



Creating Workflows

This chapter contains the following sections:

- [Viewing the Task Library, page 1](#)
- [Creating a Workflow, page 1](#)
- [Example: Creating a Workflow, page 13](#)
- [Resolving Workflow Validation Issues, page 16](#)
- [Changing Flow of Control in Workflows, page 16](#)

Viewing the Task Library

Cisco UCS Director contains web-based documentation on all predefined tasks. To view the documentation, do the following:

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- Step 1** On the menu bar, choose **Policies > Orchestration**.
- Step 2** Click the **Task Library** action.
- Step 3** Check the **Regenerate document** check box to include new tasks and tasks created using Cisco UCS Director Open Automation.
- Step 4** Click **Submit**.
The **Orchestration Task Library** appears in your default web browser.
- Note** There are several hundred entries. You can use your browser's search function to find a particular task.
- Step 5** Click an entry to see detailed information about a task.
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Creating a Workflow

Creating a workflow can be broken down into five overall steps:

- 1 Define the workflow. To define a workflow, you name the workflow and select a few other details.
- 2 Define the workflow inputs and outputs. You specify which input parameters the workflow requires to execute, and what output results from its execution.
- 3 Once the workflow inputs and outputs are defined, use the **Workflow Designer** to add a workflow task to the workflow.
- 4 Still in the Workflow Designer, connect the task into the workflow. Repeat these two steps, defining and adding a task, until you have incorporated all the tasks needed for the workflow to carry out its function.
- 5 Validate the workflow. Validating a workflow ensures that there are no errors in connecting task inputs and outputs.

These five steps are described in the following sections.

Defining a Workflow

To define a workflow, do the following:

Step 1 Navigate to **Policies > Orchestration**.

Step 2 Click the **Workflows** tab.

Step 3 Click the **Add** action.

Step 4 In the **Add Workflow Details** screen, complete the following fields:

Name	Description
Workflow Name field	The workflow name. Note Workflow names cannot contain the following characters: <code> \'%&'*+,./:;<=>?^ </code>
Version label (not editable)	Displays which version of the workflow you are creating or editing.
Description field	A description of the workflow. (Optional.)
Workflow Context drop-down list	The workflow context. Cisco UCS Director Orchestrator supports the following options: <ul style="list-style-type: none"> • Any—Enables you to use the workflow in any context. • Selected VM—Enables you to execute the workflow only when you choose a VM.
Save as Compound Task check box	Define the workflow as a compound task. See Creating a Compound Task .

Name	Description
Publish Task outputs as Compound Task outputs check box	<p>This check box appears if you choose the Save as Compound Task check box.</p> <p>Check this check box to expose all the task outputs as outputs of the compound task. Leaving the box unchecked suppresses the outputs of the included tasks so that the compound task exposes only the workflow outputs.</p>
Always execute during System initialization check box	<p>Check this check box to execute the workflow as part of the startup sequence when Cisco UCS Director is initialized.</p> <p>Note Because the workflow is executed before the Cisco UCS Director GUI starts, workflows that require user input cannot be executed at system startup.</p>
Place in New Folder check box	<p>Create a new folder in which to place the workflow. If you check this check box, the Select Folder drop-down list becomes a text field. Type the name of the new folder.</p>
Select Folder drop-down list	<p>The folder in which to place the workflow.</p>
Notify status of execution to initiating user check box	<p>Email the result status to the user who invoked the workflow. If checked, you can notify more users by entering their email addresses in the Additional User(s) to send Email Notification field.</p> <p>The result status for the workflow can be one of the following:</p> <ul style="list-style-type: none"> • Completed status • Failed execution status • Cancelled execution status <p>Leave the check box unchecked to use an email policy.</p>
Email policy drop-down list	<p>Instead of specifying email recipients individually, you can use an orchestration notification email policy. Default policies exist to notify:</p> <ul style="list-style-type: none"> • The user that starts execution of the workflow • The user and the user's group • The user's group and that group's administrator <p>You can define your own policies as well by navigating to Administration > System > Orchestration Policy and selecting Add. Policies you create are available in the Email policy drop-down list.</p>

What to Do Next

Click **Next** to define input and output for the workflow.

Defining Workflow Input and Output

You can define a set of inputs for a workflow. You can assign values for these inputs or restrict the values available to users at runtime. You can also choose whether to allow the user to change the administrator values at runtime.

To define workflow inputs and outputs, complete the following steps.

Before You Begin

Define the workflow in the **Workflow Add Details** screen as described in the previous topic.

Step 1

You can define any number of inputs for a workflow.

