Life Cycle Extensibility

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Life Cycle Extensibility

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Using vRealize Orchestrator with vRealize Automation, you can extend how you the manage the life cycle of IaaS machines.

Extending vRealize Automation requires you to use provided vRealize Orchestrator workflows and to create custom workflows.

This chapter includes the following topics:

Machine Extensibility Overview

Provisioning or decommissioning a new machine, especially for mission-critical systems, typically requires interacting with a number of different management systems, including DNS servers, load balancers, CMDBs, IP Address Management and other systems.

Machine Life Cycle Extensibility

You can inject custom logic at various predetermined IaaS life cycle stages by leveraging IaaS state change workflows, known as workflow stubs. You can use the workflow stubs to call out to vRealize Orchestrator for bi-directional integration with external management systems.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

Creating a state change workflow enables you to trigger the execution of a workflow before the IaaS master workflow enters a specific state. For example, you can create custom workflows to integrate with an external database and record information at different stages of the machine life cycle.

- Create a custom workflow that runs before the master workflow enters the MachineProvisioned state to record such information as machine owner, approvers, and so on.
- Create a custom workflow that runs before a machine enters the MachineDisposing state to record the time at which the machine was destroyed and data such as its resource utilization at last data collection, last logon, and so on.

The master workflow illustrations show the main states of the master workflow, highlighting in yellow the states you can customize by using IaaS workflow stubs. The Customizable State Change Workflows table lists the workflow stubs available, their corresponding place in the master workflow state, and examples of custom logic you could use at each state to extend the machine life cycle.

Figure 1-1. Master workflow states for provisioning machines

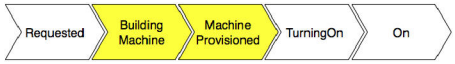


Figure 1-2. Master workflow states for importing machines

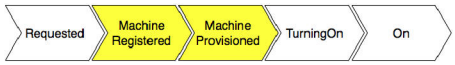


Figure 1-3. Master workflow states for machine lease expiration

Figure 1-4. Master workflow states for disposing a machine

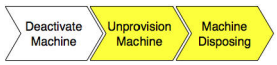


Table 1-1. Customizable State Change Workflows

Master Workflow State	Customizable Workflow Name	Extensibility Examples
BuildingMachine	WFStubBuildingMachine	Prepare for the machine to be created on the hypervisor.Create a configuration management database (CMDB) record, call out to an external system to assign an IP address to a machine, and then during machine disposal, use WFStubMachineDisposing to return the IP address to the pool.
RegisterMachine	WFStubMachineRegistered	Add an imported machine to an application provisioning tool to receive updates and undergo compliance checks.
MachineProvisioned	WFStubMachineProvisioned	The machine exists on the hypervisor, and any additional customizations are completed at this point, for example guest agent customizations. Use this workflow stub to update a configuration management database (CMDB) record with DCHP IP address and storage information. Customizations made by using the WFStubMachineProvisioned are typically reversed by using WFStubUnprovisionMachine.

Table 1-1. Customizable State Change Workflows (Continued)

Master Workflow State	Customizable Workflow Name	Extensibility Examples
Expired	WFStubMachineExpired	Move an expired machine to low cost storage to reduce archival costs and update the CMDB record and billing system to reflect storage and cost changes.
UnprovisionMachine	WFStubUnprovisionMachine	Remove machines from active directory accounts. Customizations made by using the WFStubMachineProvisioned are typically reversed by using WFStubUnprovisionMachine.
Disposing	WFStubMachineDisposing	Return IP addresses to the pool.

Choosing a Life Cycle Extensibility Scenario

You can use vRealize Orchestrator or vRealize Automation Designer to extend machine lifecycles.

You can extend machine lifecycles by using vRealize Automation Designer to call out to vRealize Orchestrator, or by using vRealize Orchestrator directly. Both approaches allow you to inject custom logic into predetermined stages of the IaaS machine lifecycle by creating custom vRealize Orchestrator workflows and then insert the custom workflows into the state change workflow stubs. However, you can only restrict custom state change logics to particular blueprints if you are using vRealize Orchestrator directly, and you can only restrict the execution of workflows to specific Distributed Execution Managers by vRealize Automation Designer.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

Table 1-2. Choosing a Lifecycle Extensibility Scenario

Scenario	Procedure
Inject custom logic into predetermined stages of the IaaS machine lifecycle and apply that custom logic to specific blueprints.	Extending Machine Lifecycles by Using vRealize Orchestrator Checklist
Inject custom logic into predetermined stages of the IaaS machine lifecycle and apply that custom logic globally to all of your blueprints.	Extending Machine Life Cycles By Using vRealize Automation Designer Checklist
Restrict execution of workflows to specific Distributed Execution Managers by using skills in vRealize Automation Designer. Skills are similar to a tag that you can apply to both workflows and DEM Worker instances. For example, you might want to restrict cloud provisioning workflows to a specific DEM running on a host with the required network access to Amazon URLs.	Associate Workflows and DEM Workers by Using Skills

Extending Machine Lifecycles By Using vRealize Orchestrator

You can inject custom logic into predetermined stages of the IaaS machine lifecycle by creating custom vRealize Orchestrator workflows and then using vRealize Orchestrator to insert the custom workflows into the lifecycle of machines built from specific blueprints.

Extending Machine Lifecycles by Using vRealize Orchestrator Checklist

The extending machine lifecycles by using vRealize Orchestrator checklist provides a high-level overview of the steps required to install and configure vRealize Orchestrator to customize IaaS machine lifecycles.

Table 1-3. Extending Machine Lifecycles by Using vRealize Orchestrator Checklist

Task	Details
❑ Configure a vRealize Automation host for your vRealize Orchestrator.	Add a vRealize Automation Host
❑ Configure an IaaS host for your vRealize Orchestrator.	Add an IaaS Host
❑ Install the vRealize Orchestrator customizations for extending IaaS machine lifecycles.	Install vRealize Orchestrator Customization
❑ Create a vRealize Automation endpoint for your vRealize Orchestrator instance.	Create a vRealize Orchestrator Endpoint
❑ Use the workflow template provided in the Extensibility subdirectory of the vRealize Automation plug-in library to create a custom vRealize Orchestrator workflow to run during the machine lifecycle. You can run multiple workflows in the same state for the same blueprint as long as you nest them under a single wrapper workflow.	For information about developing workflows with vRealize Orchestrator, see the vRealize Orchestrator documentation. For training in vRealize Orchestrator development for vRealize Automation integrations, see the training courses available from VMware Education and the instructional material provided by VMware Learning.
❑ Run the provided workflow that inserts your custom workflow into an IaaS workflow stub and configures a blueprint to call the IaaS workflow stub. **Note** The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.	Assign a State Change Workflow to a Blueprint and Its Virtual Machines

Configuring the vRealize Automation Plug-in for Machine Extensibility

You configure your vRealize Automation and IaaS hosts, install the customizations for machine extensibility, and create a vRealize Automation endpoint for your vRealize Orchestrator instance.

Add a vRealize Automation Host

You can run a workflow to add a vRealize Automation host and configure the host connection parameters.

Procedure

1. From the drop-down menu in the Orchestrator client, select **Run** or **Design**.
2. Click the **Workflows** view.
3. Expand **Library > vRealize Automation > Configuration**.
4. Right-click the **Add a vRA host** workflow and select **Start workflow**.
5. Enter a unique name for the host in the **Host Name** text box.
6. Enter the URL address of the host in the **Host URL** text box.

   For example: *https*://*hostname*.
7. Enter the name of the tenant in the **Tenant** text box.

   To use the full functionality of the plug-in for a tenant, create a dedicated vRealize Automation host for each tenant.
8. Select whether to install the SSL certificates automatically without user confirmation.
9. (Optional) To configure the length of time vRealize Orchestrator waits for a connection or response from vRealize Automation, enter timeout intervals in the **Connection timeout (seconds)** and **Operation timeout (seconds)** text boxes.
10. Select the type of connection to the host from the **Session mode** drop-down menu.

Option	Actions
Shared Session	Enter the credentials for a vRealize Automation user in the **Authentication username** and **Authentication password** text boxes.
Per User Session	Connect using the credentials of the user that is currently logged in. You must be logged in to the Orchestrator client with the credentials of the vRealize Automation system administrator. To use this option with an external vRealize Orchestrator server, you must register the Orchestrator server in the vRealize Automation component registry. **Note** To register an external vRealize Orchestrator server in the component registry, you must configure Orchestrator to use vRealize Automation as an authentication provider. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

11. Click **Submit**.

What to do next

Add a vRealize Automation Infrastructure Administration host.

Add an IaaS Host

You can run a workflow to add the IaaS host of a vRealize Automation host and configure the connection parameters.

Procedure

1. From the drop-down menu in the Orchestrator client, select **Run** or **Design**.
2. Click the **Workflows** view.
3. Expand **Library > vRealize Automation > Infrastructure Administration > Configuration**.
4. Right-click **Add an IaaS host** and select **Start workflow**.
5. Select the vRealize Automation host for which you want to configure an IaaS host from the **vCAC host** drop-down menu.
6. Enter a unique name for the host in the **Host Name** text box.
7. Enter the URL of the machine on which your Model Manager is installed.

   For example: https://*model_manager_machine.com*.
8. To install the SSL certificates, select **Yes**.
9. To use a proxy to access your model manager machine, select **Yes**.

   If you select this option, you must provide the proxy host and the proxy port on the following page.
10. Click **Next**.
11. If you are configuring an explicit proxy, provide the proxy host URL and the port.
12. Click **Next**.
13. To configure your own timeout values, click **No**.
14. (Optional) To configure the length of time vRealize Orchestrator waits for a connection or response from vRealize Automation, enter timeout intervals in the **Connection timeout (seconds)** and **Operation timeout (seconds)** text boxes.
15. Click **Next**.
16. Select the host's authentication type.

Option	Description
SSO	Select this to use vCenter Single Sign-On.
NTLM	Select this to enable NT LAN Manager (NTLM) protocol-based authentication only if your Active Directory infrastructure relies on NTLM authentication. If you select this option, you must the additional NTLM credentials and authentication options.

17 If you selected NTLM, click **Next** and enter the name of the Workstation machine and the NetBIOS domain name.

18 Click **Submit**.

Install vRealize Orchestrator Customization

You can run a workflow to install the customized state change workflow stubs and Orchestrator menu operation workflows.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

Procedure

1 From the drop-down menu in the Orchestrator client, select **Run** or **Design**.

2 Click the **Workflows** view.

3 Select **Library > vCloud Automation Center > Infrastructure Administration > Extensibility > Installation**.

4 Right-click the **Install vCO customization** workflow and select **Start workflow**.

5 Select an IaaS host.

6 Click **Next**.

7 Choose the lifecycle stages to which you want to add custom logic by selecting one or more state change workflow stubs to install.

8 Click **Submit**.

Create a vRealize Orchestrator Endpoint

You can create a vRealize Orchestrator endpoint to connect to a vRealize Orchestrator server.

You can configure multiple endpoints to connect to different vRealize Orchestrator servers, but you must configure a priority for each endpoint.

When executing vRealize Orchestrator workflows, vRealize Automation tries the highest priority vRealize Orchestrator endpoint first. If that endpoint is not reachable, then it proceeds to try the next highest priority endpoint until a vRealize Orchestrator server is available to run the workflow.

Prerequisites

- Log in to vRealize Automation as an **IaaS administrator**.

Procedure

1 Select **Infrastructure > Endpoints > Endpoints**.

2 Select **New > Orchestration > vRealize Orchestrator**.

3 Enter a name and, optionally, a description.

4 Enter a URL with the fully qualified name or IP address of the vRealize Orchestrator server and the vRealize Orchestrator port number.

   The transport protocol must be HTTPS. If no port is specified, the default port 443 is used.

   To use the default vRealize Orchestrator instance embedded in the vRealize Automation appliance, type **`https://vrealize-automation-appliance-hostname:443/vco`**.

5 Provide your vRealize Orchestrator credentials in the **User name** and **Password** text boxes to connect to the vRealize Orchestrator endpoint.

   The credentials you use should have Execute permissions for any vRealize Orchestrator workflows to call from IaaS.

   To use the default vRealize Orchestrator instance embedded in the vRealize Automation appliance, the user name is **`administrator@vsphere.local`** and the password is the administrator password that was specified when configuring SSO.

6 Enter an integer greater than or equal to 1 in **Priority** text box.

   A lower value specifies a higher priority.

7 (Optional) Click **Properties** and add supplied custom properties, property groups, or your own property definitions for the endpoint.

8 Click **OK**.

Customizing IaaS Workflows By Using vRealize Orchestrator

You use a single workflow in vRealize Orchestrator to inject your custom logic into the IaaS workflow stubs and assign your customized life cycles to machine blueprints.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

You must design your custom vRealize Orchestrator workflows to accept string inputs. If your custom workflow expects a complex data type, create a wrapper workflow that looks up this complex value and translates it to a string. For an example wrapping workflow, see the sample Workflow template, provided in **Library > vRealize Automation > Infrastructure > Extensibility**.

Assign a State Change Workflow to a Blueprint and Its Virtual Machines

You configure custom vRealize Orchestrator workflows to run at specific stages in the master machine workflow by associating your custom workflow with a state change workflow stub and assigning the workflows to a blueprint.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

Prerequisites

Use the workflow template provided in the Extensibility subdirectory of the vRealize Automation plugin library to create a custom workflow to run during the machine lifecycle.

Procedure

1. From the drop-down menu in the Orchestrator client, select **Run** or **Design**.
2. Click the **Workflows** view.
3. Select **Library > vRealize Automation > Infrastructure > Extensibility**.
4. Right-click the **Assign a state change workflow to a blueprint and its virtual machines** workflow and select **Start workflow**.
5. Choose the lifecycle stage at which to run the workflow by selecting a stub from the **vCAC workflow stub to enable** drop-down menu.
6. Select an IaaS host.
7. Click **Next**.
8. Select the blueprint to which you want to assign the workflow.
9. Choose whether or not to apply these workflows to existing machines provisioned by using this blueprint.
10. Select the workflow you want to run during the machine lifecycle.
11. Configure which workflow input values are added as custom properties to the machine.
    a. Add vCO workflow inputs as blueprint properties.
    b. Add last vCO workflow run input values as blueprint properties.
12. Click **Submit**.

Configuring Workflow Subscriptions to Extend vRealize Automation

You create workflow subscriptions that use the event broker service to monitor the registered services for event messages in vRealize Automation, and then run a specified vRealize Orchestrator workflow when the conditions in the subscription are met. To configure the subscription you specify the event topic, the triggering conditions, and the workflow that runs when triggered.

Tenant administrators can create and manage the workflow subscriptions that are specific to their tenant.

The system administrator can create and manage system workflow subscriptions. The created system workflow subscriptions are active for events in any tenant and for system events.

Event Topics Provided With vRealize Automation

Event topics describe the type of event message that is sent to the event broker service by the other services. You select an event topic and configure the workflow subscription based on the topic.

Table 1-4. Event Topics

Event Topic Name	Description	Service
Blueprint component completed	A blueprint component that is part of a composite blueprint finishes provisioning. The component is any blueprint that is part of a composite blueprint.	composition-service
Blueprint component requested	A blueprint component that is part of a composite blueprint is requested. The component is any blueprint that is part of a composite blueprint.	composition-service
Blueprint configuration	A blueprint is created, updated, or deleted.	composition-service
Business group configuration	A business group is created, updated, or deleted.	identity
Catalog item request completed	A composite blueprint finished provisioning. This event topic includes all blueprint components. It does not include standalone XaaS blueprints.	composition-service
Catalog item requested	A composite blueprint is requested. This event topic does not include XaaSblueprints.	composition-service
Component action completed	An action ran on a deployed blueprint component when a deployment action was requested.	composition-service
Component action requested	An action to run on a deployed blueprint component is requested when a deployment action was requested.	composition-service

Table 1-4. Event Topics (Continued)

Event Topic Name	Description	Service
Deployment action completed	An action on a deployed blueprint finished running, including running all the component actions.	composition-service
Deployment action requested	An action on a deployed blueprint is requested.	composition-service
EventLog default event	A standard entry is added to the event log. The log entry is not distributed to subscribers.	eventlog-service
IPAM IP lifecycle event completion	An IP allocation or deallocation request is finished.	ipam-service
Machine lifecycle	A provided IaaS action is run on a provisioned machine.	iaas-service
Machine provisioning	An IaaS machine is in the process of being provisioned.	iaas-service
Orchestration server configuration	A vRealize Orchestrator server configuration is created, updated, deleted, or modified to use a different default instance.	o11n-gateway-service
Orchestration server configuration (XaaS) - Obsolete	A vRealize Orchestrator server configuration is created, updated, deleted, or modified to use a different default instance.	advanced-designer-service
Post Approval	A post-approval policy level is configured to use the event subscription option.	approval-service
Pre Approval	A pre-approval policy level is configured to use the event subscription option.	approval-service
Resource reclamation completion event	A resource lease expired and the resources are reclaimed.	management-service

Workflow Subscriptions and Event Broker Terminology

As you work with the workflow subscriptions and the event broker service, you might encounter some terminology that is specific to the subscriptions and event broker service.

Table 1-5. Workflow Subscription and Event Broker Terminology

Term	Description
Event Topic	Describes a set of events that have same logical intent and the same structure. Every event is an instance of an event topic.
Event	Indicates a change in the state in the producer or any of the entities managed by it. The event is the entity that records information about the event occurrence.

Table 1-5. Workflow Subscription and Event Broker Terminology (Continued)

Term	Description
Message	Transports information about the event between the various services and components. For example, from the producer to the event broker service, or from the event broker service to the subscribers.
Event Broker Service	The service that dispatches messages that are published by a producer to the subscribed consumers.
Payload	The event data.
Subscription	Indicates that a subscriber is interested in being notified about an event by subscribing to an event topic and defining the criteria that triggers the notification.
Subscriber	Consumes the events published to the event broker service based on the subscription definition. The subscriber might also be referred to as the consumer.
Provider	Registers event topics in the event broker service.
Producer	Publishes events to the event broker service.
System Administrator	A user with privileges to create, read, update, and delete tenant workflow subscriptions and system workflow subscriptions using the API or vRealize Automation plug-in. vRealize Automation does not include a user interface for the system administrator.
Tenant Administrator	The user with privileges to create, read, update, and delete tenant workflow subscriptions for their tenant.
Workflow Subscription	Specifies the event topic and conditions that trigger a vRealize Orchestrator workflow.
System Workflow Subscription	A specialized workflow subscription that reacts to system events and to events in all the tenants.
Tenant Workflow Subscription	A specialized workflow subscription that specifies which conditions trigger a vRealize Orchestrator workflow for events in the same tenant.

