Technical Report

Building Automation and Orchestration for Software-Defined Storage with NetApp and VMware

Using NetApp OnCommand Workflow Automation, VMware vRealize Automation, and vRealize Orchestration for Software-Defined Storage

Jack McLeod and Sushil Kumar, NetApp
Jerry Mayfield and Bhumik Patel, VMware

May 2015 | TR-4306 | Version 2.0

TABLE OF CONTENTS

LIST OF FIGURES

1 Solution Overview

The following sections provide an overview of the NetApp® VMware vRealize suite.

1.1 Summary

NetApp and VMware—leaders in storage, data management, virtualization, and cloud solutions—share a common vision of accelerating the path to the cloud through advanced virtualization, automation, and self-service. VMware cloud infrastructure, management, and orchestration solutions on the NetApp Unified Storage Architecture provide customers with a clear path to transform their data centers into a private cloud environment by delivering IT as a service (ITaaS).

This deployment guide explains how to set up a joint NetApp and VMware solution to implement a software-defined storage solution, which is a critical component in achieving an entire software-defined data center (SDDC). The setup that is described can be used to create an orchestration and automation environment that uses NetApp clustered Data ONTAP® storage, NetApp OnCommand® Workflow Automation (WFA), VMware vRealize Automation (vRA) 6.2, and VMware vCenter Orchestrator (vRO) 5.5.1.

For more information about this solution, refer to TR-4308: Software-Defined Storage with NetApp and VMware.

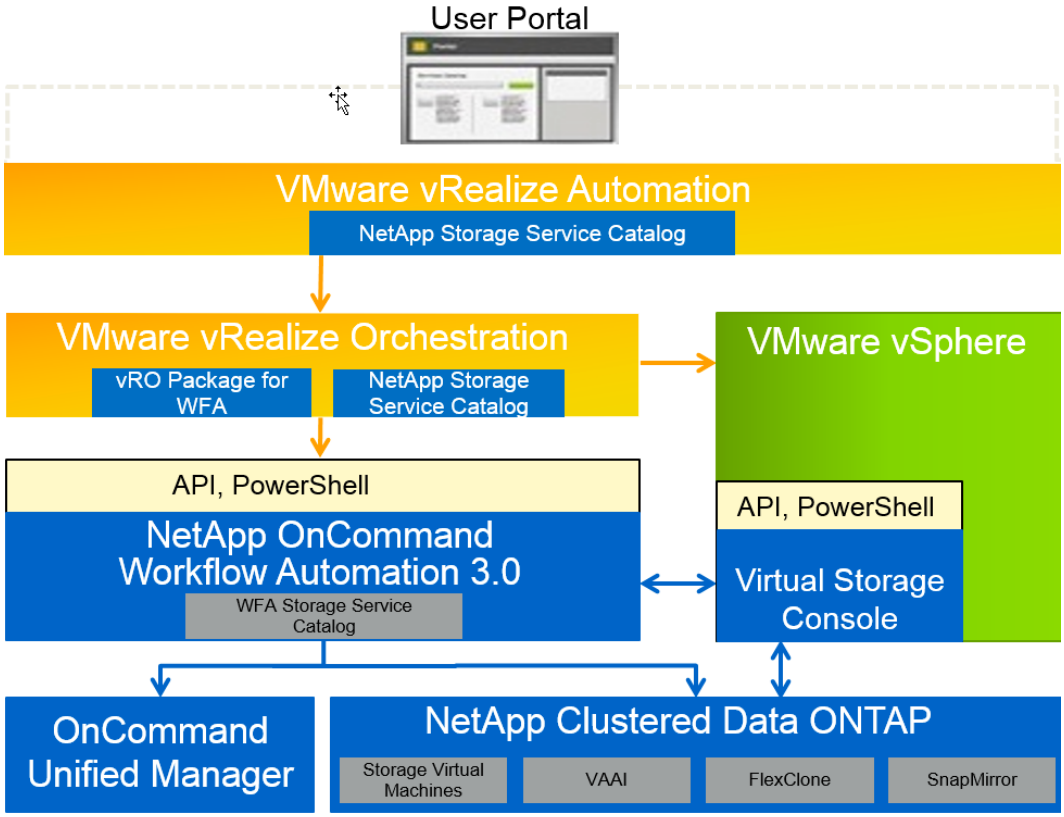
1.2 Target Audience

The target audience for this document is cloud solution architects, automation and orchestration developers, and VMware administrators. Managers, directors, and chief information officers can also use this document to understand how a NetApp and VMware software-defined storage environment is configured and set up.

1.3 Solution Summary

For multihypervisor environments, environments that require hardware orchestration or enterprise-level environments, a combination of vRO, vRA, and WFA can be used to automate and orchestrate NetApp clustered Data ONTAP software-defined storage in an SDDC. With this solution, the automation of VMware vSphere and software-defined storage through vRA and vRO, combined with the software-defined storage automation provided by WFA, can be used to create an end-to-end deployment process through all levels of a data center. Using vRA, a NetApp storage service catalog can be created that uses a combination of vRO and WFA to create true software-defined storage for the SDDC. Figure 1 shows a high-level diagram of the architecture.

Figure 1) Solution architecture overview.



2 Configure WFA and OnCommand Unified Manager

The following sections describe how to configure WFA and OnCommand Unified Manager (OCUM) 6.2 to create an orchestration and automation environment using NetApp software-defined storage.

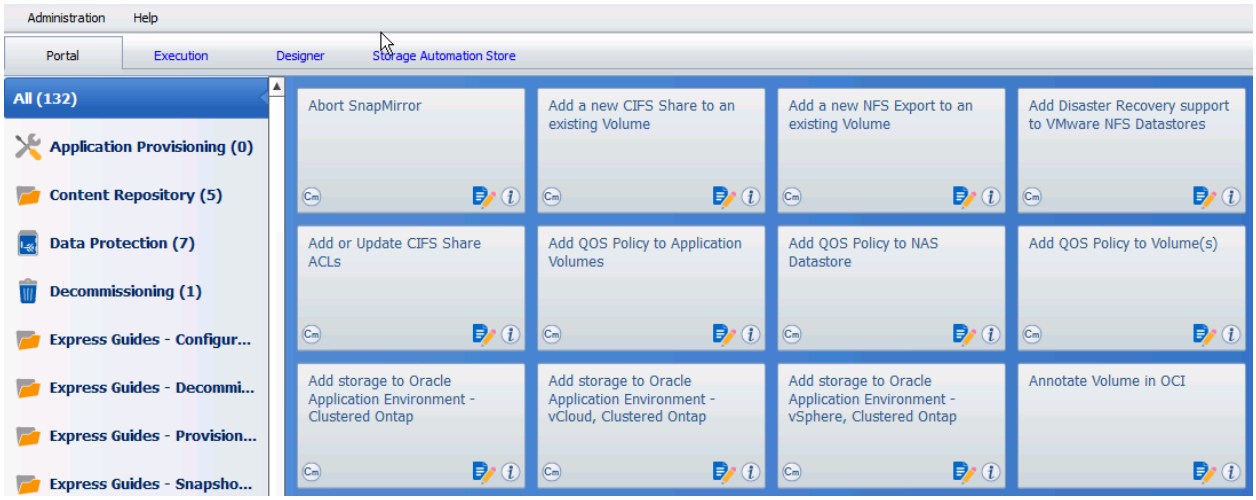
Note: OnCommand Workflow Automation 3.0 must be installed before beginning these procedures. For information about the initial installation and setup of OnCommand Workflow Automation, refer to the OnCommand Workflow Automation 3.0 Installation and Setup Guide.

2.1 Import Workflows into WFA

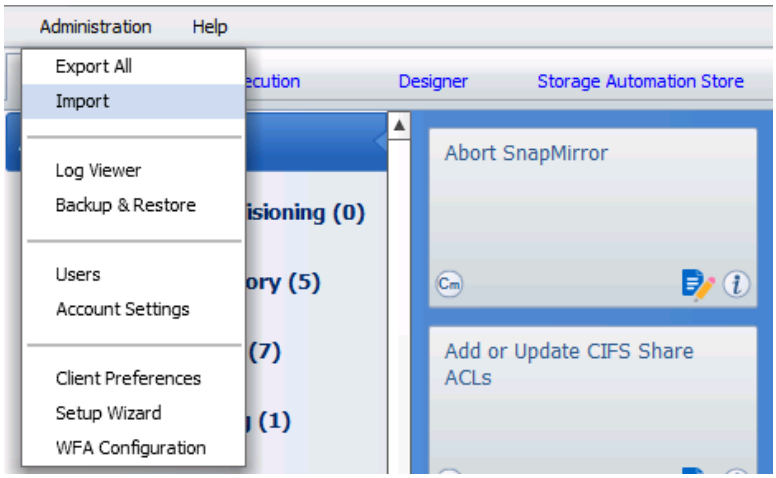
To configure a software-defined storage environment, you can use the current workflows that cover most of the basic storage and provisioning needs, or you can download a package of workflows from the NetApp community site. The NetApp community regularly creates workflows and shares them with the public.

To import WFA workflows, complete the following steps:

1. Download the zip file that contains the workflows.
2. Unzip the files locally.
3. Using a web browser, log in to WFA.



4. Click Administration > Import.

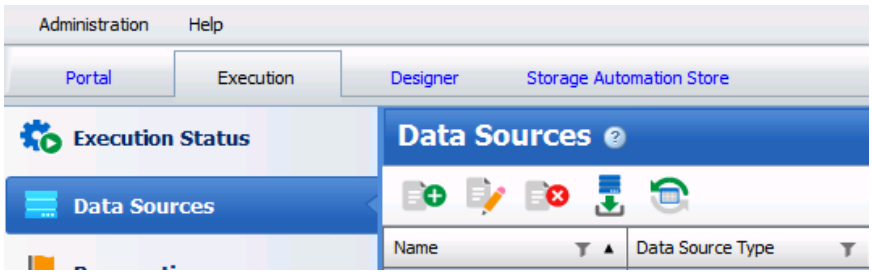


5. Select one of the compressed disk archive (DAR) files and open it.
6. Repeat steps 4 and 5 until all files are restored.

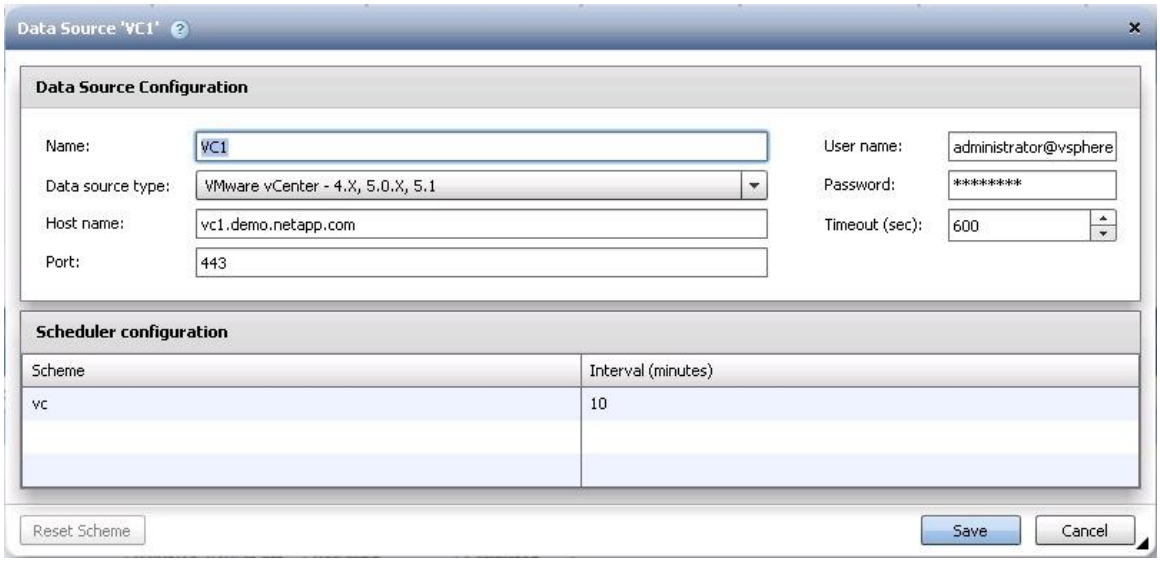
2.2 Set Up vSphere Data Source

To set up the vSphere data source, complete the following steps:

1. Using a web browser, log in to WFA.
2. Click the Execution tab and select Data Sources.
3. Click the New Data Source icon (the white plus sign on the green circle) on the toolbar.



4. In the New Data Source dialog box, select the required data source type and enter the user name or the IP address in the Host Name field.
5. Enter the vCenter credentials in the User Name and Password fields.



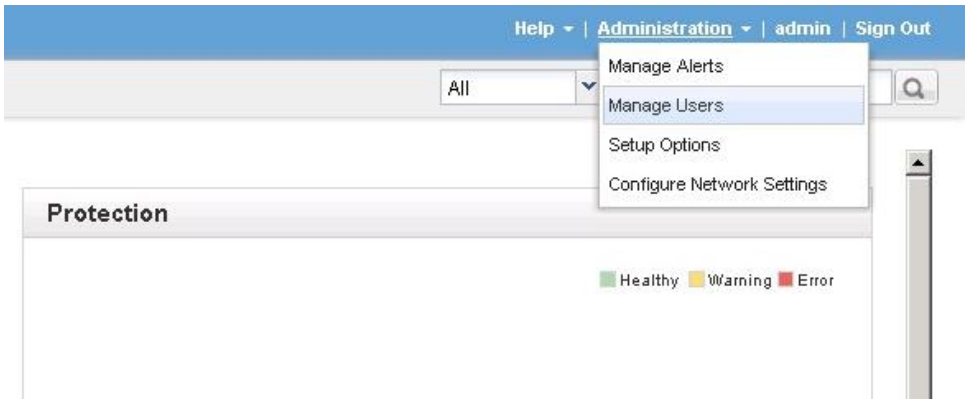
6. Enter the desired time interval. In the example in step 5, the interval is set to 10 minutes.
7. Click Save.
8. In the Data Sources table, select the data source and click Actions > Acquire Now.
9. In the History table, verify that the data acquisition status is listed as `Completed`.

2.3 Set Up OCUM Database User

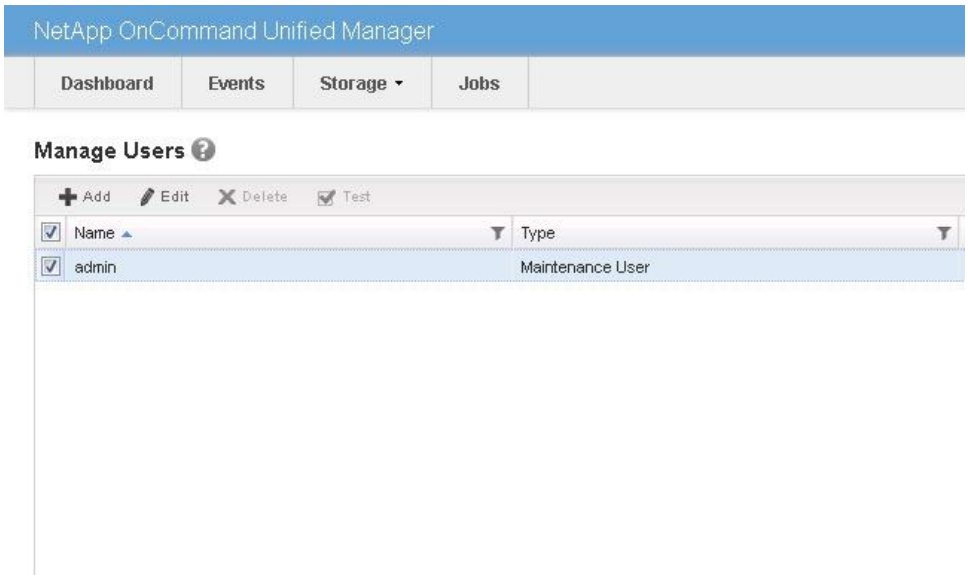
To set up the OCUM database user, complete the following steps:

Note: OnCommand Unified Manager (OCUM) must be installed to act as a data source for NetApp clustered Data ONTAP storage. To install and configure OCUM 6.2, refer to the OnCommand Unified Manager 6.2 Installation and Setup Guide. Follow the instructions in the "OnCommand Unified Manager 6.2 Installation and Setup Guide" to manage NetApp clustered Data ONTAP storage through OCUM 6.2.

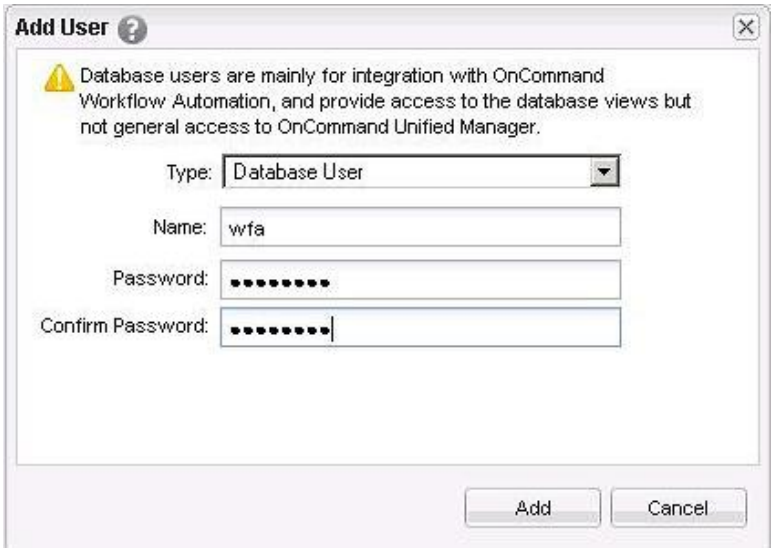
1. Log in to OCUM.
2. Click Administration and select Manage Users.



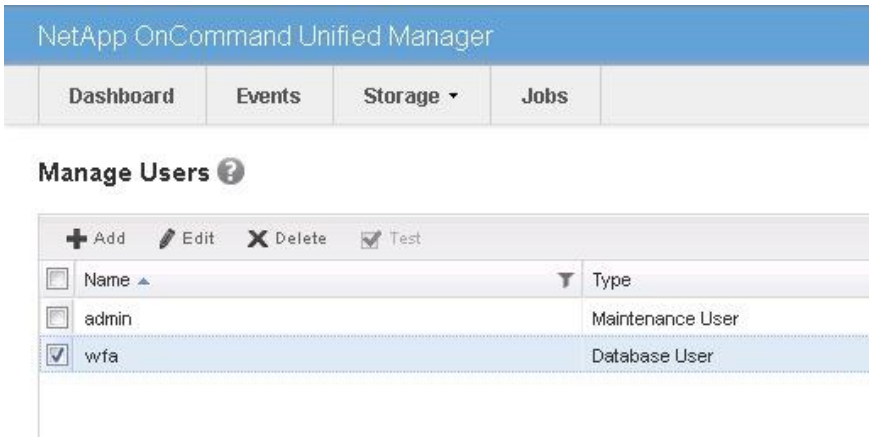
3. From the NetApp OnCommand Unified Manager page, click +Add.



4. Add a database user:
   a. Select Database User as the type.
   b. Enter a user name.
   c. Enter and confirm a password.
   d. Click Add to add this user to OnCommand Unified Manager.



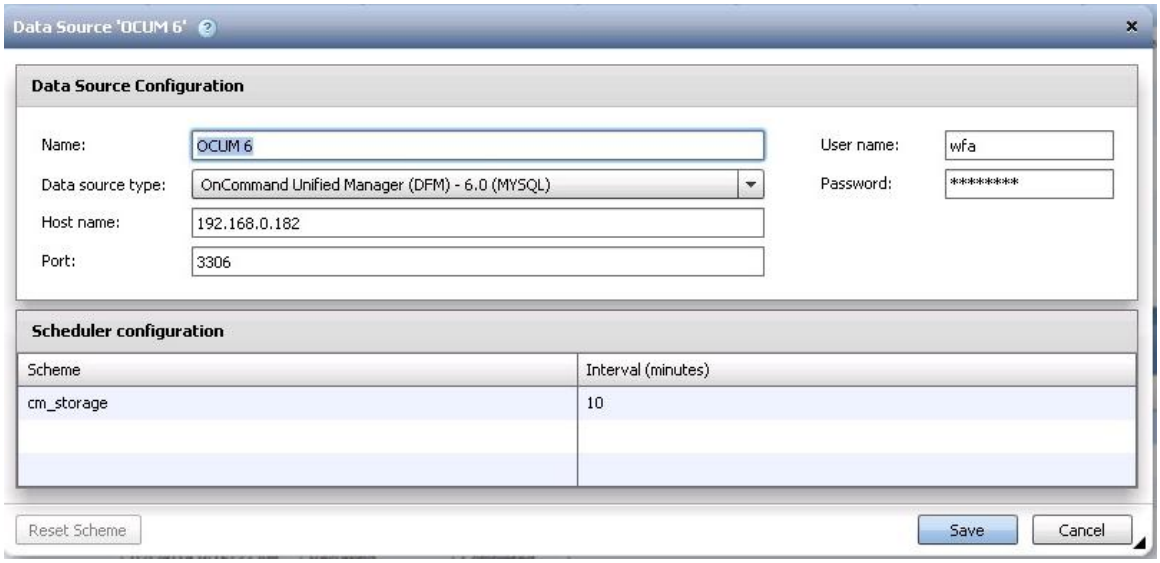
5. Verify that the new user is visible on the NetApp OnCommand Unified Manager page.



2.4 Set Up OCUM Data Source

To set up the OCUM data source, complete the following steps:

1. Using a web browser, log in to WFA.
2. Click the Execution tab and select Data Source.
3. Right-click in the top right pane and select New.
4. Select OnCommand Unified Manager (DFM)-6.0 as the data source type.
5. Enter the host name or IP address of the OCUM appliance.
6. Enter the user name and password.
7. Enter `3306` as the port number.
8. Enter the desired time interval. In the example, the interval is set to 10 minutes.

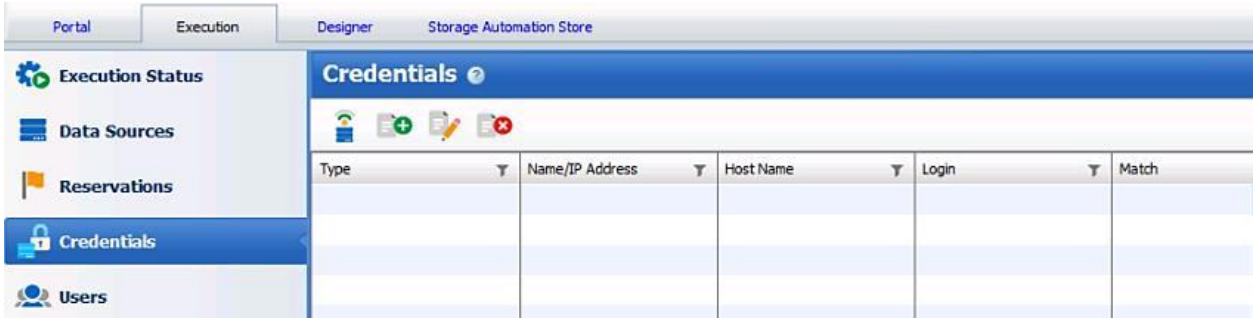


9. Click Save.
10. Right-click the new data source and select Acquire Now.

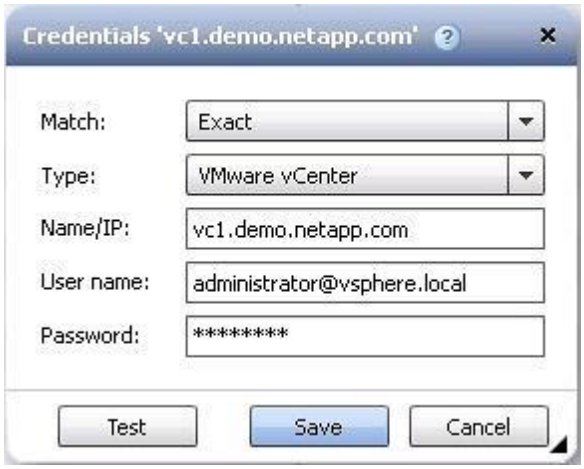
2.5 Set Up Credentials for vCenter and OCUM

To set up credentials for vCenter and OCUM, complete the following steps:

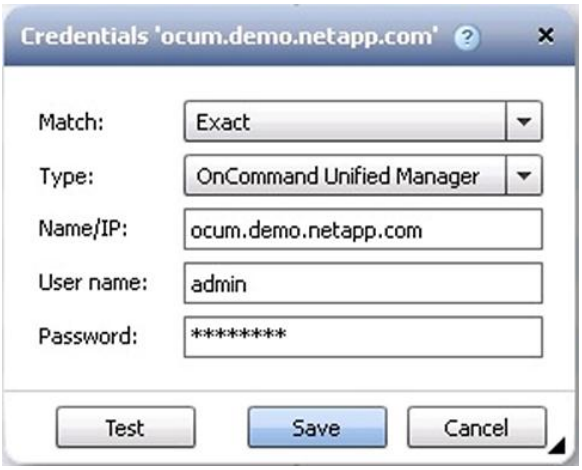
1. Using a web browser, log in to WFA.
2. Click the Execution tab and select Credentials.
3. Right-click in the Type pane and select New.



4. Configure the vCenter credentials:
   a. Select Exact from the Match drop-down list.
   b. Select VMware vCenter as the type.
   c. Enter the VMware vCenter Server fully qualified domain name (FQDN) or IP address in the Name/IP field.
   d. Enter the vCenter Server user name.
   e. Enter the vCenter Server password.



5. Click Save.
6. To add OCUM 6.0 credentials again, right-click in the right pane and select New.
7. Configure the OCUM credentials:
   a. Select Exact from the Match drop-down list.
   b. Select OnCommand Unified Manager as the type.
   c. Enter the OCUM server FQDN or IP address in the Name/IP field.
   d. Enter the OCUM user name.
   e. Enter the OCUM password. In this case, this is the admin password that we created during OCUM setup.