Rather than define inputs for a workflow, you can instead associate the workflow with an activity and use the activity's inputs as the workflow's inputs; see [Activities](#).

- To associate the workflow with an activity:
 - 1 Check the **Associate to Activity** check box.
 - 2 In the **Activity** drop-down list, choose the activity with which to associate the workflow. The activity's inputs populate the input list.
 - 3 Skip the rest of this step.
- To define inputs for the workflow without an activity, continue with this step:
 - a) In the **Workflow User Inputs** screen, click the + icon at the top of the list of values.
 - b) In the **Add Entry To** dialog box, complete the following fields:

Name	Description
Input Label field	The name or label of the input parameter.
Input Description field	A description of the input parameter.
Optional check box	Make the input parameter optional (not mandatory) at the time of workflow execution.

Name	Description
Input Type button	<p>Click this button to choose the data type of the input parameter.</p> <p>Note Reduce the number of input types by typing a match string in the filter field at the top of the list.</p> <p>Note If you later edit a workflow, the Input Type field is not editable.</p>
Multiline/Multiple Value Input check box	<p>The effect of this option depends on the input type.</p> <p>This option is available only for the Generic Text input type. Check the box to allow the user or administrator to enter multiple lines for the input value.</p> <p>Note You cannot map a multiline workflow input to a single-line task input. When creating or editing a task, no multiline workflow inputs appear in the User Input drop-down list on the User Input Mapping page.</p>
Input Field Size drop-down list	<p>This list appears if you choose the Multiline Input check box. Choose a size for the text area that is displayed to enter the input value.</p>
Value Restrictions heading	<p>Depending on the input type that you have chosen, one or more of the following are available:</p> <ul style="list-style-type: none"> • Admin Input check box—Check this box to populate inputs with default values. User input is then optional at run time. • Admin Input Filter—Check this box to define a rule-based filter to restrict available input values. User input is required at run time from the restricted range of values. See Admin Input Filters, on page 7. • Admin Input List—Check this box to define an item-by-item list of available input values. User input is required at run time from the admin-selected list of values.
Admin Input field	<p>Available when you check the Admin Input check box. Click Select to choose one or more admin input values.</p>
Override Admin Input Value check box	<p>Available when you check the Admin Input check box. Check this box to enable the user to replace the administrator value at runtime. Leaving this box unchecked hides the user's input control for this value at runtime.</p>

Name	Description
Input Filter Criteria text field	Available when you click the Admin Input Filter check box. Type a filter expression to limit the values available at run time. See Admin Input Filters , on page 7.
Admin Input Value list	Available when you click the Admin Input Filter check box. Displayed for reference—Use the column headings as attribute names in your filter expression.
Select button and list	Available when you click the Admin Input List check box. Click Select , then choose a value or values. All chosen values are available as user input choices at run time.

c) If necessary, add more inputs by repeating the previous two substeps.

Step 2 Click **Next**.

Step 3 To enter outputs for the workflow, do the following.

- a) In the **Workflow User Outputs** screen, click the + icon at the top of the list of values.
- b) In the **Add Entry To** dialog box, complete the following fields:

Name	Description
Output Label field	The name or label of the output parameter.
Output Description field	A description of the output parameter.
Optional check box	Make the output parameter optional (not mandatory) at the time of workflow execution.
Type field	The data type of the output parameter. During the editing and saving of a workflow task, the Type field is no longer editable.

c) If needed, add more outputs by repeating the previous two substeps.

Step 4 Click **Submit**.

The new workflow opens in the **Workflow Designer**.

What to Do Next

Add tasks to the workflow using the **Workflow Designer**. See [Configuring a Task in a Workflow](#), on page 9.

Admin Input Filters

When you create a workflow, you can limit the set of entries from a table or list of values seen by the user at run time. You do this by either choosing the values explicitly using an **Admin Input List**, or by using a filter expression (**Admin Input Filter**). This section describes the syntax for writing admin input filters.

There are two types of data in Cisco UCS Director Orchestrator that you can filter:

- Tabular data—A table with two or more columns. You filter the columns to choose the rows to display.
- Lists of values (LOVs)—A list of items, all of the same type. You filter the values in the list.

In addition, some inputs are numeric, for example, disk storage sizes. You must include units when you filter numeric inputs.

Filtering Tabular Data

To filter a tabular input, the input filter criteria have this form:

```
column_label operator expression [ AND column_label operator expression ]
```

where the elements of the expression are defined as follows:

Field	Entry
<i>column_label</i>	The label at the top of the column to be filtered. Type the name exactly as it appears. The label is case-sensitive and must include any spaces or special characters. Do not enclose the label in quotes.
operator	<p>One of:</p> <ul style="list-style-type: none"> • EQUALS • NOT_EQUALS • CONTAINS • NOT_CONTAINS • IS_SUBSET • NOT_SUBSET <p>The operator name is case-sensitive; it must be all uppercase. IS_SUBSET and NOT_SUBSET are operators for list type inputs.</p>
[] (brackets)	The brackets denote that the enclosed expression is optional and can be repeated. Do not include the brackets themselves in the filter criteria expression.