Blockable and Replyable Event Topics

Event topics might support blockable and replyable events. The behavior of a workflow subscription depends on whether the topic supports these event types and how you configure the workflow subscription.

Non-Blockable Event Topics

Non-blockable event topics only allow you to create non-blocking subscriptions. Non-blocking subscriptions are triggered asynchronously and you can not rely on the order that the subscriptions are triggered or that the vRealize Orchestrator workflows run. Non-blocking subscriptions only return a response if the topic is replyable.

Blockable Event Topics

Some event topics support blocking. If a workflow subscription is marked as blocking, then all messages that meet the configured conditions are not received by any other workflow subscriptions with matching conditions until the first workflow is finished. If you have multiple blocking workflow subscriptions for the same event topic, you prioritize the subscriptions.

Blocking subscriptions run in priority order. The highest priority value is 0 (zero). If you have more than one blocking subscription for the same event topic with the same priority level, the subscriptions run in alphabetical order based on the name. After all blocking subscriptions are processed, the message is sent to all the nonblocking subscriptions at the same time. Because the blocking workflow subscriptions run synchronously, the changed event payload includes the updated event when the subsequent workflow subscriptions are notified.

You apply blocking to one or more workflow subscriptions depending on the selected workflow and your goals.

For example, you have two provisioning workflow subscriptions where the second workflow depends on the results of the first. The first one changes a property during provisioning, and a second records the new property, perhaps a machine name, in a file system. The ChangeProperty subscription is prioritized as 0 and the RecordProperty is prioritized as 1 because it uses the results of the ChangeProperty subscription. When a machine is provisioned, the ChangeProperty subscription begins running. Because the RecordProperty subscription conditions are based on a post-provisioning conditions, a message triggers the RecordProperty subscription. However, because the ChangeProperty workflow is a blocking workflow, the message is not received until it is finished. When the name is changed and the first workflow is finished, the second workflow runs, recording the name in the file system.

Even if an event topics that support blocking, you can create a non-blocking workflow subscription if the workflow subscription does not have any dependant subsequent workflows. The workflow subscription is triggered and runs the vRealize Orchestrator workflow without further interaction from vRealize Automation or the outside system.

Replyable Event Topics

Some event topics support replies from the subscribed service. The service that registered the replyable event topic can accept a reply event that provides the workflow output, usually as a result of an interaction with a system or user. The reply output parameters must meet the criteria defined in the reply schema so that the vRealize Automation service that published the original replyable event can process it. For example, pre-approval and post-approval workflow subscriptions are replyable. If you create a workflow that sends an approval request to an external system, the reply, approved or rejected, is processed by vRealize Automation and the catalog item is provisioned or the user is notified that the request was rejected.

The reply can be the output from the vRealize Orchestrator workflow or it can be a failure if the workflow times out or fails. If the reply is from the workflow output parameters, the reply must be in the correct reply schema format.

Best Practices for Creating vRealize Orchestrator Workflows for Workflow Subscriptions

A workflow subscription is based on a specific topic schema. To ensure that the subscriptions can start the vRealize Orchestrator workflows, you must configure them with the correct input parameters so that they work with the event data.

Workflow Input Parameters

The custom workflow that you create can include all the parameters or a single parameter that consumes all the data in the payload.

- To include individual parameters, configure one or more parameters. Ensure that the name and type match the name and type specified in the schema. Complex types from the schema should be defined as 'Properties' in the workflow.
- To use a single parameter, configure one parameter with a type of `Properties`. You can provide any useful name. For example, you can use `payload` as the parameter name.

Workflow Output Parameters

The custom workflow that you create can include output parameters that are relevant to subsequent events necessary for a reply event topic type.

If an event topic expects a reply, the workflow output parameters must match the reply schema.

Workflow Subscription Settings

The subscription options determine when a workflow runs based on event messages in vRealize Automation. Use the options to manage your subscriptions.

A subscription represents a user's intent to subscribe to events for a given event topic and to run a workflow when an event for the topic is received that matches defined conditions.

You must be a tenant administrator to create a workflow subscription. All workflow subscriptions are specific to your tenant.

To manage your workflow subscriptions, select **Administration > Events > Subscriptions**.

Table 1-6. Workflow Subscription options

Option	Description
New	Create a new subscription.
Edit	Modify the selected subscription. If the subscription is published, the saved changes are immediately active. You cannot edit the event topic or modify the blocking option for a published or unpublished subscription.

Table 1-6. Workflow Subscription options (Continued)

Option	Description
Publish	Make the subscription active. The events from the event broker service are processed and the subscription conditions are evaluated. If a configured condition is true, the workflow is triggered.
Unpublish	Return a subscription to a draft state. The subscription is no longer active in your environment and no longer receives events. If you republish a subscription, the subscription starts to receive new events. Past events are not received.
Delete	Delete the selected subscription.

- Workflow Subscription Event Topic Tab Settings

  Event topics are classes of events provided in vRealize Automation. You select the event topic on which to define the subscription.

- Workflow Subscription Conditions Tab Settings

  The conditions you configure for the subscription determine whether the workflow is triggered to run based on the event data.

- Workflow Subscription Workflow Tab Settings

  The vRealize Orchestrator workflow that you select runs when the subscription conditions are evaluated as true.

- Workflow Subscription Details Tab Settings

  The subscription details determine how the subscription is processed.

Workflow Subscription Event Topic Tab Settings

Event topics are classes of events provided in vRealize Automation. You select the event topic on which to define the subscription.

This page is informational. You are not required to provide any values.

To select an event topic for your workflow subscriptions, select **Administration > Events > Subscriptions**. Click **New** and select an event topic.

Table 1-7. Event Topic Options

Option	Description
Topic ID	Event topic identifier.
Name	Name of the event topic.
Description	Description of the event topic.
Publisher	Name of the service for which this event topic is registered.

Table 1-7. Event Topic Options (Continued)

Option	Description
Blockable	Indicates whether you can create a blocking subscription for this event topic. Blocking subscriptions are used to change the event's payload or to synchonously run your custom logic when the results of a second workflow for the same event depend on the results of the first workflow.
Replyable	Indicates whether an event topic subscription can publish a reply event to the service that originally produced the event. If the value is yes, a reply is sent to the service that published the original event when the workflow finishes. The reply contains the output of the vRealize Orchestrator workflow and any error details.
Schema	Describes the structure of the event's payload. You can use the schema to create workflows that can use the payload information.

Workflow Subscription Conditions Tab Settings

The conditions you configure for the subscription determine whether the workflow is triggered to run based on the event data.

If you select **Run based on conditions**, the available options can include:

- Data. Information in the event message that is specific to the selected event topic. For example, if you create a condition for the machine life cycle event topic, the data fields are related to blueprints and machines. If you select a pre-approval event topic, the data fields are related to approval policies.

  You can also add conditions for fields that are not included in the schema by entering the path in the text box above the tree. Use the format **`${PATH}`**. PATH is the path in the schema. Separate the nodes using ~. For example, **`${data~machine~properties~SomeCustomProperty}`**.

- Core event message values. General information about the event message. For example, the event type, time stamp, or user name.

To select an event topic for your workflow subscriptions, select **Administration > Events > Subscriptions**. Click **New**.

Table 1-8. Conditions Tab Options

Option	Description
Run for all events	The selected workflow runs when the message for this event topic is received.
Run based on conditions	The selected workflow runs when the event message is detected and the event meets the configured conditions. If you select this option, you must specify conditions based on the event data to trigger the selected workflow for this subscription. ■ **Single condition**. The workflow is triggered when the configured clause is true. ■ **All of the following**. The workflow is triggered when all the clauses are true and you provided at least two conditions. ■ **Any of the following**. The workflow is triggered when at least one of the clauses is true and you provided at least two conditions. ■ **Not the following**. The workflow is triggered when none of the clauses are true. If you create a condition based on a constant value, the value is processed as case insensitive. For example, if your condition is Blueprint name contains UNIX, but your blueprints use Unix in the name, the condition still processes correctly. To change the condition name to match the blueprint name, you must first change the value to something that does not contain the same string. For example, to edit the condition UNIX, change the value to xxxx, save it, then change xxxx to Unix and save it.

Workflow Subscription Workflow Tab Settings

The vRealize Orchestrator workflow that you select runs when the subscription conditions are evaluated as true.

The workflow that you want to run must already exist in vRealize Orchestrator specified in **Administration > vRO Configuration > Server Configuration**.

To select a workflow for your workflow subscriptions, select **Administration > Events > Subscriptions**. Click **New**.

Table 1-9. Workflow Tab Options

Option	Description
Select a Workflow	Navigate to the workflow.
Selected Workflow	Displays information about the workflow, including input and output parameters, so that you can verify it is the one that you want to run.

Workflow Subscription Details Tab Settings

The subscription details determine how the subscription is processed.

To manage your workflow subscriptions, select **Administration > Events > Subscriptions**. Click **New**.

The options vary depending on the type of event topic.

Table 1-10. Details Tab Options

Options	Descriptions
Name	By default, the displayed name is the name of the selected workflow. This name is displayed in the subscription list. The name must be unique in the tenant.
Priority	The order in which the blocking subscriptions run. Zero is the highest priority. If an event topic has multiple blocking workflow subscriptions with the same priority, the subscriptions are then processed in alphabetical order based on the subscription name. This option is only available for blocking workflow subscriptions.
Timeout (min)	Specify the number of minutes the workflow has to finish before it is considered failed. If the workflow fails to finish in the specified amount of time, the workflow is canceled and the message is sent to the next subscription in the priority list. If you do not provide a value, the timeout is unlimited. Services that expect a reply, to blocking or replyable events, might have their own default timeout values. For example, IaaS provisioning and life cycle event topics time out at 30 minutes. This value is configured on the IaaS server. Approval topics have a 24 hour default value. This value is configured on the system.

Table 1-10. Details Tab Options (Continued)

Options	Descriptions
Description	By default, the displayed description is the workflow description.
Blocking	Determines if the workflow can block subsequent workflows for the same event topic from receiving an event message while waiting for a reply. Subscriptions with blocking enabled receive messages before subscriptions that are not configured as blocking for the same event topic, based on priority order. When the workflow is finished, a message is sent to the next prioritized blocking subscription. After all blocking subscriptions have processed, the message is sent to all non-blocking subscriptions simultaneously. The blocking option is available only if the event topic is blockable. This information is provided on the Event Topic tab. The blocking eligibility is indicated on the Event Topic tab. ■ If you do not select the check box, the event broker does not block subsequent workflows. ■ If you select check box, the event broker calculates which workflow subscriptions are eligible for this event based on the configured conditions and runs the workflows in priority order. The event broker waits for a response from each workflow before running the next one. All the changed parameters from the running of the current workflow are passed to the next one in the queue. While waiting for a response, no other workflows are notified of the event until the consuming system responds. You cannot modify this option after the workflow subscription is published.

Working with Provisioning and Life Cycle Workflow Subscriptions

You create provisioning and life cycle workflow subscriptions so that you can use vRealize Orchestrator to extend your management of IaaS machines. The provisioning subscriptions extend what you can do during the provisioning process. The life cycle subscriptions extend what you can do when the user is managing the provisioned items.

IaaS Service Integration

You create a workflow subscription based on a provisioning or life cycle event topic that runs a custom vRealize Orchestrator workflow based on a message generated by the IaaS service. vRealize Automation includes two event topics that you can use for IaaS integration.

- Machine provisioning. Create workflow subscriptions that run workflows during the provisioning and disposal of IaaS machines.
- Machine lifecycle. Create workflow subscriptions that run workflows related to management actions that an owning user runs on the provisioned machine.

Configuring vRealize Orchestrator Workflows for Provisioning and Life Cycle Workflows

You must configure your vRealize Orchestrator workflows to support the IaaS service message.

Provisioning and Life Cycle Event Topic Schema

The machine provisioning and machine life cycle event topics use the same life cycle schema. The differences are in the triggering states. Machine provisioning receives messages based on provisioning states and events, and machine life cycle receives messages based on active states and events. Some provisioning states include BuildingMachine and Disposing. Some life cycle states include InstallTools and Off.

The event message is the event data payload. The following is the structure of the event data payload.

```
{
  machine : {
      id                : STRING,      /* IaaS machine ID */
      name              : STRING,      /* machine name */
      externalReference : STRING,      /* machine ID on the hypervisor */
      owner             : STRING,      /* machine owner */
      type              : INTEGER,     /* machine type: 0 – virtual machine; 1 – physical machine; 2 –
cloud machine */
      properties        : Properties   /* machine properties, see notes below how to expose virtual
machine properties */
  },
  blueprintName   : STRING,      /* blueprint name */
  componentId     : STRING,      /* component id */
  componentTypeId : STRING,      /* component type id */
  endpointId      : STRING,      /* endpoint id */
  requestId       : STRING,      /* request id */
  lifecycleState  : {                                          /* see Life Cycle State
Definitions*/
      state : STRING,
      phase : STRING,
      event : STRING
  },
  virtualMachineEvent                : STRING,     /* fire an event on that machine – only processed
by Manager Service as consumer */
  workflowNextState                  : STRING,     /* force the workflow to a specific state – only
processed by Manager Service as consumer */
  virtualMachineAddOrUpdateProperties : Properties, /* properties on the machine to add/update – only
processed by Manager Service as consumer */
  virtualMachineDeleteProperties      : Properties  /* properties to remove from the machine – only
processed by Manager Service as consumer */
}
```

The vRealize Orchestrator parameters are mapped to the event's payload by name and type.

When you use `virtualMachineEvent` and `workflowNextState` as output parameters, the values that you provide must represent a state or event from the workflow that triggered the event and started the current vRealize Orchestrator workflow. To review the possible life cycle states and events, see VMPS Master Workflow Life Cycle States and Provisioning Life Cycle States by Machine Type.

Working with Extensibility Custom Properties

The virtual machine custom properties are not included in the event payload unless they are specified as an extensibility custom property for the life cycle state. You can add these properties to IaaS endpoints, reservations, blueprints, requests, and other objects that support custom properties.

The format of the custom property that you add to an object is `Extensibility.Lifecycle.Properties.{workflowName}.{stateName}`.

For example, if you want to include hidden properties and all properties starting with "Virtual" when the virtual machine state is BuildingMachine, you add the custom properties to the machine in the blueprint. The custom property name for this example is `Extensibility.Lifecycle.Properties.VMPSMasterWorkflow32.BuildingMachine`, and the values are `__*` and `Virtual*`, separated by a comma.

The double underscore (`__*`) includes the hidden properties. The `Virtual*` value includes all properties that begin with virtual. The asterisk (*) is a wildcard and can be used as the only value, but using the wildcard this way results in the transfer of large amounts of data.

If you have multiple, subsequently triggered workflow subscriptions that include custom properties, you must include the appropriate entries in the workflows to ensure that the payload check retains the custom properties.

Table 1-11. Task Entries to Preserve Custom Properties

State	Task Entries
Added or updated custom properties	`virtualMachineAddOrUpdateProperties = payload.virtualMachineAddOrUpdateProperties || new Properties();`
Deleted custom properties	`virtualMachineDeleteProperties = payload.virtualMachineDeleteProperties || new Properties();`

Creating a vRealize Orchestrator Workflow Based on the Life Cycle or Provisioning Schema

The custom workflow that you create must have an input parameter that is `payload` with the type `Properties`. The provisioning or life cycle event data payload is put in this parameter when the workflow runs in vRealize Orchestrator. You can also include separate input parameters that match the name and the type of the fields in the event's payload.

Workflow Subscription Life Cycle State Definitions

If you configure workflow subscription conditions based on life cycle states, the following definitions might help you identify the values.

Each message contains a lifecycleState element that is based on the IaaS machine state changes.

The element has the following structure in the message.

```
lifecycleState : {
    state : STRING,
    phase : STRING,
    event : STRING
}
```

Table 1-12. LifecycleState Elements

Property	Description	Format and Values	Examples
state	Contains workflow name and state name.	{workflowName}.{stateName}	■ VMPSMasterWorkflow32.Requested ■ VMPSMasterWorkflow32.MachineActivated ■ BasicVmWorkflow.BuildComplete
phase	Contains the phase that triggered a message.	PRE, POST, EVENT	■ PRE. An event is published when entering this state. ■ POST. An event is published when exiting this state. ■ EVENT. An event is published when an IaaS event is received in this state..
event	Contains the event. This property is optional and exists only when the phase is EVENT.	{workflowName}.{stateName}.EVENT.{eventName}	■ VMPSMasterWorkflow32.Requested.EVENT.OnProvisionMachine ■ VMPSMasterWorkflow32.VMPSMasterWorkflow32.EVENT.OnBuildSuccess ■ BasicVmWorkflow.CreatingMachine.EVENT.OnCreatingMachineComplete

VMPS Master Workflow Life Cycle States

The VMPS master workflow life cycle states represent an IaaS virtual machine life cycle, from request to destruction .You can use the VMPS master workflow states and events when you create triggering conditions based on life cycle state events and life cycle state names.

Each virtual machine goes through four basic stages.

- Request. Includes approvals.
- Provision. Includes different provisioning types, such as create, clone, kickstart, or WIM.
- Manage. Includes actions, such as power on, power off, or snapshot.
- Destroy. Includes deactivating, unprovisioning, and disposing of the machine.

These basic stages are included in the master workflow. You can use the VMPSMasterWorkflow32 states when you create conditions for the following event topics:

- Machine life cycle
- Machine provisioning

The global event states are messages sent to the event broker by the VMPS Master Workflow. Global events can be triggered at any time.

You can subscribe the client to listen for events, but the events should not be thrown unless the table entry has a trigger string value. For example, Events [Triggering String] (Topic).