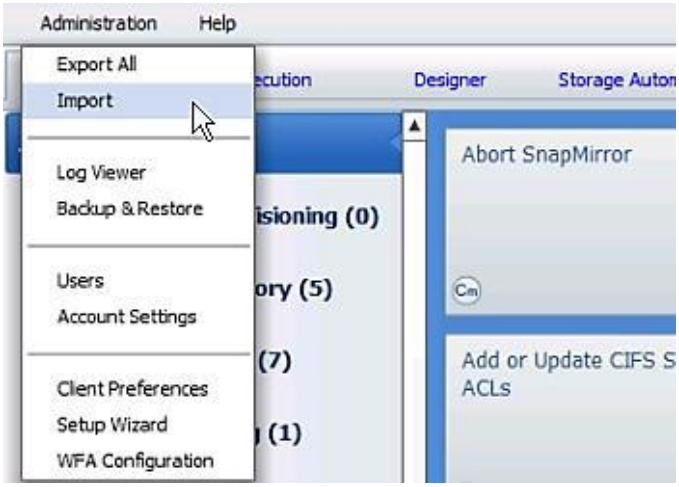


8. Click Save.

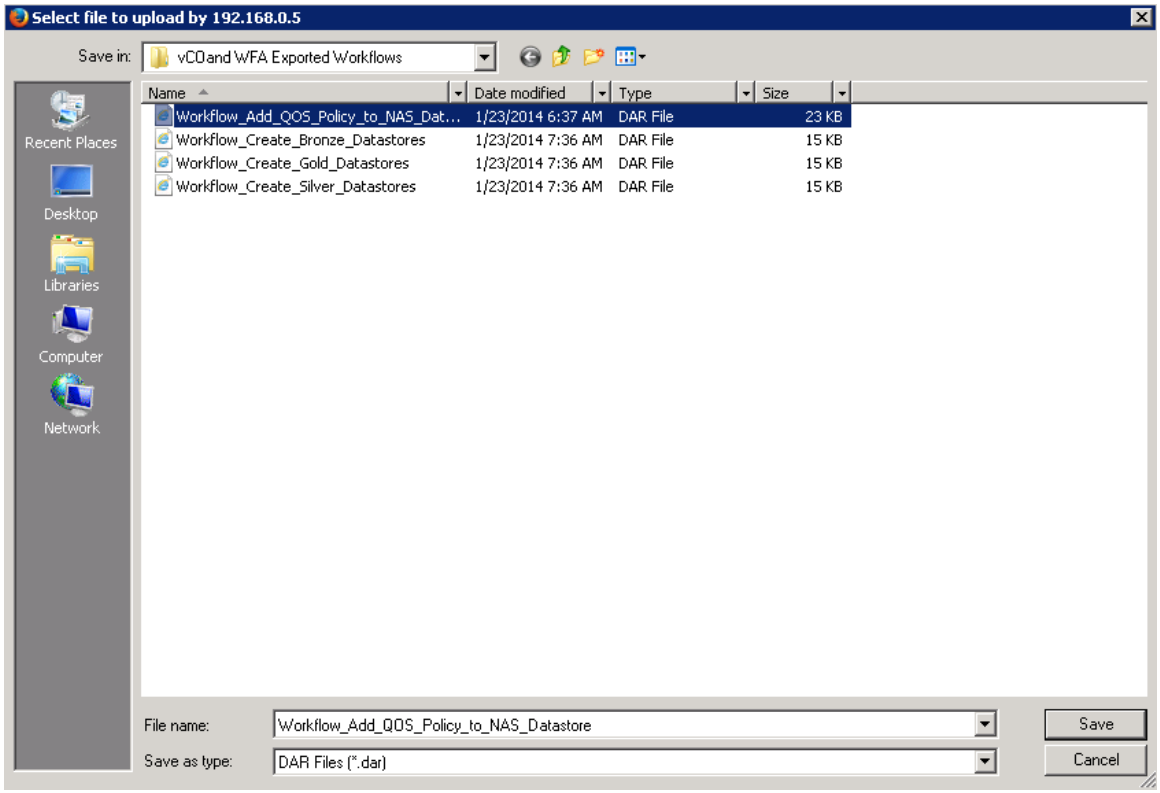
2.6 Import Storage Orchestration Workflows into WFA

To import an existing workflow, complete the following steps:

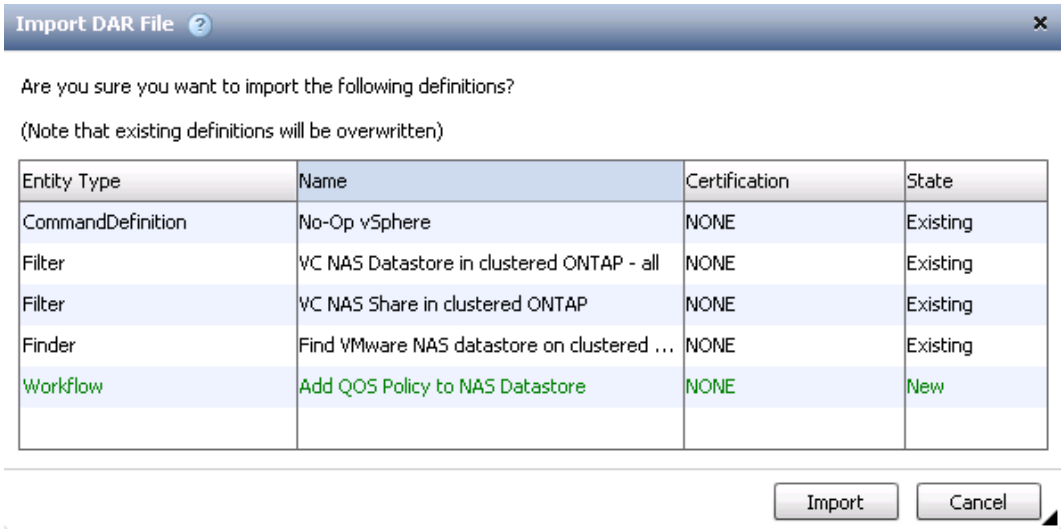
1. Using a web browser, log in to WFA.
2. Click Administration > Import.



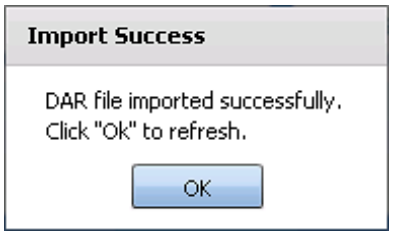
3. Browse to the folder that contains existing workflows and click Save.



4. On the Import DAR File page, click Import to import the workflow.



5. In the confirmation message, click OK.

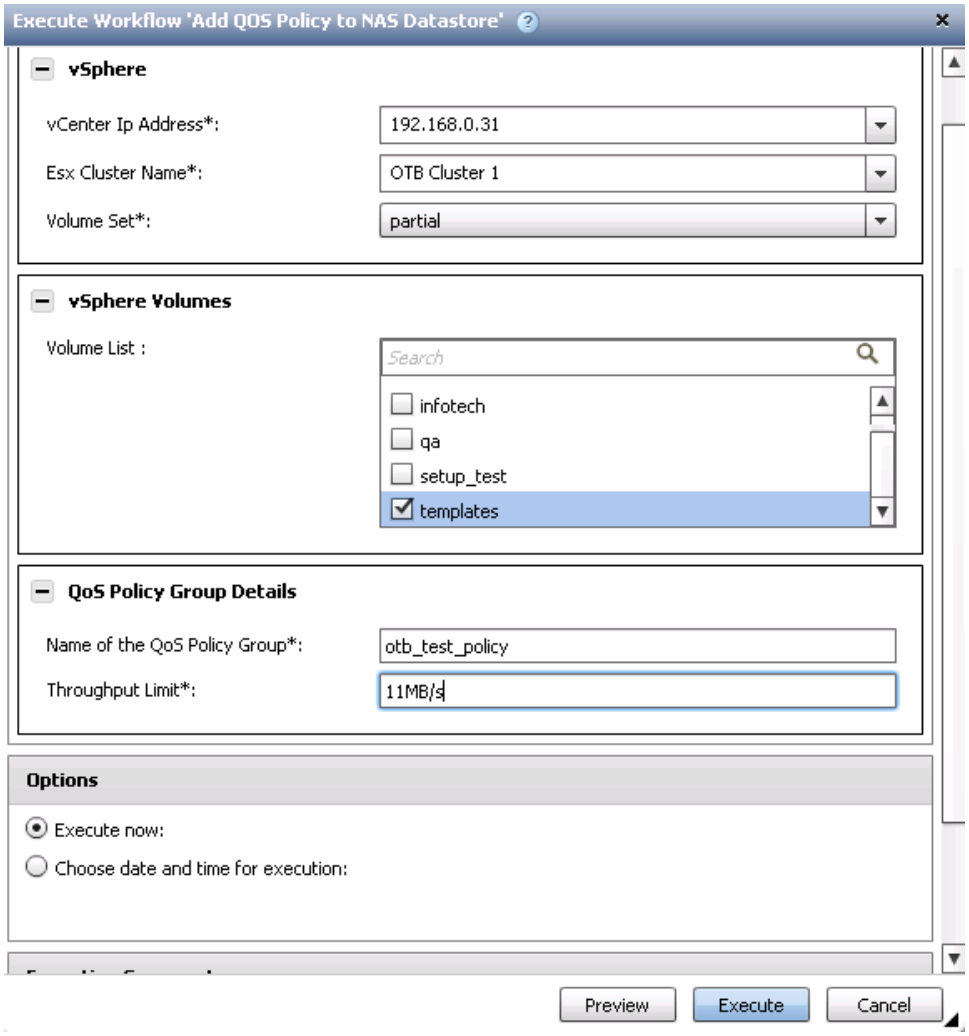


6. Verify that the workflow is now displayed on the WFA Workflows page. In the example, the newly added workflow is Add QoS Policy to NAS Datastore.

2.7 Run a WFA Workflow

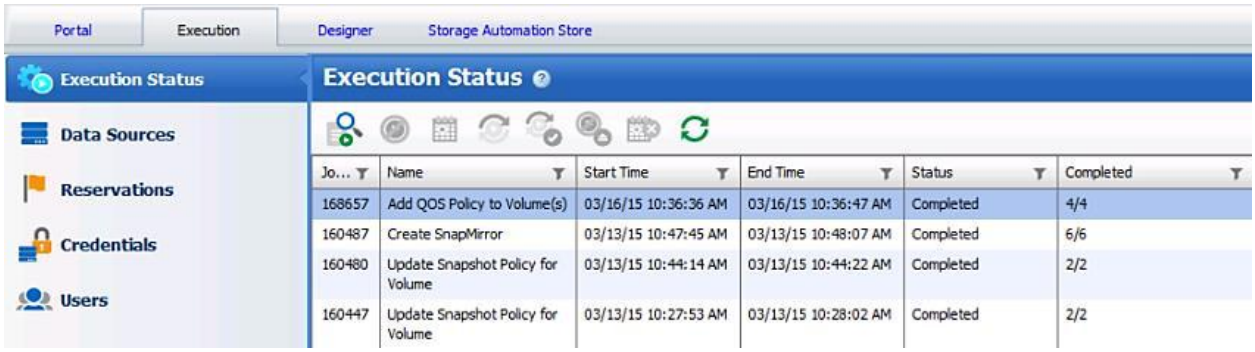
To run an existing workflow, complete the following steps:

1. Using a web browser, log in to WFA.
2. Double-click a workflow. In the example, the selected workflow is Add QoS Policy to NAS Datastore.
3. On the Execute Workflow page, configure the details for vSphere, vSphere Volumes, and QoS Policy Group Details and click Execute Now.



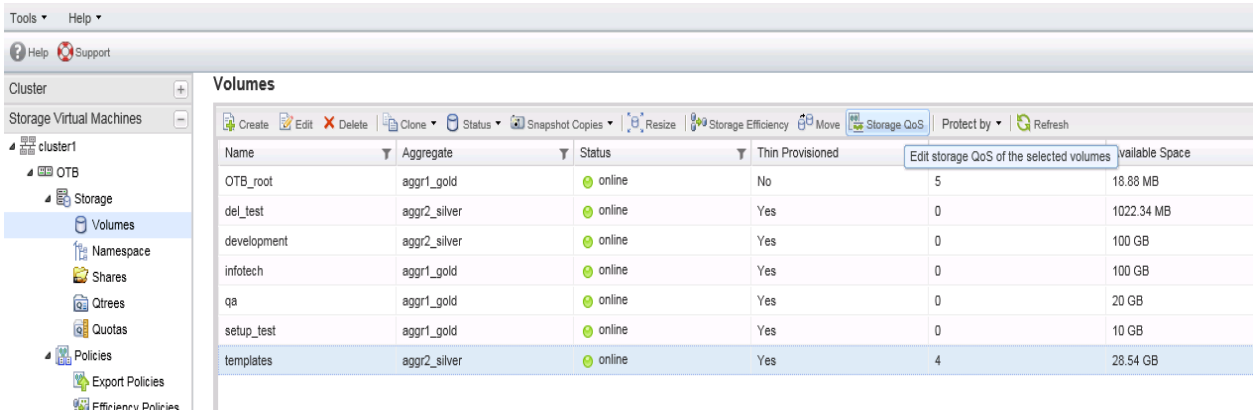
4. On the Execution of Workflow page, the workflow status changes to green to indicate that the workflow completed successfully.

5. On the Execution tab, click Execution Status to verify the status of the workflow.

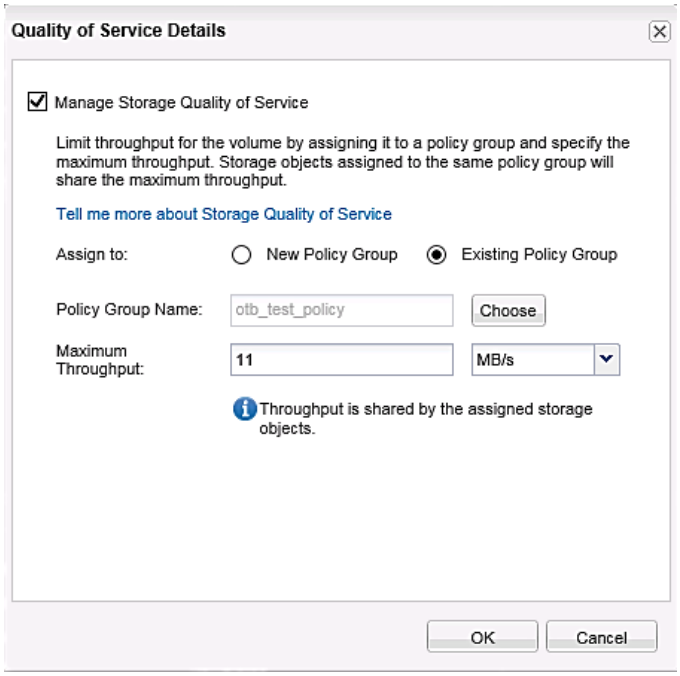


6. Log in to System Manager and navigate to Volumes. Select the volume to which the QoS policy was applied and click Storage QoS.

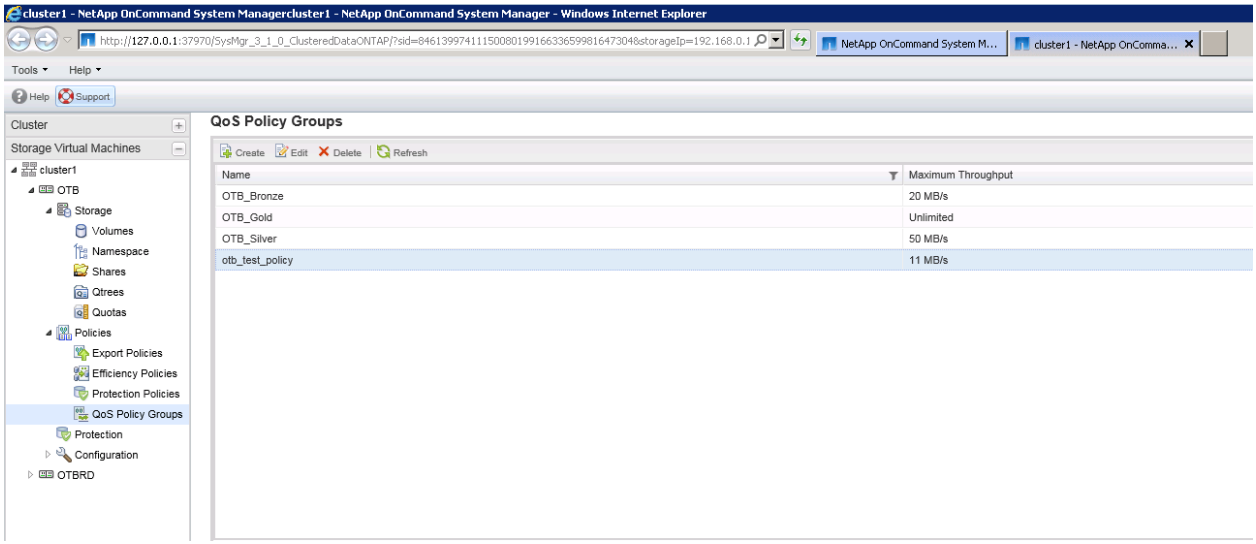
   Note: For more information about how to install and configure NetApp System Manager, refer to OnCommand System Manager 3.1 Installation and Setup Guide.



7. Verify that the QoS policy for the volume is displayed and click OK.



8. Click Policies > QoS Policy Groups and verify that the policy was created.



Note: To view additional sample workflows, refer to the OnCommand Workflow Automation Community site. For detailed information about workflow creation, refer to the OnCommand Workflow Automation 3.0 documentation on the NetApp Support site.

3 Configure vRealize Orchestrator

The following sections describe how to configure vRealize Orchestrator.

3.1 Set Up vRealize Orchestrator

vRealize Orchestrator 6.0 is the workflow engine integrated in VMware vRealize Automation.

The vRealize Orchestrator server distributed with vRealize Automation is preconfigured. Therefore, when the system administrator deploys the vRealize Automation appliance, an instance of vRealize Orchestrator Server is also deployed. The Orchestrator service must be started, however.

To verify and start the vRO service, complete the following steps:

1. Log in to the vRA appliance using root credentials and check the service status.

```
login as: root
VMware vCloud Automation Center Appliance
root@10.61.87.220's password:
Last login: Mon Mar 10 15:16:15 UTC 2014 on tty1
Last login: Mon Mar 10 15:24:02 2014 from stlcx250s1-a3.srvceng.rtp.netapp.com
vcac60:~ # service vco-configurator status
Status-ing tcServer
Instance name:         configuration
Runtime version:       7.0.55.A.RELEASE
tc Runtime Base:       /var/lib/vco/configuration
Status:                NOT RUNNING
```

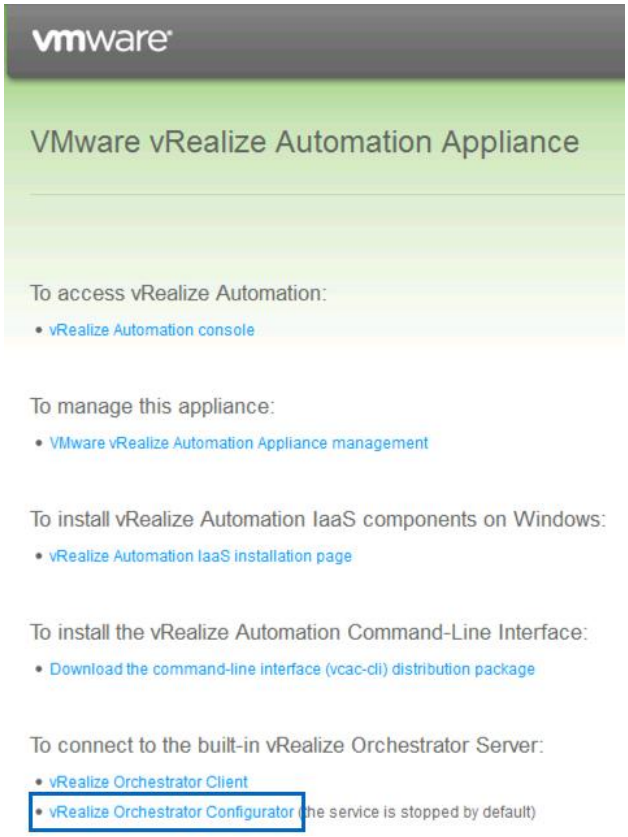
2. Run the `service vco-configurator start` command to start the service.

```
vcac60:~ # service vco-configurator start
Starting tcServer
Using CATALINA_BASE:   /var/lib/vco/configuration
Using CATALINA_HOME:   /usr/local/tcserver/vfabric-tc-server-standard/tomcat-7.0
.55.A.RELEASE
Using CATALINA_TMPDIR: /var/lib/vco/configuration/temp
Using JRE_HOME:        /usr/java/jre-vmware
```



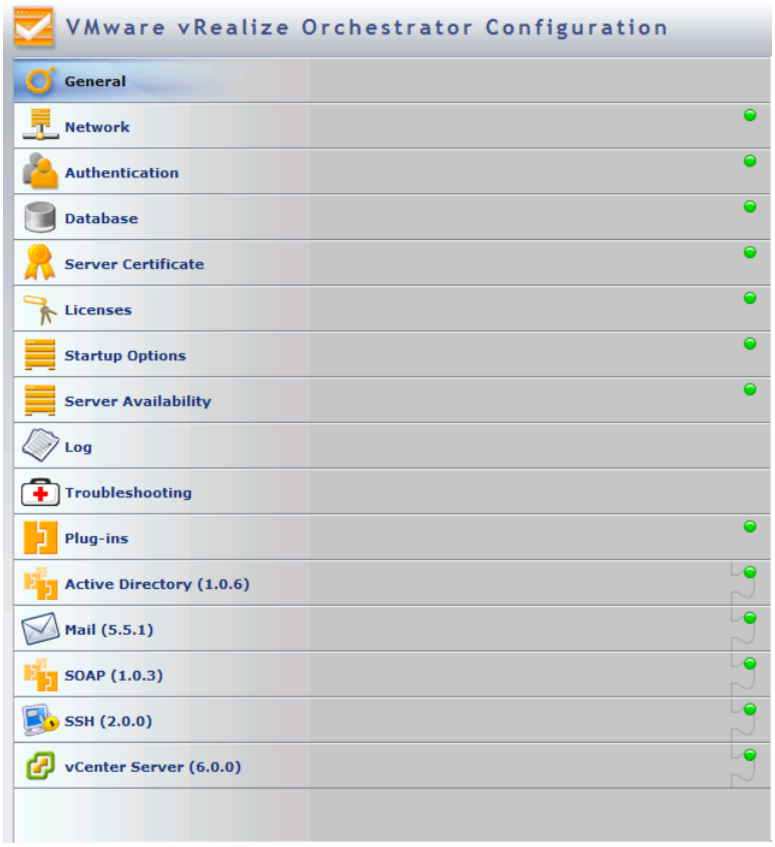
```
Using CLASSPATH:       /usr/local/tcserver/vfabric-tc-server-standard/tomcat-7.0
.55.A.RELEASE/bin/bootstrap.jar:/usr/local/tcserver/vfabric-tc-server-standard/t
omcat-7.0.55.A.RELEASE/bin/tomcat-juli.jar
Using CATALINA_PID:    /var/lib/vco/configuration/logs/tcserver.pid
Status:                RUNNING as PID=9980
vcac60:~ #
```

3. Browse the FQDN of the vRA 6.2 appliance and click vRealize Orchestrator Configurator.

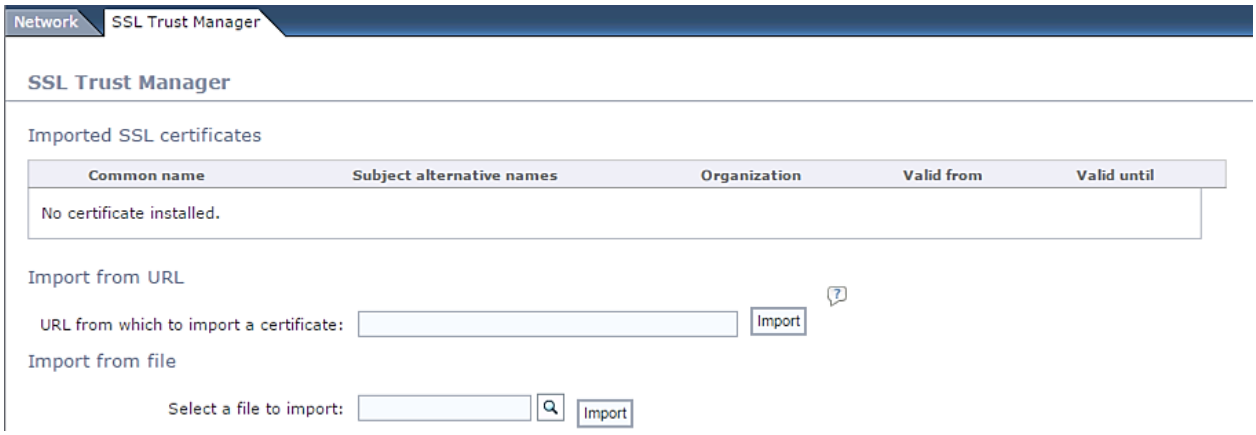


4. Navigate to https://vrealize_automation_appliance_ip:8283 and log in to vRO by using the default user name and password.

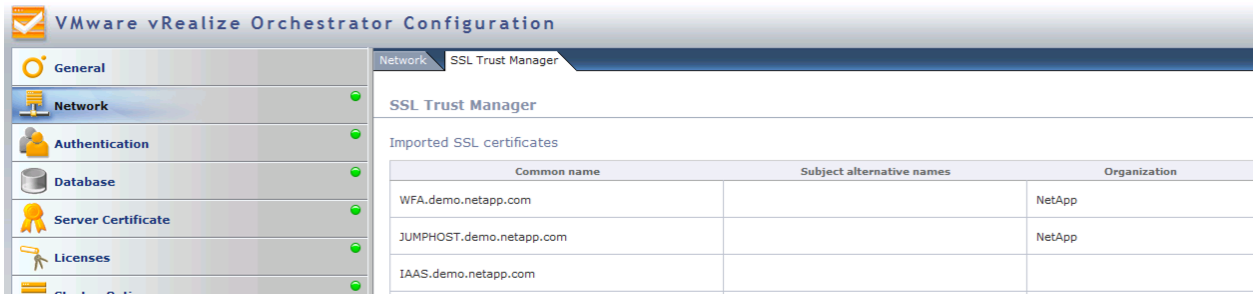
5. From the vRO Configurator, click Network and then click the SSL Trust Manager tab.