Field	Entry
AND	<p>Indicates extra criteria to be met. If one or more AND criteria are appended, all of them must be met to match a record.</p> <p>The criteria are applied serially. All records that meet the first criterion are subjected to the second criterion, then those results to the third, and so on.</p> <p>No operators besides AND can be used to append extra criteria. In particular, OR cannot be used. In other words, more criteria can be used only to narrow the search further, not to expand it.</p>
<i>expression</i>	<p>The syntax for <i>expression</i> is:</p> <pre>match_expression [OR match_expression]</pre>
OR	<p>Indicates a union of any of the specified <i>match_expressions</i>. In other words, only one of the <i>match_expressions</i> has meet the criterion for that part of the expression to be true.</p>
<i>match_expression</i>	<p>A simple regular expression that uses a subset of standard wildcard search characters and escape characters. The full POSIX regular expression syntax is not supported.</p> <p>You can match literal values provided they do not contain regex special characters or that you escape the special characters.</p> <p>For more information about regular expressions, consult any regular expression reference on the Internet; there are many.</p> <p>If <i>match_expression</i> is enclosed in quotes, a case-sensitive comparison is made, if applicable.</p>

Following is an example of a table-type filter:

```
Cloud CONTAINS vcenter21 OR vcenter98 AND Power Status EQUALS off OR unknown
```

The expression `Cloud CONTAINS vcenter21 OR vcenter98` matches names containing `vcenter21` and `vcenter98`, such as `vcenter211` and `TESTvcenter98`. If you are interested only in `vcenter21` and `vcenter98`, a better expression is `Cloud EQUALS vcenter21 OR vcenter98`.

Filtering Lists of Values

LOV types are lists of single values. To filter an LOV you therefore omit the column name and the AND operator. The top-level search syntax is:

```
operator match_expression [ OR match_expression ]
```

The elements of the syntax are as described for tabular data, with the exception that `IS_SUBSET` and `NOT_SUBSET` operators are not permitted.

For example, if the power status values from the tabular data example were in an LOV, the search would look like this:

```
EQUALS off OR unknown
```

Filtering Numeric Data

Certain numeric data such as disk size, LUN size, and volume size are specified with units--megabytes (MB), gigabytes (GB), or terabytes (TB). If the units are given in a table column, the units are part of the column label and must be included in your criteria; for example:

```
LUN Size (GB) EQUALS 10.0
```

Numeric expressions in filter criteria are regex matches and not numerical comparisons. For example, consider this filter criterion:

```
LUN Size (GB) EQUALS 10
```

The expression does *not* match records with LUN size given as 10.0.

Configuring a Task in a Workflow

Cisco UCS Director Orchestrator contains predefined tasks that you can use to create workflows. These tasks are organized in folders based on their functionality and can be accessed in the left panel of the **Workflow Designer** interface.

Documentation for the predefined tasks is available by opening the **Task Library**; see [Viewing the Task Library](#), on page 1.



Note

Cisco UCS Director Orchestrator's predefined tasks cover many if not most of the common operations required in a typical environment. For operations not represented in the predefined tasks, you can create custom tasks. See the [Cisco UCS Director Custom Task Getting Started Guide](#).

To configure a predefined task for use in a workflow, do the following:

Before You Begin

Define a workflow and its inputs and outputs as described in the previous sections.

- Step 1** From the **Workflows** tab on the **Orchestrator** page, choose a workflow.
- Step 2** Click **Workflow Designer**. The Cisco UCS Director Orchestrator **Workflow Designer** window appears.
- Step 3** On the left side of the **Workflow Designer**, choose a category from the **Available Tasks** area by expanding folders in the task hierarchy.
- Step 4** Drag and drop your chosen task onto the **Workflow Designer** area.
- Step 5** In the **Task Information** screen, complete the following fields:

Name	Description
Task Name field	A name for this instance of the task. You can accept the automatically generated default or enter your own name for the task.
Task Category drop-down list	The category (also the folder name) in which the task appears. Cannot be changed.
Task Type drop-down list	The type (or generic name) of the task. Cannot be changed.