Table 1-13. Global Events

State(Topic)	Events [Triggering String] (Topic)
Global	■ onBuildFailure (Provision) ■ OnBuildSuccess (Provision) ■ OnFinalizeMachine [Destroy] (Provision) ■ OnForceUnregisterEvent [ForceUnregister] (Provision) ■ ReconfigureVM.Pending [ReconfigureVM.Pending] (Active) ■ ReconfigureVM.ExecutionUpdated (Active) ■ ReconfigureVM.RetryRequestMade (Active) ■ ReconfigureVM.Failed (Active) ■ ReconfigureVM.Successful (Active) ■ ReconfigureVM.Complete (Active) ■ ReconfigureVM.Canceled (Active)

The active global states are actions that you can run on provisioned machines.

Table 1-14. Active Events

State	Events [Triggering String] (Topic)
Active	■ OnExpireLease [Expire] (Active) ■ OnForceExpire [ForceExpire] (Active) ■ onReprovision [Reprovision] (Active) ■ onResetBuildSuccess [ResetBuildSuccess] (Active)

In the master workflow, provision events occur during the machine provisioning life cycle. Active events are actions you can run on provisioned machines. For an illustration of the master workflow, see Example of VMPS Master Workflow.

Each machine type has its own provisioning workflow. For information about individual machine types, see Provisioning Life Cycle States by Machine Type.

Table 1-15. VMPSMasterWorkflow32 States and Events

State(Topic)	Events [Triggering String] (Topic)
BuildingMachine ■ Pre(Provision) ■ Post(Provision)	
DeactivateMachine ■ Pre(Provision) ■ Post(Provision)	

Table 1-15. VMPSMasterWorkflow32 States and Events (Continued)

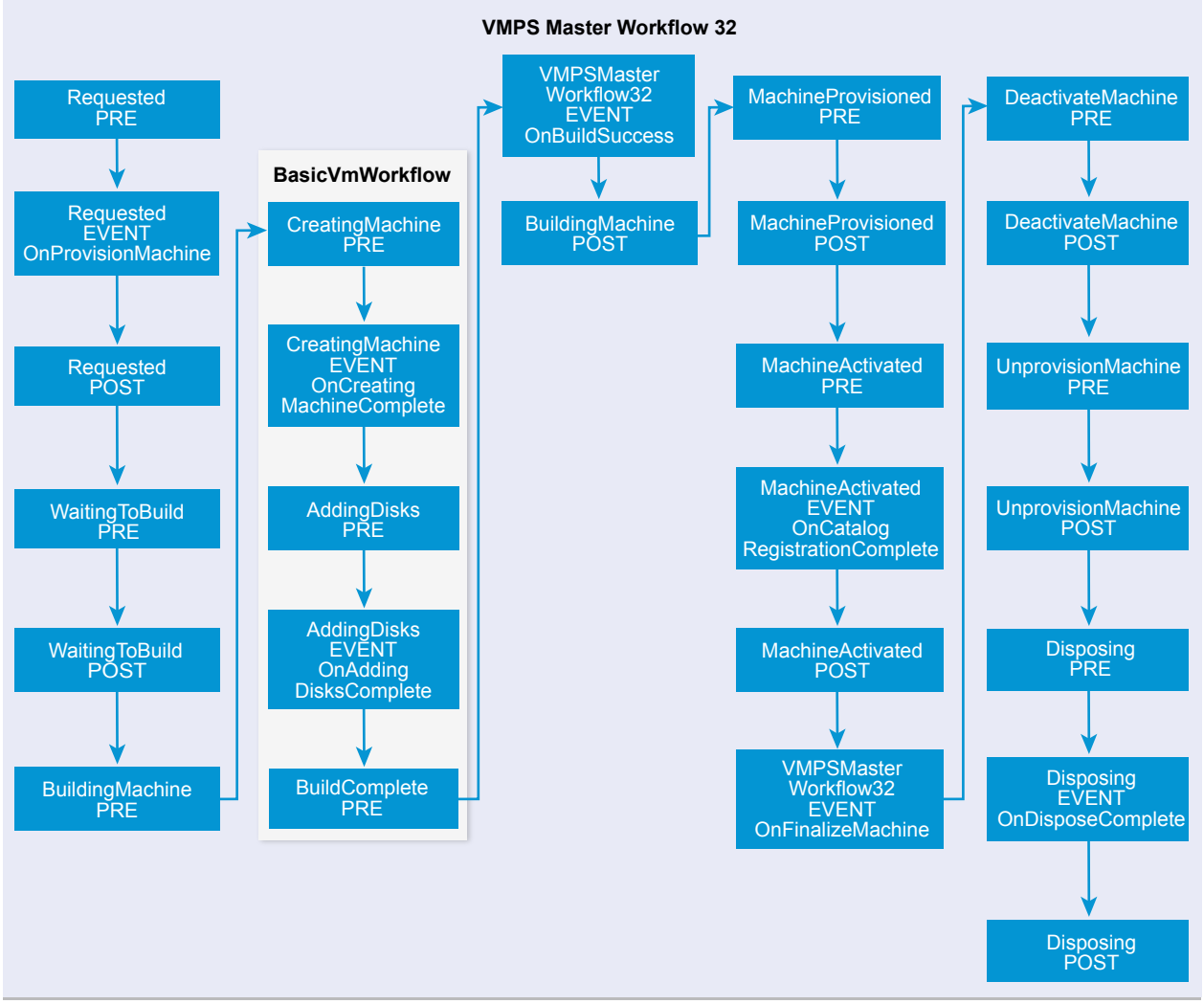
State(Topic)	Events [Triggering String] (Topic)
Disposing ■ Pre(Provision) ■ Post(Provision)	■ OnDisposeComplete(Provision) ■ OnDisposeTimeout(Provision) ■ OnUnregisterMachine [Unregister] (Provision)
Expired ■ Pre(Active) ■ Post(Active)	■ OnActiveExpiredMachine [ActivateExpiredMachine] (Active) ■ TurnOffFromExpired [TurnOffExpiredMachine] (Active)
InstallTools ■ Pre(Active) ■ Post(Active)	■ InstallToolsComplete(Active) ■ TimeoutInstallTools(Active)
Leased	■ OnChangeLease (Active) ■ OnUpdateDescription (Active) ■ OnUpdateOwner (Active)
MachineActivated ■ Pre(Provision) ■ Post(Provision)	■ OnCatalogRegistrationComplete (Provision)
MachineProvisioned ■ Pre(Provision) ■ Post(Provision)	
Off ■ Pre(Active) ■ Post(Active)	■ OnForceOn [ForceOn] (Active) ■ OnResetOff [Turn Off] (Active) ■ OnTurnOn [Turn On] (Active)
On ■ Pre(Active) ■ Post(Active)	■ OnForceOff [ForceOff] (Active) ■ onInstallTools [InstallTools] (Active) ■ OnReboot [Reboot] (Active) ■ OnReset [Reset] (Active) ■ OnResetOn [Turn On] (Active) ■ OnShutdown [Shutdown] (Active) ■ OnSuspend [Suspend] (Active) ■ OnTurnOff [Turn Off] (Active)
Rebooting ■ Pre(Active) ■ Post(Active)	■ OnRebootComplete(Active) ■ TimoutFromReboot(Active)
RegisterMachine ■ Pre(Provision) ■ Post(Provision)	■ onRegisterComplete(Provision) ■ RegisterTimeout(Provision)
Requested ■ Pre(Provision) ■ Post(Provision)	■ OnProvisionMachine [Provision] (Provision)
Resetting ■ Pre(Active) ■ Post(Active)	■ OnResetComplete(Active) ■ TimoutFromReset(Active)

Table 1-15. VMPSMasterWorkflow32 States and Events (Continued)

State(Topic)	Events [Triggering String] (Topic)
ShuttingDown ■ Pre(Active) ■ Post(Active)	■ OnShutdownComplete(Active) ■ TimoutFromShutdown(Active)
Suspending ■ Pre(Active) ■ Post(Active)	■ OnSuspendComplete(Active) ■ TimoutFromSuspend(Active)
TurningOff ■ Pre(Active) ■ Post(Active)	■ OnTurningOffComplete(Active) ■ TimoutFromPowerOff(Active)
TurningOn ■ Pre(Active) ■ Post(Active)	■ OnTurningOnComplete(Active) ■ TimeoutPowerOn(Active)
UnprovisionMachine ■ Pre(Provision) ■ Post(Provision)	
WaitingToBuild ■ Pre(Provision) ■ Post(Provision)	

Example of VMPS Master Workflow

The VMPS workflow is the master in which the other provisioning workflows are embedded. This example includes the Basic VM Workflow to illustrate the life cycle of a virtual machine. It does not represent a specific workflow in your environment.



Provisioning Life Cycle States by Machine Type

The life cycle states by machine type are specific to certain virtual machine types. In addition to the master workflow, you can use the provisioning workflow states and events when you create triggering conditions for workflow subscriptions.

You can subscribe the client to listen for events, but the events should not be thrown unless the table entry has a trigger string value. For example, Events [Triggering String] (Topic).

Blade Logic Bare Metal

State (Topic)	Events (Topic)
BuildFinished ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	

Opsware Bare Metal

State (Topic)	Events (Topic)
BuildFinished ■ Pre(Provision)	
OpswareRegister ■ Pre(Provision)	■ OnOpswareRegister(Provision)

Cloud Provisioning Workflow

State (Topic)	Events (Topic)
BuildComplete ■ Pre(Provision)	
CloudProvisioning ■ Pre(Provision)	■ OnCloudProvisioningTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	

App Service Provisioning Workflow

State (Topic)	Events (Topic)
AppServiceProvisioning ■ Pre(Provision)	■ OnAppServiceProvisioningTimeout(Provision)
BuildComplete ■ Pre(Provision)	
FailedProvisioning ■ Pre(Provision)	

Basic VM Workflow

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	

Opsware Virtual

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildFinished ■ Pre(Provision)	
CreatingVM ■ Pre(Provision)	■ OnCreateVMComplete(Provision) ■ OnCreateVMTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
OpswareRegister ■ Pre(Provision)	■ OnOpswareRegister(Provision)

Cloud Linux Kickstart Workflow

State (Topic)	Events (Topic)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
CustomizeOS ■ Pre(Provision)	■ OnCustomizeOSComplete(Provision) ■ OnCustomizeOSTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
InstallingOS ■ Pre(Provision)	■ OnInstallingOSComplete(Provision) ■ OnInstallingOSTimeout(Provision)

Clone Workflow

State (Topic)	Events (Topic)
BuildComplete ■ Pre(Provision)	
CloneMachine ■ Pre(Provision)	■ OnCloneMachineComplete(Provision) ■ OnCloneMachineTimeout(Provision)
CustomizeMachine ■ Pre(Provision)	■ OnCustomizeMachineComplete(Provision) ■ OnCustomizeMachineTimeout(Provision)
CustomizeOS	■ OnCustomizeOS(Provision) ■ OnCustomizeOSComplete(Provision) ■ OnCustomizeOSTimeout(Provision)

State (Topic)	Events (Topic)
EjectCD ■ Pre(Provision)	■ OnEjectCDComplete(Provision) ■ OnEjectCDTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeComplete(Provision) ■ OnFinalizeTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
InstallSoftware ■ Pre(Provision)	■ OnInstallSoftwareComplete(Provision) ■ OnInstallSoftwareTimeout(Provision)
MountCD ■ Pre(Provision)	■ OnMountCDComplete(Provision) ■ OnMountCDTimeout(Provision)
PostInstallSoftwareChecks ■ Pre(Provision)	
PrepareInstallSoftware ■ Pre(Provision)	

Cloud WIM Image Workflow

State (Topic)	Events (Topic)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
InstallOS ■ Pre(Provision)	■ onInstallOSComplete(Provision) ■ OnInstallOSTimeout(Provision)
Reboot ■ Pre(Provision)	■ OnRebootComplete(Provision) ■ OnRebootTimeout(Provision)
SetupOS ■ Pre(Provision)	■ OnSetupOSComplete(Provision) ■ OnSetupOSTimeout(Provision)

External Provisioning Workflow

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
EpiRegister ■ Pre(Provision)	■ OnEpiRegisterComplete(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)

Linux Kickstart Workflow

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
CustomizeOS ■ Pre(Provision)	■ OnCustomizeOSComplete(Provision) ■ OnCustomizeOSTimeout(Provision)
EjectingCD ■ Pre(Provision)	■ OnEjectingCDComplete(Provision) ■ OnEjectingCDTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
InstallingOS ■ Pre(Provision)	■ OnInstallingOSComplete(Provision) ■ OnInstallingOSTimeout(Provision)

Physical Provisioning Workflow

State (Topic)	Events (Topic)
FailedProvisioning ■ Pre(Provision)	
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeProvisioningTimeout(Provision)
InitializeProvisioning ■ Pre(Provision)	■ OnInitializeProvisioningTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnTimeout(Provision)
InstallOS ■ Pre(Provision)	■ OnInstallOSComplete(Provision) ■ OnInstallOSTimeout(Provision)
Reboot ■ Pre(Provision)	■ OnRebootComplete(Provision) ■ OnRebootTimeout(Provision)
SetupOS ■ Pre(Provision)	■ OnSetupOSComplete(Provision) ■ OnSetupOSTimeout(Provision)

Physical PXE Provisioning Workflow

State (Topic)	Events (Topic)
CheckHardwareType ■ Pre(Provision)	
CleanPxe ■ Pre(Provision)	■ OnCleanPxeTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeProvisioningTimeout(Provision)
InitializeProvisioning ■ Pre(Provision)	■ OnInitializeProvisioningTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnTimeout(Provision)
InstallOS ■ Pre(Provision)	■ OnInstallOSComplete(Provision) ■ OnInstallOSTimeout(Provision)
Reboot ■ Pre(Provision)	■ OnRebootComplete(Provision) ■ OnRebootTimeout(Provision)
SetupOS ■ Pre(Provision)	■ OnSetupOSComplete(Provision) ■ OnSetupOSTimeout(Provision)
SetupPxe ■ Pre(Provision)	■ OnSetupPxeTimeout(Provision)

Physical SCCM Provisioning Workflow

State (Topic)	Events (Topic)
CheckHardwareType ■ Pre(Provision)	
Complete ■ Pre(Provision)	■ OnCompleteProvisioningComplete(Provision) ■ OnCompleteProvisioningTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	■ OnFailedProvisioningTimeout(Provision)
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeProvisioningTimeout(Provision)
InitializeProvisioning ■ Pre(Provision)	■ OnInitializeProvisioningTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnTimeout(Provision)
SccmRegistration ■ Pre(Provision)	■ OnSccmRegistrationTimeout(Provision)

Physical SCCM PXE Provisioning Workflow

State (Topic)	Events (Topic)
CheckHardwareType ■ Pre(Provision)	
CleanPxe ■ Pre(Provision)	■ OnCleanPxeTimeout(Provision)
Complete ■ Pre(Provision)	■ OnCompleteProvisioningComplete(Provision) ■ OnCompleteProvisioningTimeout(Provision)
Disposing ■ Pre(Provision)	
FailedProvisioning ■ Pre(Provision)	■ OnFailedProvisioningTimeout(Provision)
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeProvisioningTimeout(Provision)
InitializeProvisioning ■ Pre(Provision)	■ OnInitializeProvisioningTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnTimeout(Provision)
SccmRegistration ■ Pre(Provision)	■ OnSccmRegistrationTimeout(Provision)
SetupPxe ■ Pre(Provision)	■ OnSetupPxeTimeout(Provision)

vApp Clone Workflow

State (Topic)	Events [Triggering String] (Topic)
Global	■ OnFailProvisioning(Provision) ■ OnMasterProvisioned(Provision)
BuildComplete ■ Pre(Provision)	
CloneMachine ■ Pre(Provision)	■ OnCloneMachineComplete(Provision) ■ OnCloneMachineTimeout(Provision)
CustomizeMachine ■ Pre(Provision)	■ OnCustomizeMachineComplete(Provision) ■ OnCustomizeMachineTimeout(Provision)
CustomizeOS	■ OnCustomizeOS(Provision) ■ OnCustomizeOSComplete(Provision) ■ OnCustomizeOSTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
FinalizeProvisioning ■ Pre(Provision)	■ OnFinalizeComplete(Provision) ■ OnFinalizeTimeout(Provision)
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
WaitingForMaster ■ Pre(Provision)	■ OnWaitingForMasterTimeout(Provision)

Virtual SCCM Provisioning Workflow

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ CreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
Disposing ■ Pre(Provision)	
EjectingCD ■ Pre(Provision)	■ OnEjectingCDComplete(Provision) ■ OnEjectingCDTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnPowerOnTimeout(Provision)

State (Topic)	Events (Topic)
InstallingOS ■ Pre(Provision)	■ OnInstallingOSComplete(Provision) ■ OnInstallingOSTimeout(Provision)
SccmRegistration ■ Pre(Provision)	■ OnSccmRegistrationTimeout(Provision)

WIM Image Workflow

State (Topic)	Events (Topic)
AddingDisks ■ Pre(Provision)	■ OnAddingDisksComplete(Provision) ■ OnAddingDisksTimeout(Provision)
BuildComplete ■ Pre(Provision)	
CreatingMachine ■ Pre(Provision)	■ OnCreatingMachineComplete(Provision) ■ OnCreatingMachineTimeout(Provision)
EjectingCD ■ Pre(Provision)	■ OnEjectingCDComplete(Provision) ■ OnEjectingCDTimeout(Provision)
FailedProvisioning ■ Pre(Provision)	
InitialPowerOn ■ Pre(Provision)	■ OnInitialPowerOnComplete(Provision) ■ OnInitialPowerOnTimeout(Provision)
InstallOS ■ Pre(Provision)	■ onInstallOSComplete(Provision) ■ OnInstallOSTimeout(Provision)
Reboot ■ Pre(Provision)	■ OnRebootComplete(Provision) ■ OnRebootTimeout(Provision)
SetupOS ■ Pre(Provision)	■ OnSetupOSComplete(Provision) ■ OnSetupOSTimeout(Provision)

Configuring the Timeout Values for States and Events

The default timeout value for all states and events is 30 minutes and is configured in the vRealize Automation global settings. Some workflows might take more time to run successfully. To accommodate different workflows in your environment, you can add timeout override values for individual workflows or states.