6. Enter the FQDN or IP address of the WFA 3.0 server and click Import to import the WFA SSL certificate.



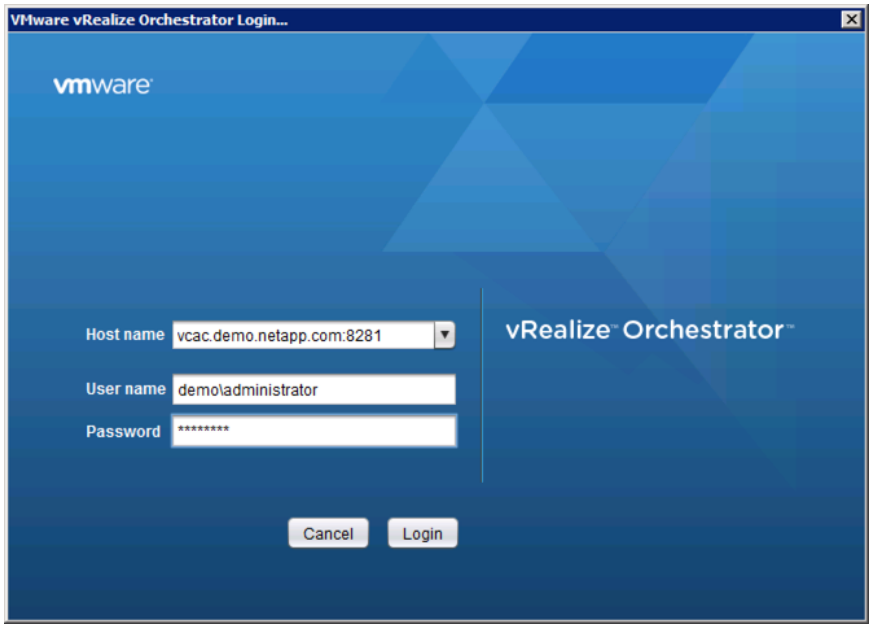
7. Repeat steps 1 to 6 for vCenter Server to provide the IP or FQDN of the vCenter server and click Import.
8. To confirm that the certificates were imported, verify that the WFA and vCenter entries are listed on the SSL Trust Manager tab.

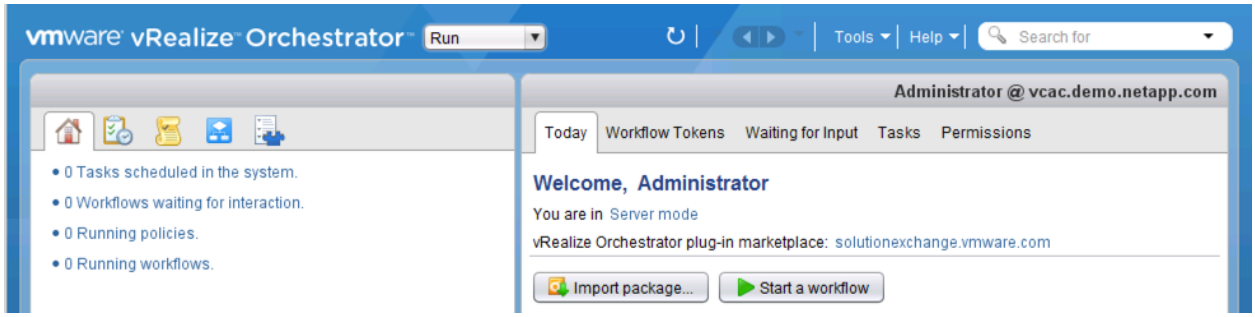


3.2 Install and Configure NetApp vRealize Integration Package for OnCommand WFA

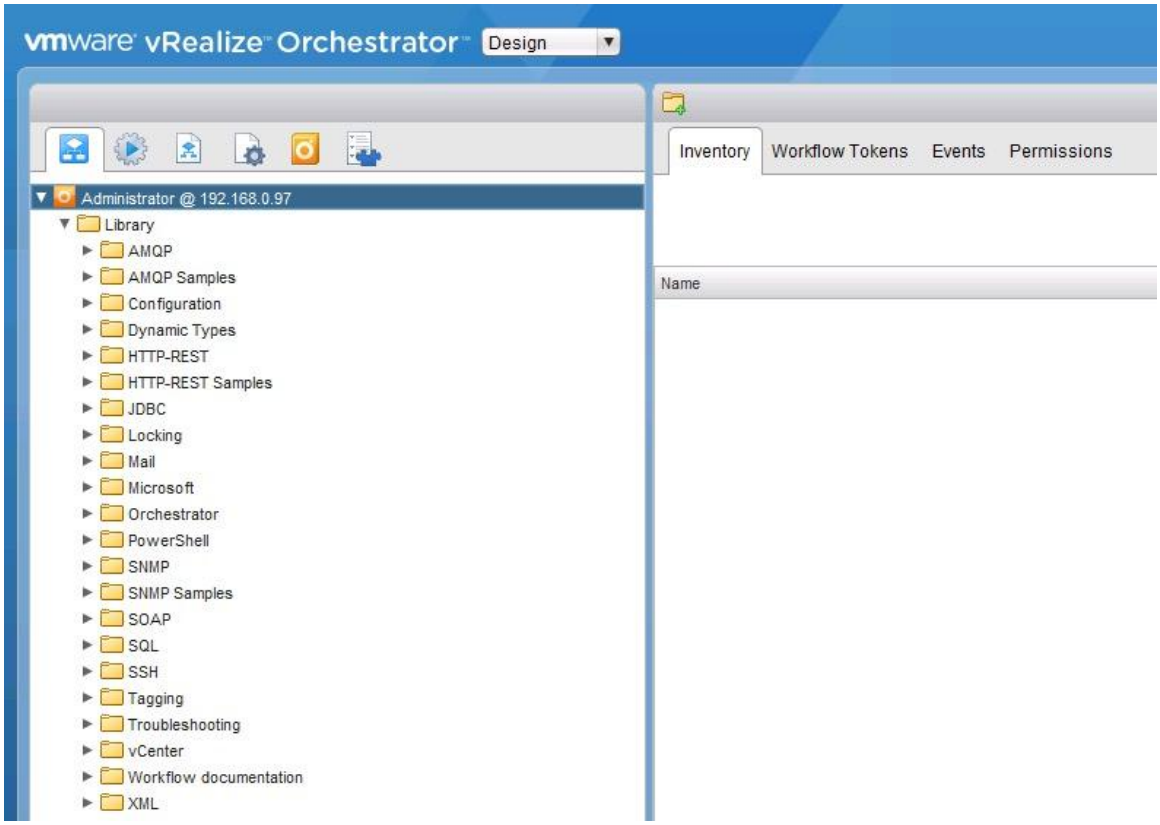
To install and configure the NetApp vRealize Integration Package for OnCommand WFA, complete the following steps:

1. Download the NetApp vRealize Integration Package for OnCommand WFA from the NetApp Community site.
2. Start the vRO client and click Import Package.

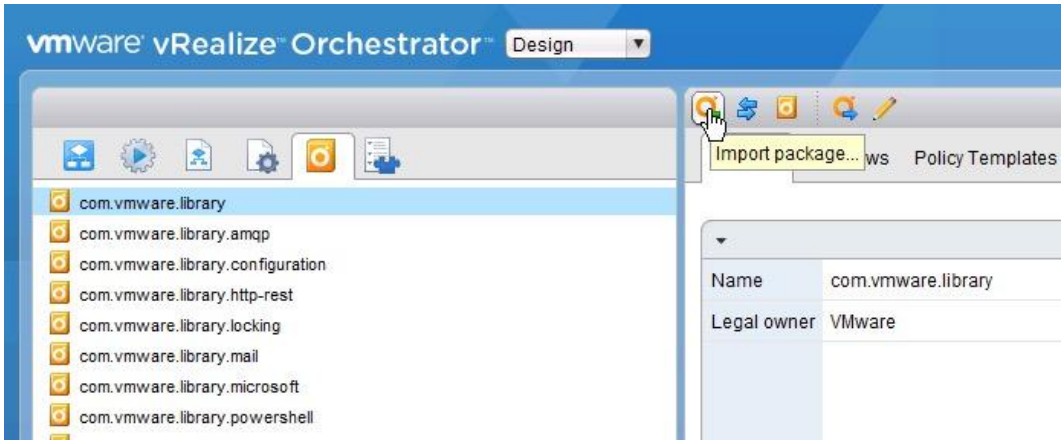




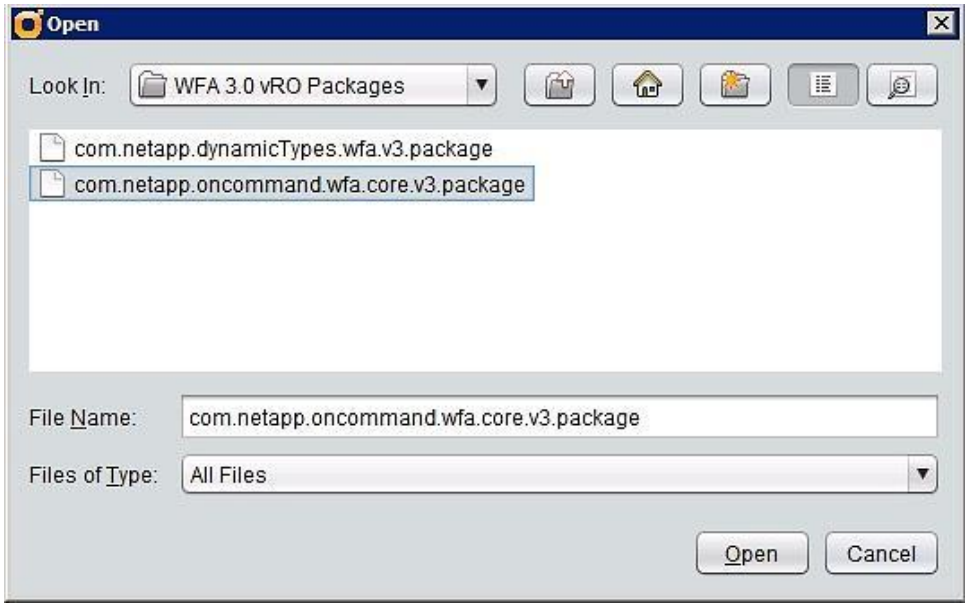
3. Log into vRealize Orchestrator and select Design.



4. Click the Packages tab and then click the Import Package icon.

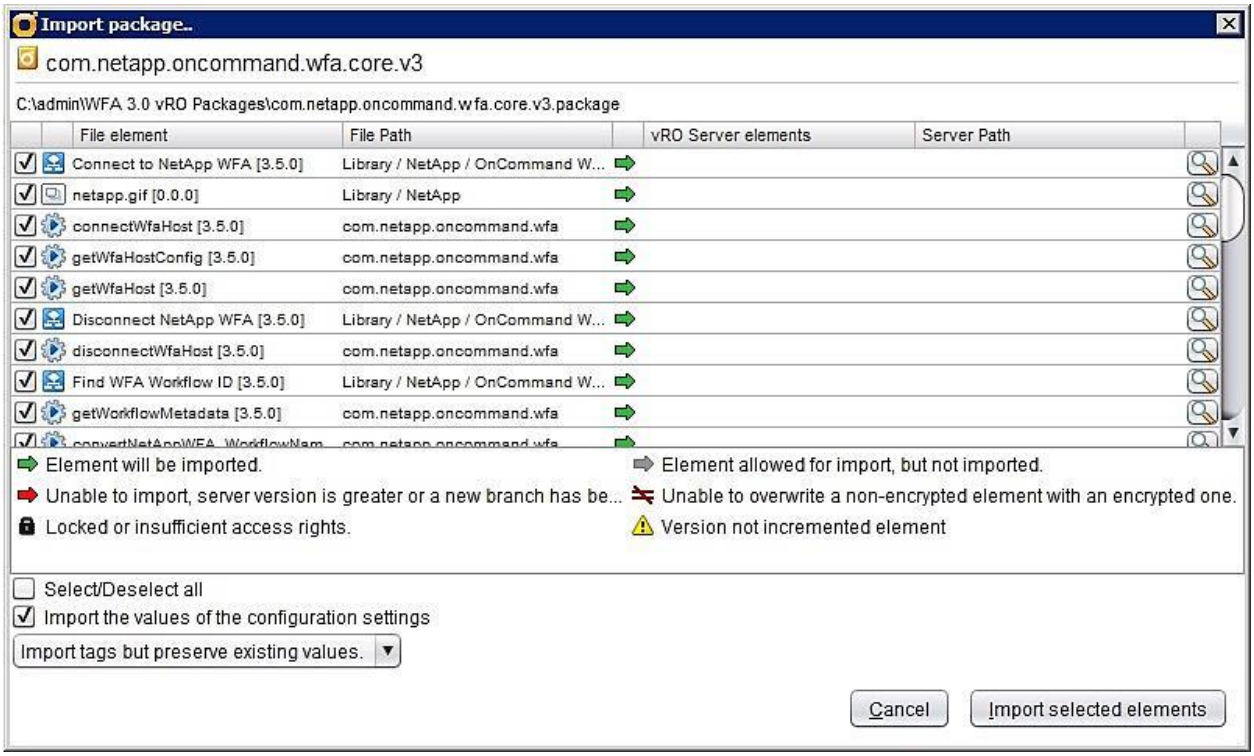


5. Select `com.netapp.oncommand.wfa.core.v3.package` from the location to which you saved the downloaded package. Click Open.

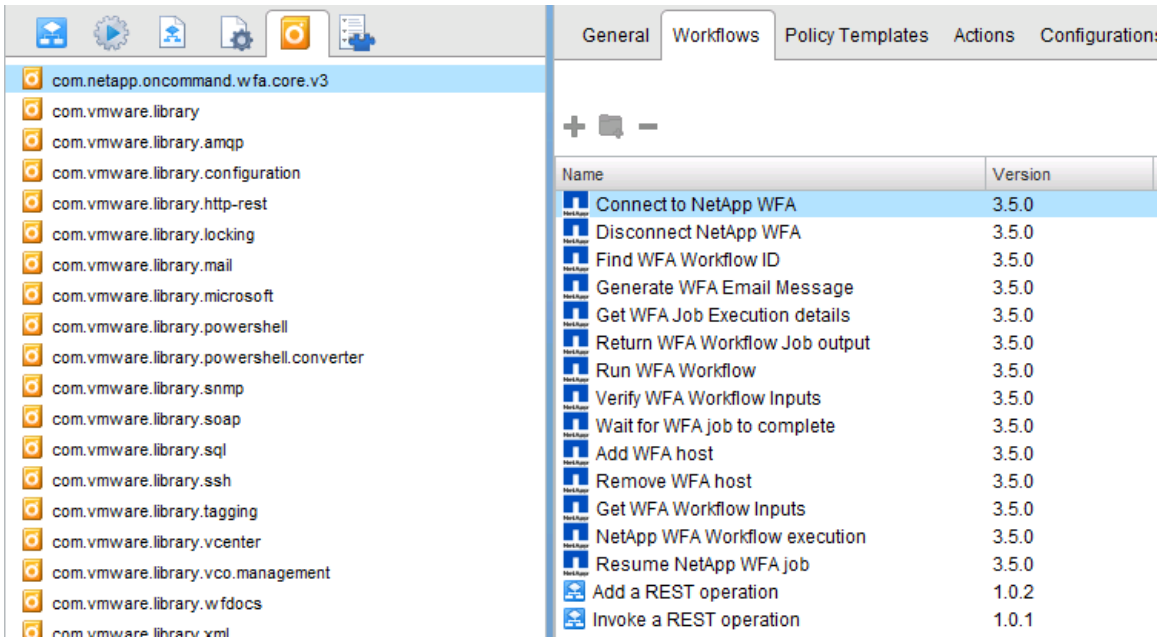


6. At the Package Import Information window, click Import.

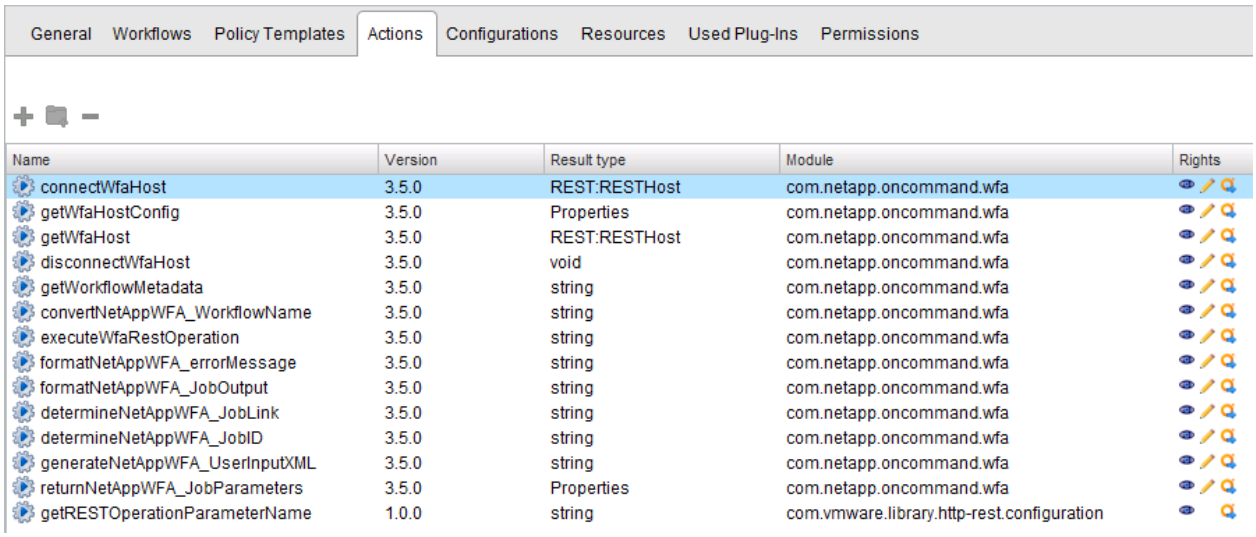
7. At the next window, verify that all of the new elements in the package are selected. Then click Import Selected Elements at the bottom right.



8. Once the import is finished, a new package called `com.netapp.oncommand.wfa.core.v3` will be displayed.
9. Click the package and then click the Workflows tab at the top. You will see that this package contains 16 workflows.

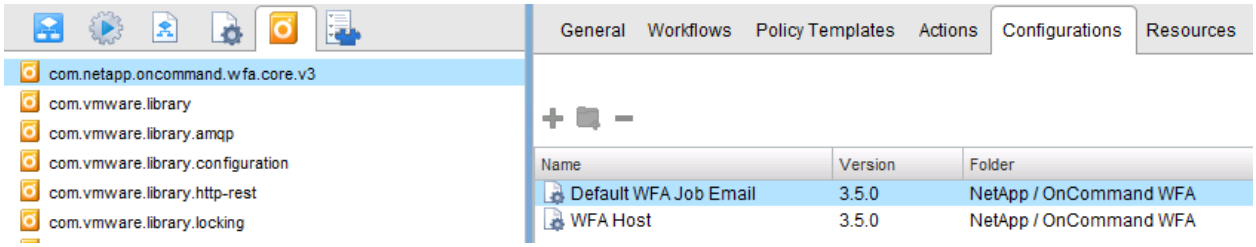


10. Next, click the Actions tab. The new package contains 14 actions.

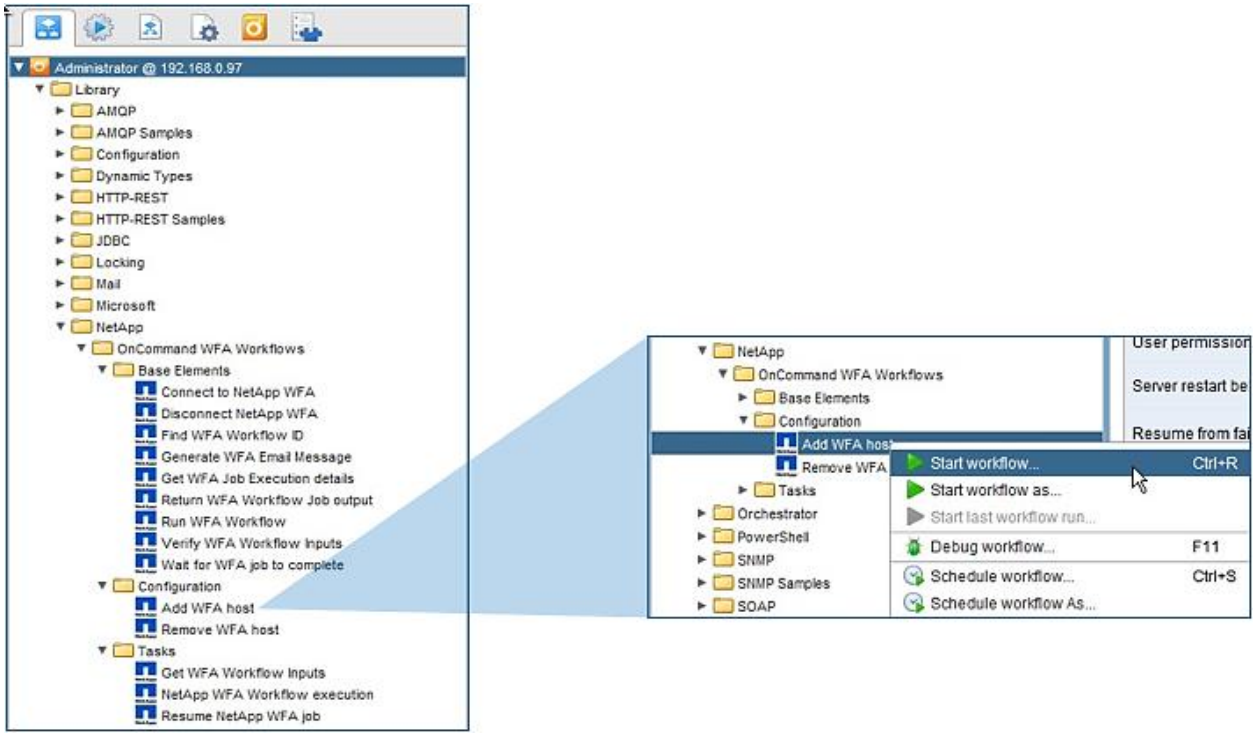


Name	Version	Result type	Module	Rights
connectWfaHost	3.5.0	REST:RESTHost	com.netapp.oncommand.wfa	
getWfaHostConfig	3.5.0	Properties	com.netapp.oncommand.wfa	
getWfaHost	3.5.0	REST:RESTHost	com.netapp.oncommand.wfa	
disconnectWfaHost	3.5.0	void	com.netapp.oncommand.wfa	
getWorkflowMetadata	3.5.0	string	com.netapp.oncommand.wfa	
convertNetAppWFA_WorkflowName	3.5.0	string	com.netapp.oncommand.wfa	
executeWfaRestOperation	3.5.0	string	com.netapp.oncommand.wfa	
formatNetAppWFA_errorMessage	3.5.0	string	com.netapp.oncommand.wfa	
formatNetAppWFA_JobOutput	3.5.0	string	com.netapp.oncommand.wfa	
determineNetAppWFA_JobLink	3.5.0	string	com.netapp.oncommand.wfa	
determineNetAppWFA_JobID	3.5.0	string	com.netapp.oncommand.wfa	
generateNetAppWFA_UserInputXML	3.5.0	string	com.netapp.oncommand.wfa	
returnNetAppWFA_JobParameters	3.5.0	Properties	com.netapp.oncommand.wfa	
getRESTOperationParameterName	1.0.0	string	com.vmware.library.http-rest.configuration	

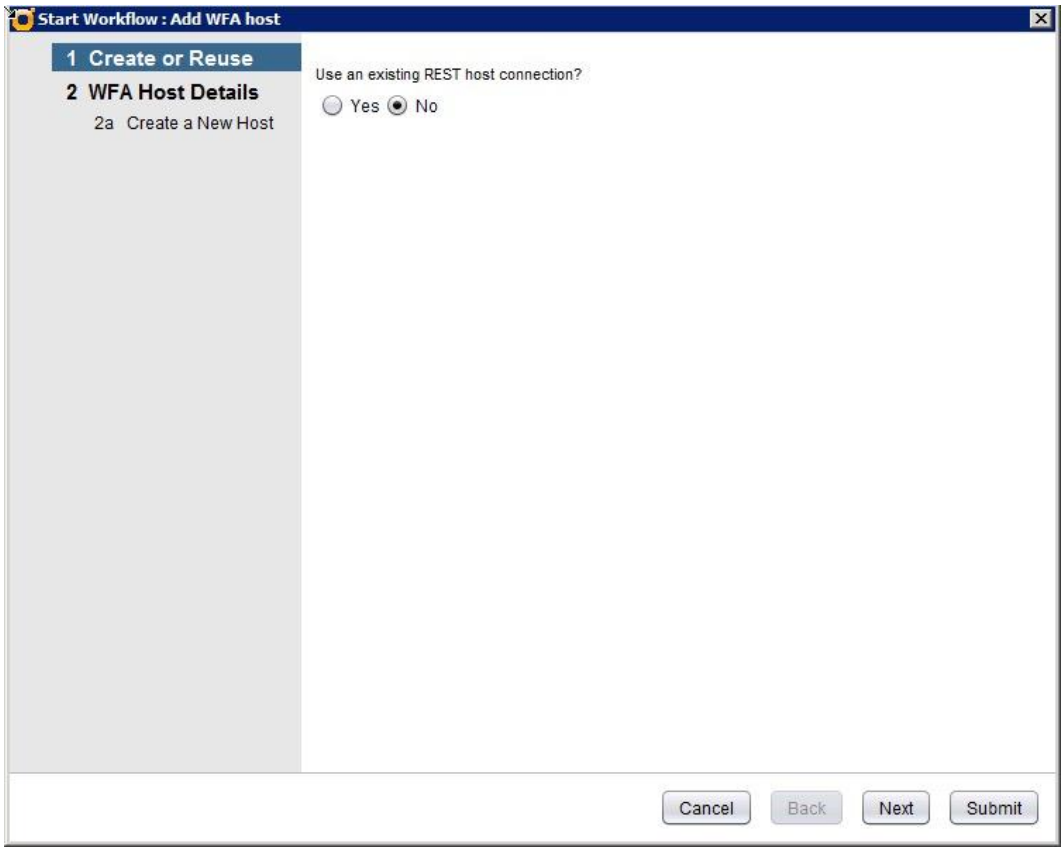
11. Next, click the Configurations tab. The package contains two configurations.