Name	Description
Comment field	An optional comment about this use of the task in this workflow.
Retry Execution check box	Check this box to retry the task if it fails. The Retry Count and Retry Frequency controls appear.
Disable Rollback check box	Check this box to disable the task's rollback script. If you check this box, the task is unchecked in the Rollback Service Request dialog and cannot be rolled back; see Rolling Back a Service Request . If the task does not support rollback, checking this box has no effect.
Retry Count drop-down list	The number of times (up to 5) to retry the task on failure.
Retry Frequency field	A comma-separated list of integers specifying how many seconds to wait between retries. For example, if you selected a retry count of three, enter 1, 10, 60 to retry after one, 10, or 60 seconds, respectively.

Step 6 Click **Next**.

Step 7 In the **User Input Mapping** screen, complete the following fields:

Name	Description
Manage Workflow User Inputs button	Click this button to add to or edit the workflow user inputs.
Task Input headings	Each task input is displayed as a heading on the remainder of this page. The input is labeled (Mandatory) if it required.
Map to User Input check box	Below each task input heading is a check box. Check this box to populate the task input from a workflow user input at runtime.
User Input drop-down list	This drop-down list appears if you check the Map to User Input check box. Select the workflow user input to map to the task input. Note You cannot map a multiline workflow input to a single-line task input. The multiline workflow input does not appear in the User Input drop-down when creating or editing a task. See Defining Workflow Input and Output , on page 4.

Step 8 Click **Next**.

Step 9 Any task input that was not mapped to a user input cannot be entered at runtime. Instead, specify the input value now. In the **Task Inputs** screen, complete the following fields:

Name	Description
Task Input heading	Each task input that was not mapped to a user input on the previous page is displayed with an appropriate input control (text field, drop-down list, and so on). Use the input controls to specify the value. Optional inputs can be left blank.

Step 10 Click **Next**.

Step 11 In the **User Output Mapping** screen, complete the following fields:

Name	Description
Task Output heading	Each task output is displayed as a heading on this page. The output is labeled (Mandatory) if it required.
Map to User Output check box	Below each task output heading is a check box. Check this box to populate a workflow user output from the task output at runtime.
User Output drop-down list	This drop-down list appears if you check the Map to User Output check box. Select the workflow user output to map to the task output.

Step 12 Click **Submit**.

If this is the first task configured in this workflow, the Workflow Designer automatically connects it to the default tasks. If the task is not the first, you must connect it manually.

What to Do Next

Connect the task to the workflow.

Connecting a Task to a Workflow

To be part of a workflow, a task must be connected to other tasks. You can insert a task anywhere in a workflow by dragging and dropping the flow arrows between tasks.

There are three default tasks in every workflow: **Start**, **Completed (Success)**, and **Completed (Failure)**. When you add the first task to a workflow, it automatically connects to the default tasks.

Before You Begin

You have created a task in the **Workflow Designer**. The task is not yet part of the workflow.

Step 1

Connect a task from the existing workflow to the new task. To connect the tasks:

- a) Mouse over the bottom of the task from which you want to map an output.

The **On success** or **On failure** drop-down appears, depending on which side of the box your cursor occupies.

Note The **Start** task has only one (unlabeled) drop-down.

- b) Click and hold your left mouse button.

- c) Drag the cursor anywhere inside the task to which you are connecting, and release the mouse button. A colored arrow connects the two tasks, indicating the flow of operation from one task to the other.

Note Instead of dragging and dropping, you can click the down-arrow icon and choose the name of the task to which you want to connect. The colored arrow appears as if you had dragged it to that task.

Note Typically you connect a task's **On success** drop-down to the next task, and connect the **On failure** drop-down to the **Completed (Failed)** task. There are exceptions, however. For example, you could insert a task to do cleanup or error handling, in which case you would connect **On failure** to the cleanup task.

However, the **Workflow Designer** does not permit you to connect a task's **On success** drop-down to the **Completed (Failure)** task.

Step 2

Similarly, drag and drop from the **On success** drop-down of the new task to **Completed (Success)** or to another existing task in the workflow.

Step 3

Drag and drop from the **On failure** drop-down of the new task to **Completed (Failure)** or to another existing task in the workflow.

The task is integrated into the workflow. The **Workflow Designer** automatically arranges the tasks in the workspace.



Note

You can disable the automatic arrangement of the workflow by unchecking the **Auto Layout** check box at the top of the **Workflow Designer**.

What to Do Next

Add more tasks if necessary to complete the workflow. When you are finished, validate the workflow.

Validating a Workflow

Validating a workflow ensures that the inputs and outputs of its component tasks are connected with no major errors. You can validate a workflow without leaving the **Workflow Designer**.

Before You Begin

A workflow is open in the **Workflow Designer**.