To modify the default timeout value, select **Infrastructure > Administration > Global Settings** and edit the value for **Extensibility lifecycle message timeout**. If you make changes to the global setting, you must restart the manager service.

To configure individual timeout values, add the workflow or event property to the `appSetting` section of the `ManagerService.exe.config file`, located on the IaaS server. The file is typically located in the `%System–Drive%\Program Files x86\VMware\vCAC\Server` directory. You should always make a copy of the file before editing it. If you make changes to the individual settings, you must restart the manager service.

The basic format for the keys is similar to the following examples.

- For a workflow. `Extensibility.{workflow}.Timeout`
- For events. `Extensibility.{workflow}.{state}.EVENT.{event}.Timeout`
- For states. `Extensibility.{workflow}.{state}.(PRE/POST).Timeout`

Use the following as examples when adding keys to the `appSetting` section. The timeout value format is D.HH:mm:ss.ms. D is day and ms is milliseconds. Day and milliseconds are optional. Hours, minutes, and seconds are required.

- To set the timeout for the entire BasicVmWorkflow workflow to 30 minutes, add `<add key="Extensibility.BasicVmWorkflow.Timeout" value="00:30:00"/>`.
- To set the timeout for the OnFinalizeMachine global event in the VMPSMasterWorkflow32 to two hours, add `<add key="Extensibility.VMPSMasterWorkflow32.VMPSMasterWorkflow32.EVENT.OnFinalizeMachine.Timeout" value="02:00:00"/>`.
- To set the timeout for the pre-request state of the VMPSMasterWorkflow32 to 2 days, add `<add key="Extensibility.VMPSMasterWorkflow32.Requested.PRE.Timeout" value="2.00:00:00"/>`.

Configuring the Error Behavior for States and Events

The workflow subscription timeout and error handling has default behavior. You can custom the behavior for machines in your environment.

IaaS handles event timeout and error proccessing from the Event Broker Service.

At each state transition, SendEBSMessage sends an event to the Event Broker Service and waits for a reply. By default, if a timeout or an error is reported by the Event Broker Service, might occur, it is logged and the workflow resumes.

If a timeout or an error occurs during the following states in the master workflow, the workflow is forced into the error state rather than resuming the workflow.

Table 1-16. Exceptions Where Workflows Do Not Resume

State Where Error Occurs	Error State
PRE MachineProvisioned	UnprovisionMachine
PRE BuildingMachine	Disposing
PRE RegisterMachine	Finalized

To customize the timeout or error behavior, you can add custom properties to the machine for any events or states where you want to trigger an event or force a state change. Use the following examples to configure the custom properties.

- `Extensibility.Lifecycle.Error.Event.{Workflow}.{State}`. The value of the property is the name of the event to be triggered on in the workflow in case of timeout or error.

- `Extensibility.Lifecycle.Error.State.{Workflow}.{State}`. The value of the property is the name of the state in which the workflow will forcibly transition to in case of timeout or error.

Scenario: Take a Post-Provisioning Snapshot of a Virtual Machine

As a tenant administrator, you want your service catalog users to have a post-provisioning snapshot of their virtual machines so that they can revert to the fresh machine rather than requesting a new one.

Procedure

1 Scenario: Create a vRealize Orchestrator Workflow for a Post-Provisioning Snapshot Action

You create a vRealize Orchestrator workflow that accepts the required input parameter. You design the workflow to accomplish your post-provisioning goal.

2 Scenario: Create a Post-Provisioning Snapshot Workflow Subscription

As a tenant administrator, you want to create a snapshot of each virtual machine after it is created. You configure a workflow subscription based on the machine provisioning event topic, and publish it to make it active.

Scenario: Create a vRealize Orchestrator Workflow for a Post-Provisioning Snapshot Action

You create a vRealize Orchestrator workflow that accepts the required input parameter. You design the workflow to accomplish your post-provisioning goal.

For information about creating vRealize Orchestrator folders and workflows, see *Developing with VMware vRealize Orchestrator*.

Prerequisites

Log in to the vRealize Orchestrator that is the instance configured for vRealize Automation with privileges that allow you to create a workflow.

Procedure

1 Create a folder for your workflow subscription workflows in the workflow library.

2 Create a new workflow.

For this scenario, name the workflow **`Automation Post-Provisioning Snapshot`**.

3 Add the following input parameter.

Name	Type
payload	Properties

4 Add a scriptable task that accepts the input parameter and creates a virtual machine snapshot.

5 Save the workflow.

What to do next

You create a workflow subscription that runs your Automation Post-Provisioning Snapshot workflow. Scenario: Create a Post-Provisioning Snapshot Workflow Subscription.

Scenario: Create a Post-Provisioning Snapshot Workflow Subscription

As a tenant administrator, you want to create a snapshot of each virtual machine after it is created. You configure a workflow subscription based on the machine provisioning event topic, and publish it to make it active.

You configure the workflow subscription to run a create snapshot workflow when a virtual machine is provisioned and the detected event message is in the activated state.

Prerequisites

- Log in to vRealize Automation as a **tenant administrator**.
- Configure a vCenter Server plug-in as a vRealize Orchestrator endpoint. See *Configuring vRealize Automation*.
- Verify that you have a vSphere virtual machine blueprint.
- Verify that you have a vRealize Orchestrator workflow that creates a snapshot of a virtual machine. You cannot use the Create a snapshot workflow provided by the vRealize Automation plug-in. The provided snapshot workflow is specific to XaaS integration. See Configuring vRealize Orchestrator Workflows for Provisioning and Life Cycle Workflows.

Procedure

1. Select **Administration > Events > Subscriptions**
2. Click the **New** icon ( ).
3. Select **Machine provisioning**.
4. Click **Next**.
5. On the Conditions tab, configure the triggering conditions.
   a. Select **Run based on conditions**.
   b. From the **Clause** drop-down menu, select **All of the following**.
   c. Configure the following conditions:

Property	Operator	Value
Data > Machine > Machine type	Equals	Constant > Virtual Machine
Data > Lifecycle state > Lifecycle state name	Equals	Constant > VMPSMasterWorkflow32.MachineActivated
Data > Lifecycle state > State phase	Equals	Constant > POST

   d. Click **Next**.
6. On the Workflow tab, browse the Orchestrator tree and select your **Automation Post-Provisioning Snapshot** workflow.
7. Click **Next**.

8 On the Details tab, enter the **Name** and **Description**.

   In this scenario, enter **`Post-Provisioning Virtual Machine Snapshot`** as the name and **`Create a snapshot when new virtual machine is provisioned and activated`** as the description.

9 Click **Finish**.

10 Select the Post-Provisioning Virtual Machine Snapshot row and click **Publish**.

The workflow subscription is active and will trigger your snapshot workflow when an event message indicates that a requested virtual machine is provisioned and activated.

What to do next

To test the workflow subscription, request a virtual machine in the service catalog. After the request indicates successful provisioning, verify that the snapshot was created.

Working with Approval Workflow Subscriptions

You create pre-approval and post-approval workflow subscriptions so that you can send an approval request to an external system for processing. The response, approved or rejected, is then processed by vRealize Automation.

Approval Service Integration

You create a pre-approval or post-approval workflow subscription that runs a custom vRealize Orchestrator workflow that processes the approval request in a system outside of vRealize Automation.

In an approval policy approval level, you can select **Use event subscription** as the approver. This level can be one of several in an approval policy. When a service catalog user requests an item to which an approval policy is applied that includes the **Use event subscription** approver, the approval service sends a message to the event broker service with the following results.

- If you have a published workflow subscription with matching criteria, vRealize Orchestrator runs your approve or reject workflow.
- If you have a published workflow subscription, but the criteria do not match, you unpublished the workflow subscription, or you do not have a published subscription, the approval level is approved and the approval process goes to the next approval level.

The approval workflow subscription receives messages from the approval service and compares the messages to the configured criteria for approval subscriptions. When it finds a message that matches the criteria, the selected vRealize Orchestrator workflow starts to run. The published event data is passed to the workflow as input and processed in the method specified in the workflow. The results of the workflow are returned to vRealize Automation and the request is processed. If approved, the next approval level is evaluated. If rejected, the request is rejected. If the approval service does not receive a reply within 24 hours, the default timeout for the approval service, the request is processed as rejected.

Configuring vRealize Orchestrator Workflows for Approval Event Topics

You must configure your custom vRealize Orchestrator workflow to support the approval message and to reply with correctly formatted information that vRealize Automation can process.

Approval Event Topic Schema

The pre-approval and post-approval event message schema includes the field names and values, the information included in the request, and information about the source of the request.

The following is the structure of the event data payload.

```
{
    fieldNames : Properties,            // Property names

    fieldValues : Properties,           // Property values

    // Information about the request
    requestInfo : {
        requestRef : STRING,            // Identifier for the source request
        itemName : STRING,              // Name of the requested item
        itemDescription : STRING,       // Description of the requested item
        reason : STRING,                // Justification provided by the user specifying why the
request is required
        description : STRING,           // Description entered by the user specifying the purpose of
the request
        approvalLevel:ExternalReference,// Approval level ID. This is a searchable field
        approvalLevelName : STRING,     // Approval level name
        createDate : DATE_TIME,         // Time the approval request is created
        requestedFor : STRING,          // Principal id of the user for whom the source request is
initiated
        subtenantId : STRING,           // Business group id
        requestedBy : STRING            // Principal id of the user who actually submits the request
    },

    // Information about the source of the request
    sourceInfo : {
        externalInstanceId : STRING,    // Identifier of the source object, as defined by the intiator
service
        serviceId : STRING,             // Identifier of the service which initiated the approval
        externalClassId : STRING        // Identifier of the class to which the source object belongs
    }
}
```

Property names and property values can be the custom properties or system properties that you configure in the approval policy level. These properties are configured in the approval policy to allow the approver to change the values during an approval process. For example, if CPU is included, the approver can decrease the number of CPUs in the approval request form.

The reply event data payload is the information that it returned to vRealize Automation by the workflow. The contents of the reply payload determines whether the request is approved or rejected.

```
{
    approved : BOOLEAN,

    // Property values
    fieldValues : Properties
}
```

The approved parameter in the reply event payload is either true, for approved, or false, for rejected requests. The property values are the custom or system properties that were modified by the vRealize Orchestrator workflow and returned to vRealize Automation and included in the approval process.

As a best practice, you should configure the vRealize Orchestrator workflow with an output parameter for `businessJustification`. You can use this parameter to pass comments provided by the approver in the outside system to the vRealize Automation approval process. These comments can be for approvals or rejections.

Creating a vRealize Orchestrator Workflow Based on the Approval Schema

The custom approval workflow that you create must have an input parameter, with any useful name, that is configured with the type `Properties`. The approval event data payload is put into this parameter when the workflow subscription is triggered to run.

The output parameters of the workflow that are sent back to vRealize Automation are `approved : Boolean` and `fieldValues : Properties`. The returned `approved : Boolean` parameter determines if the approval level is approved or rejected. The `fieldValues : Properties` parameter contains the values that were modified in the external system.

Scenario: Send Software Requests to an External System for Approval

As a tenant administrator, you want users outside vRealize Automation to approve a software component when a service catalog user requests a machine that includes software. You configure an approval policy that requires approval for all software provisioning and a workflow subscription that is configured to run when it receives pre-approval messages that match your defined conditions.

Procedure

1 Scenario: Create a vRealize Orchestrator Workflow for Approval Workflow Subscriptions

   You create a vRealize Orchestrator workflow that accepts the required approval input parameters from vRealize Automation and returns the necessary output parameters to complete the approval process.

2 Scenario: Create an Approval Policy for External Approval

   As a tenant administrator, you create an approval policy that generates an event message that is published by the approval service. If you configured a workflow subscription with criteria that match the event message, vRealize Orchestrator runs the selected workflow.

3 Scenario: Create a Pre-Approval Workflow Subscription

As a tenant administrator, you create a pre-approval workflow subscription that runs a vRealize Orchestrator workflow when a service catalog request generates an approval request that matches the configured conditions.

Scenario: Create a vRealize Orchestrator Workflow for Approval Workflow Subscriptions

You create a vRealize Orchestrator workflow that accepts the required approval input parameters from vRealize Automation and returns the necessary output parameters to complete the approval process.

You must design the workflow to accomplish your approval goal. For information about creating vRealize Orchestrator folders and workflows, see *Developing with VMware vRealize Orchestrator*.

Prerequisites

Log in to the vRealize Orchestrator that is the instance configured for vRealize Automation with privileges that allow you to create a workflow.

Procedure

1 Create a folder for your workflow subscription workflows in the workflow library.

2 Create a new workflow.

For this scenario, name the workflow **`Automation Approval Request`**.

a Add the following input parameter.

Name	Type
input	Properties

b Add the following output parameters.

Name	Type
approved	boolean
fieldValues	Properties

3 Create a scriptable task that processes the input and output parameters.

4 Save the workflow.

What to do next

You create an approval policy that uses the workflow subscription as an approver. Scenario: Create an Approval Policy for External Approval

Scenario: Create an Approval Policy for External Approval

As a tenant administrator, you create an approval policy that generates an event message that is published by the approval service. If you configured a workflow subscription with criteria that match the event message, vRealize Orchestrator runs the selected workflow.

Prerequisites

- Log in to vRealize Automation as a **tenant administrator** or **approval administrator**.

Procedure

1. Select **Administration > Approval Policies**.
2. Create an approval policy for your software components.
   a. Click the **New** icon ( ).
   b. Select **Select an approval policy type**.
   c. In the list, select **Service Catalog - Catalog Item Request - Software Component**.
   d. Click **OK**.
   e. Configure the following options:

Option	Configuration
Name	Enter `Software external approval`.
Description	Enter `Approval request sent to external approval system`.
Status	Select **Active**.

3. On the **Pre Approval** tab, click the **Add** icon ( ).
4. Configure the **Level Information** tab with the triggering criteria and the approval actions.
   a. In the **Name** text box, enter `External level for software`.
   b. In the **Description** text box, enter `Software approval request sent to external approval system`.
   c. Select **Always required**.
   d. Select **Use event subscription**.
5. Click **OK**.

What to do next

- Create a pre-approval workflow subscription that receives event messages based on the configured approval level. See Scenario: Create a Pre-Approval Workflow Subscription.
- Apply the approval policy to a software component in an entitlement. See *Configuring vRealize Automation*.

Scenario: Create a Pre-Approval Workflow Subscription

As a tenant administrator, you create a pre-approval workflow subscription that runs a vRealize Orchestrator workflow when a service catalog request generates an approval request that matches the configured conditions.

Prerequisites

- Log in to vRealize Automation as a **tenant administrator**.
- Configure an approval policy level named External level for software. See Scenario: Create an Approval Policy for External Approval.
- Create a custom vRealize Orchestrator workflow that sends the request to your external system. In this scenario, use the Automation Approval Request workflow.

Procedure

1 Select **Administration > Events > Subscriptions**

2 Click the **New** icon ( ).

3 Click **Pre Approval**.

4 Click **Next**.

5 On the **Conditions** tab, configure the triggering conditions.

   a Select **Run based on conditions**.

   b From the **Clause** drop-down menu, configure the following condition:

Property	Operator	Value
Data > Information about the request > Approval level name	Equals	External level for software

   c Click **Next**.

6 On the Workflow tab, browse the Orchestrator tree and select your **Automation Approval Request** workflow.

7 Click **Next**.

8 On the Details tab, enter the name and description.

   In this scenario, enter **`Software External`** as the name and **Sends approval request to external system** as the description.

9 In the **Timeout (min)** text box, enter 120.

   The amount of time you specify until the subscription workflow times out depends on the target system. If vRealize Automation does not process a reply from the target system in the specified number of minutes, the request is automatically rejected.

   If you do not provide a value, the default timeout is 24 hours.

10 Click **Finish**.

11 Select the Software External row and click **Publish**.

The Software External pre-approval event subscription now receives pre-approval event messages.

What to do next

- If you applied the approval policy to a software component in an active entitlement, request the item in the service catalog and verify that your approval policy and workflow subscription work as designed.

Troubleshooting Workflow Subscriptions

Troubleshooting workflow subscriptions includes some common problems. You might also need to examine various logs.

- Troubleshooting vRealize Orchestrator Workflows That Do Not Start

  You configure a workflow subscription to run a custom workflow when the event message is received, but the workflow does not run.

- Troubleshooting Provisioning Requests That Take Too Much Time

  An IaaS machine take ten or more hours to provision.

- Troubleshooting a vRealize Orchestrator Workflow That Does Not Run for an Approval Request

  You configured a pre-approval or post-approval workflow subscription to run a vRealize Orchestrator workflow. The workflow does not run when a machine that matches the defined criteria is requested in the service catalog.

- Troubleshooting a Rejected Approval Request That Should Be Approved

  You configure a pre-approval or post-approval workflow subscription that runs the specified vRealize Orchestrator workflow, but the request is rejected when you know that it was approved.

- Troubleshooting a Rejected Approval Request

  You configure a pre-approval or post-approval workflow subscription that runs the specified vRealize Orchestrator workflow, but the request is unexpectedly rejected.

Troubleshooting vRealize Orchestrator Workflows That Do Not Start

You configure a workflow subscription to run a custom workflow when the event message is received, but the workflow does not run.

Solution

1. Verify that you published the workflow subscription.
2. Verify that the workflow subscription conditions are configured correctly.
3. Verify that the vRealize Orchestrator server has the specified workflow.

Troubleshooting Provisioning Requests That Take Too Much Time

An IaaS machine take ten or more hours to provision.

Cause

If you configured a workflow subscription to trigger on a provisioning state, you might have two instances of the IaaS manager service running in your environment.

