uniform processes across your organization.</li></ul>

Term	Description
project principal	<i>Project principal</i> is a special user ID associated with each project. If a project name is "xyz," the project principal for that project is "project: xyz" (with an embedded space). This principal is used when procedures within the project are run, so you can create access control entries for this principal to control runtime behavior.

Term	Description
property	<p>A property is a <code>name-value</code> pair associated with ElectricFlow objects to provide additional information beyond what is already built into the system. Built-in data is accessible through the property mechanism also. Two types of properties: <i>intrinsic</i> and <i>custom</i>.</p> <p><b><i>ElectricFlow provides Intrinsic properties and allows you to create Custom properties.</i></b></p> <p><b>Note:</b> Intrinsic properties are case-sensitive. Custom properties, like all other object names in the ElectricFlow system, are case-preserving, but not case-sensitive.</p> <ul style="list-style-type: none"><li>• <b>Intrinsic properties</b> These properties represent attributes that describe the object to which they are attached, and are automatically by ElectricFlow for each similar type object. For example, every project has a <code>Description</code> property that can be referenced with a non-local property path such as <code>/projects/Examples/description</code>.</li><li>• <b>Custom properties</b> Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner, and behave in every way like an intrinsic object-level property with one exception: they are not created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution.</li></ul>

Term	Description
property sheet	A property sheet is a collection of properties that can be nested to any depth. The property value can be a string or a nested property sheet. Most objects have an associated "property sheet" that contains custom properties created by user scripts.

Term	Description
proxy agent	A proxy agent is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported agent platform. Proxy agents have limitations, such as the inability to work with plugins or communicate with ectool commands.

Term	Description
proxy resource	This resource type requires SSH keys for authentication. You can create proxy resources ( <a href="#">agents</a> and <a href="#">targets</a> ) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment.



Term	Description
proxy target	A proxy target is an agent machine on an unsupported platform that can run commands via an SSH server.

Term	Description
publisher	A publisher is the job that completes the <i>publish</i> operation for an artifact version.

Term	Description
quiet time	<p>An inactivity period before starting a build within a continuous integration system. This time period allows developers to make multiple, coordinated check-ins to ensure a build does not start with some of the changes only—assuming all changes are checked-in within the specified inactivity time period. This time period also gives developers an opportunity to "back-out" a change if they realize it is not correct.</p> <p>Using ElectricSentry, the inactivity time period can be configured globally for all projects or individually for a single project.</p>

Term	Description
reports	<p>ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.</p> <ul style="list-style-type: none"><li>• Real-time reports—filtered view of your workload in real-time</li><li>• Build reports—summary reports produced at the end of a build and attached to the job</li><li>• Batch reports—summaries of your build environment with trends over time, two types:<ul style="list-style-type: none"><li>• Default Batch reports—automatically installed during ElectricFlow installation and scheduled to run daily (Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)</li><li>• Optional Batch reports—you can configure, rename, and schedule these reports to fit your requirements (Category Report, Procedure Usage Report, Count Over Time Report, Multiple Series Reports)</li></ul></li><li>• Custom reports—your choice to create and add at any time</li></ul>

Term	Description
repository or repository server	<p>The artifact repository is a machine where artifact versions are stored in either uncompressed <code>tar</code> archives or compressed <code>tar-gzip</code> archives. The repository server is configured to store artifact versions in a directory referred to as the repository <i>backing store</i>.</p> <p>By default, the backing store is the <code>&lt;datadir&gt;/repository-data</code> directory in the repository installation—this default setting can be changed.</p> <p>A <i>repository</i> is an object that stores artifact versions. This object primarily contains information about how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found.</p> <p>Connection information is stored in the repository object on the ElectricFlow server.</p>

Term	Description
resource	<p>A resource specifies an agent machine where job steps can be executed. Resources can be grouped into a "pool", also known as a "resource pool."</p> <p>ElectricFlow supports two types of resources:</p> <ul style="list-style-type: none"><li>• <b>Standard</b>—specifies a machine running the ElectricFlow agent on one of the supported agent platforms</li><li>• <b>Proxy</b>—requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment.</li></ul>

Term	Description
schedule	A schedule is an object used to execute procedures automatically in response to system events. For example, a schedule can specify executing a procedure at specific times on specific days. Three types of schedules are available: Standard, Continuous Integration, and Custom (custom schedules are typically continuous integration schedules that do not use the ECSCM plugin).