Click the **Validate** button.

Task connection errors are displayed in red above the affected tasks. If no errors are detected, a success dialog pops up.

What to Do Next

If connection errors are displayed in the **Workflow Designer**, use the **Workflow Validation** tool to resolve the issues. See [Resolving Workflow Validation Issues](#), on page 16.

Example: Creating a Workflow

This simple example walks you through the creation of a workflow that power cycles (turns off and back on) a VM.

Before You Begin

You must have a VM available in Cisco UCS Director.

Step 1

Define the workflow. Do the following:

- Navigate to **Policies > Orchestration**.
- Click the **Workflows** tab.
- Click the **Add** action.
- Complete the fields in the **Add Workflow Details** screen as follows:

Field	Entry
Workflow Name field	Type <i>PowerCycleVM</i> .
Description field	Type <i>Shut down and restart a VM</i> .
Workflow Context drop-down list	Select Any .
Save as Compound Task check box	Leave this unchecked.
Always execute during System initialization check box	Leave this unchecked.
Place in New Folder check box	Check this check box.
Folder Name text field	Type <i>OrchestrationExamples</i>
Notify status of execution to initiating user check box	Leave this unchecked.
Email policy drop-down list	Choose No email .

Field	Entry
Version Label text field	Leave the default value, 0.

e) Click **Next**.

Step 2

Define an input to specify the name of the VM. Do the following:

- In the **Workflow User Inputs** screen, click the + icon at the top of the list of values.
- Complete the fields in the **Add Entry To** dialog box as follows:

Field	Entry
Input Label field	Type <i>VM Name</i> .
Input Description field	Type <i>Name of the VM to power cycle</i> .
Optional check box	Leave this unchecked.
Input Type button	Click the button labeled Select The Select dialog comes up.

- In the **Select** dialog, type *vm selector* in the search box.
- Click the check box next to the VM Selector entry.
- Click **Select**.
- Define an administrator (fixed) value for the VM name by completing the next set of fields as follows:

Field	Entry
Admin Input check box	Check this check box.
Admin Input Filter and Admin Input List check boxes	These check boxes disappear when you check Admin Input . Both of these check boxes enable the administrator to filter the choices available to the user when the workflow is run. Instead, for this example, the Admin Input Value supplies a single fixed value at runtime.
Override Admin Input Value check box	Leaving this box unchecked hides the user's input control for this value at runtime. For this example, leave the box unchecked.
Admin Input Value button	Click Select to choose a value for the administrator input. The Select list of values comes up. Click a check box to select an existing VM instance, then click Select .

g) Click **Next**.

Step 3 Do not define an output. Click **Submit**.
The **Workflow Designer** window appears.

Step 4 Add a task to power off the VM by doing the following:

- a) In the **Available Tasks** search field at the top left of the **Workflow Designer** window, type *power*.
The **Available Tasks** window now displays only tasks containing the string *power*.
- b) From the **Generic VM Tasks** folder, drag and drop the **VM Power Action** icon into the work area.
The **Add Task** dialog appears.
- c) In the **Task Information** dialog, type *Power Off 1* in the **Task Name** text field.
- d) Click **Next**.
- e) In the **User Input Mapping** dialog, complete these fields:

Field	Entry
Map to User Input check box	Check this check box.
User Input drop-down list	Since there is only one user input of the correct type (or of any type, in this case), the user input name that you created (<i>VM Name</i>) is already selected in the drop-down list.

- f) Click **Next**.
- g) In the **Task Inputs** dialog's **VM Action** drop-down list, select **Power OFF**.
- h) Click **Next**.
- i) Click **Submit**.
The task is automatically connected in the new workflow.

Step 5 Add a task to power on the VM. The procedure is similar to the previous step, with the following differences:

- In the **Task Information** dialog, type *Power On 1* in the **Task Name** text field.
- In the **Task Inputs** dialog's **VM Action** drop-down list, select **Power ON**.
Note You could create this workflow with a single **Reboot** task rather than powering off and back on. However, for purposes of this example go ahead and create the workflow with the two power management tasks.
- When you click **Submit**, the task does not automatically connect to the existing workflow. Instead, connect it by hand:
 - 1 Mouse over the lower left corner of the **Power Off 1** task icon. The **On Success** drop-down appears.
 - 2 Drag and drop from the **On Success** drop-down area to anywhere in the **Power On 1** icon.
The **Power On 1** task is inserted between the **Power Off 1** task and the **Completed** task.
 - 3 Using the same drag-and-drop technique, connect the **Power On 1 > On Failure** drop-down to the **Completed (Failed)** task.