Solution

- Verify that only one instance of the IaaS manager service is active. If you have more than one instance active, you will also see similar errors in the logs:

```
[EventBrokerService] Failed resuming workflow b6e9276a-f20f-40f1-99ad-6d9524560cc2 on queue
3679fa71-ac2a-42d5-8626-f98ea096f0d3.
System.Workflow.Runtime.QueueException: Event Queue operation failed with MessageQueueErrorCode
QueueNotFound for queue '3679fa71-ac2a-42d5-8626-f98ea096f0d3'.
   at System.Workflow.Runtime.WorkflowQueuingService.EnqueueEvent(IComparable queueName, Object
item)
   at System.Workflow.Runtime.WorkflowExecutor.EnqueueItem(IComparable queueName, Object item,
IPendingWork pendingWork, Object workItem)
   at System.Workflow.Runtime.WorkflowInstance.EnqueueItem(IComparable queueName, Object item,
IPendingWork pendingWork, Object workItem)
   at DynamicOps.VMPS.Service.Workflow.Services.EventBrokerService.OnMessage(EventObject obj)
[UTC:2015-11-14 07:14:25 Local:2015-11-13 23:14:25] [Error]: Thread-Id="15" - context="HKBsp6Tt"
token="JeuTG7ru" [EventBrokerClient] Invoking subscription callback failed: Event Queue operation
failed with MessageQueueErrorCode QueueNotFound for queue '3679fa71-ac2a-42d5-8626-f98ea096f0d3'.
```

Troubleshooting a vRealize Orchestrator Workflow That Does Not Run for an Approval Request

You configured a pre-approval or post-approval workflow subscription to run a vRealize Orchestrator workflow. The workflow does not run when a machine that matches the defined criteria is requested in the service catalog.

Cause

To successfully run a workflow subscription for an approval, you must ensure that all the components are configured correctly.

Solution

1. Verify that the approval policy is active and that you selected **Use event subscription** for an approval level in the policy.
2. Verify that the approval policy is correctly applied in your entitlement.
3. Verify that your workflow subscription is correctly configured and published.
4. Review the event logs for messages related to approvals.

Troubleshooting a Rejected Approval Request That Should Be Approved

You configure a pre-approval or post-approval workflow subscription that runs the specified vRealize Orchestrator workflow, but the request is rejected when you know that it was approved.

Solution

1 Review the workflow in vRealize Orchestrator.
   a Log in to vRealize Orchestrator as with administrator privileges.
   b Verify that the workflow ran without errors.
   c Verify that the expected values were returned for the `approval` and `fieldValues` parameters.
2 Review the request in vRealize Automation.
   a Log in to vRealize Automation as the user who requested the rejected item.
   b Click the **Requests** tab.
   c Open the rejected request.
   d Click **Approval Status** and review the Justification column for more information.

      If an error occurred, information about the error is displayed as Justification data.

Troubleshooting a Rejected Approval Request

You configure a pre-approval or post-approval workflow subscription that runs the specified vRealize Orchestrator workflow, but the request is unexpectedly rejected.

Problem

All the approval levels prior to this external approval level were approved, and this level should have been approved, but was processed as rejected.

Cause

One possible cause is an internal error when vRealize Orchestrator tried to run the workflow. For example, the workflow is missing or the vRealize Orchestrator server is not running.

Solution

1 Select **Administration > Events > Event Logs**.
2 Review the logs for messages related to approvals.

Extending Machine Life Cycles By Using vRealize Automation Designer

You can inject custom logic into predetermined stages of the IaaS machine life cycle by using vRealize Automation Designer to directly edit the state change workflow stubs and, optionally, call out to custom vRealize Orchestrator workflows.

Note The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation.

Extending Machine Life Cycles By Using vRealize Automation Designer Checklist

The Extending Machine Life Cycles By Using vRealize Automation Designer Checklist provides a high-level overview of the steps required to install and configure vRealize Automation Designer to customize IaaS machine life cycles.

Table 1-17. Extending Machine Lifecycles By Using vRealize Automation Designer Checklist

Task	Details
❑ Download and install vRealize Automation Designer.	Installing vRealize Automation Designer
❑ Create a vRealize Automation endpoint for your vRealize Orchestrator instance.	Create a vRealize Orchestrator Endpoint
❑ Associate your vRealize Orchestrator endpoint with a machine blueprint.	Associate a vRealize Orchestrator Endpoint with a Blueprint

Table 1-17. Extending Machine Lifecycles By Using vRealize Automation Designer Checklist (Continued)

Task	Details
❑ Using vRealize Automation Designer activities, customize an IaaS Workflow stub. **Note** The workflow stubs are replaced by the event broker workflow subscriptions. They are still available, supported, and they can be used, but expect them to be removed in a future version of vRealize Automation. To ensure future product compatibility, you should use the workflow subscriptions to run custom workflows based on state changes. See Configuring Workflow Subscriptions to Extend vRealize Automation. Optionally, you can use vRealize Orchestrator workflow activities to call out to custom vRealize Orchestrator workflows.	Customize an IaaS Workflow
❑ After you create a custom state change workflow, a tenant administrator or business group manager must enable it for specific blueprints by adding a custom property.	Configure a Blueprint to Call a State Change Workflow

Installing and Configuring vRealize Automation Designer

You can install vRealize Automation Designer on a Windows machine and configure it to communicate with a remote Model Manager instance. If you are using IaaS workflows to call vRealize Orchestrator workflows, you must also configure the vRealize Orchestrator instance in IaaS.

Installing vRealize Automation Designer

You can install vRealize Automation Designer on a Windows machine and configure it to communicate with a remote Model Manager instance.

vRealize Automation Designer Prerequisites

vRealize Automation Designer is typically installed on a development machine rather than a server.

Supported Operating Systems

Supported operating systems for vRealize Automation Designer are listed in the *vRealize Automation Support Matrix* on the VMware vRealize Automation Documentation page.

System Configuration Requirements

See the *vRealize Automation Support Matrix* for your vRealize Automation version for potential updates to this information.

- .NET Framework 4.5 must be installed.

- The vRealize Automation Designer host must have network access to the IaaS Website components (specifically, the Model Manager Web component).
- If the Model Manager is installed remotely, the certificate used for the Model Manager Web component must be trusted on the vRealize Automation Designer host.

Download the vRealize Automation Designer Installer

You can download the vRealize Automation Designer installer from the vRealize Automation appliance.

Prerequisites

- Log in to the Windows machine as a local administrator.
- If you are using Internet Explorer, verify that Enhanced Security Configuration is not enabled. See `res://iesetup.dll/SoftAdmin.htm`.

Procedure

1. Open a browser.
2. Navigate to the Windows installer download page by using the host name of the (https://*vra-va-hostname.domain.name*:5480/installer/).
3. Click **vRealize Automation Designer**.
4. When prompted, save the installer.

What to do next

Install vRealize Automation Designer.

Install vRealize Automation Designer

The vRealize Automation Designer installer is packaged as Windows installation wizard.

Prerequisites

Download the vRealize Automation Designer Installer.

Procedure

1. Navigate to the directory where you downloaded the installer.
2. Right-click `DesignCenter-Setup.exe` and select **Run as administrator**.
3. On the **Welcome** page, click **Next**.
4. Read the License Agreement, select **I accept the terms in the License Agreement**, and click **Next**.
5. On the **Custom Setup** page, click **Next**.
6. Specify the fully qualified domain name and port of the Model Manager Web instance in *hostname:port* format.

   The default port is 443.
7. Specify the Model Manager service user credentials.

8 Click **Next**.

The installer validates the combination of Model Manager host and credentials by attempting to access to the Model Manager. If an error is returned, you must provide the correct combination of Model Manager host and credentials before proceeding.

9 Click **Install**.

10 Click **Finish**.

What to do next

You can launch the vRealize Automation Designer from the Windows Start menu by navigating to the installation directory.

Configuring vRealize Orchestrator Endpoints

If you are using vRealize Automation workflows to call vRealize Orchestrator workflows, you must configure the vRealize Orchestrator instance or server as an endpoint.

You can associate a vRealize Orchestrator endpoint with a machine blueprint to make sure that all of the vRealize Orchestrator workflows for machines provisioned from that blueprint are run using that endpoint.

vRealize Automation by default includes an embedded vRealize Orchestrator instance. It is recommended that you use the embedded instance as your vRealize Orchestrator endpoint for running vRealize Automation workflows in a production or test environment or when creating a proof of concept.

You can also install a plug-in on an external vRealize Orchestrator server, although this method is not recommended for production.

vCenter Orchestrator Integration Prerequisites

If you are using vRealize Automation workflows to execute vRealize Orchestrator workflows that have input or output parameters of type `VC:VirtualMachine`, verify that you have the vRealize Orchestrator workflows for converting virtual machine types between vRealize Orchestrator and IaaS.

The required workflows are included by default in vRealize Orchestrator 5.5 and later as part of the vCenter plug-in.

If you are using vRealize Orchestrator 5.1, install the vRealize Automation integration package for vRealize Orchestrator. Download the package `com.vmware.library.vcenter.vcac-integration.package` from thevRealize Orchestrator community site at http://communities.vmware.com/community/vmtn/server/vcenter/orchestrator. Import the package on each vRealize Orchestrator server that you set up as an endpoint in IaaS.

For information about importing packages to vRealize Orchestrator, refer to the vRealize Orchestrator documentation.

Create a vRealize Orchestrator Endpoint

You can create a vRealize Orchestrator endpoint to connect to a vRealize Orchestrator server.

You can configure multiple endpoints to connect to different vRealize Orchestrator servers, but you must configure a priority for each endpoint.

When executing vRealize Orchestrator workflows, vRealize Automation tries the highest priority vRealize Orchestrator endpoint first. If that endpoint is not reachable, then it proceeds to try the next highest priority endpoint until a vRealize Orchestrator server is available to run the workflow.

Prerequisites

- Log in to vRealize Automation as an **IaaS administrator**.

Procedure

1. Select **Infrastructure > Endpoints > Endpoints**.
2. Select **New > Orchestration > vRealize Orchestrator**.
3. Enter a name and, optionally, a description.
4. Enter a URL with the fully qualified name or IP address of the vRealize Orchestrator server and the vRealize Orchestrator port number.

   The transport protocol must be HTTPS. If no port is specified, the default port 443 is used.

   To use the default vRealize Orchestrator instance embedded in the vRealize Automation appliance, type **`https://vrealize-automation-appliance-hostname:443/vco`**.
5. Provide your vRealize Orchestrator credentials in the **User name** and **Password** text boxes to connect to the vRealize Orchestrator endpoint.

   The credentials you use should have Execute permissions for any vRealize Orchestrator workflows to call from IaaS.

   To use the default vRealize Orchestrator instance embedded in the vRealize Automation appliance, the user name is **`administrator@vsphere.local`** and the password is the administrator password that was specified when configuring SSO.
6. Enter an integer greater than or equal to 1 in **Priority** text box.

   A lower value specifies a higher priority.
7. (Optional) Click **Properties** and add supplied custom properties, property groups, or your own property definitions for the endpoint.
8. Click **OK**.

Associate a vRealize Orchestrator Endpoint with a Blueprint

You can specify a particular vRealize Orchestrator endpoint to use with a blueprint.

When IaaS runs a vRealize Orchestrator workflow for any machine provisioned from this blueprint, it always uses the associated endpoint. If the endpoint is not reachable, the workflow fails.

Prerequisites

Log in to vRealize Automation as an **infrastructure architect**.

Procedure

1. Select **Design > Blueprints**.

2 Create a new blueprint or edit an existing blueprint.

   If you are editing an existing blueprint, the vRealize Orchestrator endpoint you specify only applies to new machines provisioned from the updated blueprint. Existing machines provisioned from the blueprint continue to use the highest priority endpoint unless you manually add this property to the machine.

3 Click the **Properties** tab.

   a Click **New Property**.

   b Type **`VMware.VCenterOrchestrator.EndpointName`** in the **Name** text box.

      The property name is case sensitive.

   c Type the name of a vRealize Orchestrator endpoint in the **Value** text box.

   d Click the **Save** icon ().

4 Click **OK**.

Customizing IaaS Workflows By Using vRealize Automation Designer

VMware provides a number of workflows that you can customize using the vRealize Automation Designer. These include state change workflows and menu operation workflows.

IaaS workflows are created using Microsoft Windows Workflow Foundation 4, part of .NET Framework 4. For information on Windows Workflow Foundation and workflow creation, refer to the Microsoft documentation. vRealize Automation also provides several vRealize Automation Designer activities for running and monitoring vRealize Orchestrator workflows.

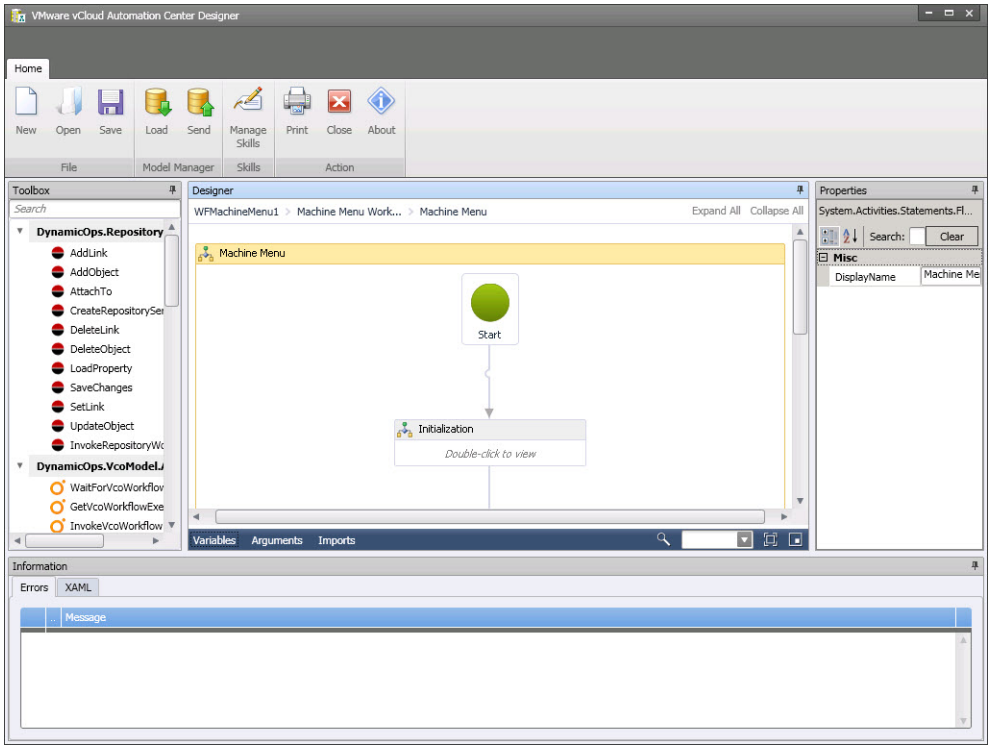
The customizable workflow templates provided by VMware demonstrate best practices for structuring workflows with separate sequences for initialization, custom logic, and finalization. The entire workflow is wrapped in a TryCatch block for error handling. Any uncaught or rethrown exceptions are logged by the Distributed Execution Manager that executes the workflow.

After you create a custom IaaS workflow, a blueprint author must enable the workflow on specific blueprints.

The vRealize Automation Designer Console

The vRealize Automation Designer console provides a visual workflow editor for customizing IaaS workflows.

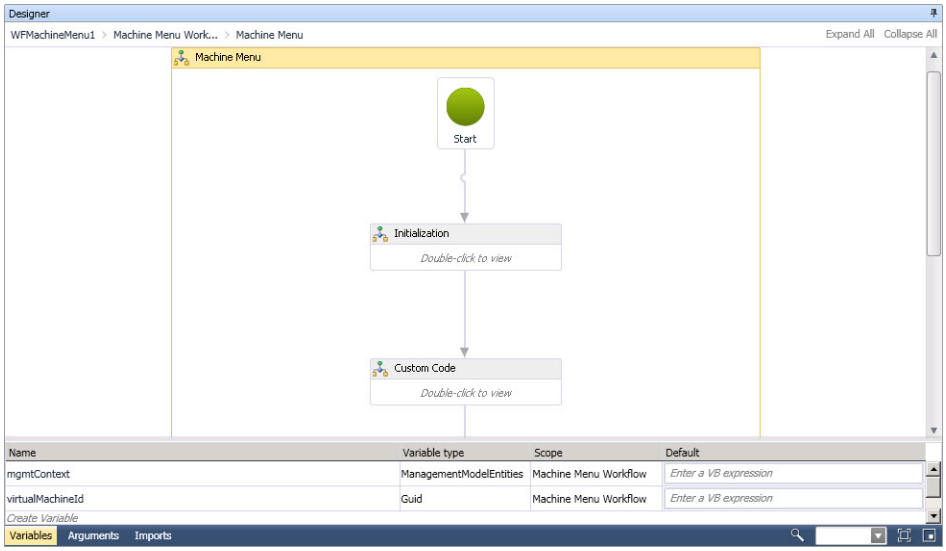
You must have local administrator rights on the vRealize Automation Designer host (typically a development machine) in order to launch the vRealize Automation Designer console.



The Toolbox pane on the left provides access to the vRealize Automation workflow activity library. You can drag activities from the toolbox onto the Designer pane to add them to a workflow. The Properties pane displays the configurable properties of the currently selected activity on the Designer pane. This interface is very similar to the workflow designer in Visual Studio.

The detail tabs at the bottom of the Designer pane enable you to display and edit variables within the scope of the selected activity or arguments to the selected activity.

Note Variables and arguments are both specified as Visual Basic expressions. However, variable names are not case sensitive while argument names are case sensitive. For information about valid arguments for the IaaS workflow activities, see vRealize Automation Workflow Activity Reference.



The Imports tab displays imported namespaces from which you can select entity types to add to the workflow.

The collapsible Information pane at the bottom of the console displays any errors in configuring activities and provides access to the XAML representation of the workflow.

IaaS Workflow Types

You can customize two types of workflows by using vRealize Automation Designer: state change workflows and menu operation workflows.

- A state change workflow is executed when the master workflow transitions between states, for example at a particular stage during the process of provisioning a new machine.
- A menu operation workflow is executed when a user selects an option from the Action menu in the service catalog or from the machine menu in the Infrastructure tab.