Term	Description
Sentry schedule	A continuous integration schedule created using the ElectricSentry engine for continuous integration or the CI Continuous Integration Dashboard, which is an easy- to-use front-end user interface for the ElectricSentry engine.



Term	Description
shortcut	<p>One type of shortcut is part of the ElectricFlow Home page facility and records the location of a page you visit frequently (either inside or outside of ElectricFlow), so you can return to that page with a single click from the Home page.</p> <p>Another type of shortcut is a context-relative shortcut to property paths. This shortcut can be used to reference a property without knowing the exact name of the object that contains the property. You might think of a shortcut as another part of the property hierarchy. These shortcuts resolve to the correct property path even though its path elements may have changed because a project or procedure was renamed. Shortcuts are particularly useful if you do not know your exact location in the property hierarchical tree.</p>

Term	Description
state	<p>Workflows always have a single active <i>state</i>. Each state in a workflow, when it becomes active, can perform an action. A state can run a procedure to create a subjob or run a workflow definition to create a subworkflow—in the same way that procedures can call other procedures. One or more states can be designated as "starting" states to provide multiple entry points into the workflow.</p> <p>See <a href="#">state definition</a>.</p>

Term	Description
state definition	<p>Workflow objects are split into two types: <i>Definition</i> objects and <i>Instance</i> objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.</p> <p>When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.</p> <p><b>Note:</b> We omit the "Instance" qualifier for brevity in the API and the UI.</p> <p>Each workflow can contain one or more state objects. Defining states for a workflow is analogous to defining steps for a procedure.</p>

Term	Description
step	<p>A step is a procedure component. Each step specifies a command to execute on a particular resource or a subprocedure (nested procedure) to invoke. Commonly created steps include:</p> <ul style="list-style-type: none"><li>• Command—This step invokes a <code>bat</code>, <code>cmd</code>, <code>shell</code>, <code>perl</code> script, or similar.</li><li>• Subprocedure—This step invokes another ElectricFlow procedure.</li><li>• Plugin step—These include task-specific steps. Depending on which step-type you choose, the information you need to enter is somewhat different. Some of the step types bundled with ElectricFlow include:<ul style="list-style-type: none"><li>• Publish or retrieve artifact version</li><li>• Send Email</li><li>• Various SCM step types</li><li>• Build tools</li></ul></li></ul>

Term	Description
stored credential	<i>Stored credentials</i> are given a name and stored in encrypted form in the database. Each project contains a list of stored credentials it owns. These credentials are managed from the Project Details page.

Term	Description
subprocedure	Creating subprocedures is a way of "nesting" procedures. A step (from any procedure) can call a procedure from another project or the same project. The procedure called by the step then becomes a subprocedure.

Term	Description
substitution	A mechanism used to include property values in step commands and elsewhere. For example, if a step command is specified as "echo <code>\$(status)</code> ", and when the step executes there is a property named "status" with value "success", the actual command executed will be "echo success".

Term	Description
system object	<p>This is a special object whose access control lists are used to control access to some ElectricFlow internals.</p> <p>System objects are: admin, artifactVersions, directory, emailConfigs, forceAbort, licensing, log, plugins, priority, projects, repositories, resources, server, session, <b>and</b> workspaces.</p>



Term	Description
tag	<p>A way to categorize a project to identify its relationship to one or more other projects or groups. You can edit a project to add a tag. Enter a tag if you want to categorize or "mark" a project to identify its relationship to one or more other projects or groups.</p> <p>For example, you might want to tag a group of projects as "production" or "workflow", or you might want to use your name so you can quickly sort the project list to see only those projects that are useful to you.</p>