Step 6 Validate the workflow by clicking **Validate Workflow** button at the top of the **Workflow Designer**.
The **Valid Workflow** dialog comes up, confirming that the workflow and task inputs and outputs are connected properly.

Step 7 Click **Close** to leave the **Workflow Designer**.

Resolving Workflow Validation Issues

Cisco UCS Director supplies a wizard-based tool to aid you in troubleshooting workflow validation errors.

Before You Begin

A workflow has failed validation in the **Workflow Designer**.

-
- Step 1** On the menu bar, choose **Policies > Orchestration**.
- Step 2** Click the **Workflows** tab.
- Step 3** Choose the workflow that failed validation.
- Step 4** Click **Validate Workflow**.
- Step 5** In the **Workflow Validation** dialog box, double click the description under **Resolution**.
- Step 6** In the **Validation Errors** dialog box, view the summary for the issue detected. Complete the remaining prompts in the wizard to resolve the validation error.
-

Changing Flow of Control in Workflows

Normally, a workflow executes as a linear series of tasks. However, Cisco UCS Director Orchestrator provides tasks that enable changes to the flow of control within a workflow. The following sections describe how to create these flow-of-control constructs:

- Loops.
- If-then branches.
- Conditional switches with an arbitrary number of branches.

Looping in Workflows

You can create a loop to perform a selected series of tasks multiple times. A loop can be configured to iterate one of two ways:

- By count—Iterate a specified number of times.
- By item—Iterate over a list of items.

Before You Begin

Open a workflow in which you want to include a loop in the **Workflow Designer**.

Step 1 In the **Available Tasks** pane of the **Workflow Designer**, click the **Procedural Tasks** folder.

Step 2 Drag the **Start Loop** task into the **Workflow Designer** work area.

Step 3 In the **Add Task** window, complete the following fields:

Name	Description
Task Name field	The name of the task.
Comment field	Comments for the task.
Retry Execution check box	Check the check box to retry later if the task fails.
Retry count drop-down list	Choose the number of retry attempts.
Retry Frequency drop-down list	Choose the duration between retry attempts.

Step 4 Click **Next**.

Step 5 In the **User Input Mapping** screen, click **Next**.

Step 6 In the **Task Inputs** screen, complete the following fields:

Name	Description
List based iteration check box	Check this check box to perform the loop tasks on every item in a list. The following two fields appear.
Input for list-based iteration	Choose a list of input values for the list-based iteration.
User Input to assign iterated values drop-down list	The user input for the list-based iteration. Create a workflow input with the same type as your list elements and map it to the Start Loop task here.
Count based iteration check box	Check this check box to perform loop tasks based on a count. The following field appears.
Number of times to loop field	The number of times to perform the loop.

- Step 7** In the **User Output Mapping** screen, click **Submit**.
- Step 8** From the **Available Tasks** pane, drag the tasks that you want as part of the loop.
- Step 9** Create links between the task icons in the loop using the **On Success** connector.
- Step 10** Create a link between the **Start** task icon (or whichever task is immediately before the loop) and the **Start Loop** task icon.
- Step 11** In the **Available Tasks** pane, click the **Procedural Tasks** folder.
- Step 12** Drag the **End Loop** task into the **Workflow Designer**.
- Step 13** Complete the remaining screens in the **Add Task (End Loop)** wizard.
- Step 14** Click **Submit**.
- Step 15** Connect the **On Success** connector of the last task in the loop to the **End Loop** task icon.
- Step 16** In the **End Loop** task icon, connect the **On Success** connector to the **Completed (Success)** or to another task to execute after the loop.
- Step 17** In the **End Loop** task icon, connect the **On Failure** connection to the **Completed (Failure)** (or another task) task icon.

Example: Looping in a Workflow

This example demonstrates repeating workflow tasks for elements in a list. You will modify the *PowerCycleVM* workflow to restart a list of VMs instead of a single VM.

Before You Begin

Create the example workflow as described in [Example: Creating a Workflow](#), on page 13.

- Step 1** Open the *PowerCycleVM* workflow.
- Navigate to **Policies > Orchestration**.
 - Click on the **Workflows** tab.
 - Locate and select the *PowerCycleVM* workflow you created in [Example: Creating a Workflow](#), on page 13.
 - Click on **Workflow Designer**.
- Step 2** Add the **Start Loop** task to the workflow.
- From the **Available Tasks** window in the **Procedural Tasks** folder, drag and drop **Start Loop** onto the work area.
 - In the **Task Information** window, complete the following fields:

Field	Entry
Task Name text field	Type <i>StartVMLoop</i> .
Comment text field	Type <i>Loop through a list of VMs</i>
Task Details heading	Make a note of the message under the Task Details heading regarding the task output <i>START_LOOP_OUTPUT</i> .