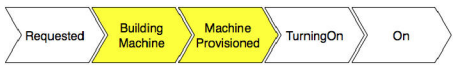
State Change Workflows

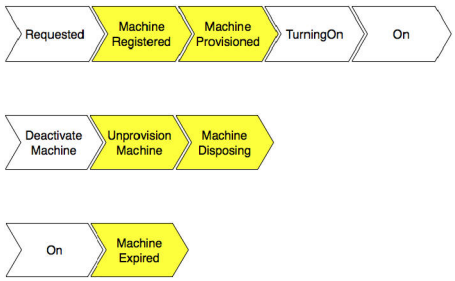
Creating a state change workflow enables you to trigger the execution of a workflow before the IaaS master workflow enters a specific state.

For example, you can create custom workflows to integrate with an external database and record information at different stages of the machine life cycle:

- Create a custom workflow that runs before the master workflow enters the MachineProvisioned state to record such information as machine owner, approvers and so on.
- Create a custom workflow that runs before a machine enters the MachineDisposing state to record the time at which the machine was destroyed and data such as its resource utilization at last data collection, last logon, and so on.

The following illustrations show the main states of the master workflow.





vRealize Automation Designer provides a customizable workflow for each of these states.

Table 1-18. Customizable State Change Workflows

Master Workflow State	Customizable Workflow Name
BuildingMachine	WFStubBuildingMachine
Disposing	WFStubMachineDisposing
Expired	WFStubMachineExpired
MachineProvisioned	WFStubMachineProvisioned
RegisterMachine	WFStubMachineRegistered
UnprovisionMachine	WFStubUnprovisionMachine

Configuring a State Change Workflow Overview

You can customize a state change workflow by using vRealize Automation Designer. A blueprint author can then enable it for specific blueprints.

The following is a high-level overview of the steps required to enable state change workflows:

1 A workflow developer customizes one of the state change workflow templates by using vRealize Automation Designer. See Customize an IaaS Workflow.

  Any IaaS workflow can call a vRealize Orchestrator workflow. For more information, see Using vRealize Orchestrator Workflow Activities.

2 A tenant administrator or business group manager configures a blueprint to call the customized workflow for machines provisioned from that blueprint. See Configure a Blueprint to Call a State Change Workflow.

Menu Operation Workflows

A menu operation workflow is executed when a user selects an option from the Actions menu in the service catalog or the machine menu in the Infrastructure tab.

For example, you can create a custom workflow that enables a user to create a support ticket related to a machine by selecting Raise Support Issue from the machine menu.

vRealize Automation Designer provides templates for customizing menu operation workflows.

In addition to the workflow definition, a menu operation workflow depends on an operation configuration file, which defines the aspects of the custom menu option such as the display text, which roles have access to it, and the machine states for which the operation is available.

Note An XaaS architect can define custom actions for any catalog item by using the XaaS. Creating custom actions for IaaS machines other than those provisioned by using vSphere or vCloud Director requires vRealize Automation 6.1 or later.

Configuring a Menu Operation Workflow Overview

You can customize a menu operation workflow by using vRealize Automation Designer and the CloudUtil command-line utility. A blueprint author can then enable it for specific blueprints.

The following is a high-level overview of the steps required to enable menu operation workflows:

1 A workflow developer customizes one of the menu operation workflow templates by using vRealize Automation Designer. See Customize an IaaS Workflow.

  Any IaaS workflow can call a vRealize Orchestrator workflow. For more information, see Using vRealize Orchestrator Workflow Activities.

2 A workflow developer configures the menu operation in the Model Manager. See Configure a Menu Operation.

3 A workflow developer registers the new menu operation with the service catalog. See Register New Menu Operations with the Service Catalog.

4 A tenant administrator or business group manager configures a blueprint to enable the menu operation for machines provisioned from that blueprint. See Configure a Blueprint to Enable a Menu Operation Workflow.

If the menu operation is intended to be used in the service catalog, it must also be entitled to users. For more information, see *Tenant Administration*.

Customize an IaaS Workflow

vRealize Automation Designer enables you to edit the customizable workflows and update workflows in the Model Manager.

Prerequisites

Launch the vRealize Automation Designer.

Procedure

1 Click **Load**.

2 Select the workflow that you want to customize.

Option	Description
WFMachineMenu*N*	Customizable menu operation workflow
WFStubBuildingMachine	Customizable state change workflow that executes before a machine enters the BuildingMachine state

Option	Description
WFStubMachineDisposing	Customizable state change workflow that executes before a machine enters the Disposing state
WFStubMachineExpired	Customizable state change workflow that executes before a machine enters the Expired state
WFStubMachineProvisioned	Customizable state change workflow that executes before a machine enters the MachineProvisioned state
WFStubMachineRegistered	Customizable state change workflow that executes before a machine enters the RegisterMachine state
WFStubUnprovisionMachine	Customizable state change workflow that executes before a machine enters the UnprovisionMachine state

3 Click **OK**.

The workflow displays in the Designer pane.

4 Customize the workflow by dragging activities from the Toolbox to the Designer pane and configuring their arguments.

5 When you are finished editing the workflow, update the workflow in the Model Manager by clicking **Send**.

The workflow is saved and appears as a new revision in the list the next time you load a workflow. You can access an earlier version of a workflow at any time. See Revert to a Previous Revision of a Workflow.

Using vRealize Orchestrator Workflow Activities

You can use vRealize Automation Designer activities to call vRealize Orchestrator workflows either synchronously or asynchronously.

A vRealize Orchestrator endpoint is specified in one of the following ways:

- `VirtualMachineId` is the name of the variable representing the virtual machine ID. A virtual machine with this ID is selected and the value that is retrieved from the `VMware.VCenterOrchestrator.EndpointName` custom property for a virtual machine is used as the vRealize Orchestrator endpoint name.
- `GetVcoEndpointByManagementEndpoint` returns the value of a custom property on a specified `ManagementEndpoint` object. If the `CustomPropertyName` is not specified, the value of the `VMware.VCenterOrchestrator.EndpointName` property is used.
- `GetVcoEndpointByHost` returns the value of a custom property on a specified host. If the `CustomPropertyName` is not specified, the value of the `VMware.VCenterOrchestrator.EndpointName` property is used.

Synchronous Execution

The `InvokeVcoWorkflow` activity calls a vRealize Orchestrator workflow and blocks further execution of its parent IaaS workflow until the vRealize Orchestrator workflow completes. The activity returns the output parameters for the vRealize Orchestrator workflow.

In addition, the synchronous execution supports the following property:

- `WorkflowTimeout` is a timeout value in seconds. If the vRealize Orchestrator workflow does not finish in the specified time, an exception is generated rather than blocking the workflow until a response is returned. If no value is defined or a value of zero is supplied, the timeout is not activated. The workflow status is checked every 10 seconds during that period unless the polling time is modified for the endpoint by specifying a value in the `VMware.VCenterOrchestrator.PollingInterval` custom property.

Asynchronous Execution

The `InvokeVcoWorkflowAsync` activity is a “fire and forget” activity that calls a vRealize Orchestrator workflow and continues to execute activities in the IaaS workflow without waiting for the vRealize Orchestrator workflow to complete.

The activity returns either a unique workflow execution token that can be used to monitor the workflow or an error if the REST API call to the vRealize Orchestrator server failed (for example, if the server could not be reached).

Two additional activities are available for use with this activity:

- `GetVcoWorkflowExecutionStatus` enables you to poll the vRealize Orchestrator workflow for its status.
- `WaitForVcoWorkflowCompletion` enables you to block further execution of the IaaS workflow until the vRealize Orchestrator workflow has completed or timed out. You can use this activity to retrieve the results of a vRealize Orchestrator workflow that you execute asynchronously.

Call a vRealize Orchestrator Workflow

You can use either the `InvokeVcoWorkflow` or the `InvokeVcoWorkflowAsync` activity to call a vRealize Orchestrator workflow from an IaaS workflow.

Some vRealize Orchestrator workflows require user interaction during execution. For these workflows, the user prompt appears in the vRealize Orchestrator client rather than in the vRealize Automation console, so it is not apparent to the end user in vRealize Automation that a workflow is waiting for input.

To avoid workflows that block on user input, do not call vRealize Orchestrator workflows that require user interaction from IaaS workflows.

Procedure

1. In vRealize Automation Designer, open a workflow and navigate to the context where you want to call a vRealize Orchestrator workflow.
2. Drag the `InvokeVcoWorkflow` or the `InvokeVcoWorkflowAsync` activity into the Designer pane.
3. Select the vCenter Orchestrator workflow to execute.
   a. Under General, click the ellipsis next to Workflow.
   b. In the Browse for vCO workflow dialog box, select a workflow.
   c. Click **OK**.

The Inputs and Outputs sections display the input and output parameters of the selected workflow.

4 In the Properties pane, specify one of the following target parameters.

- `VirtualMachineId` is the name of the variable representing the virtual machine ID. A virtual machine with this ID is selected and the value that is retrieved from the `VMware.VCenterOrchestrator.EndpointName` custom property for a virtual machine is used as the vRealize Orchestrator endpoint name.
- `VcoEndpointName` is the endpoint name that is used to run the workflow. If specified, this value overrides the `VirtualMachineId` value when selecting the vRealize Orchestrator endpoint.
- `WorkflowTimeout` is a timeout value in seconds. If the vRealize Orchestrator workflow does not finish in the specified time, an exception is generated rather than blocking the workflow until a response is returned. If no value is defined or a value of zero is supplied, the timeout is not activated. The workflow status is checked every 10 seconds during that period unless the polling time is modified for the endpoint by specifying a value in the `VMware.VCenterOrchestrator.PollingInterval` custom property.

5 Specify the parameters for the vRealize Orchestrator workflow.

- Enter the values in the activity in the Designer pane.
- In the Properties pane, click the ellipsis next to **InputParameters** or **OutputParameters** to open the Parameters dialog box. This dialog box displays the IaaS type of each parameter. If the parameter type appears in bold, the parameter is required.

Point to the text box for any parameter to view a tooltip indicating the vRealize Orchestrator type.

If you are using the `InvokeVcoWorkflowAsync` activity, the output parameters of the vRealize Orchestrator workflow are displayed with their corresponding types for informational purposes, but you cannot specify an expression for the parameter in this activity.

What to do next

To retrieve the results of a workflow that you execute asynchronously, use the `WaitForVcoWorkflowCompletion` activity.

Get the Status of a vRealize Orchestrator Workflow

You can check the status of a vRealize Orchestrator workflow that was called with the `InvokeVcoWorkflowAsync` activity using the `GetVcoWorkflowExecutionStatus` activity.

Prerequisites

Call a vRealize Orchestrator Workflow using the `InvokeVcoWorkflowAsync` activity.

Procedure

1 In vRealize Automation Designer, open a workflow where you have used the `InvokeVcoWorkflowAsync` activity.

2 Navigate to the context where you want to check the status of the vRealize Orchestrator workflow.

3 Drag the `GetVcoWorkflowExecutionStatus` activity into the Designer pane.

4 In the Properties pane, specify the name of the variable representing the virtual machine ID in `VirtualMachineId`.

   The customizable workflows contain a variable by default named `virtualMachineId` that is set during initialization.

5 Create a variable of type `DynamicOps.VcoModel.Common.VcoWorkflowExecutionToken`.

6 Specify the name of the token variable as the `executionToken` output parameter on the `InvokeVcoWorkflowAsync` activity.

7 Specify the same variable name as the `WorkflowExecutionToken` property of the `GetVcoWorkflowExecutionStatus` activity.

8 Create a variable of type string.

9 Specify the name of the string variable as the `VcoWorkflowExecutionStatus` property of the `GetVcoWorkflowExecutionStatus` activity.

When the workflow runs, the value of the `VcoWorkflowExecutionStatus` variable is set to the status of the vRealize Orchestrator workflow.

Get the Results of a vRealize Orchestrator Workflow

If you want to call a vRealize Orchestrator workflow asynchronously and then retrieve the results of the completed workflow at a later point, you can use the `WaitForVcoWorkflowCompletion` activity.

The `WaitForVcoWorkflowCompletion` activity blocks execution of the IaaS workflow until the vRealize Orchestrator workflow has completed or a timeout is reached. The activity returns the results of the vRealize Orchestrator workflow if it completes successfully, an error if the workflow fails, or null if the workflow times out.

Prerequisites

Call a vRealize Orchestrator Workflow using the `InvokeVcoWorkflowAsync` activity.

Procedure

1 In vRealize Automation Designer, open a workflow where you have used the `InvokeVcoWorkflowAsync` activity.

2 Navigate to the context where you want to retrieve the results of the vRealize Orchestrator workflow.

3 Drag the `WaitForVcoWorkflowCompletion` activity into the Designer pane.

4 In the Properties pane, specify the name of the variable representing the virtual machine ID in `VirtualMachineId`.

   The customizable workflows contain a variable by default named `virtualMachineId` that is set during initialization.

5 Create a variable of type DynamicOps.VcoModel.Common.VcoWorkflowExecutionToken.

6 Create a variable of type `DynamicOps.VcoModel.Common.VcoWorkflowExecutionToken`.

7 Specify the name of the token variable as the `executionToken` output parameter on the `InvokeVcoWorkflowAsync` activity.

8 Specify the same variable name as the `WorkflowExecutionToken` property of the `WaitForVcoWorkflowCompletion` activity.

9 Retrieve the output of the vRealize Orchestrator workflow.

   a Create a variable of type `DynamicOps.VcoModel.Common.VcoWorkflowExecutionResult`.

   b Specify the name of the results variable as the `WorkflowOutput` property of the `WaitForVcoWorkflowCompletion` activity.

   When the workflow runs, the value of the variable is set to the results of the vRealize Orchestrator workflow, if any.

vRealize Orchestrator and IaaS Object Types

When you use either the `InvokeVcoWorkflow` or the `InvokeVcoWorkflowAsync` activity in vRealize Automation Designer, input and output properties for the activity are automatically populated based on the parameters of the vRealize Orchestrator workflow that you select.

vRealize Orchestrator primitive types are converted into the following IaaS types:

Table 1-19. vRealize Orchestrator and IaaS Object Types

vRealize Orchestrator Type	IaaS Type
string	string
boolean	bool
number	decimal
SecureString	string
Text	string
Array/T	Array<T>
Properties	Dictionary<string,object>
Date	DateTime
VC:VirtualMachine	VirtualMachine

Note If you are using vRealize Orchestrator 5.1, you must have installed the vRealize Automation integration package to enable the conversion of `VC:VirtualMachine` object types to `VirtualMachine`.

All other vRealize Orchestrator types are converted to the IaaS type `VcoSdkObject`.

Configure a Blueprint to Call a State Change Workflow

After you create a custom state change workflow, a tenant administrator or business group manager must enable it for specific blueprints by adding a custom property.

Each state change workflow is associated with a specific custom property. When a machine is entering a state with a corresponding state change workflow, IaaS checks to see if the machine has the corresponding custom property; if so, the associated workflow is executed. For example, if a machine has the custom property `ExternalWFStubs.MachineProvisioned`, the `WFStubMachineProvisioned` workflow is executed before the master workflow enters the MachineProvisioned state.

While custom properties can be applied to a machine from a number of sources, typically the property for a state change workflow is specified in a blueprint, enabling the workflow for all machines provisioned from that blueprint.

Prerequisites

Log in to vRealize Automation as a **tenant administrator** or **business group manager**.

Procedure

1 Select **Design > Blueprints**.

2 Point to the name of a blueprint and click **Edit**.

3 Click the **Properties** tab.

4 Click **New Property**.

5 Type the name of the custom property associated with the workflow you want to enable in the **Name** text box.

Customizable Workflow Name	Associated Property Name
WFStubMachineProvisioned	ExternalWFStubs.MachineProvisioned
WFStubBuildingMachine	ExternalWFStubs.BuildingMachine
WFStubMachineDisposing	ExternalWFStubs.MachineDisposing
WFStubUnprovisionMachine	ExternalWFStubs.UnprovisionMachine
WFStubMachineRegistered	ExternalWFStubs.MachineRegistered
WFStubMachineExpired	ExternalWFStubs.MachineExpired

6 Leave the **Value** text box blank.

The workflow depends on the presence of the property, not on any particular value.

7 Click the **Save** icon ( ).

8 Click **OK**.

The workflow is now enabled for new machines that are provisioned from this blueprint.

Configuring a Menu Operation Workflow

After you customize a menu operation workflow, additional configuration is required before it is available to users in the vRealize Automation console.

Configure a Menu Operation

To configure a menu operation, you create an operation configuration file and install it in the Model Manager.

Procedure

1 Create an Operation Configuration File

The operation configuration file is required for menu operation workflows. It specifies the aspects of the custom menu option in the vRealize Automation console such as the display text, which roles have access to the option, and the machine states for which the option is available.

2 Install an Operation in the Model Manager

You install an operation in the Model Manager by using the CloudUtil command-line utility.

What to do next

If the menu operation is intended to be used in the service catalog, it must be registered with the service catalog so that it can be entitled to users. Register New Menu Operations with the Service Catalog.

Create an Operation Configuration File

The operation configuration file is required for menu operation workflows. It specifies the aspects of the custom menu option in the vRealize Automation console such as the display text, which roles have access to the option, and the machine states for which the option is available.

Procedure

1 Create a new XML file.

```
<?xml version="1.0" encoding="utf-8"?>
```

2 Create the root element `customOperations`.

```
<customOperations xmlns="http://www.dynamicops.com/schemas/2009/OperationConfig/">
</customOperations>
```

The element must specify the XML namespace `http://www.dynamicops.com/schemas/2009/OperationConfig/`.

3 For each operation you want to define, add an `operation` element within `customOperations`.

```
<operation name="WFMachineMenu1" displayName="Execute Machine Menu task">
</operation>
```

The `operation` element takes the following attributes:

Attribute	Description
name	The name of the workflow that this operation executes.
displayName	A descriptive label for the option in the machine menu.

4 Specify the roles to grant access to the menu operation.

a Add the `authorizedTasks` element.

```
<operation name="WFMachineMenu1" displayName="Execute Machine Menu task">
  <authorizedTasks>
  </authorizedTasks>
</operation>
```

b For each role that you want to grant access to the operation, add a `task` element, for example:

```
<authorizedTasks>
  <task>VRM User Custom Event</task>
  <task>VRM Support Custom Event</task>
  <task>Group Administrator Custom Event</task>
  <task>Enterprise Administrator Custom Event</task>
  <task>VRM Administrator Custom Event</task>
</authorizedTasks>
```

The valid contents of the `task` element are as follows:

Element content	Description
VRM User Custom Event	Grants access to the operation for all users.
VRM Support Custom Event	Grants access to the operation for support users.
Group Administrator Custom Event	Grants access to the operation for business group managers.
Enterprise Administrator Custom Event	Grants access to the operation for fabric administrators.
VRM Administrator Custom Event	Grants access to the operation for IaaS administrators only.