Term	Description
transition	<p>Transitions are used to move workflow progress from one state to another state. Four types of transitions are available to move a workflow to the next state:</p> <ul style="list-style-type: none"><li>• On Enter—transitions before sending notifiers or starting the sub-action</li><li>• On Start—transitions immediately after starting the sub-action. These transitions are ignored if no sub-action is specified for the source state.</li><li>• On Completion—transitions when the sub-action completes. These transitions are ignored if no sub-action is specified for the source state. <b>Note:</b> On Completion transitions are taken only if the state is still active when the sub-action completes, and are ignored if the workflow has transitioned to another state—this can occur if an On Start or Manual transition occurred before the sub-action completed.</li><li>• Manual —transitions when a user selects the transition in the UI and specifies parameters. The same action can occur using ectool or the Perl API by calling transitionWorkflow. Only users who have "execute" permission on the transition are allowed to use the Manual transition. See <a href="#">transition definition</a>.</li></ul>

Term	Description
transition definition	<p>Workflow objects are split into two types: <i>Definition</i> objects and <i>Instance</i> objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.</p> <p>When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.</p> <p><b>Note:</b> We omit the "Instance" qualifier for brevity in the API and the UI.</p> <p>Each state can contain one or more transition objects. The transition definition object requires a name for the transition. This transition name will appear on the Workflow Definition Details page for quick reference and also on the State Definition Details page when you select the Transition Definitions tab.</p> <p>You can define one or more transitions for each state, depending on which transition options you want to apply to a particular state.</p>

Term	Description
user	<p>A user defines an account used to log into the system and control access to ElectricFlow objects. A user can be defined externally in an LDAP or Active Directory repository, or locally in ElectricFlow.</p> <p>See <a href="#">local user</a>.</p>

Term	Description
workflow	<p>You can use a workflow to design and manage processes at a higher level than individual jobs. For example, workflows allow you to combine procedures into processes to create build-test-deploy lifecycles.</p> <p>A workflow contains <i>states</i> and <i>transitions</i> you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small lifecycle combinations to meet your needs.</p> <p>See <a href="#">workflow definition</a>.</p>

Term	Description
workflow definition	<p>Workflow objects are split into two types: <i>Definition</i> objects and <i>Instance</i> objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.</p> <p>When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.</p> <p><b>Note:</b> We omit the "Instance" qualifier for brevity in the API and the UI.</p>
workflow name template	<p>This is the template used to determine the default name of jobs launched from the workflow definition.</p> <p>For example:</p> <pre> \$[projectName]_\$/[increment /myproject/workflowCounter]_ \$[timestamp] </pre> <p>(substitute your values for the names above)</p> <p>Produces a workflow name like:</p> <pre> projectName_123_20140102130321 </pre>
workspace	A workspace is a subtree of files and directories where job file data is stored. The term "workspace" typically refers to the top-level directory in this subtree.
workspace root	A workspace root is a directory in which ElectricFlow allocates job workspace directories. Each workspace root has a logical name used to refer to it in steps and procedures.
zone	<p>A zone is a way to partition a collection of agents to secure them from use by other groups—similar to creating multiple top-level networks.</p> <p>For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.</p> <p>A <i>default</i> zone is created during ElectricFlow installation.</p> <p>The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).</p>

## Appendix A: Plugins That Are Bundled with ElectricFlow

The following plugins are bundled in this version of ElectricFlow.

Name	Version
EC-ALM	1.0.8.111171
EC-AmazonECS	1.0.2.70
EC-Ant	2.0.9.111171
EC-AzureContainerService	1.0.0.10
EC-CSH	2.0.2.111171
EC-CheckStyle	2.0.5.111171
EC-Chef	1.2.0.24
EC-Clover-CMD	2.0.3.111171
EC-Cobertura	2.0.6.111171
EC-CodeScanner	2.0.4.111171
EC-Core	1.2.5.111171
EC-Coverity	1.0.2.111171
EC-CppCheck	2.0.5.111171
EC-CppNcss	2.0.4.111171
EC-DBI	2.0.2.111171