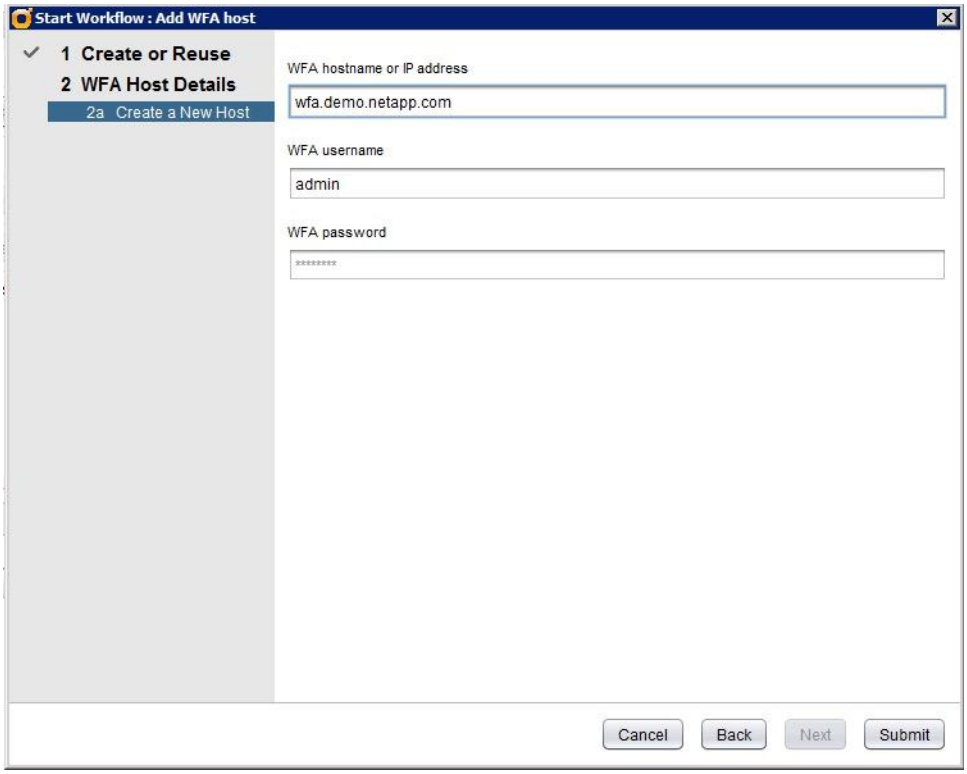
12. Click again the Workflows tab at the top of vRealize Operations. Navigate to Library > NetApp > Configuration. In this folder, right-click Add WFA Host and click Start Workflow.



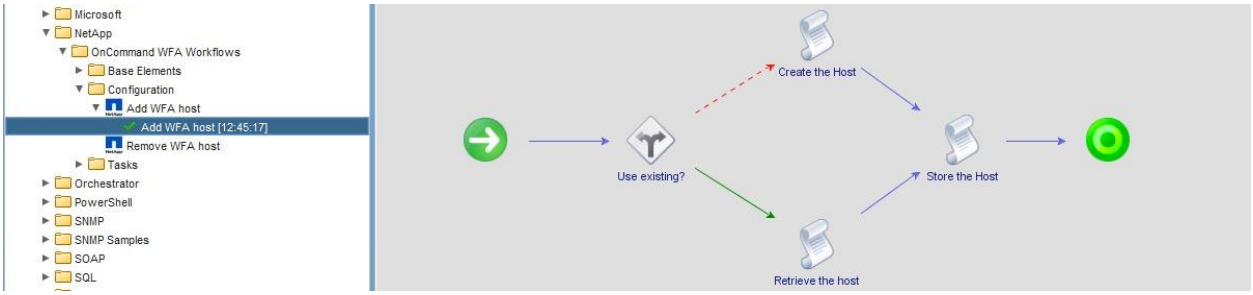
13. If this is the first time you are setting up this package, at the Add WFA Host page, in the Create or Reuse section, select No when you are asked to use an existing REST host connection. Click Next.



14. At the WFA Host Details page, enter the IP address or FQDN of the WFA server that you will use. Also, enter a user name (which must at least have privileges to run the workflows you want to make available to vRO) and a password for the user name in the respective fields. Then click Submit.

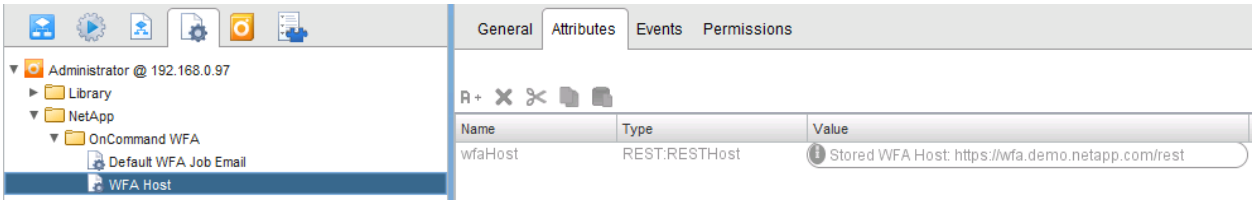


15. The workflow runs and sets up the REST host using the information provided between vRealize Orchestrator and NetApp OnCommand WFA.

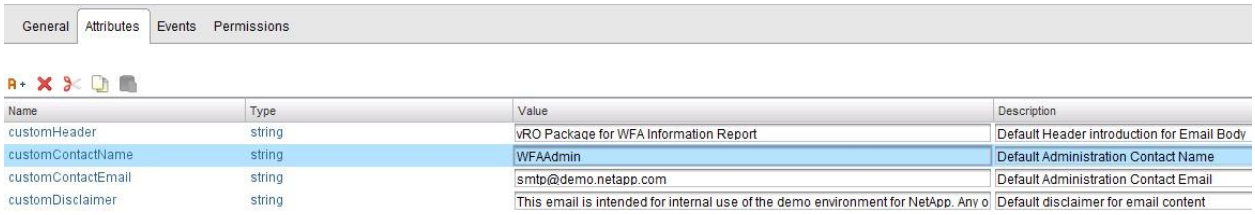


16. Once the workflow is complete (indicated by a green check next to it), click the Configuration tab at the top of the window. Select from the drop-down folders NetApp > OnCommand WFA.
17. You will see two configuration options: Default WFA Job Email and WFA Host. WFA Host will be filled out automatically, based on the previous setup when you ran Add WFA host. Click each option and notice the configurations that are already done.

    The following screenshot shows the WFA Host configuration:



18. If you would like to set up the Default WFA Job Email, enter information for each section under the corresponding value and based on what you need for each section. Then click Save at the bottom of the window.



Note: For more information about vRealize Automation and vRealize Orchestrator, refer to Advanced Service Designer Configuration and VMware vRealize Orchestrator Documentation.

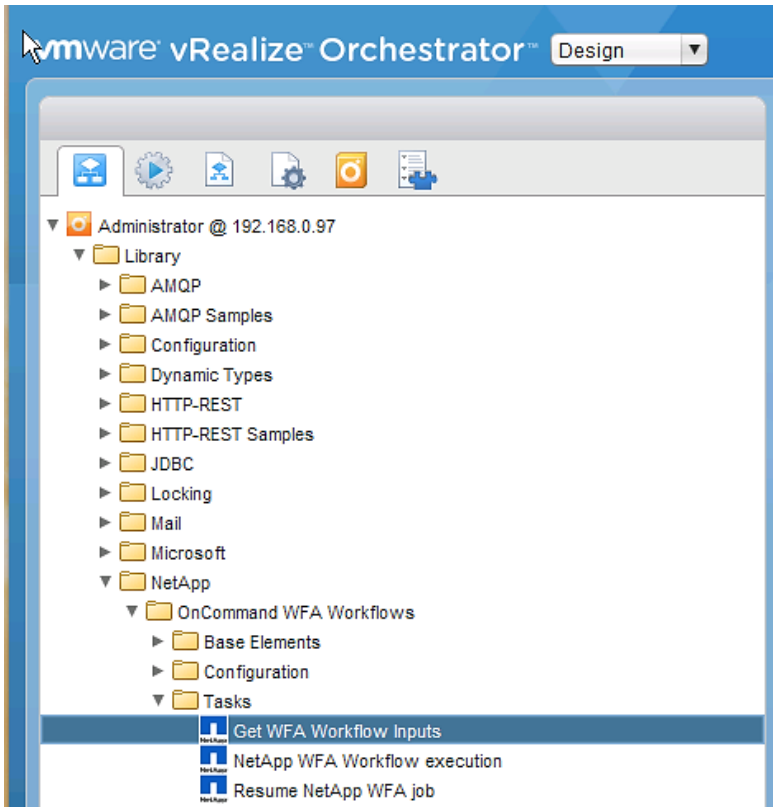
4 Integrate vRO with OnCommand WFA

The following sections describe how to create a vRO workflow to call a WFA workflow.

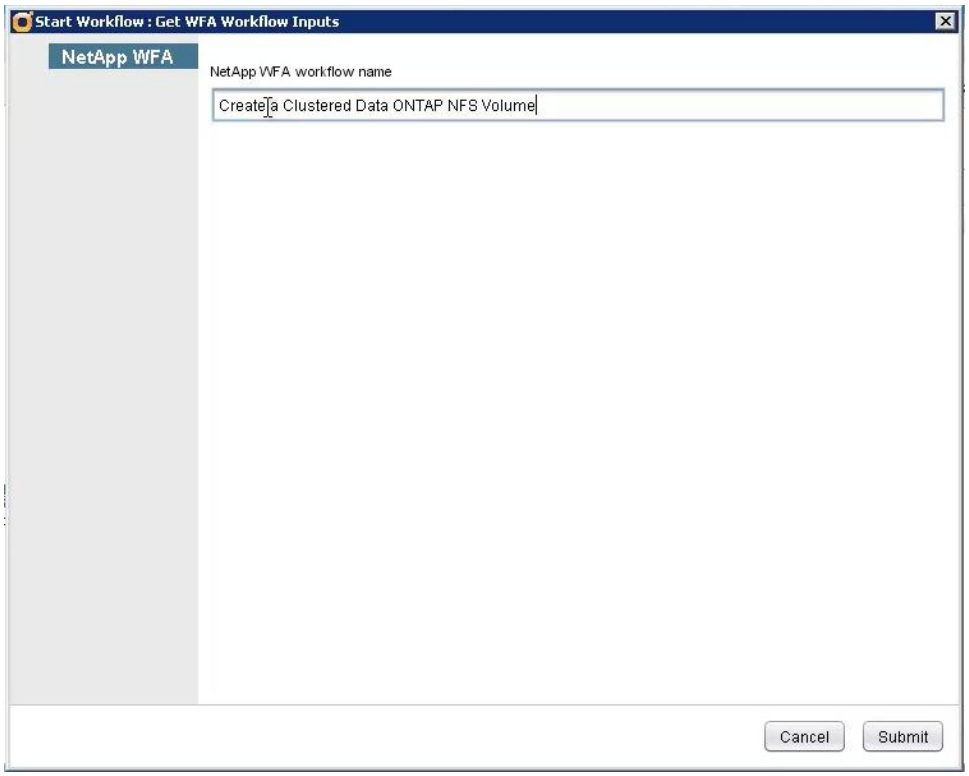
4.1 Acquire WFA User Inputs

To acquire WFA user inputs, complete the following steps:

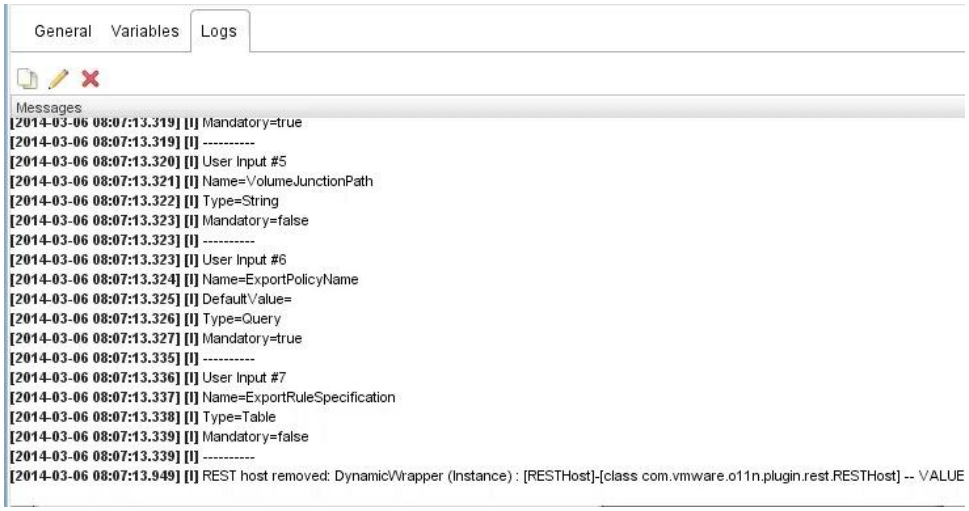
1. Start the vRO client and click the Workflows tab. Navigate to Administrator > Library > NetApp > Tasks. Right-click Get WFA Workflow Inputs and select Start Workflow.



2. When the workflow starts, enter the name of the WFA workflow (exactly as it appears in WFA) in the NetApp WFA Workflow Name field. In this example, Create a Clustered Data ONTAP NFS Volume is used.



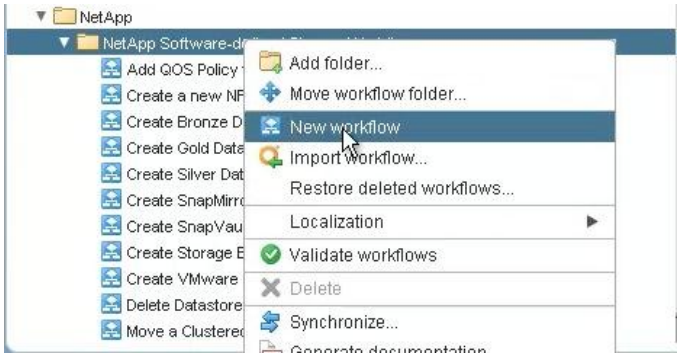
The workflow gets the user inputs required for the vRO workflow to call the WFA workflow.



4.2 Create New Workflow

To create a new workflow, complete the following steps:

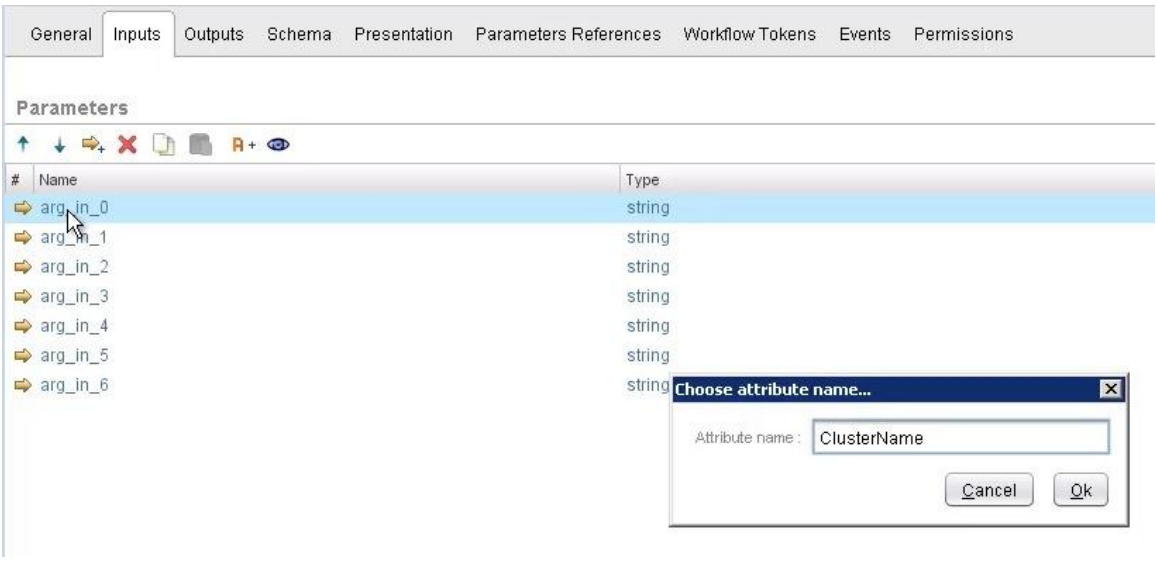
1. Right-click the folder in which the workflows will be stored and select New Workflow.



2. Enter the name of the workflow and click OK. For simplicity, NetApp recommends that you name the workflow the same as the WFA workflow.

3. After the new workflow is created, an Edit Workflow page is displayed. Click the Inputs tab and click Add Inputs (the button featuring the gold right-direction arrow). Create as many inputs as are shown after running the Get WFA Workflow Inputs workflow in vRO.

4. Add all of the inputs required. In the example workflow, seven inputs are required.

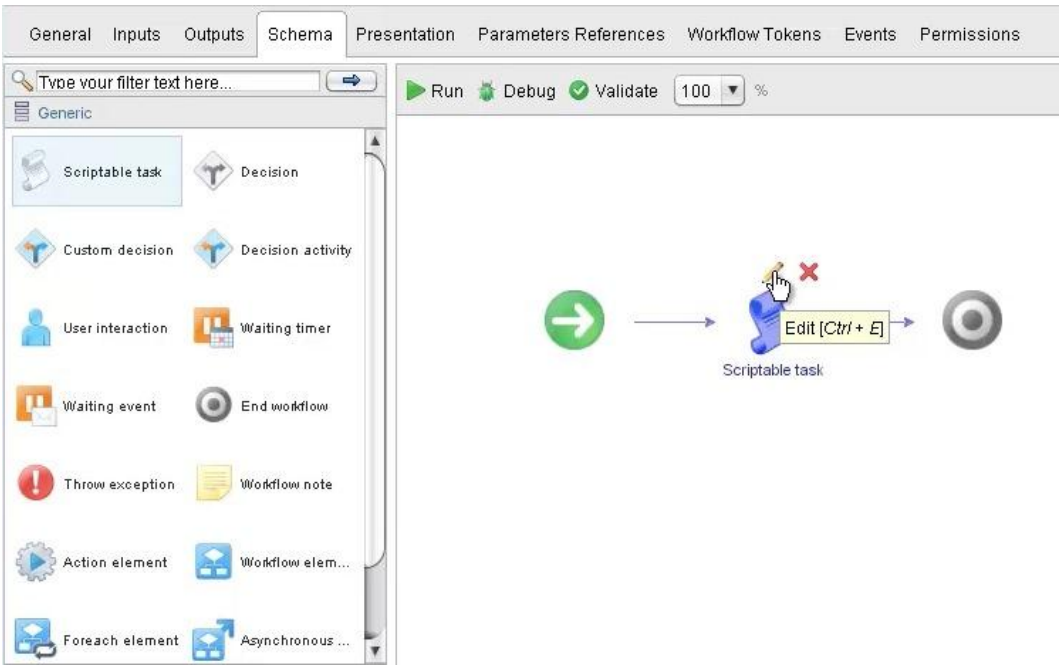


5. Rename each of the inputs added in step 4.

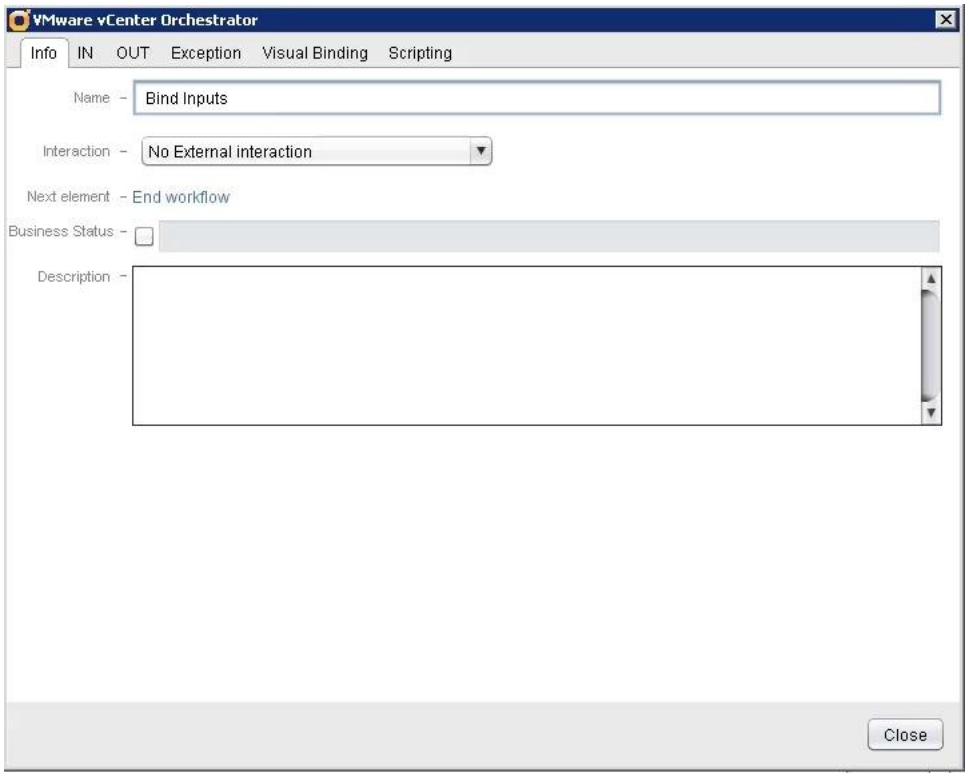
4.3 Create Scriptable Task for vRO Workflow

To create a scriptable task for the vRO workflows, complete the following steps:

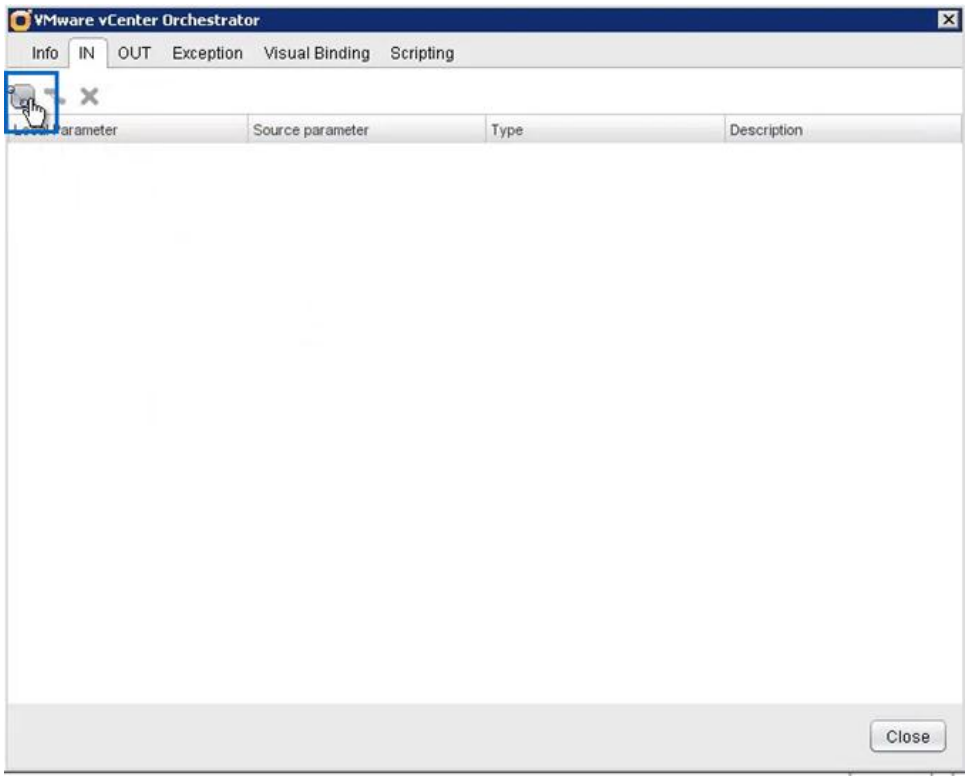
1. Click the Schema tab, select Scriptable Task from the left pane, and drag it to the right pane. In the right pane, point to the Scriptable Task and click the pencil icon.



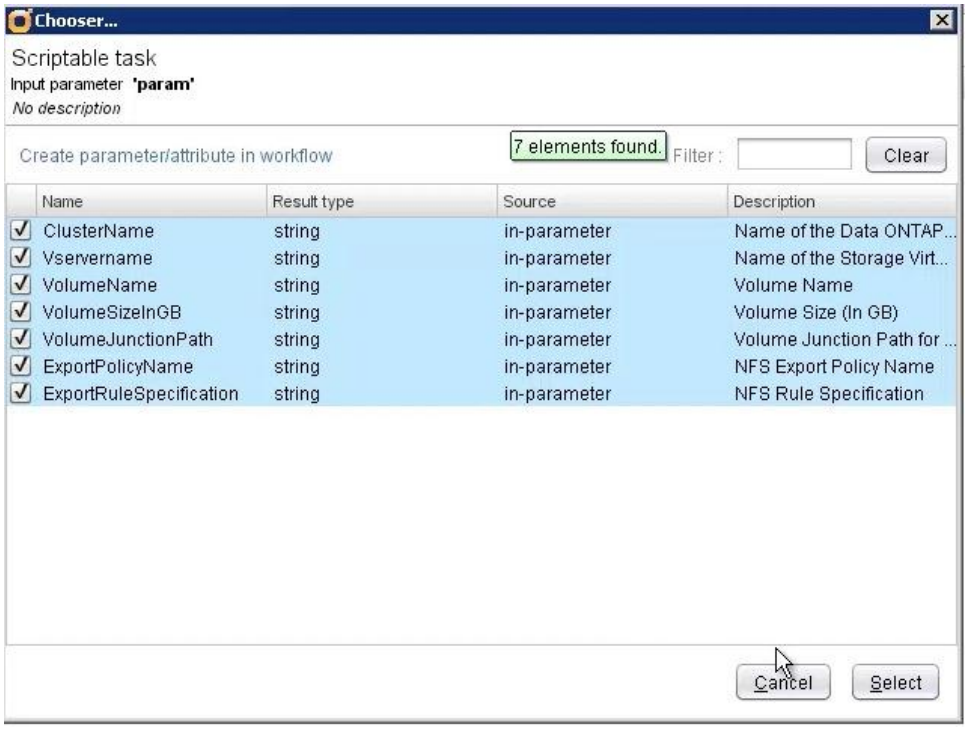
The following page is displayed:



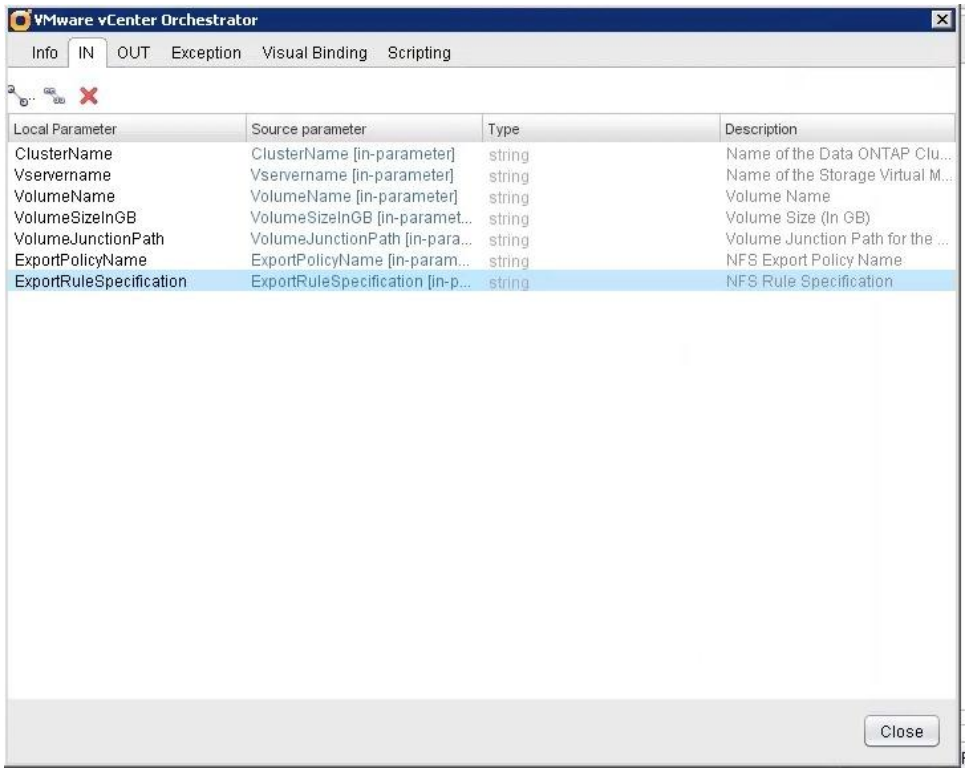
2. Click the In tab and click Bind to Workflow Parameter/Attribute.