- c) Click **Next**.
- d) Replace the workflow input to accept a list of VMs . In the **User Input Mapping** window, click **Manage Workflow User Inputs**.
- e) Click the **Add** icon.
- f) In the **Add Entry To** dialog, complete the following fields:

Field	Entry
Input Label text field	Type <i>VM Names</i> .
Input Description text field	Type <i>List of VMs to restart</i> .
Optional checkbox	Leave this unchecked.
Input Type button	Click this button to bring up the Select list of values. Use the search box to locate and select multiVM as the input type. Click Select .
Value Restrictions heading	Click the Admin Input checkbox. Click Select . Choose several VMs , then click Select .

- g) Click **Submit**.
- h) On the **User Input Mapping** window, under the **Input for list based iteration** heading, check the **Map to User Input** checkbox.
The **User Input** drop-down list appears.
- i) In the User Input drop-down list, select *VM Names*.
- j) Click **Next**.
- k) Check the **List based iteration** checkbox.
The **User input to assign iterated values** drop-down list appears.
Note This field is a feature of the **Start Loop** task. Since the output variable *START_LOOP_OUTPUT* is of type **generic text**, it cannot (usually) be mapped to the input of the tasks inside the loop. Instead, the Start Loop task assigns each item of the input list to the variable as it iterates.
- l) Select *VM Name* in the **User input to assign iterated values** drop-down list.
Note There is nothing special about the **VM Name** workflow input variable; you are reusing it since you no longer need it as input to the workflow. (The workflow input is now **VM Names**, which is a list of VMs.)
- m) Click **Next**.
- n) There is no output mapping, so click **Submit** to save the task.
- o) Drag and drop to connect the **Start** task to the **StartVMLoop** task.
The **Workflow Designer** connects the **StartVMLoop > On Success** dropdown to the **Power Off 1** task (because it was the previous target of the **Start** task).
- p) Drag and drop to connect the **StartVMLoop > On failure** dropdown to the **Completed (Failed)** task.

Step 3

The End Loop task is just a placeholder with no inputs or outputs. To add the **End Loop** task to the workflow, do the following:

- a) Drag and drop the **End Loop** task from the **Procedural Task** folder onto the work area.
- b) In the Task Information window, complete the following fields:

Field	Entry
Task Name text field	Type <i>EndVMLoop</i> .
Comment text field	Type <i>End of VM loop</i> .

- c) Click **Next**.
- d) In the **User Input Mapping** window, click **Next**.
- e) In the **Task Inputs** window, click **Next**.
- f) In the **User Output Mapping** window, click **Next**.
- g) Drag and drop to connect the **Power On 1** task to the **EndVMLoop** task.
- h) Drag and drop to connect the **EndVMLoop > On failure** dropdown to the **Completed (Failed)** task.

Step 4 Click **Close** to close the **Workflow Designer**.

What to Do Next

Execute the task to restart the VMs specified in the workflow.

Adding an If-Then Branch to a Workflow

You can create a two-way branch in a workflow using an if-then construct.

Before You Begin

You have a workflow open in the **Workflow Designer**.

Step 1 In the **Available Tasks** pane of the **Workflow Designer**, click the **Procedural Tasks** folder.

Step 2 Drag the **If Else** task into the **Workflow Designer** work area.

Step 3 In the **Add Task** screen, complete the following fields:

Name	Description
Task Name field	The name of the task.
Comment field	Comments for the task.
Retry Execution check box	Check the check box to retry later if the task fails.
Retry count drop-down list	Choose the number of retry attempts.
Retry Frequency drop-down list	Choose the duration between retry attempts.

Step 4 Click **Next**.

Step 5 In the **User Input Mapping** screen, click **Next**.

Step 6 In the **Task Inputs** screen, complete the following fields:

Name	Description
Specify the condition field	<p>Enter the condition evaluated to determine the course of the workflow. The flow of control depends on whether the condition evaluates to true or to false.</p> <p>The conditions that you define must contain only the following operators: ==, !=, <, <=, >, >=, , &&, contains, startsWith, endsWith</p> <p>Following are some example conditions:</p> <ul style="list-style-type: none"> • <code>TaskName.OUTPUT_ATTRIBUTE_NAME == "2"</code> • <code>WORKFLOW_USERINPUT_LABEL_NAME contains "xyz"</code> • <code>TaskName.OUTPUT_ATTRIBUTE_NAME == WORKFLOW_USERINPUT_LABEL_NAME WORKFLOW_USERINPUT_LABEL_NAME != "123"</code>

Step 7 In the **User Output Mapping** screen, click **Submit**.