5 (Optional) Specify the machine states for which the operation is available.

a Add the `machineStates` element.

```
<operation name="WFMachineMenu1" displayName="Execute Machine Menu task">
  <machineStates>
  </machineStates>
</operation>
```

b For each state in which the operation should be available, add a `state` element.

```
<machineStates>
  <state>On</state>
  <state>Off</state>
</machineStates>
```

The value may be any of the possible machine states. For a full list of machine states, see *IaaS Configuration for Virtual Platforms*, *IaaS Configuration for Physical Machines*, or *IaaS Configuration for Cloud Platforms*.

If the element is omitted, the operation is available for all machine states.

The following is an example of a complete operation configuration file:

```
<?xml version="1.0" encoding="utf-8" ?>
<customOperations xmlns="http://www.dynamicops.com/schemas/2009/OperationConfig/">
  <operation name="WFMachineMenu1" displayName="Execute Machine Menu task">
    <authorizedTasks>
      <task>VRM User Custom Event</task>
      <task>VRM Support Custom Event</task>
      <task>Group Administrator Custom Event</task>
      <task>Enterprise Administrator Custom Event</task>
      <task>VRM Administrator Custom Event</task>
    </authorizedTasks>
    <machineStates>
      <state>On</state>
      <state>Off</state>
    </machineStates>
  </operation>
</customOperations>
```

Install an Operation in the Model Manager

You install an operation in the Model Manager by using the CloudUtil command-line utility.

Prerequisites

Create an Operation Configuration File.

Procedure

1. Open an elevated command prompt.
2. Run the CloudUtil.exe command with the following arguments.
   - ```
     CloudUtil.exe Operation-Create -c <path to operation definition file>
     ```
   - Optionally, you can specify a Model Manager host and request a stack trace in case of error.

     ```
     CloudUtil.exe Operation-Create -c <path to operation definition file>
     --repository <Model Manager Root URI> -v
     ```

What to do next

If the menu operation is intended to be used in the service catalog, it must be registered with the service catalog so that it can be entitled to users. Register New Menu Operations with the Service Catalog.

Register New Menu Operations with the Service Catalog

After installing new menu operations, the workflow developer must register them with the service catalog so they can be entitled to users.

Prerequisites

- Configure a Menu Operation.
     ```

- On the IaaS Model Manager host, log in to Windows as a local user with **administrator** privileges.

Procedure

1. Open an elevated command prompt.
2. Navigate to the IaaS root installation directory.

   In a typical installation, this is `C:\Program Files (x86)\VMware\vCAC`.
3. Navigate to `Server\Model Manager Data\Cafe`.
4. Execute the following command:

   ```
   Vcac-Config.exe RegisterCatalogTypes -v
   ```

What to do next

A tenant administrator or business group manager must entitle the new action before it is available to users in the service catalog. For more information, see *Tenant Administration*.

Configure a Blueprint to Enable a Menu Operation Workflow

You enable a menu operation workflow for machines provisioned from a specific blueprint by updating the security configuration for the blueprint.

Prerequisites

Log in to vRealize Automation as a **tenant administrator** or **business group manager**.

Procedure

1. Select **Design > Blueprints**.
2. Point to the name of a blueprint and click **Edit**.
3. Click the **Actions** tab.
4. Select the checkbox that corresponds to the operation that you want to enable.
5. Click **OK**.

The menu operation is now enabled for machines provisioned from this blueprint and available to all user roles specified in the operation configuration file.

What to do next

If the menu operation is intended to be used in the service catalog, it must also be entitled to users. For more information, see *Tenant Administration*.

Revert to a Previous Revision of a Workflow

The **Load Workflow** dialog displays all revisions of a workflow in the Model Manager so that you have access to the full version history of the workflows.

Each time you send a workflow to the Model Manager, the Revision and Time Stamp are updated.

Prerequisites

Launch the vRealize Automation Designer console.

Procedure

1. Click **Load**.
2. Select the revision of the workflow that you want to revert to.

   The original workflows provided by VMware are revision 0 (zero).
3. Click **OK**.
4. Update the workflow in the Model Manager by clicking **Send**.

The earlier revision becomes the latest revision in the Model Manager. For example, if you have created revisions 1 and 2 of a workflow, then load and save revision 0, revisions 0 and 3 are now identical and you have returned the workflow to the version provided by VMware.

Workflows and Distributed Execution Management

You can use skills to restrict execution of workflows to specific Distributed Execution Managers.

A skill is similar to a tag that you can apply to both workflows and DEM Worker instances. If a workflow is not associated with any skills, any DEM Worker can execute it. If a workflow is associated with one or more skills, then only DEM Workers that are associated with all of the same skills can execute it.

Skills are useful when a particular workflow requires a DEM installed on a host with specific prerequisites. For example, you may want to restrict cloud provisioning workflows to a specific DEM running on a host with the required network access to Amazon URLs.

Skills can also be used to associate workflows with a particular data center location. For example, you might install one DEM in your Boston data center and another in your London data center, and use skills to direct certain operations to one data center or the other.

Associate Workflows and DEM Workers by Using Skills

You associate workflows with a specific DEM Worker or set of Worker instances by adding a skill to the Model Manager and then associating the skill with one or more workflows and DEM Workers.

Prerequisites

Launch the vRealize Automation Designer console.

Procedure

1. On the ribbon, click **Manage Skills**.
2. In the text field at the upper left of the **Manage Skills** dialog, type the name of a new skill and click the Add button.

   The skill name must be unique. If the name of the new skill matches the name of an existing skill, the Add button is unavailable.

3 Select the name of the skill in the list on the left.

4 Associate the skill with one or more DEM Workers.

   a Click the **Add** icon () next to Distributed Execution Managers.

   b In the **Select DEMs** dialog, select one or more DEM Worker instances.

   c Click **OK**.

5 Associate the skill with one or more Workflows.

   a Click the **Add** icon () next to Workflows.

   b In the **Select Workflows** dialog, select one or more workflows.

   c Click **OK**.

   The workflows associated with this skill can only be executed by the DEM Workers that are associated with this skill.

6 When you are done adding skills and associating them with DEM workers and workflows, click **OK** to close the **Manage Skills** dialog and save your changes to the Model Manager.

Remove Associations between Skills and DEM Workers

When you remove the association between a skill and a DEM Worker, that Worker instance can no longer execute the workflows associated with the skill.

Prerequisites

Launch the vRealize Automation Designer console.

Procedure

1 On the ribbon, click **Manage Skills**.

2 In the **Manage Skills** dialog, select the name of the skill in the list on the left.

3 Select the name of one or more DEM Worker instances from the Distributed Execution Managers list and click the **Remove** icon ().

4 Click **OK** to close the **Manage Skills** dialog and save your changes to the Model Manager.

Remove Associations between Skills and Workflows

When you remove the association between a skill and a workflow, that workflow is no longer restricted to the DEM Workers that are associated with the same skill.

Prerequisites

Launch the vRealize Automation Designer console.

Procedure

1 On the ribbon, click **Manage Skills**.

2 In the **Manage Skills** dialog, select the name of the skill in the list on the left.

3 Select the name of one or more workflows from the Workflows list and click the **Remove** icon ().

4 Click **OK** to close the **Manage Skills** dialog and save your changes to the Model Manager.

Remove a Skill

Removing a skill also removes its associations to any DEM Workers and workflows.

Prerequisites

Launch the vRealize Automation Designer console.

Procedure

1 On the ribbon, click **Manage Skills**.

2 In the **Manage Skills** dialog, select the name of the skill in the list on the left.

3 Click the **Remove** icon () at the top of the list of skills.

After you confirm that you want to delete the skill, its name appears dimmed to indicate that it is marked for deletion.

4 Click **OK** to close the **Manage Skills** dialog and save your changes to the Model Manager or **Cancel** if you do not want to delete the skill and its associations with DEMs and workflows.

CloudUtil Command Reference

This section provides a reference to the commands in the CloudUtil command line interface.

CloudUtil is the command line interface for the vRealize Automation Designer. You run the commands on the Windows machine on which you are running the designer. The default installation location on the Windows machine is `C:\Program Files (x86)\VMware\vCAC\Design Center`.

Note In the CloudUtil commands, the Model Manager is referred to as the `repository` and a Distributed Execution Manager (DEM) is referred to as an *`agent`*.

DEM Commands

The DEM commands enable you to view a list of Distributed Execution Managers registered with the Model Manager and add or remove associations between skills and DEMs.

DEM-Add-Skills

Associates skills with a registered Distributed Execution Manager.

Synopsis

```
CloudUtil.exe DEM-Add-Skills -n|--name <Name> -s|--skills <Skills> [--repository <Model Manager Root URI>] [-v|--verbose]
```

DEM-Add-Skills Arguments

Argument	Description
-n | - -name	Name of a registered Distributed Execution Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-s | - -skills	Comma-delimited list of skills to associate with this Distributed Execution Manager.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Note The skills must already exist in the Model Manager. See Skill-Install.

DEM-List

Lists all Distributed Execution Managers registered with the Model Manager and their associated skills.

Synopsis

```
CloudUtil.exe DEM-List [--repository <Model Manager Root URI>] [-v|--verbose]
```

DEM-List Arguments

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

DEM-Remove-Skills

Removes association between skills and a Distributed Execution Manager.

Synopsis

```
CloudUtil.exe DEM-Remove-Skills -n|--name <Name> -s|--skills <Skills> [--repository <Model Manager Root URI>] [-v|--verbose]
```

DEM-Remove-Skills Arguments

Argument	Description
-n | - -name	Name of a registered Distributed Execution Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-s | - -skills	Comma-delimited list of skills to remove from this Distributed Execution Manager.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File Commands

The File commands enable you to store and manage files (typically scripts) in the Model Manager.

File-Export

Exports a file from the Model Manager.

Synopsis

```
CloudUtil.exe File-Export -n|--name <Name> -o|--output <Output File> [-i|--iteration <Iteration>] [--
repository <Model Manager Root URI>] [-v|--verbose]
```

File-Export Arguments

Argument	Description
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **`0.0`**.
-n | - -name	Friendly name of the file in the Model Manager.
-o | - -output	Path for file output.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-Import

Imports a file into the Model Manager.

Synopsis

```
CloudUtil.exe File-Import -n|--name <Name> -f|--filename <File Name> [-d|--description <Description>]
[-i|--iteration <Iteration>] [--repository <Model Manager Root URI>] [-v|--verbose]
```

File-Import Arguments

Argument	Description
-d | - -description	(Optional) Description of the file.
-f | - -filename	Path to a file to import into the Model Manager.
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **0.0**.
-n | - -name	Friendly name to assign to the file in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-List

Lists all files imported into the Model Manager.

Synopsis

```
CloudUtil.exe File-List [--repository <Model Manager Root URI>] [-v|--verbose]
```

File-List Arguments

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-Remove-All

Removes all revisions for a given version of a file from the Model Manager.

Synopsis

```
CloudUtil.exe File-Remove-All -n|--name <Name> [-i|--iteration <Iteration>]
[--repository <Model Manager Root URI>] [-v|--verbose]
```

File-Remove-All Arguments

Table 1-20.

Argument	Description
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **0.0**.
-n | - -name	Friendly name of the file in the Model Manager.

Table 1-20. (Continued)

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-Remove-Rev

Removes a specific revision of a file from the Model Manager.

Synopsis

```
CloudUtil.exe File-Remove-Rev -n|--name <Name> -r|--revision <Revision> [-i|--iteration <Iteration>]
[--repository <Model Manager Root URI>] [-v|--verbose]
```

File-Export Arguments

Argument	Description
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **0.0**.
-n | - -name	Friendly name of the file in the Model Manager.
-r | - -revision	Revision of the file to remove.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-Rollback

Reverts a file in the Model Manager to a specified revision.

Synopsis

```
CloudUtil.exe File-Rollback -n|--name <Name> -r|--revision <Revision> [-i|--iteration <Iteration>] [--
repository <Model Manager Root URI>] [-v|--verbose]
```

File-Rollback Arguments

Table 1-21.

Argument	Description
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **0.0**.
-n | - -name	Friendly name of the file in the Model Manager.
-r | - -revision	Revision of the file to revert to.

Table 1-21. (Continued)

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

File-Update

Updates a previously imported file in the Model Manager with a new revision.

Synopsis

```
CloudUtil.exe File-Update -n|--name <Name> -f|--filename <File Name> [-i|--iteration <Iteration>] [--
repository <Model Manager Root URI>] [-v|--verbose]
```

File-Update Arguments

Argument	Description
-f | - -filename	Path to the updated file.
-i | - -iteration	(Optional) Version string of the file in the Model Manager. Default is **`0.0`**.
-n | - -name	Friendly name of the file in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Operation Commands

The Operation commands enable you to manage custom operations in the Model Manager.

Operation-Create

Creates a custom operation or set of operations that can be performed on a machine based on an operation definition file.

Synopsis

```
CloudUtil.exe Operation-Create -c|--operationConfig <Operation Definition File> [--repository <Model
Manager Root URI>] [-v|--verbose]
```

Operation-Create Arguments

Argument	Description
-c | - -operationConfig	Path to an operation definition file (XML).
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Operation-Delete

Deletes a custom operation from the Model Manager.

Synopsis

```
CloudUtil.exe Operation-Delete -n|--name <Name> [--force] [--repository <Model Manager
Root URI>] [-v|--verbose]
```

Operation-Delete Arguments

Argument	Description
- -force	(Optional) Force deletion of the operation.
-n | - -name	Name of the custom operation in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Operation-List

Lists all custom operations in the Model Manager.

Synopsis

```
CloudUtil.exe Operation-List [--repository <Model Manager Root URI>] [-v|--verbose]
```

Operation-List Arguments

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Skill Commands

The Skill commands enable you to manage the skills associated with Distributed Execution Managers and workflows.

Skill-Install

Installs a skill in the Model Manager.

Synopsis

```
CloudUtil.exe Skill-Install -n|--name <Name> [--repository <Model Manager Root URI>] [-v|--verbose]
```

Skill-Install Arguments

Argument	Description
-n | - -name	Name for the skill in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Skill-List

List all skills installed in the Model Manager.

Synopsis

```
CloudUtil.exe Skill-List [--repository <Model Manager Root URI>] [-v|--verbose]
```

Skill-List Arguments

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Skill-Uninstall

Uninstall a skill from the Model Manager.

Synopsis

```
CloudUtil.exe Skill-Uninstall -n|--name <Name> [--repository <Model Manager Root URI>]
[-v|--verbose]
```

Skill-Uninstall Arguments

Argument	Description
-n | - -name	Name of the skill to uninstall from the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Note A skill cannot be uninstalled if it is associated with either a Distributed Execution Manager or a workflow. See DEM-Remove-Skills or Workflow-Remove-Skills.

Workflow Commands

The Workflow commands enable you to manage customizable IaaS workflows in the Model Manager, as well as the skills associated with any workflows.

Workflow-Add-Skills

Associate skills with a workflow in the Model Manager.

```
CloudUtil.exe Workflow-Add-Skills -n|--name <Name> -s|--skills <Skills> [--repository <Model Manager Root URI>] [-v|--verbose]
```

Table 1-22. Workflow-Add-Skills Arguments

Argument	Description
Name	Name of a workflow in the Model Manager.
Skills	Comma-delimited list of skills to associate with this workflow.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Note The skills must already exist in the Model Manager. See Skill-Install.

Workflow-List

List all workflows installed in the Model Manager and their associated skills.

```
CloudUtil.exe Workflow-List [--repository <Model Manager Root URI>] [-v|--verbose]
```

Table 1-23. Workflow-List Arguments

Argument	Description
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Workflow-Remove-Skills

Removes association between skills and a workflow in the Model Manager.

Synopsis

```
CloudUtil.exe Workflow-Remove-Skills -n|--name <Name> -s|--skills <Skills> [--repository
<Model Manager Root URI>] [-v|--verbose]
```

Workflow-Remove-Skills Arguments

Argument	Description
-n | - -name	Name of a workflow in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-s | - -skills	Comma-delimited list of skills to remove from this workflow.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Workflow-Rollback

Reverts a workflow to a given revision.

Synopsis

```
CloudUtil.exe Workflow-Rollback -n|--name <Name> -r|--revision <Revision> [--repository <Model Manager
Root URI>] [-v|--verbose]
```

Workflow-Rollback Arguments

Argument	Description
-n | - -name	Name of the workflow in the Model Manager.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-r | - -revision	Revision of the workflow to revert to.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Workflow-Update

Update a customizable workflow with a new revision.