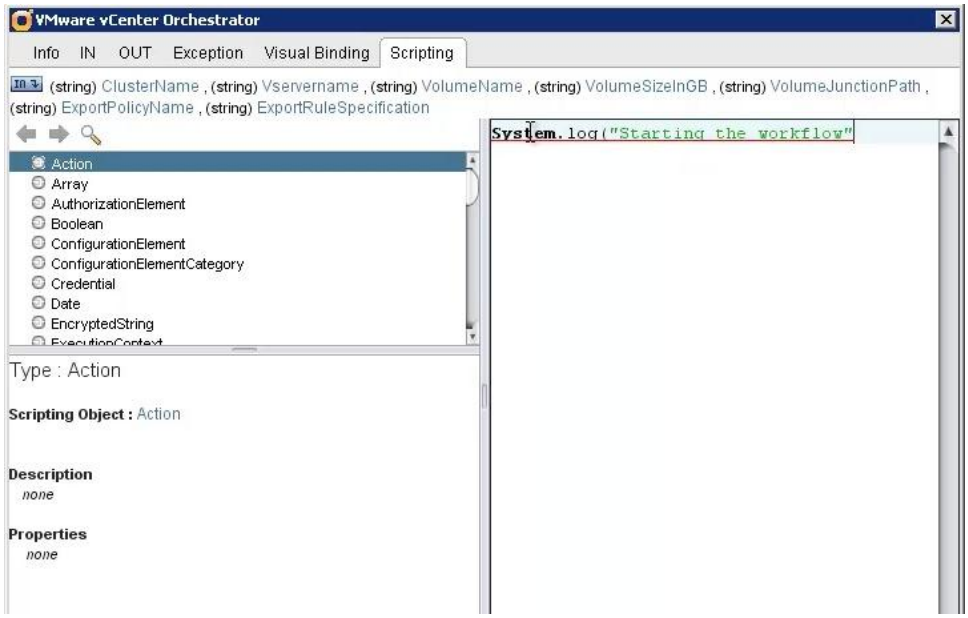
3. Select the checkbox for each parameter on this page and click Select.



4. From the In tab, verify that the local parameters are set.



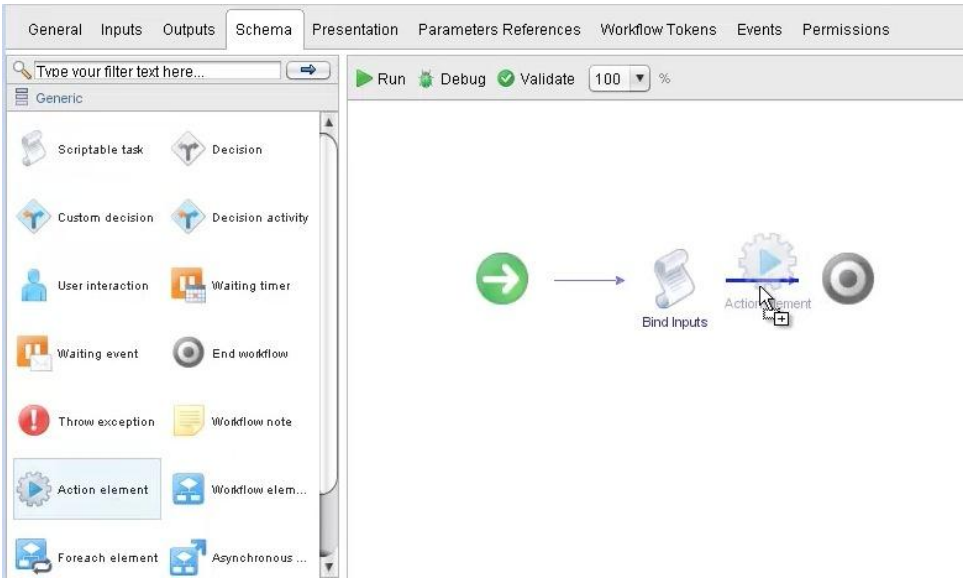
5. Click the Scripting tab and enter `System.log("Starting the workflow")` in the right pane. Click Close.



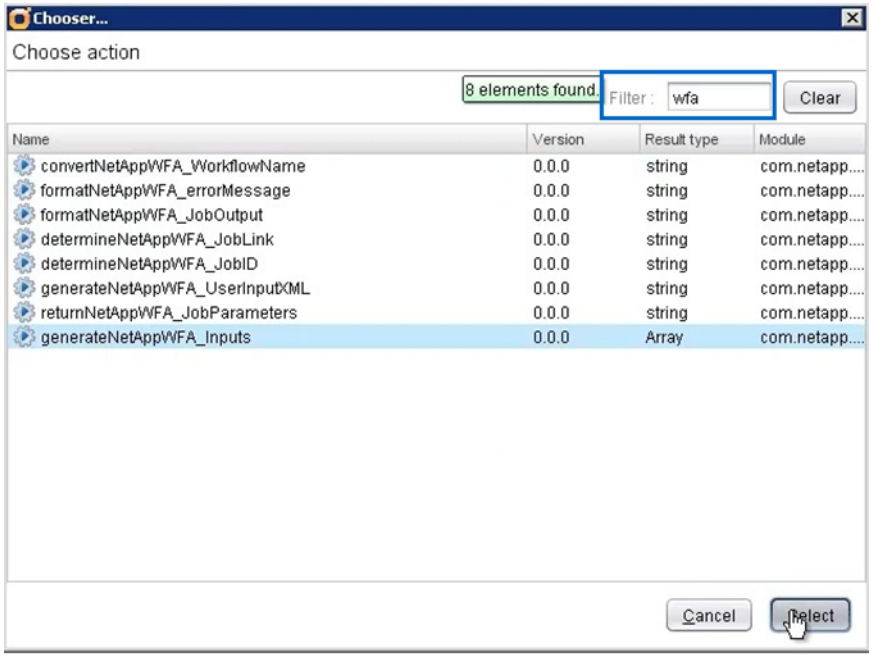
4.4 Create GenerateWFA_Inputs Action Element

To create a generateNetAppWFA_Inputs action element, complete the following steps:

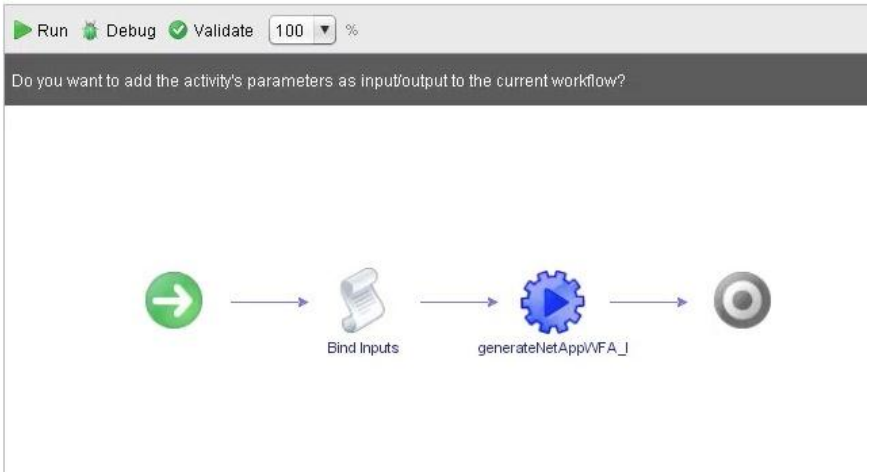
1. From the Schema tab, select Action Element in the left pane and drag it to the right of the Bind Inputs icon to open the Choose Action page.



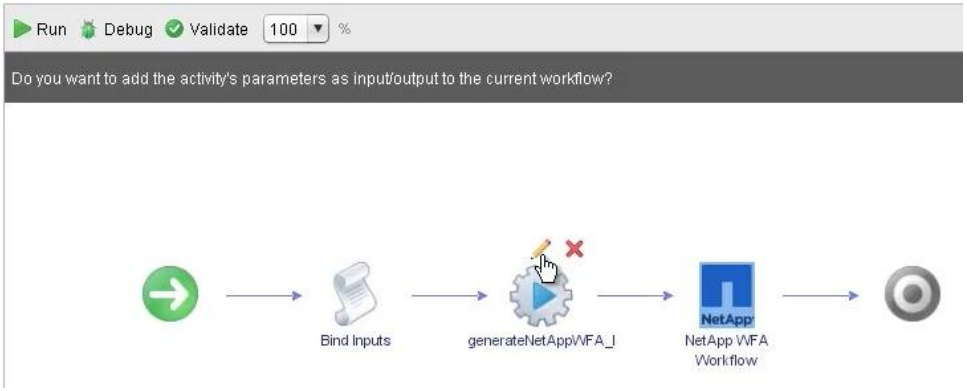
2. On the Choose Action page, enter `wfa` in the Filter field. From the list of actions, click generateNetAppWFA_Inputs and click Select.



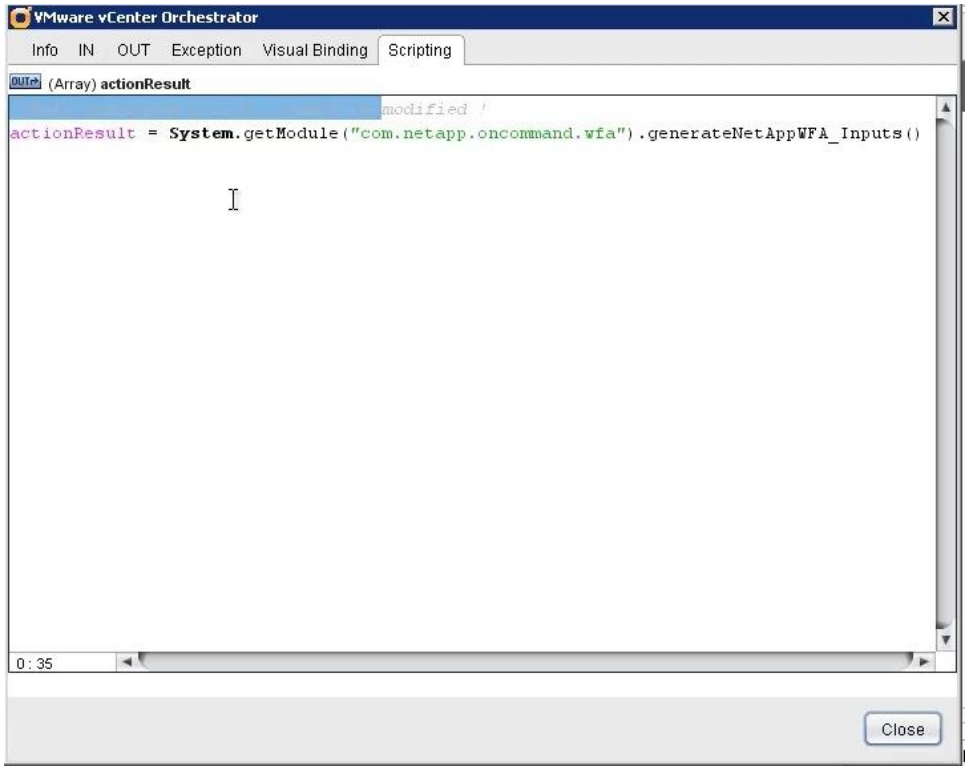
3. On the Schema tab, verify that the generateNetAppWFA_Inputs action was created.



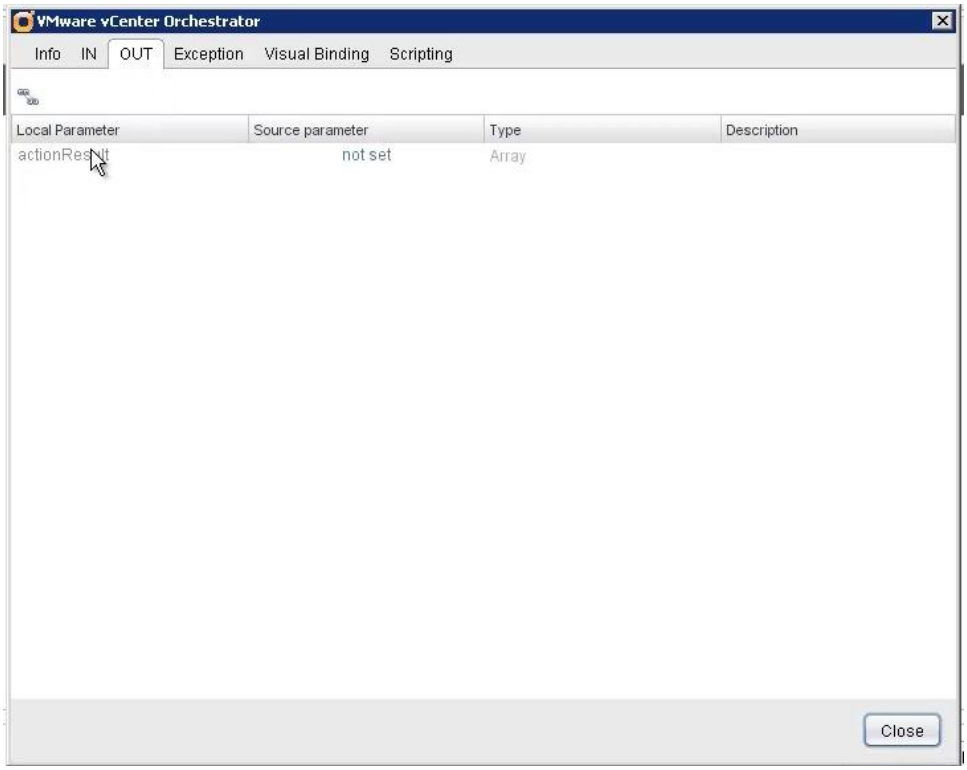
4. From the Schema tab, point to generateNetAppWFA_Inputs and click the pencil icon.



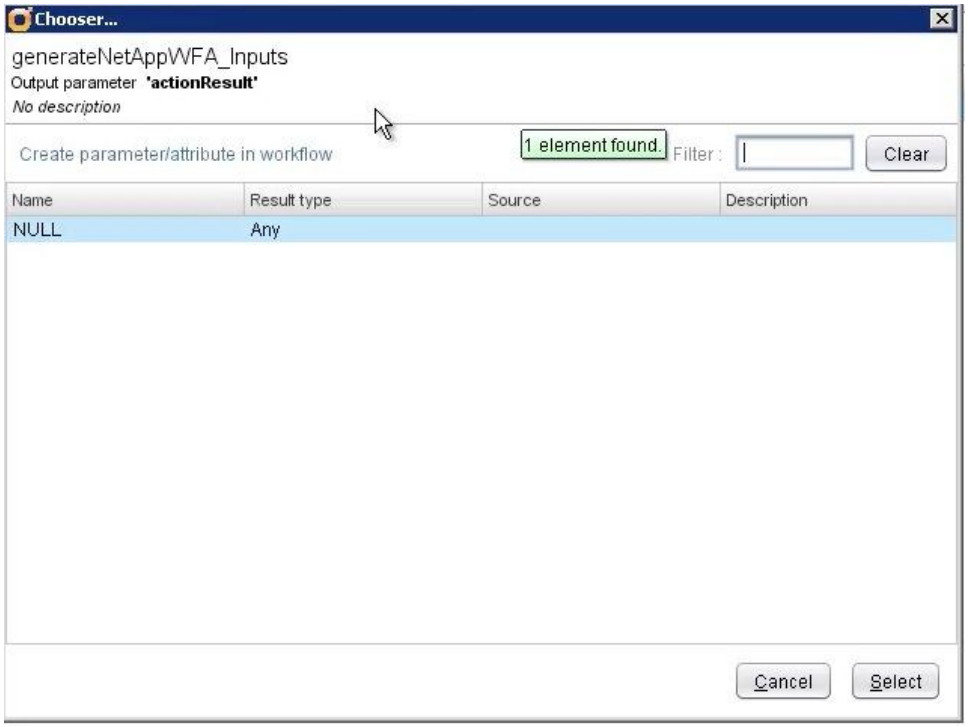
5. Click the Scripting tab to review the page.



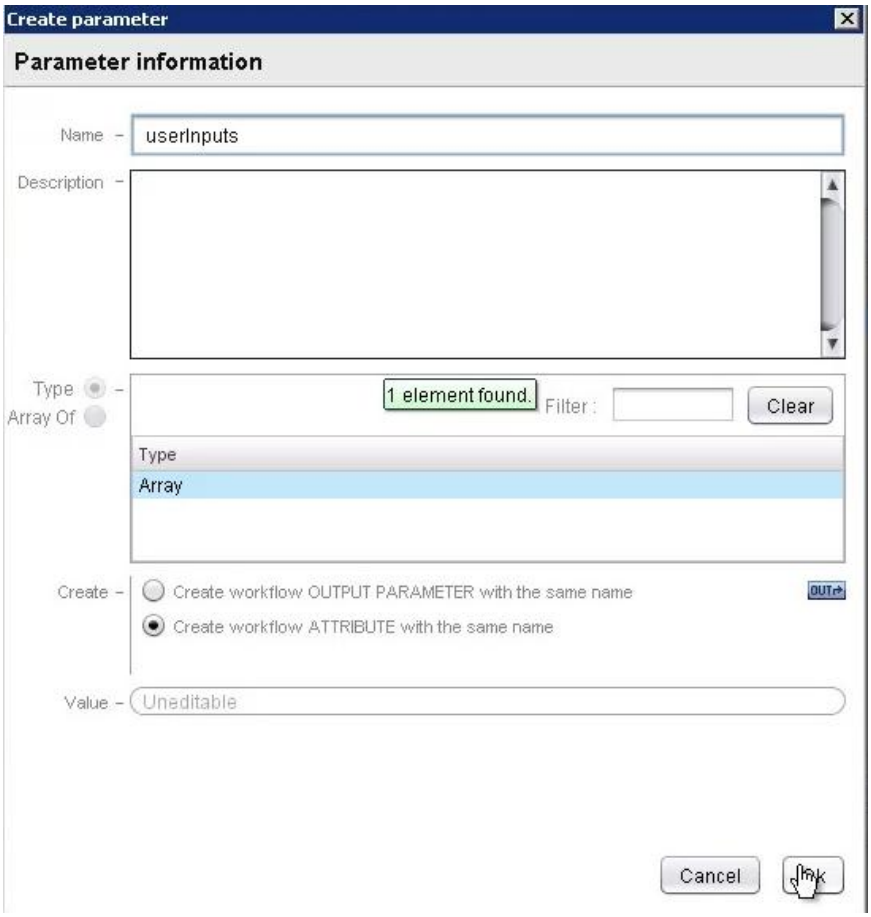
6. Click the Out tab. Next to ActionResult, click Not Set in the Source Parameter column.



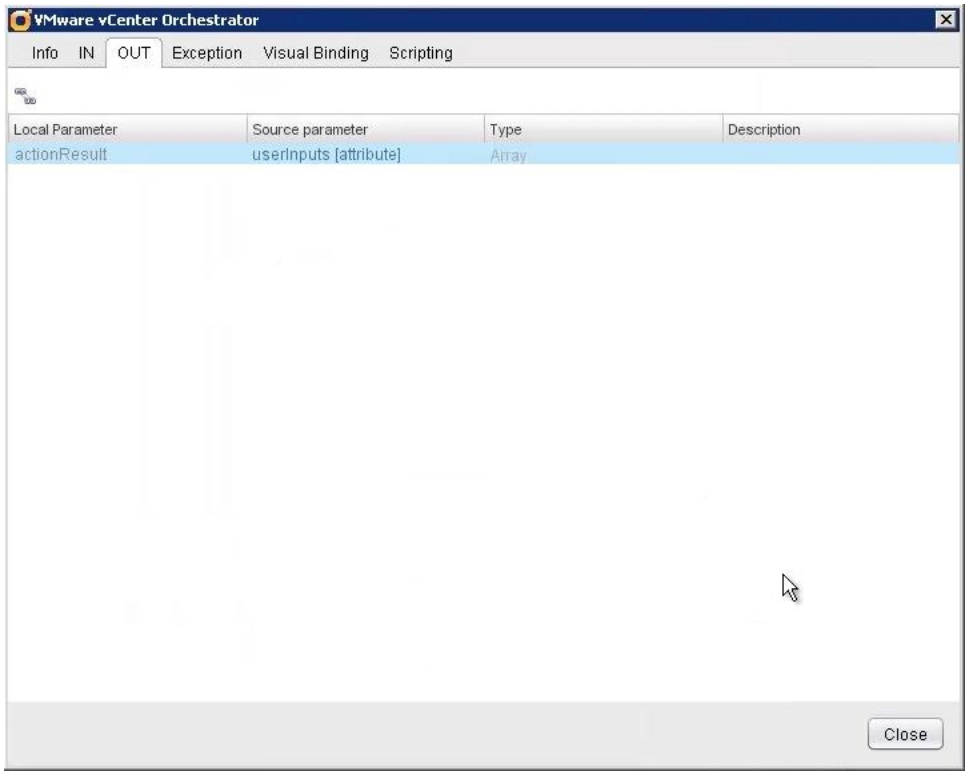
7. On the generateNetAppWFA_Inputs page, click Create Parameter/Attribute in Workflow.



8. On the Parameter information page, change the name from `actionResult` to `userInputs` and click OK.



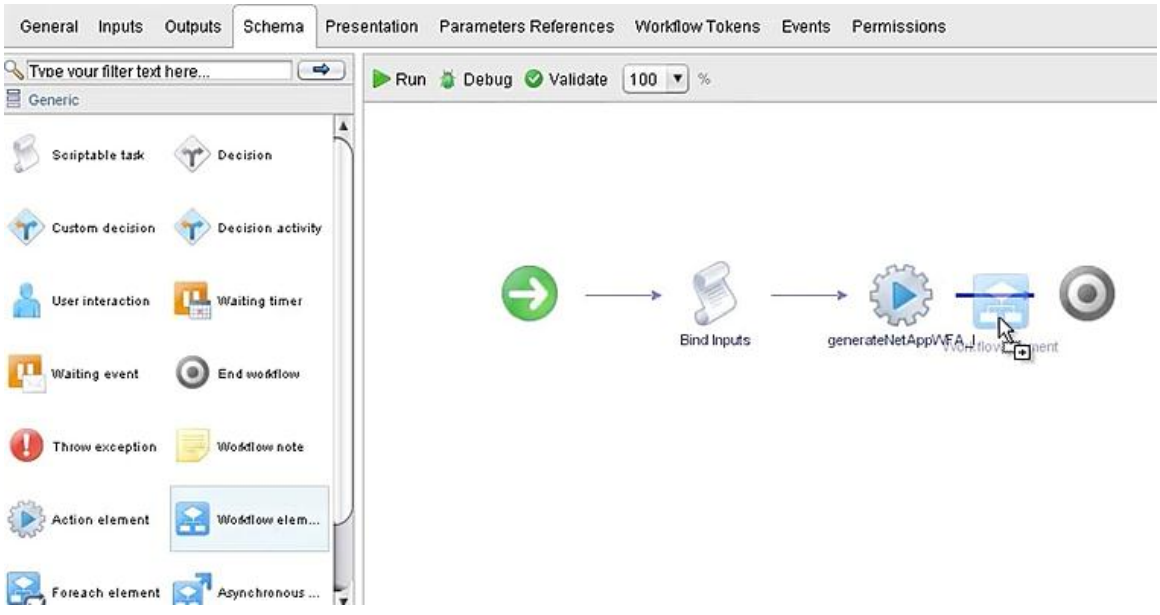
9. From the Out tab, click Close.