Step 8 In the **If-Else** task icon, click and drag the **True** connector and the **False** connector to other task icons.

Step 9 In the **If-Else** task icon, click and drag the **On Failure** connector to the **Completed (Failed)** task icon (or another task icon).

Note Do not confuse the **False** and **On Failure** connectors. The **False** connector defines the path if the condition statement evaluates to false. The **On Failure** connector defines the path for failure of the task, for example if the task cannot evaluate the condition statement.

Using Conditional Branching in a Workflow

You can create a multiple-path branch in a workflow using a conditional construct. A single conditional task can have any number of branches.

Before You Begin

You have a workflow open in the **Workflow Designer**.

Step 1 In the **Available Tasks** pane of the **Workflow Designer**, click the **Procedural Tasks** folder.

Step 2 Drag the **Conditional** task into **Workflow Designer** work area.

Step 3 In the **Add Task** screen, complete the following fields:

Name	Description
Task Name field	The name of the task.
Comment field	Comments for the task.
Retry Execution check box	Check the check box to retry later if the task fails.
Retry count drop-down list	Choose the number of retry attempts.
Retry Frequency drop-down list	Choose the duration between retry attempts.

Step 4 Click **Next**.

Step 5 In the **User Input Mapping** screen, click **Next**.

Step 6 In the **Task Inputs** screen, click the + icon to add a condition statement for each execution path of the workflow. For example, if your workflow has three possible execution paths, add three entries into the conditions table, one entry for each condition. Click the default entry in the table to specify the condition when the workflow takes the default execution path.

Note The condition statements do not have to be mutually exclusive. At run time, the statements are evaluated in the order they are listed. Execution continues with the path of the first statement to evaluate to true.

Step 7 In the **Add Entry to** screen, complete the following fields:

Name	Description
Label field	The label for the condition
Condition field	<p>Enter the condition to be evaluated to determine the course of the workflow. The conditions that you define must contain the following operators:</p> <p>==, !=, <, <=, >, >=, , &&, contains, startsWith, endsWith</p> <p>Following are some examples that you can use while specifying conditions:</p> <ul style="list-style-type: none"> • TaskName.OUTPUT ATTRIBUTE NAME=="2" • WORKFLOW USERINPUT LABEL NAME contains "xyz" • TaskName.OUTPUT ATTRIBUTE NAME == WORKFLOW USERINPUT LABEL NAME WORKFLOW USERINPUT LABEL NAME != "123"

Click **Submit**.

- Step 8** In the **User Output Mapping** screen, click **Submit**.
- Step 9** From the **Available Tasks** pane, click and drag the tasks that you want to add to the various execution paths of the workflow.
- Step 10** Create a link between the **Start** task icon (or whichever task is immediately before the branch) and the **Conditional task** icon.
- Step 11** For each condition in the conditional task, create a link between the connector in the **Conditional Task** icon to the next task for the condition's execution path. For example, link the **default** connector in the **Conditional task** icon to the task you want to execute if none of the other conditions are met.
- Step 12** Link the **On failure** connector to the **Completed (Failed)** (or another task) task icon.

Creating Approvals

To require approval of a user, you add an approval task to the workflow.

Before You Begin

Open a workflow in the **Workflow Designer**.

- Step 1** In the **Workflow Designer Available Tasks** window, open **Cloupia Tasks > General Tasks**.
- Step 2** Drag the **User Approval** task onto the work area.
- Step 3** Configure the task. See [Configuring a Task in a Workflow](#), on page 9. Complete the following fields:

Name	Description
Task Name field	The task name.
Comment text box	A comment about the approval task (Optional.)
Retry Execution check box	Leave this box unchecked. If the administrator rejects the approval, the workflow stops with the approval task in a failed state. If you enable execution retries, the workflow presents the administrator with an approval multiple times. This is probably not the behavior you want from the workflow.

Step 4 Click **Next**.

Step 5 In the **User Input Mappings** click **Next**. You define all the task inputs in the **Task Inputs** window.

Step 6 In the Task Inputs window, complete the following fields:

Step 7

Name	Description
User ID Select button	Click Select and use the Select dialog to choose the user whose approval is required to execute this workflow. Then click Submit .
Approval required from all the users check box	You can ignore this check box.
Number of approval request Reminder fields	Type the number of times to remind the user to approve this workflow. Entering 0 causes the reminder to be sent until the workflow approval has been approved or rejected.
Reminder Interval (Hours) field	Type the number of hours between approval reminders.

Step 8 Click **Next**.

Step 9 In the **User Output Mapping** window, click **Submit**.