```
CloudUtil.exe Workflow-Update -f|--filename <File Name> -n|--name <Name> [-d|--description
<Description>] [--repository <Model Manager Root URI>] [-v|--verbose]
```

Table 1-24. Workflow-Update Arguments

Argument	Description
File Name	Path to a file (XAML) containing the updated workflow.
Name	Name of the workflow to update.
Description	(Optional) Description of workflow.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Import Commands

The import commands enable you to import one or more virtual machines into a vRealize Automation deployment.

Machine-BulkRegisterExport

Creates a CSV data file that is used to import virtual machines to a vRealize Automation deployment.

Synopsis

```
CloudUtil.exe Machine-BulkRegisterExport [-b|--blueprint] [-m|--managed] [-e|--exportNames] [-p|--
properties] -f|--filename <Value> [-g|--group <Value>] [-i|--ignore] [-o|--owner <Value>] [-t|--
machinetype <Value>] [-n|--resourceName <Value>] [-r|--resourceType <Value>] [--repository <Value>] [-
sn|--sourcename <Value>] [-st|--sourcetype <Value>] -u|--user <value> [-v|--verbose]
```

Machine-BulkRegisterExport Arguments

Table 1-25.

Argument	Description
-b | - -blueprint	(Optional) Include blueprint name.
-e | - -exportNames	(Optional) Export names instead of GUIDs.
-f | - -filename	Specify the name of the CSV data file containing a list of machine names, for example, `filename.csv`. File is saved in the current path by default. You can also specify the complete path to a preferred directory.
-g | - -group	(Optional) Specify business group name, for example, Engineering.

Table 1-25. (Continued)

Argument	Description
-i | - -ignore	(Optional) Ignore invalid arguments.
-m | - -managed	(Optional) Export managed virtual machines. The default is export unmanaged virtual machines.
-n | - -resourceName	(Optional) To filter by resource name, specify the name of the Compute Resource or Endpoint.
-o | - -owner	(Optional) Specify owner of imported virtual machine, for example, jsmith.
-p | - -properties	(Optional) Export properties for managed virtual machines.
-r | - -resourceType	(Optional) To filter by resource type, specify 1 for Compute Resource or 2 for Endpoint .
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-sn | - -sourcename	(Optional) Specify the name of the cluster or endpoint.
-st | - -sourcetype	(Optional) Specify the source type as Cluster or Endpoint.
-t | - -machinetype	(Optional) Specify machine type to be exported, for example, Virtual, Physical, Cloud, AppService, vApp.
-u | - -user	Specify the Fabric Administrator who performs the bulk registration.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.

Machine-BulkRegisterImport

Imports one or more virtual machines to a target vRealize Automation deployment.

Synopsis

```
CloudUtil.exe Machine-BulkRegisterImport [-b|--batch][-d|--delay <value>] -f|--filename <value> [-i|--
ignore] [-h|--humanreadable] -n|--name <value> [--repository <value>] [-s|--skipUser] -t|--time
<value> -u|--user <value> [-v|--verbose] [-w|--whatIf]
```

Machine-BulkRegisterImport Arguments

Table 1-26.

Argument	Description
-b | - -batch	(Optional) Batch size.
-d | - -delay	(Optional) Specify processing delay time in this format: hh:mm:ss, for example, 02:20:10.
-f | - -filename	Specify the CSV data file name containing the list of machine names. For example, `filename.csv`.

Table 1-26. (Continued)

Argument	Description
-h | --humanreadable	(Optional) Input file contains the virtual machine names and not the GUIDs.
-i | - -ignore	(Optional) Ignore registered or managed virtual machines.
-n | - -name	Specify the name of the work queue to perform the import to the target vRealize Automation.
- -repository	(Optional) The root URI of the Model Manager, for example, http://*hostname*/repository. Default is specified in the CloudUtil config file in the repositoryAddress key under the <appSettings> section.
-s | - -skipUser	(Optional) Sets a machine's owner to the value listed in the Owner column of the CSV data file without verifying that the user exists. Selecting this option can decrease the time required for import.
-t | - -time	Specify the workflow start time in the format MM/DD/YYYY hh:mm GMT, for example, 04/18/2014 10:01 GMT. The specified start time is assumed to be the server's local time and not the local time of the user's workstation.
-u | - -user	Specify the Fabric Administrator who performs the bulk registration.
-v | - -verbose	(Optional) If an error occurs, outputs a stack trace instead of just the exception message.
whatif	(Optional) Set to validate the CSV file but do not import any virtual machines.

vRealize Automation Workflow Activity Reference

VMware provides a library of workflow activities with vRealize Automation Designer for use in customizing workflows.

Note The CDK is deprecated beginning with vRealize Automation 7.0. You can use the vRealize Orchestrator workflows to address use cases that you previously addressed with CDK.

Five categories of Windows Workflow Foundation activities are also included in vRealize Automation Designer, including Control Flow, Flowchart, Primitives, Collection and Error Handling.

This section provides a reference to the IaaS workflow activities included with vRealize Automation Designer in the `DynamicOps.Repository.Activities` and `DynamicOps.Cdk.Activities` namespaces. Activities related to calling vRealize Orchestrator workflows are described in Using vRealize Orchestrator Workflow Activities.

Note In the IaaS activity library, the Model Manager is referred to as the `repository`.

DynamicOps.Repository.Activities

The `DynamicOps.Repository.Activities` namespace contains basic workflow activities for IaaS workflows.

Note The CDK is deprecated beginning with vRealize Automation 7.0. You can use the vRealize Orchestrator workflows to address use cases that you previously addressed with CDK.

AddLink

Adds the specified link to the set of objects the `DataServiceContext` is tracking.

Table 1-27. AddLink Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` to which to add the link.
Source	Object	The source object for the new link.
SourceProperty	String	The name of the navigation property on the source object that returns the related object.
Target	Object	The object related to the source object by the new link.

AddObject

Adds the specified object to the set of objects the `DataServiceContext` is tracking.

Table 1-28. AddObject Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` to which to add the object.
Instance	Object	The object to be tracked by the `DataServiceContext`.

AttachTo

Notifies the `DataServiceContext` to start tracking the specified resource.

Table 1-29. AttachTo Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` that should track the resource.
Instance	Object	The resource to be tracked by the `DataServiceContext`. The resource is attached in the Unchanged state.

CreateRepositoryServiceContext<T>

Creates a context for a model loaded into the Model Manager.

When you add this activity to a workflow in vRealize Automation Designer, you must select a class that inherits from the `RepositoryServiceContext` class.

Table 1-30. CreateRepositoryServiceContext<T> Activity Input Parameters

Argument	Type	Description
Uri	URI	(Optional) Root URI to use in connecting to the model.
Username	String	(Optional) Username to use in connecting to the context.

Table 1-31. CreateRepositoryServiceContext<T> Activity Output Parameters

Argument	Type	Description
Result	RepositoryServiceContext	The specific type returned is an instance of the class selected when the activity was added to the workflow.

DeleteLink

Changes the state of the link to deleted in the list of links being tracked by the `DataServiceContext`.

Table 1-32. DeleteLink Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` from which to delete the link.
Source	Object	The source object in the link to be marked for deletion.
SourceProperty	String	The name of the navigation property on the source object that is used to access the target object.
Target	Object	The target object involved in the link that is bound to the source object. The target object must be of the type identified by the source property or a subtype.

DeleteObject

Changes the state of the specified object to be deleted in the `DataServiceContext`.

Table 1-33. DeleteObject Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` from which to delete the resource.
Instance	Object	The tracked entity to be changed to the deleted state.

InvokeRepositoryWorkflow

Executes a workflow installed in the Model Manager.

Table 1-34. InvokeRepositoryWorkflow Activity Input Parameters

Argument	Type	Description
WorkflowType	WorkflowDefinition entity	The workflow to execute.
WorkflowInputs	Dictionary<string, object>	(Optional) Inputs to the workflow.
CallingInstance	WorkflowInstance entity	(Optional) The workflow that calls the executed workflow and to which it will return.

LoadProperty

Loads deferred content for a specified property from the data service.

Table 1-35. LoadProperty Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` from which to load the property.
Instance	Object	The entity that contains the property to load.
InstanceProperty	String	The name of the property of the specified entity to load.

SaveChanges

Saves the changes that the `DataServiceContext` is tracking to storage.

Table 1-36. SaveChanges Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` that is tracking the changes to save.

SetLink

Notifies the `DataServiceContext` that a new link exists between the objects specified and that the link is represented by the property specified in the `SourceProperty` argument.

Table 1-37. SetLink Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` to notify of the link.
Source	Object	The source object for the new link.
SourceProperty	String	The property on the source object that identifies the target object of the new link.
Target	Object	The child object involved in the new link to initialize by calling this method. The target object must be a subtype of the type identified by SourceProperty. If Target is set to null, the call represents a delete link operation.

UpdateObject

Changes the state of the specified object in the `DataServiceContext` to Modified.

Table 1-38. UpdateObject Activity Input Parameters

Argument	Type	Description
DataServiceContext	RepositoryServiceContext	The `DataServiceContext` tracking the entity to update.
Instance	Object	The tracked entity to be assigned to the Modified state.

DynamicOps.Cdk.Activities

The `DynamicOps.Cdk.Activities` namespace contains advanced activities for IaaS workflows.

Note The CDK is deprecated beginning with vRealize Automation 7.0. You can use the vRealize Orchestrator workflows to address use cases that you previously addressed with CDK.

ExecutePowerShellScript

Executes a PowerShell script stored in the Model Manager under the specified name.

Before you use the `ExecutePowerShellScript` activity, you must first load the script that you want to execute into the Model Manager using the `CloudUtil File_Import` command.

Table 1-39. ExecutePowerShellScript Activity Input Parameters

Argument	Type	Description
ScriptName	String	Name in the Model Manager of the script to execute.
ScriptVersion	Object	(Optional) Version in the Model Manager of the script to execute. Default is 0.0.
MachineId	Guid	(Optional) If specified, the machine is loaded and all its properties are passed to the script.
Arguments	Dictionary<string,string>	Additional arguments to pass to the script. If MachineId is specified and there is a machine property with the same name as an argument (case-insensitive), the value of the machine property overrides the value of the argument.
PSModules	IEnumerable<string>	(Optional) Modules loaded into the PowerShell runtime during command execution. This option is only available in the Properties pane and not in the Designer pane.

Table 1-40. ExecutePowerShellScript Activity Output Parameters

Argument	Type	Description
Output	Collection<PSObject>	Output of script if any. Throws exception on error.

If you receive the error message `Type PSObject is not defined` in the vRealize Automation Designer console when you are dealing with the output of `ExecutePowerShellScript`, perform the following steps:

1 Click **Imports** in the lower left corner of the Designer pane.

2 Select the **System.Management.Automation** assembly.

ExecuteSshScript

Executes an SSH script stored in the model manager under the specified name.

Before you use the `ExecuteSshScript` activity, you must first load the script that you want to execute into the Model Manager using the `CloudUtil File_Import` command.

Table 1-41. ExecuteSshScript Activity Input Parameters

Argument	Type	Description
ScriptName	String	Name in the Model Manager of the script to execute.
Host	String	Server name against which to execute the script.
Username	String	Username to use in connecting to the host.
Password	String	Password to use in connecting to the host.
ScriptVersion	Object	(Optional) Version in the Model Manager of the script to execute. Default is 0.0.
Timeout	TimeSpan	(Optional) Period of time after which execution of the script times out. Default is 30 minutes.

Table 1-42. ExecuteSshScript Activity Output Parameters

Argument	Type	Description
EnvironmentVariables	Dictionary<string, string>	Script execution result if any.

GetMachineName

Gets a machine's name.

Table 1-43. GetMachineName Activity Input Parameters

Argument	Type	Description
MachineId	Guid	The machine whose name to retrieve.

Table 1-44. GetMachineName Activity Output Parameters

Argument	Type	Description
MachineName	String	Name of the machine identifed by `MachineId`.

GetMachineOwner

Gets the username of a machine's owner.

Table 1-45. GetMachineOwner Activity Input Parameters

Argument	Type	Description
MachineId	Guid	The machine whose owner to retrieve.

Table 1-46. GetMachineOwner Activity Output Parameters

Argument	Type	Description
Owner	String	Owner of the machine identified by `MachineId`, or null if there is no owner.

GetMachineProperties

Gets the list of custom properties associated with a machine.

Table 1-47. GetMachineProperties Activity Input Parameters

Argument	Type	Description
MachineId	Guid	The machine whose properties to retrieve.

Table 1-48. GetMachineProperties Activity Output Parameters

Argument	Type	Description
Properties	Dictionary<string, string>	List of the machine's properties. Values are returned decrypted if they were stored encrypted.

GetMachineProperty

Gets the value of the specified property for a machine.

Table 1-49. GetMachineProperty Activity Input Parameters

Argument	Type	Description
MachineId	Guid	The machine from which to retrieve a property.
PropertyName	String	Name of the property whose value to return.
IsRequired	bool	If the property is required and is not found the activity throws an exception, otherwise returns null.

Table 1-50. GetMachineProperty Activity Output Parameters

Argument	Type	Description
PropertyValue	String	Value of the property specified by `PropertyName`. The value is returned decrypted if it was stored encrypted.

GetScriptFromName

Gets the contents of the script stored in the Model Manager under the specified name.

Table 1-51. GetScriptFromName Activity Input Parameters

Argument	Type	Description
ScriptName	String	Name in the Model Manager of the script to retrieve.
ScriptVersion	Object	(Optional) Version in the Model Manager of the script to retrieve. Default is 0.0.

Table 1-52. GetScriptFromName Activity Output Parameters

Argument	Type	Description
ScriptContent	String	Contents of the script identified by `ScriptName`.

InvokePowerShell

Executes a PowerShell command.

Table 1-53. InvokePowerShell Activity Input Parameters

Argument	Type	Description
CommandText	String	Command to execute.
Arguments	IEnumerable<string>	(Optional) Arguments to the command.
Input	IEnumerable	(Optional) The input pipeline.
IsScript	bool	(Optional) Indicates whether `CommandText` is a script. Default is False. This option is only available in the Properties pane and not in the Designer pane.
Parameters	Collection	(Optional) Collection of name-value pairs passed as parameters to the PowerShell script. This option is only available in the Properties pane and not in the Designer pane.
PowerShellVariables	Collection	(Optional) Variables copied into the PowerShell runtime. This option is only available in the Properties pane and not in the Designer pane.
PSModules	IEnumerable<string>	(Optional) Modules loaded into the PowerShell runtime during command execution. This option is only available in the Properties pane and not in the Designer pane.
Runspace	Runspace	(Optional) Creating a PowerShell runspace and supplying it to this argument enables you to reuse the same runspace in multiple PowerShell invocations, which may result in performance improvements. This option is only available in the Properties pane and not in the Designer pane.

Table 1-54. InvokePowerShell Activity Output Parameters

Argument	Type	Description
Output	Collection<PSObject>	Output of command if any. Throws exception on error.
Errors	Collection<ErrorRecord>	Errors resulting from execution if any.

If you receive the error message `Type PSObject is not defined` in the vRealize Automation Designer console when you are dealing with the output of `ExecutePowerShellScript`, perform the following steps:

1 Click **Imports** in the lower left corner of the Designer pane.

2 Select the **System.Management.Automation** assembly.

InvokeSshCommand

Executes an SSH command.

Table 1-55. InvokeSshCommand Activity Input Parameters

Argument	Type	Description
CommandText	String	Command to execute.
Host	String	Server name against which to execute the command.
Username	String	Username to use in connecting to the host.
Password	String	Password to use in connecting to the host.
Timeout	TimeSpan	(Optional) Period of time after which execution of the command times out. Default is 30 minutes.

Table 1-56. InvokeSshCommand Activity Output Parameters

Argument	Type	Description
EnvironmentVariables	Dictionary<string, string>	Output of command if any. Throws exception on error.

LogMachineEvent

Logs a machine event to the user log that is visible to the machine owner.

Table 1-57. LogMachineEvent Activity Input Parameters

Argument	Type	Description
MachineId	Guid	Machine generating the event to log.
Message	String	Message to write to the user log.
Type	String	Select a message type from the drop-down list (Info, Warn, Error)

LogMessage

Logs to the Distributed Execution Manager log.

Table 1-58. LogMessage Activity Input Parameters

Argument	Type	Description
Message	String	Message to write to the DEM log.
MessageCategory	String	Select a category from the drop-down menu (**Debug**, **Error**, **Info**, **Trace**) or enter a custom category.
MessageSeverity	String	Select a severity from the drop-down menu; bound to the list of Severities supplied in `System.Diagnostics.TraceEventType`.

RunProcess

Executes a process on the same machine as the DEM that executes this activity.

Note vRealize Automation cannot present the UI from processes launched by the `RunProcess` activity to the user, therefore these process must be non-interactive. In order to avoid leaving orphaned processes on the DEM machine, the processes must also be self-terminating.

Table 1-59. RunProcess Activity Input Parameters

Argument	Type	Description
Command	String	Path to the executable to run on the DEM machine.
WorkingDirectory	String	(Optional) The working directory under which the process should run.
Arguments	String	(Optional) The list of command-line arguments to pass to the command.
WaitForExit	bool	(Optional) If true, the workflow waits for the process to complete before continuing with the workflow. Default is false. This option is only available in the Properties pane and not in the Designer pane.

SendEmail

Sends an email to the given set of addresses.

Table 1-60. SendEmail Activity Input Parameters

Argument	Type	Description
To	IEnumerable<string>	The list of addresses to which to send the email.
From	String	The address with which to populate the “From” field of the email.
Subject	String	The subject line for the email.
Body	String	The body text of the email.
Host	String	The host name or IP address of the outgoing SMTP server.
Port	Integer	The SMTP port on the server specified in Host. This option is only available in the Properties pane and not in the Designer pane.
CC	IEnumerable<string>	(Optional) The address or list of addresses to copy on the email. This option is only available in the Properties pane and not in the Designer pane.
Bcc	IEnumerable<string>	(Optional) The address or list of addresses to blind copy on the email. This option is only available in the Properties pane and not in the Designer pane.

Table 1-60. SendEmail Activity Input Parameters (Continued)

Argument	Type	Description
EnableSsl	bool	(Optional) Indicates whether to use SSL. This option is only available in the Properties pane and not in the Designer pane.
UserName	String	The user name with which to authenticate with the SMTP server specified in `Host` . This option is only available in the Properties pane and not in the Designer pane.
Password	String	The password of the user specified in `UserName`. This option is only available in the Properties pane and not in the Designer pane.

SetMachineProperty

Creates or updates a custom property on a machine.

Table 1-61. SetMachineProperty Activity Input Parameters

Argument	Type	Description
MachineId	Guid	Machine on which to create or update the custom property.
PropertyName	String	Name of property to create or update.
PropertyValue	String	Value with which to create or update the property.
IsEncrypted	bool	(Optional) Indicates whether the value of the property is encrypted.
IsHidden	bool	(Optional) Indicates whether the property is a hidden property.
IsRuntime	bool	(Optional) Indicates whether the requesting user provides the property value at request time (equivalent to being marked Prompt User in the vRealize Automation console).

SetWorkflowResult

Sets an external workflow's state to either Complete or Failed to be honored by `ExternalWF.xml` settings.

Table 1-62. SetWorkflowResult Activity Input Parameters

Argument	Type	Description
WorkflowId	Guid	The workflow for which to set the state.
Next State	WorkflowState	Select **Complete** or **Failed** from the drop-down menu.