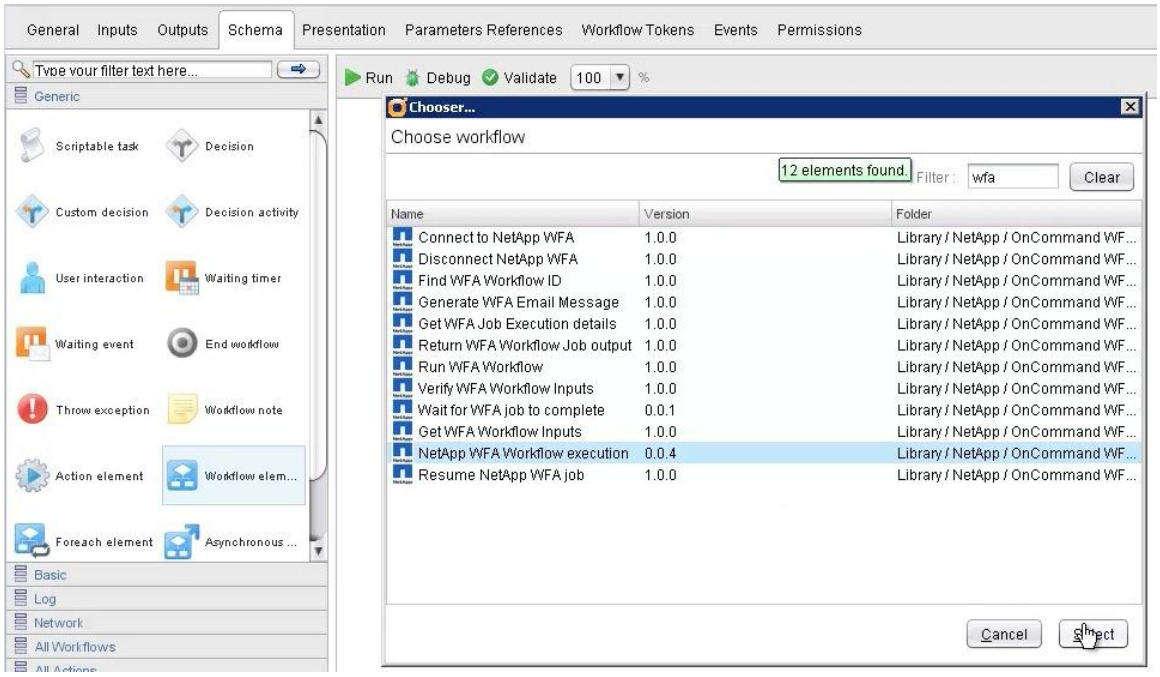
4.5 Create NetApp WFA Workflow Element

To create a NetApp WFA workflow element, complete the following steps:

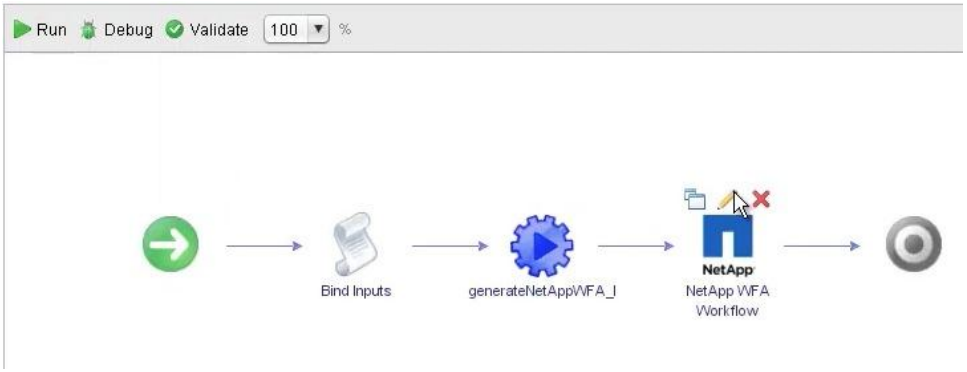
1. From the left pane of the Schema tab, select Workflow Elements and drag it to the right of the generateNetAppWFA_Inputs action icon.



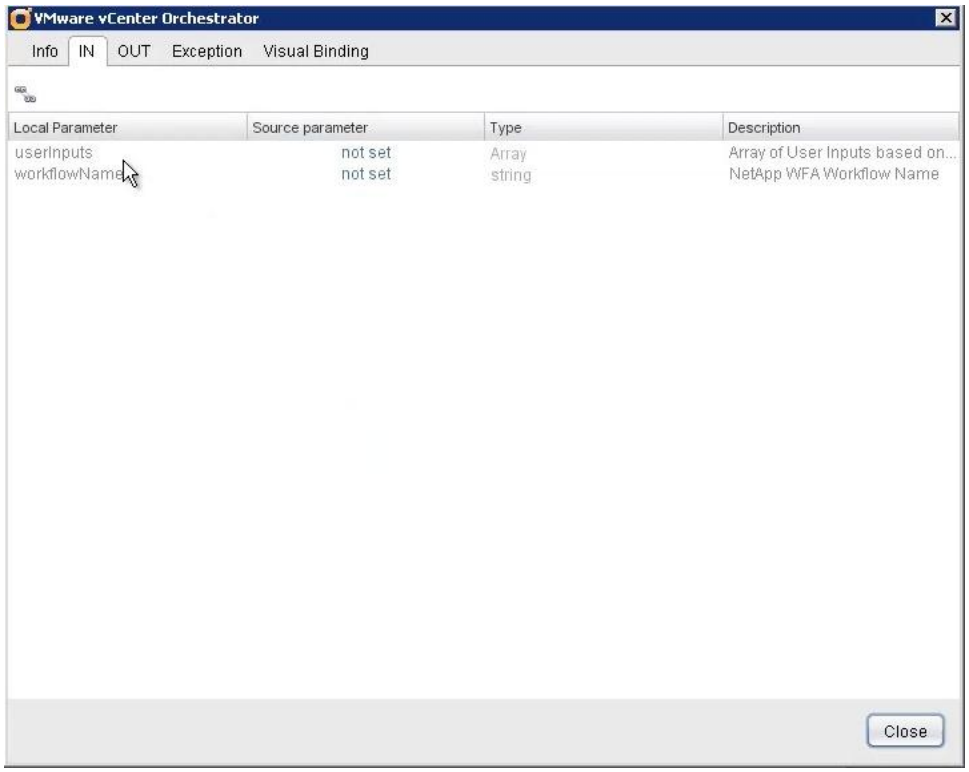
2. On the Choose Workflow page, click NetApp WFA Workflow Execution and click Select.



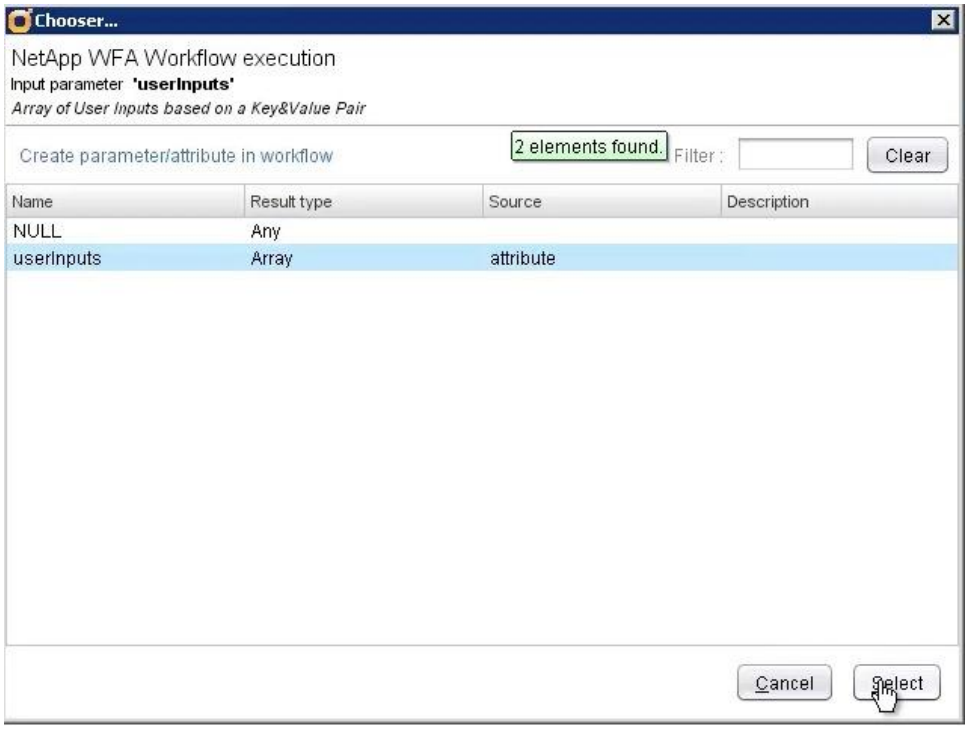
3. From the Schema tab, point to NetApp WFA Workflow and click the pencil icon.



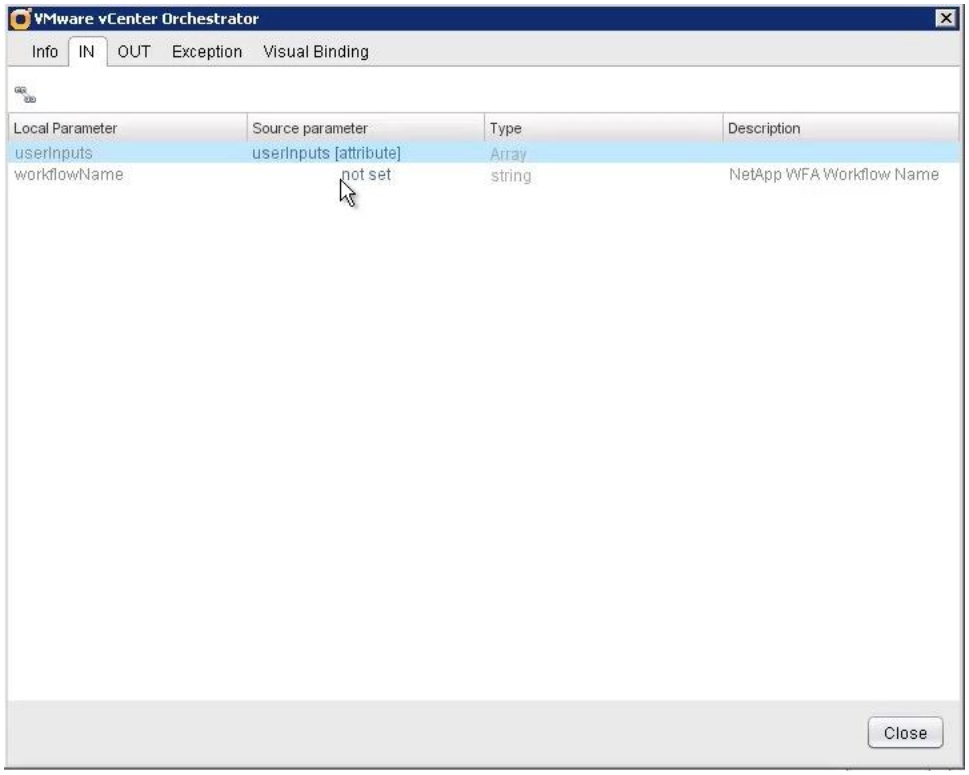
4. Click the In tab. Next to UserInputs, click Not Set in the Source Parameter column.



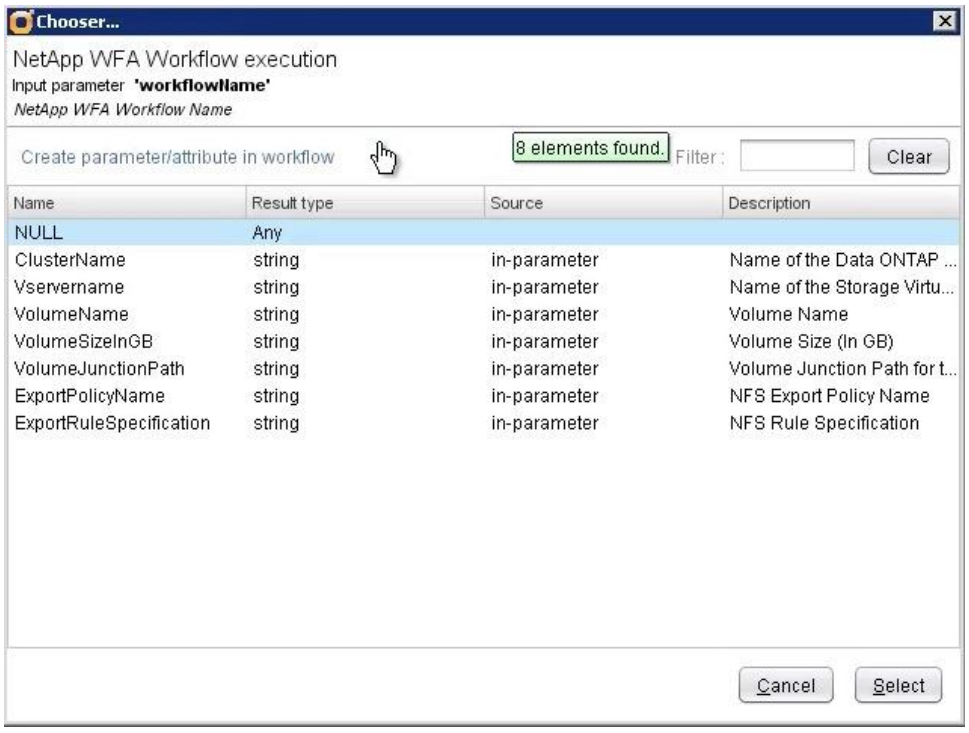
5. Click UserInputs and then click Select.



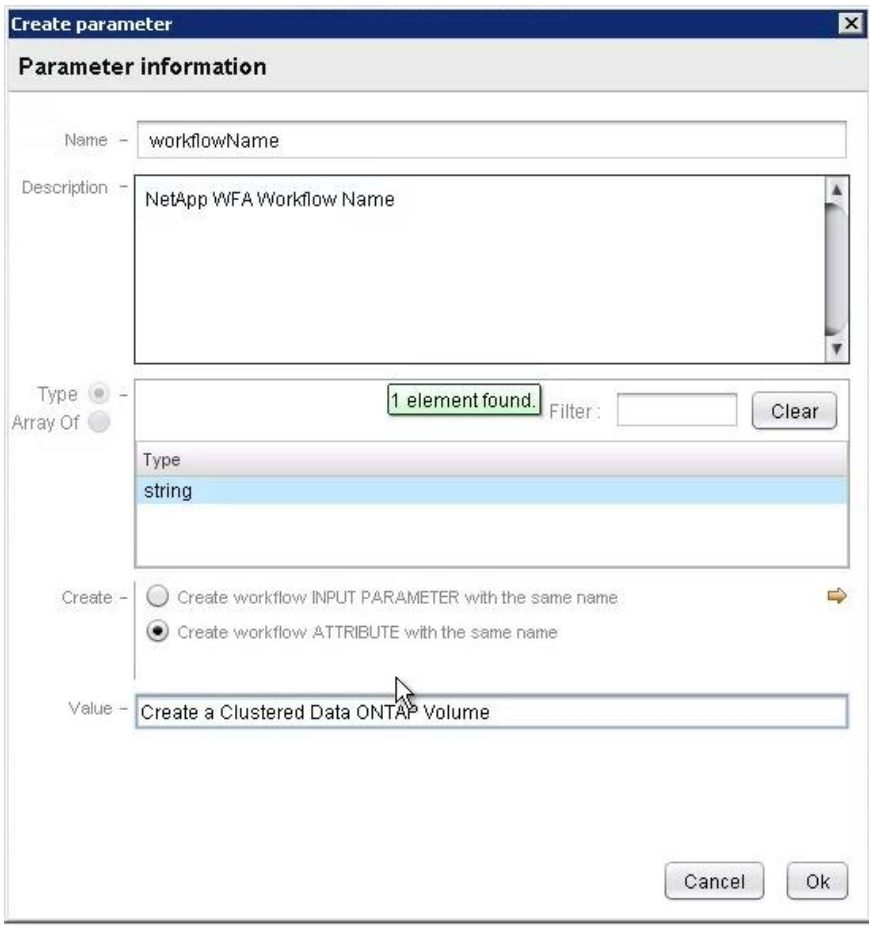
6. Next to WorkflowName, click Not Set in the Source Parameter column.



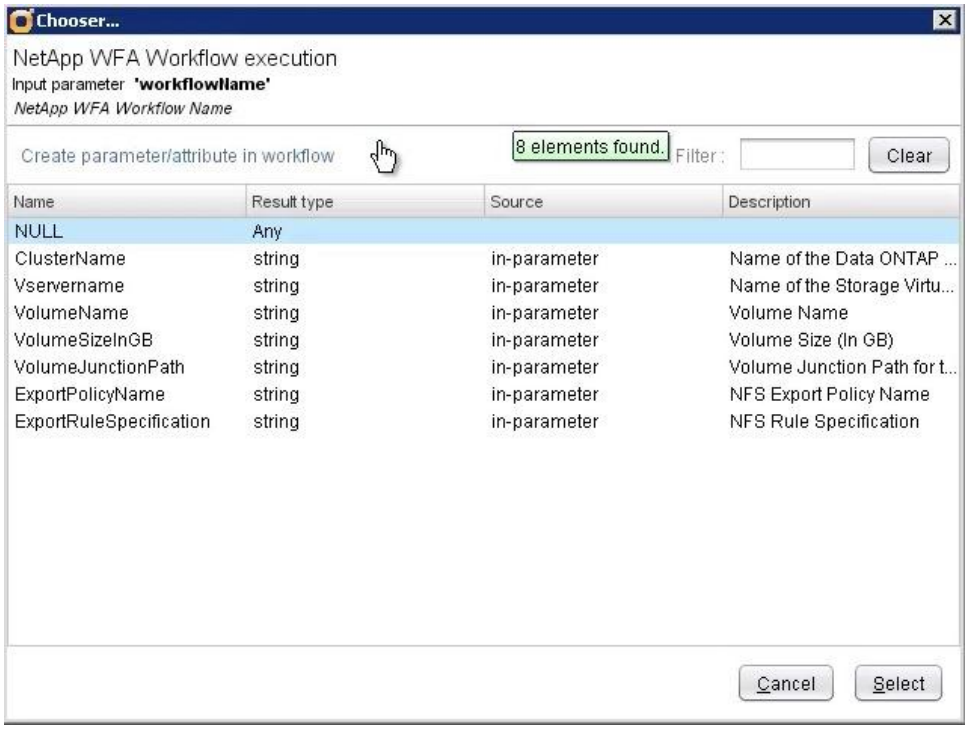
7. Click Create Parameter/Attribute in Workflow.



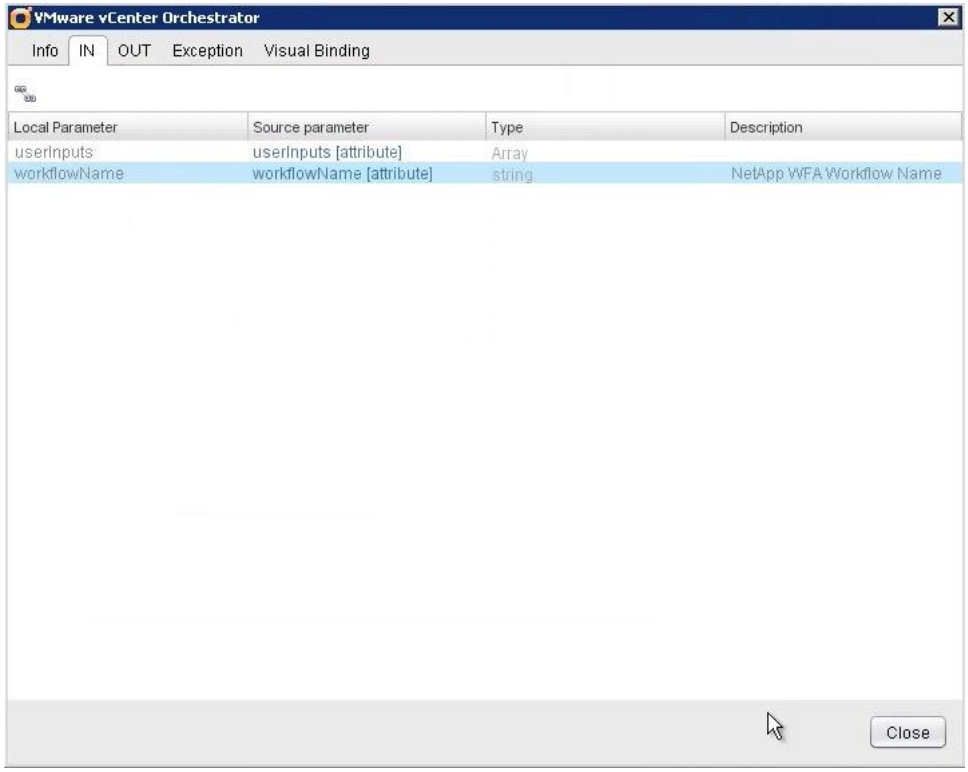
8. On the Parameter Information page, enter the workflow name in the Value field. In this example, Create a Clustered Data ONTAP Volume is used. Click OK.



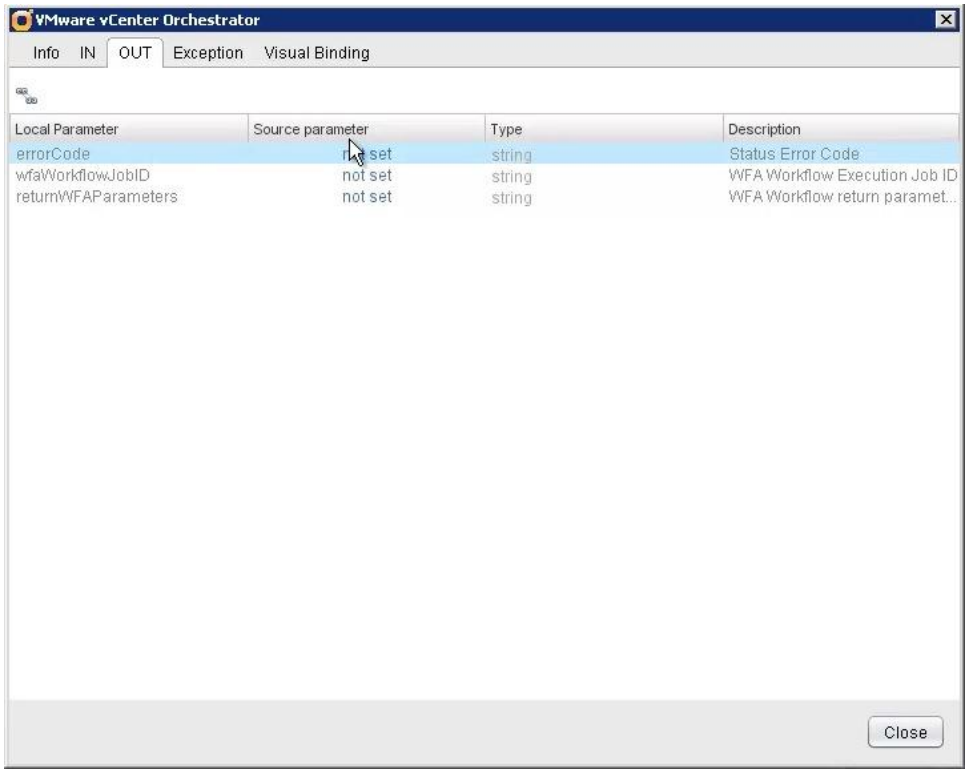
9. On the NetApp WFA Workflow Execution page, click Select.



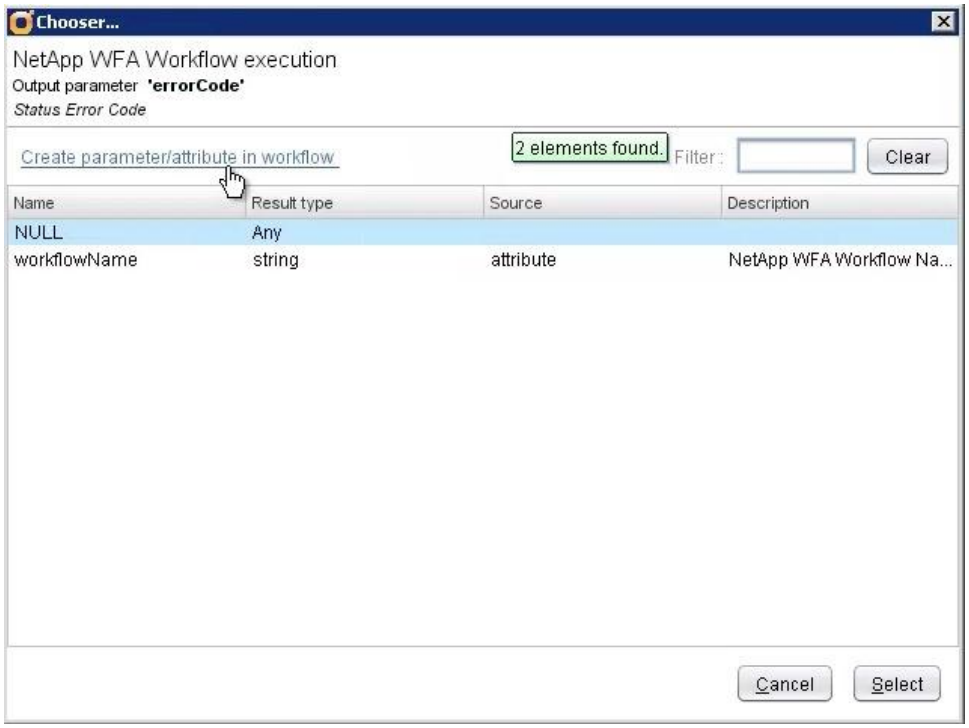
10. From the In tab, verify that local and source parameters similar to those shown in the example are listed.