EC-DefectTracking	1.1.7.111171
EC-DefectTracking-ALM	1.0.5.111171
EC-DefectTracking-Bugzilla	2.0.7.111171
EC-DefectTracking-CQ	2.0.5.111171
EC-DefectTracking-Fortress	2.0.7.111171
EC-DefectTracking-JIRA	2.1.3.111171
EC-DefectTracking-MKS	2.0.3.111171
EC-DefectTracking-QC	2.0.9.111171
EC-DefectTracking-RTC	2.1.1.111171
EC-DefectTracking-Rally	2.0.5.111171
EC-DefectTracking-TFS	2.0.7.111171
EC-DefectTracking-TeamForge	2.0.7.111171
EC-DefectTracking-TestTrack	2.0.3.111171
EC-Dynatrace	1.0.0.21
EC-EC2	2.3.4.91
EC-EMMA	2.0.1.111171
EC-EMake	1.0.6.111171
EC-ESX	2.2.1.27
EC-FileOps	2.0.5.116463
EC-FileSysRepo	1.0.0.32
EC-FindBugs	2.0.4.111171
EC-Flog	2.0.3.111171
EC-GoogleContainerEngine	1.0.1.65



EC-Groovy	2.0.3.111171
EC-HPQualityCenter	3.0.3.111171
EC-IIS	2.0.7.5
EC-IIS7	2.0.7.11
EC-JBoss	2.1.5.48
EC-JMeter	2.0.4.111171
EC-JTest	2.0.4.111171
EC-Jasmine	2.0.1.111171
EC-Jetty	1.0.3.111171
EC-KVM	1.0.6.111171
EC-Klocwork	2.0.3.111171
EC-Klocwork-EA	1.0.4.111171
EC-Kubernetes	1.0.0.23
EC-LabManager	2.2.3.111171
EC-MSBuild	2.0.5.111171
EC-MSSystemCenterVMM	2.0.2.111171
EC-MSTest	1.0.4.111171
EC-MYSQL	2.0.8.111171
EC-Make	2.0.5.111171
EC-Maven	2.3.2.111171
EC-NAnt	2.0.4.111171
EC-NCover	2.0.2.111171
EC-NMake	2.0.3.111171

EC-NMakeATT	1.0.7.111171
EC-OpenShift	1.2.0.11
EC-OpenStack	1.3.3.224
EC-Oracle	2.0.5.111171
EC-PHP	2.0.4.111171
EC-PMD	2.0.4.111171
EC-Pclint	2.0.4.111171
EC-Powershell	2.0.4.111171
EC-PureCoverage	1.0.5.111171
EC-Purify	2.0.4.111171
EC-Python	2.0.6.111171
EC-QTP	2.0.7.111171
EC-Quantify	1.0.6.111171
EC-Rake	2.0.3.111171
EC-Rcov	2.0.4.111171
EC-ReportEngine	1.0.0.111171
EC-Reports	2.1.0.111171
EC-Ruby	2.0.6.111171
EC-SQLServer	2.0.7.111171
EC-Security	1.2.1.111171
EC-Selenium	2.0.5.111171
EC-SendEmail	1.0.1.111171
EC-ServiceNow	2.1.0.15

EC-SilkCentral	1.0.5.111171
EC-SilkTest	1.0.7.111171
EC-Sonar	2.0.4.111171
EC-Splint	2.0.3.111171
EC-TCSH	2.0.3.111171
EC-Tclsh	2.0.3.111171
EC-TestNG	2.0.4.111171
EC-Tomcat	2.1.1.111171
EC-Twitter	1.0.1.111171
EC-VirtualBox	1.0.4.111171
EC-VisualStudio	2.0.3.111171
EC-WebLogic	3.2.3.106
EC-WebSphere	2.2.3.132
EC-vCloudDirector	1.4.6.111171
ECSCM	2.2.12.116463
ECSCM-Accurev	2.0.2.111171
ECSCM-Bazaar	2.0.2.111171
ECSCM-CVS	2.0.6.111171
ECSCM-ClearCase	2.0.2.111171
ECSCM-File	2.0.3.116463
ECSCM-Git	3.7.3.20
ECSCM-MKS	2.2.1.4
ECSCM-Mercurial	2.0.5.111171

ECSCM-Perforce	2.8.5.111171
ECSCM-Property	2.0.1.111171
ECSCM-Repo	2.2.0.93709
ECSCM-SVN	3.3.1.111171
ECSCM-StarTeam	2.0.2.111171
ECSCM-TFS	2.3.4.111171
ECSCM-Vault	2.0.1.111171
EF-Utilities	1.0.7.37