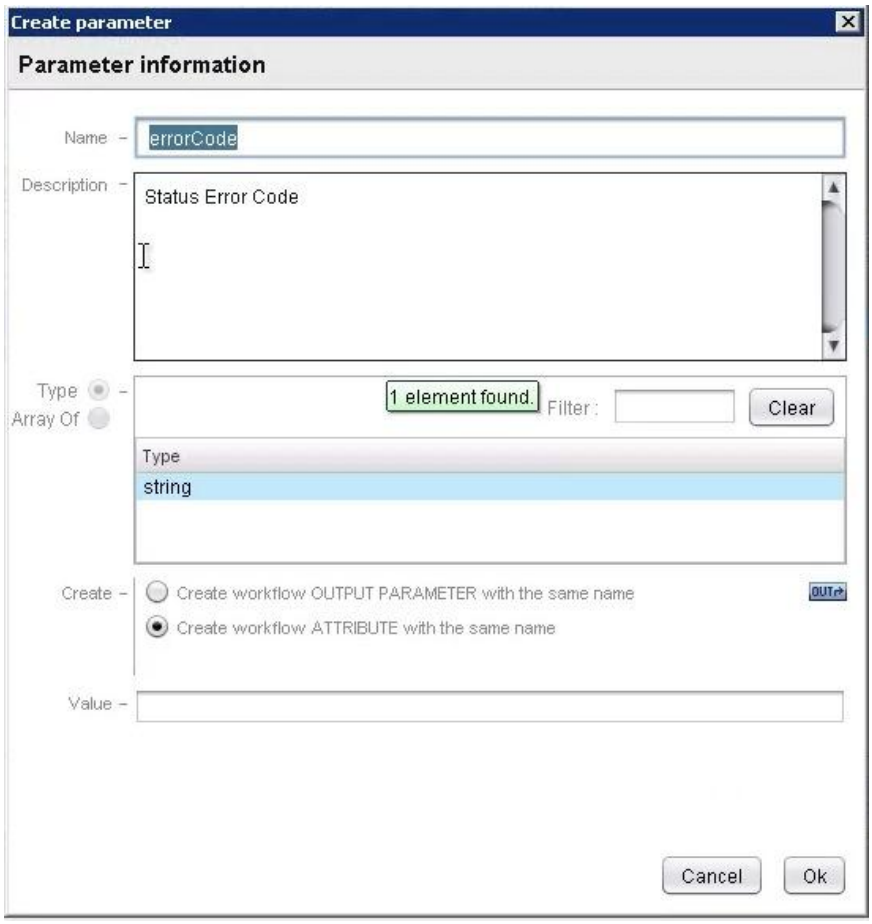
11. Click the Out tab. Next to ErrorCode, click Not Set in the Source Parameter column.



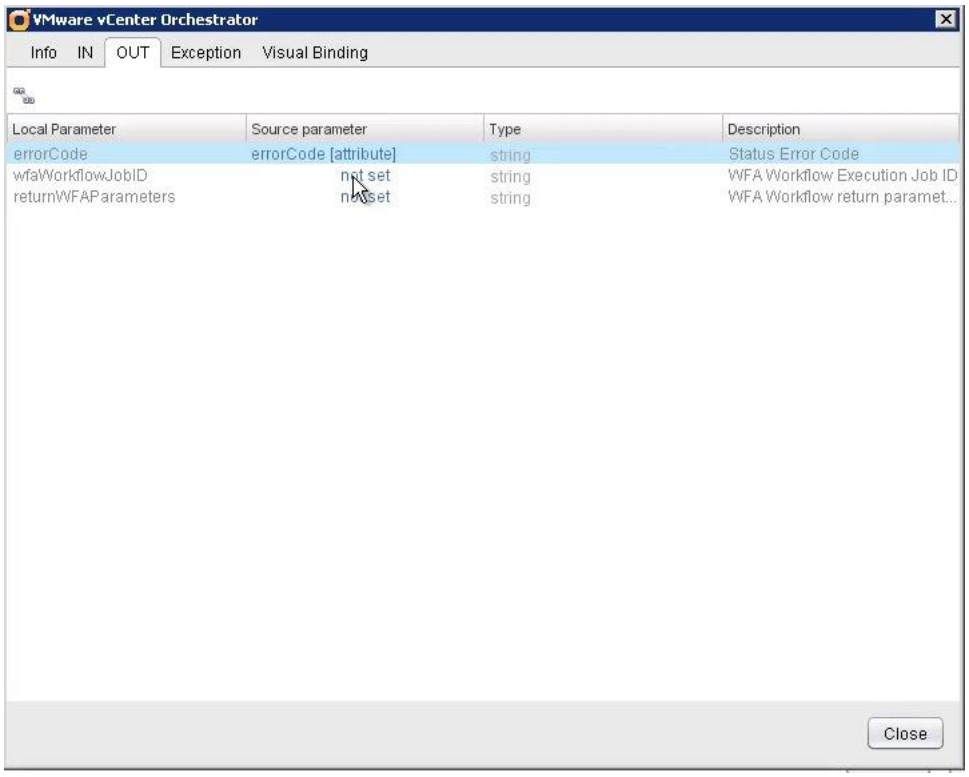
12. Click Create Parameter/Attribute in Workflow.



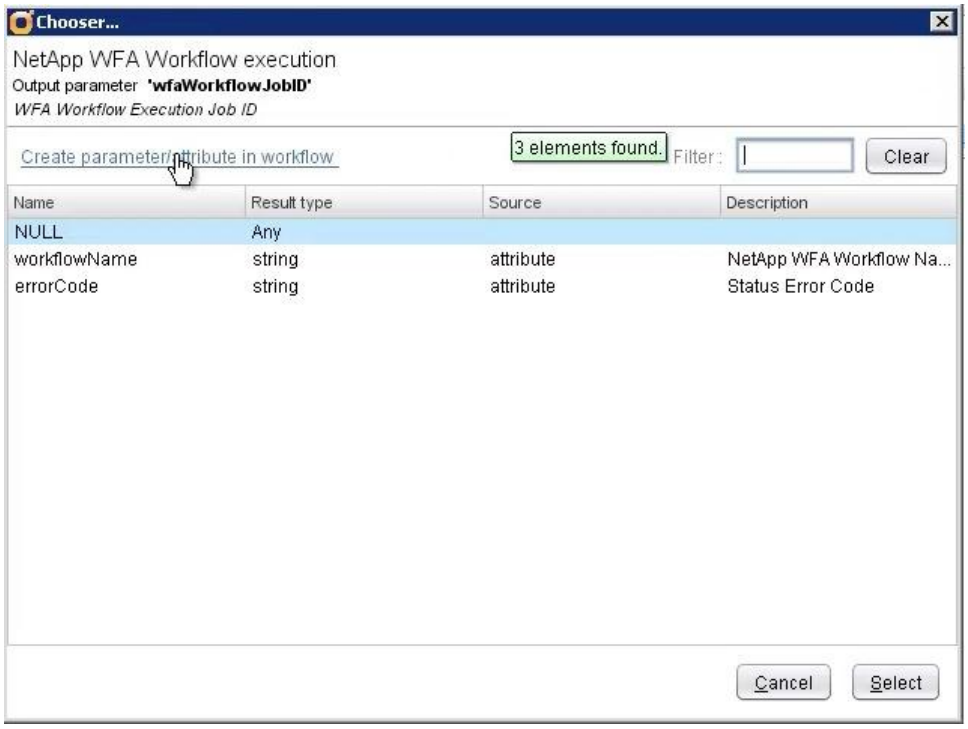
13. Verify that `errorCode` is listed in the Name field and click OK.



14. Next to WfaWorkflowJobID, click Not Set in the Source Parameter column.

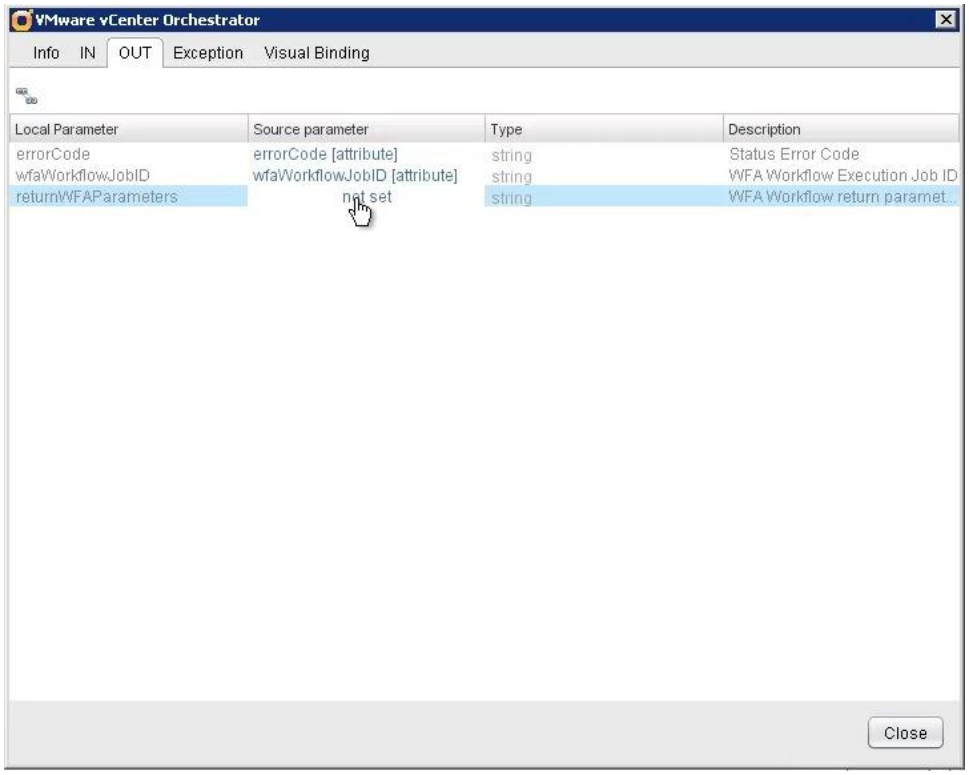


15. Click Create Parameter/Attribute in Workflow.

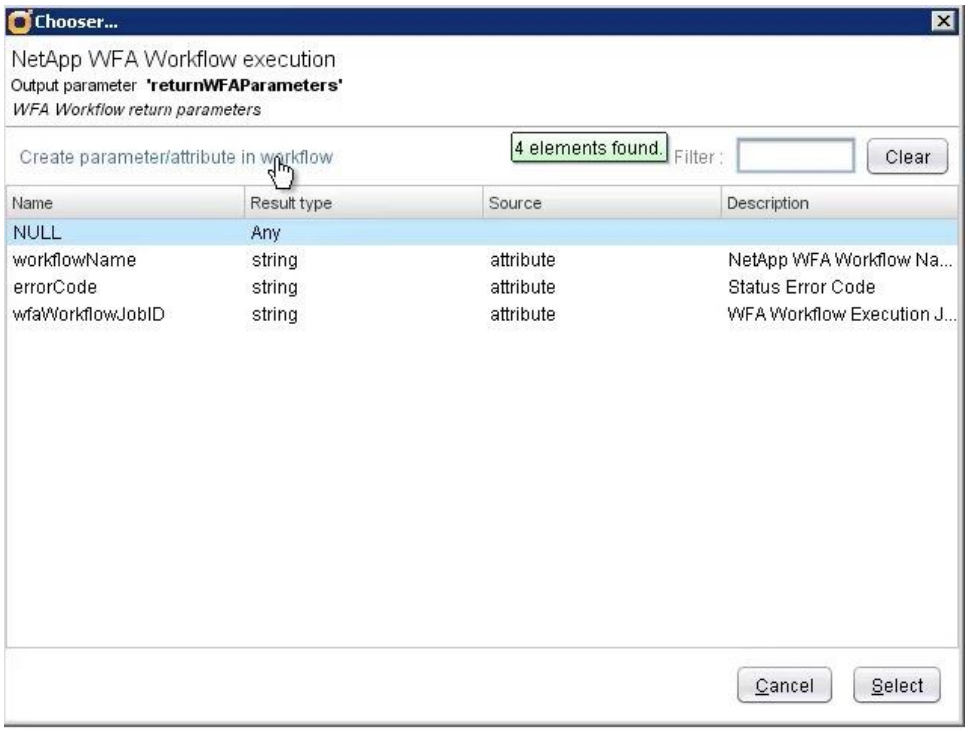


16. Verify that `wfaWorkflowJobID` is listed in the Name field and click OK.

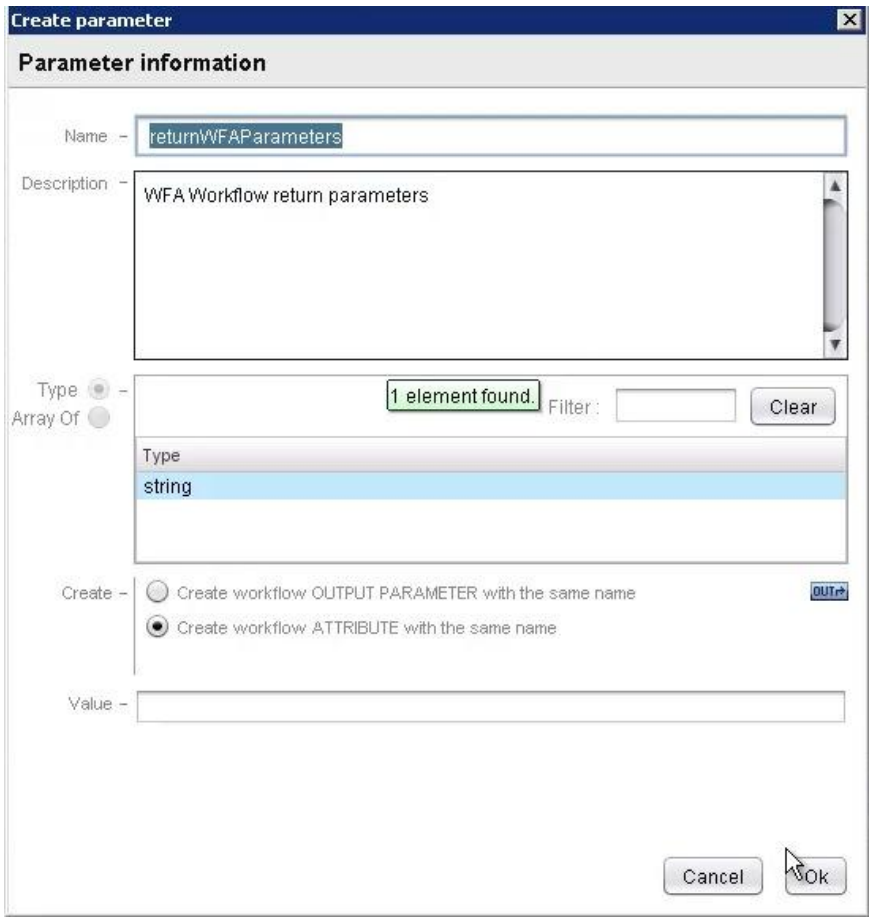
17. Next to ReturnWFAParameters, click Not Set in the Source Parameter column.



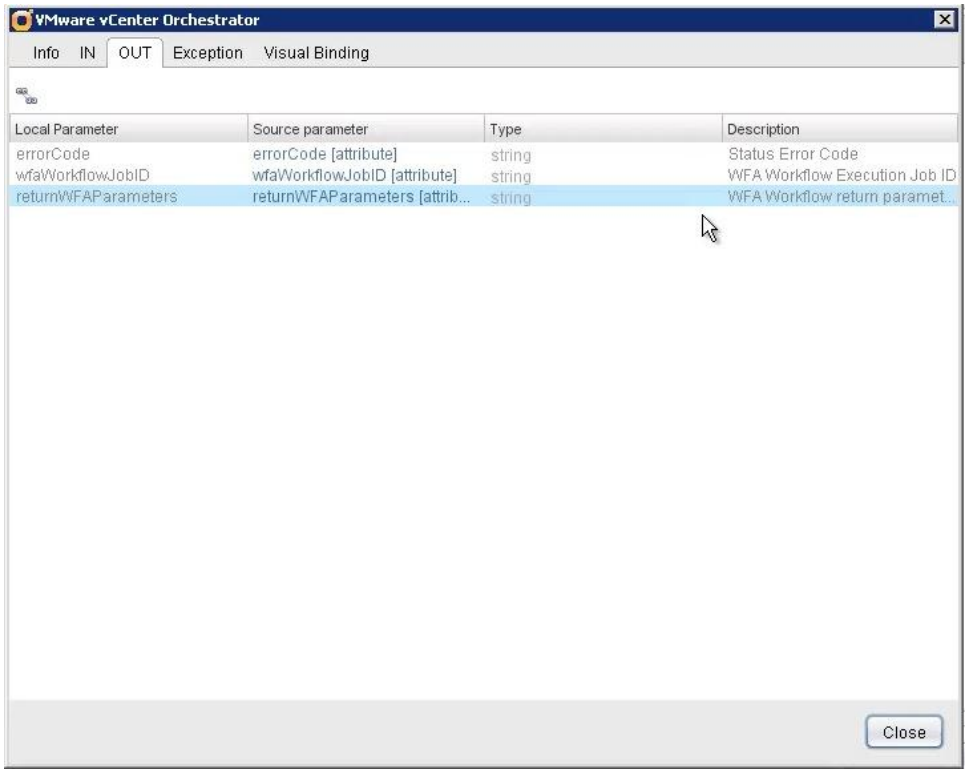
18. Click Create Parameter/Attribute in Workflow.



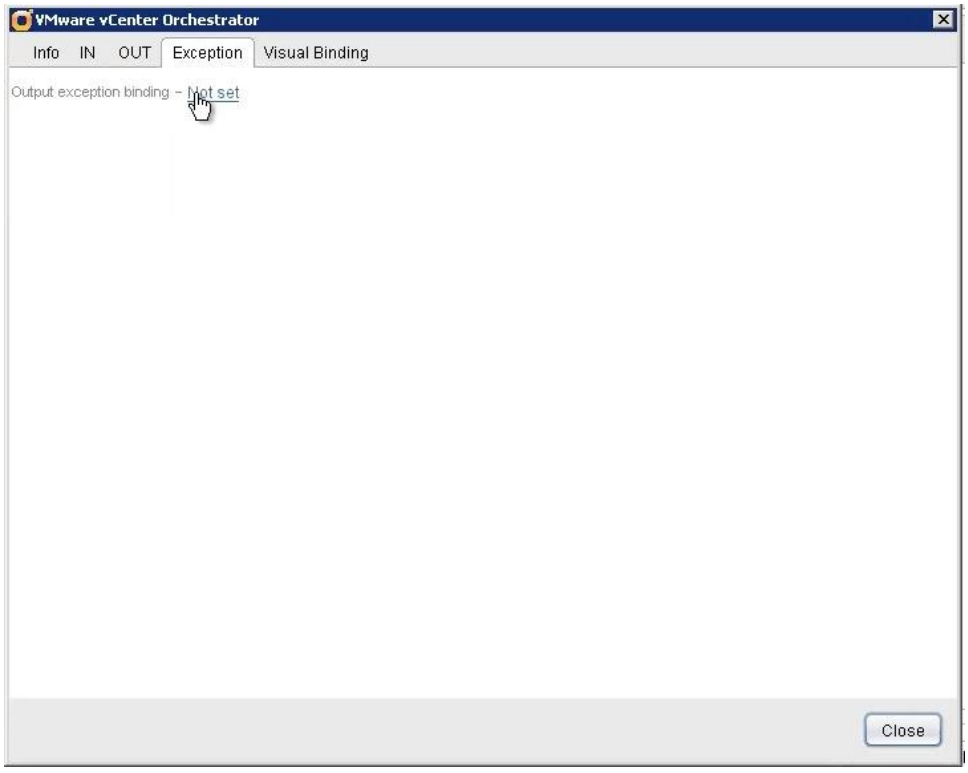
19. Verify that `returnWFAParameters` is listed in the Name field and click OK.



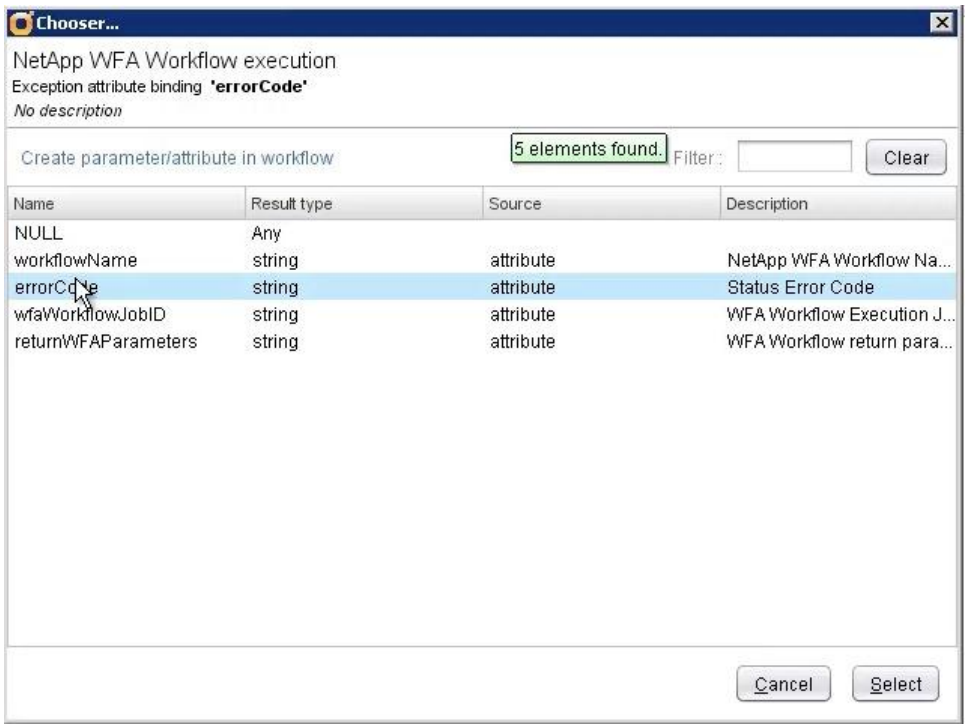
20. From the Out tab, verify that local and source parameters similar to those shown in the example are listed and click the Exception tab.



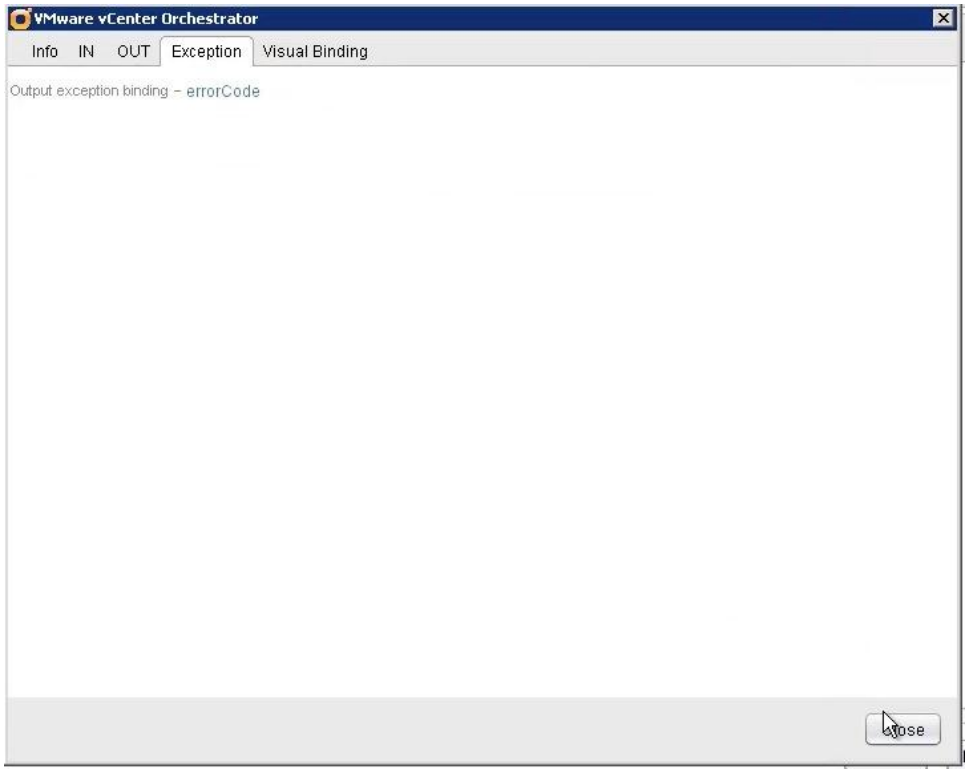
21. From the Exception tab, click Not Set.



22. Click ErrorCode and click Select.



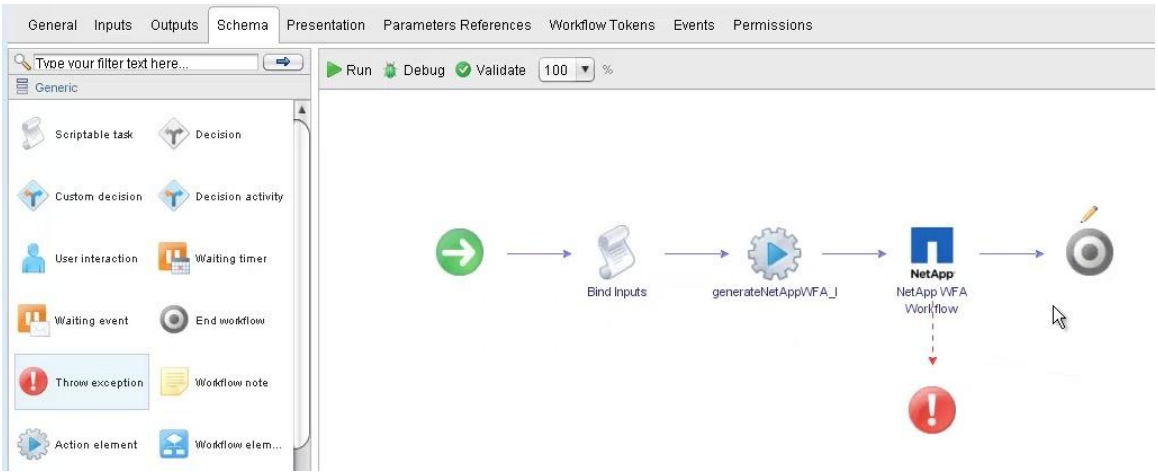
23. Verify that the information on the Exception tab is similar to the example and click Close.



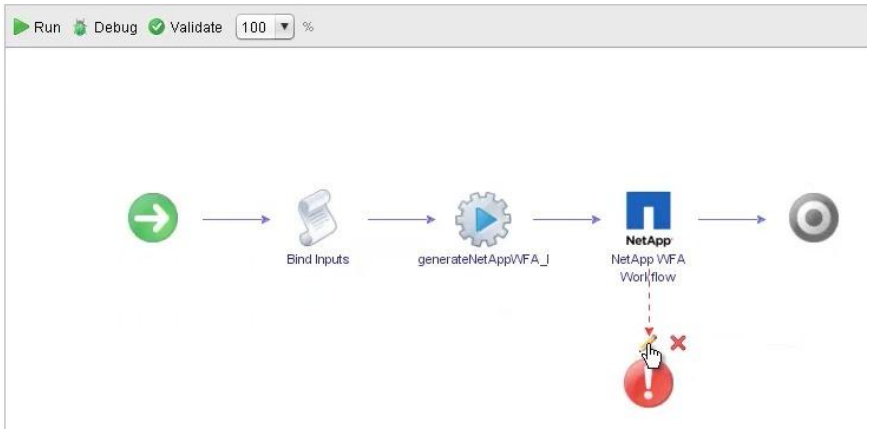
4.6 Create Throw Exception for Workflow

To create the throw exception for the workflow, complete the following steps:

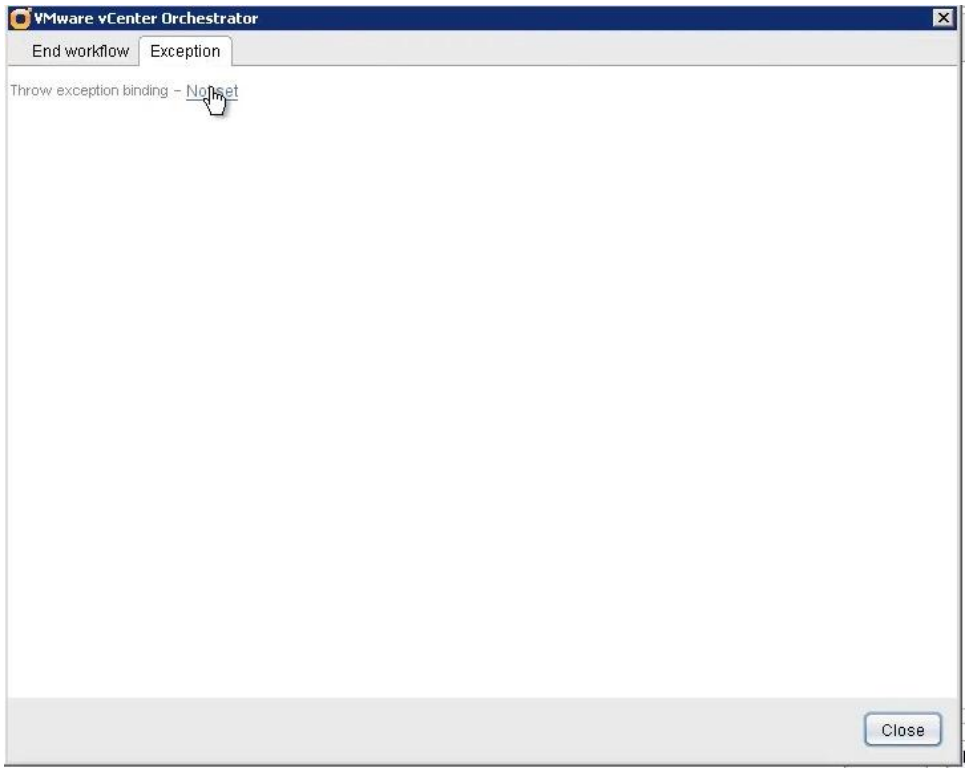
1. From the Schema tab, select Throw Exception and drag it into the right pane under NetApp WFA Workflow.



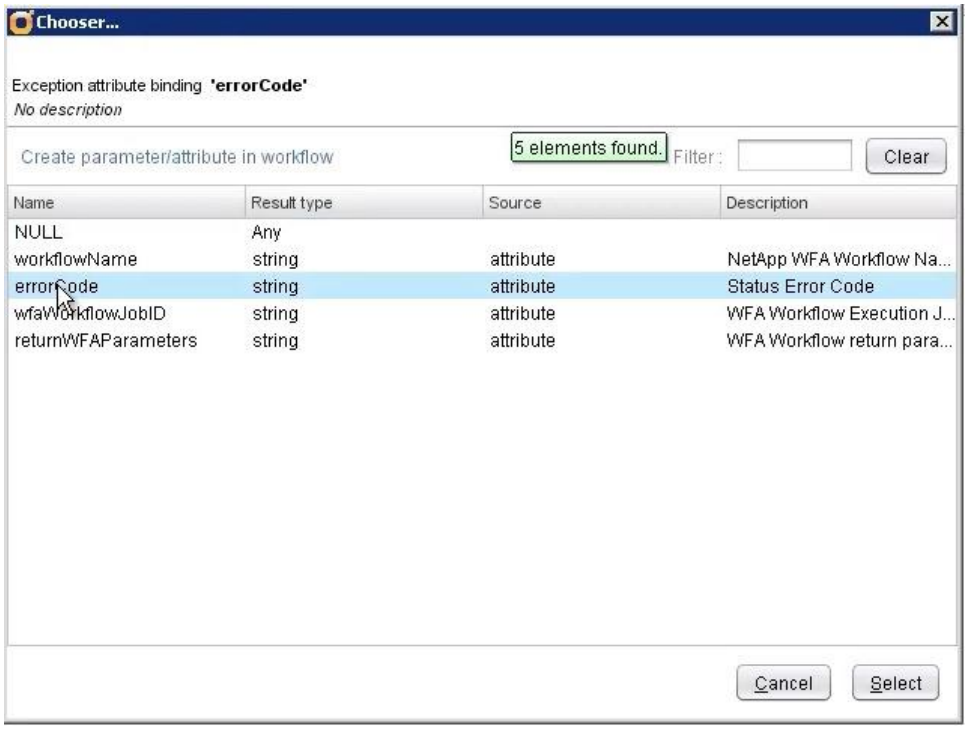
2. Point to Throw Exception and click the pencil icon.



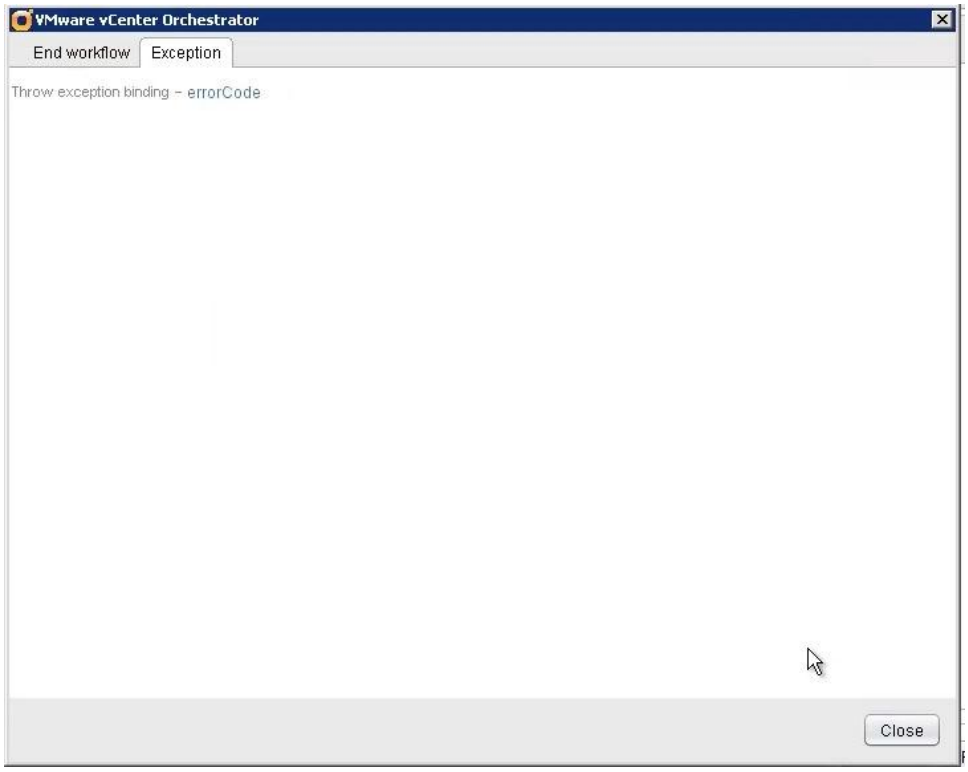
3. From the Exception tab, click Not Set.



4. Click ErrorCode and click Select.



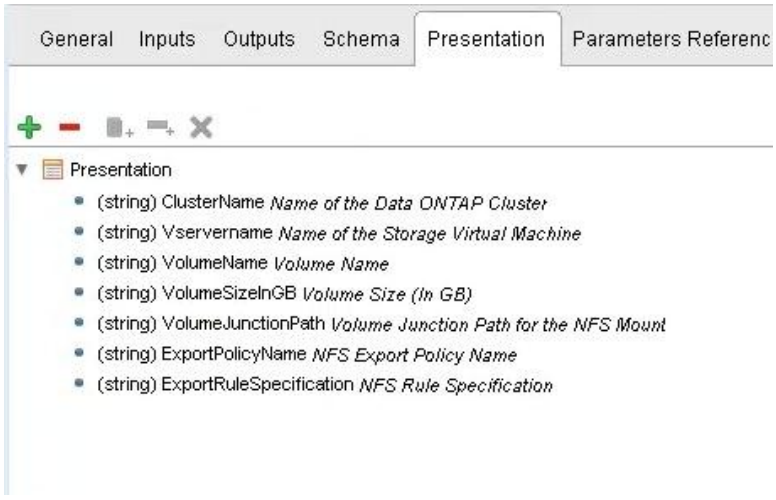
5. Verify that the information on the Exception tab is similar to the example and click Close.



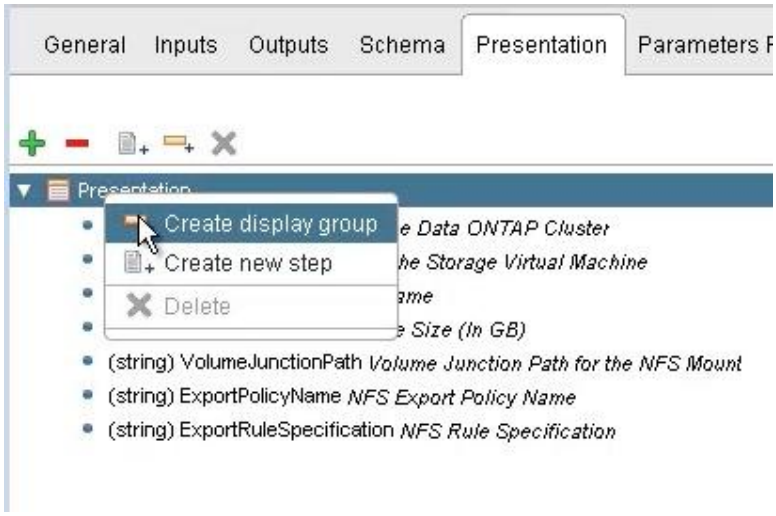
4.7 Edit Presentation of Workflow

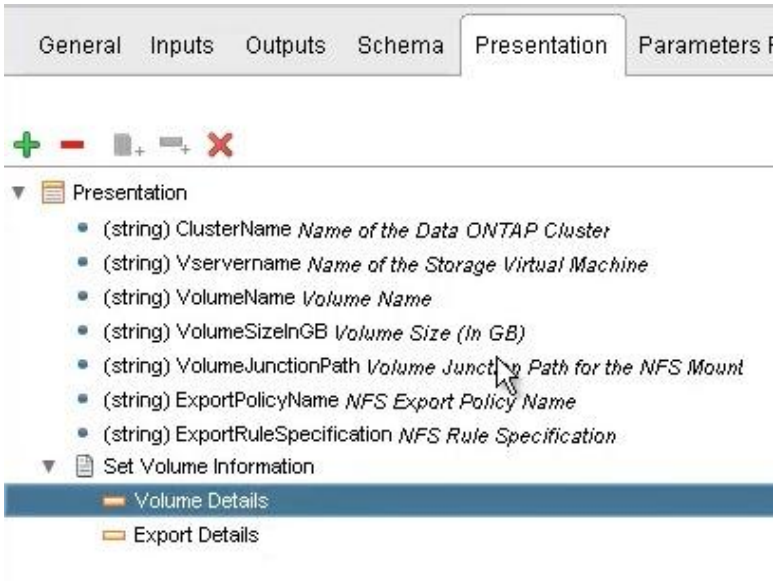
To edit the presentation of the workflow, complete the following steps:

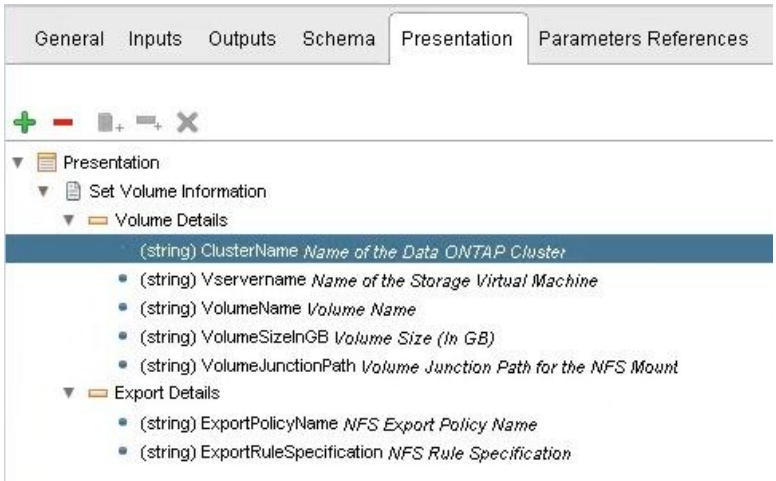
1. Click the Presentation tab.



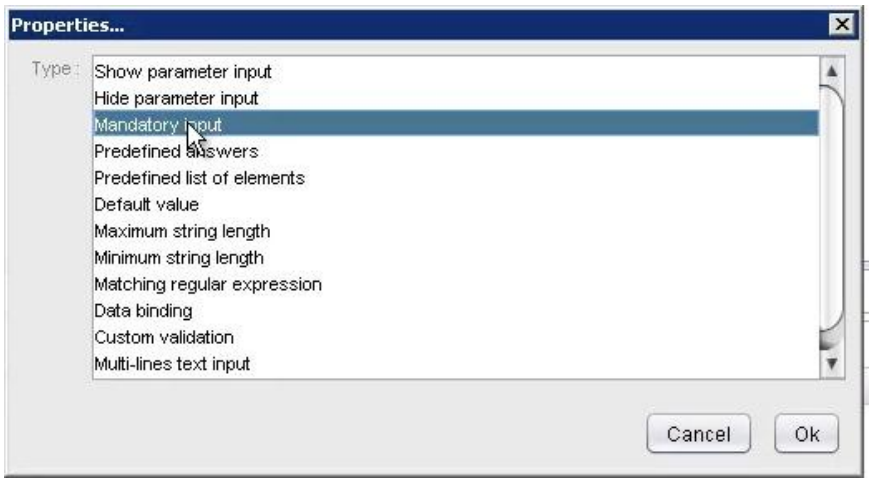
2. Set up the presentation of the workflow according to your preferences. In the examples, the Volume Details and Export Details inputs are set up under the Set Volume Information display group.

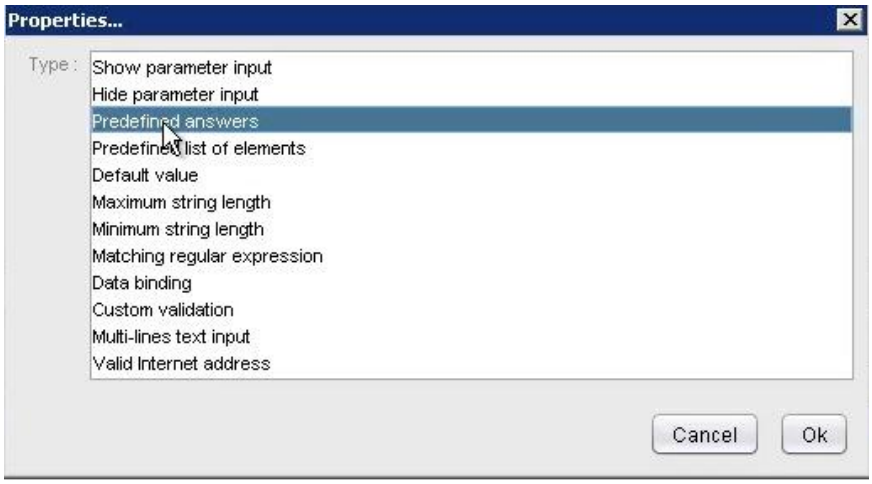


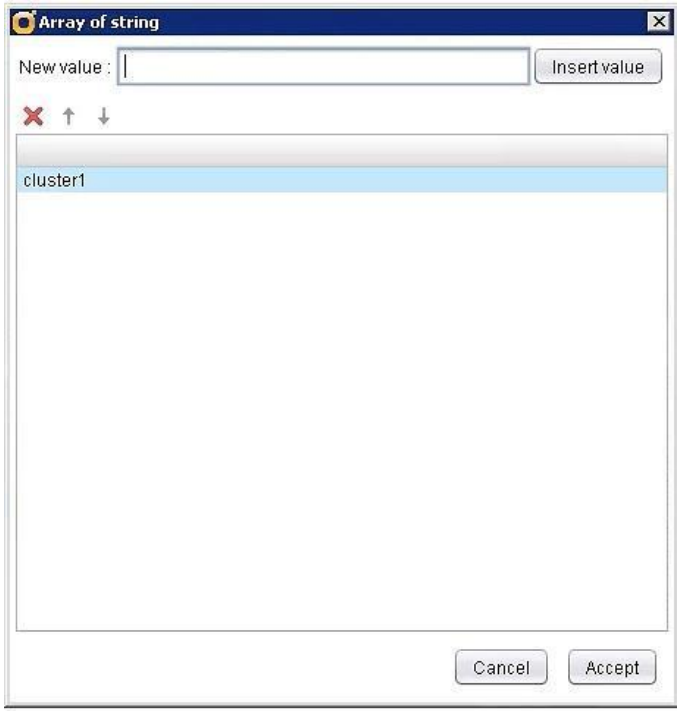


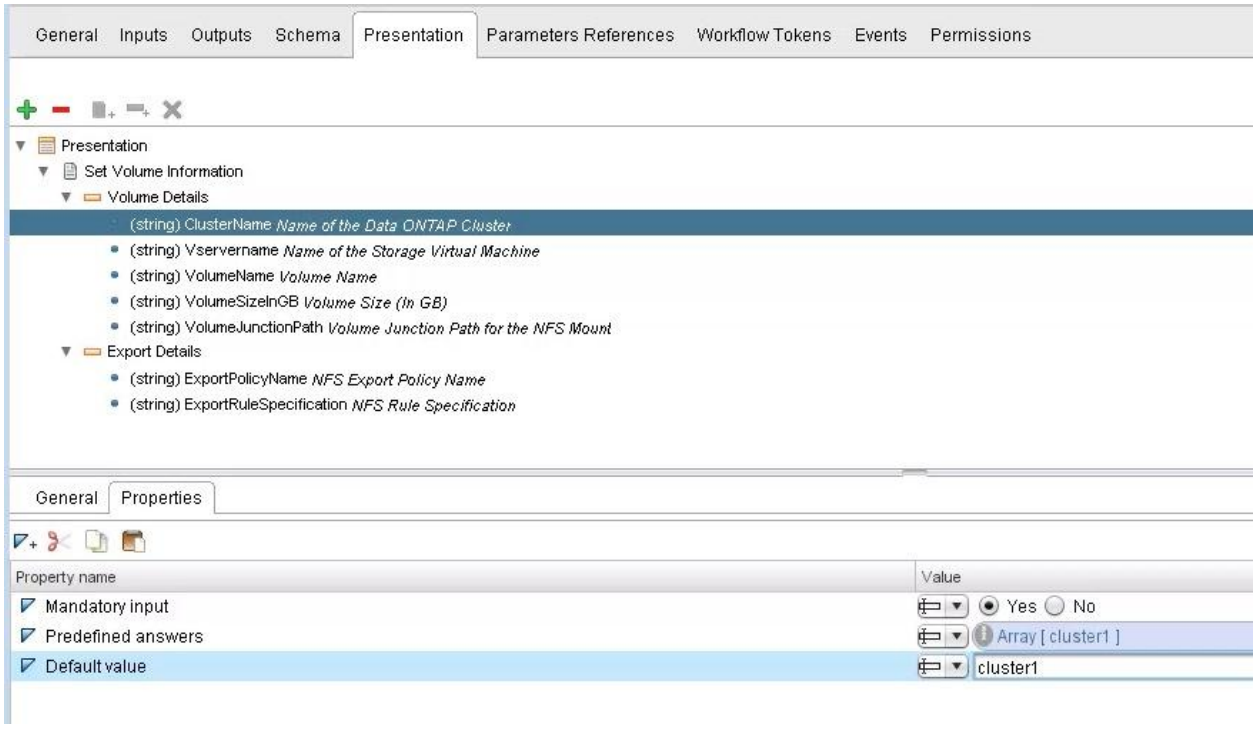


3. Set the input parameter properties. In the examples, the ClusterName input parameter property is set as Mandatory Input with a predefined list of answers and a default value.

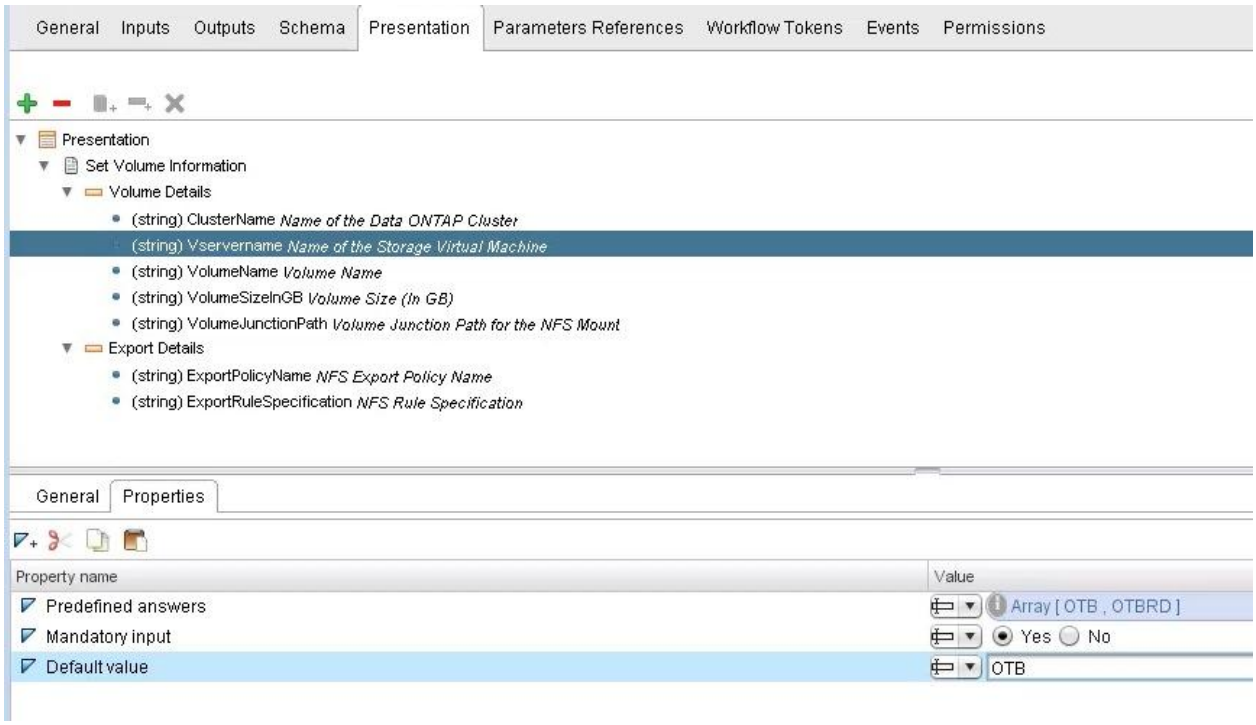


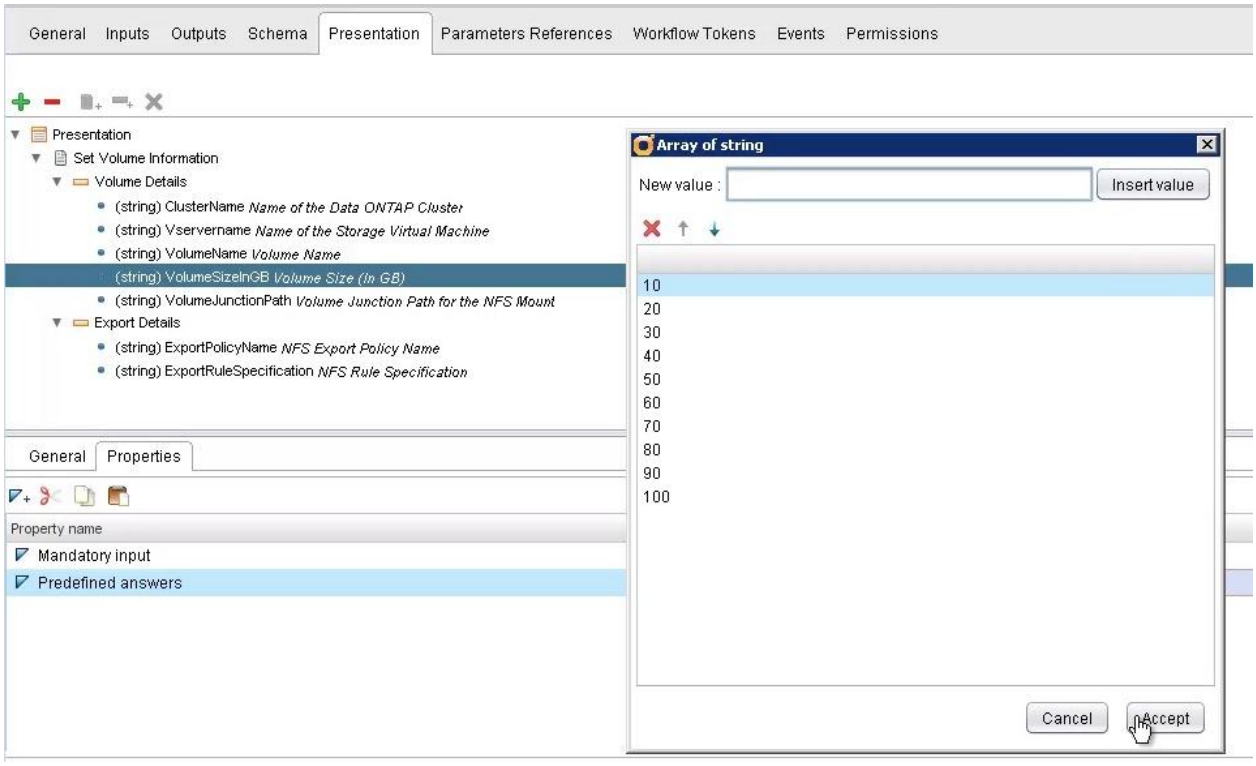


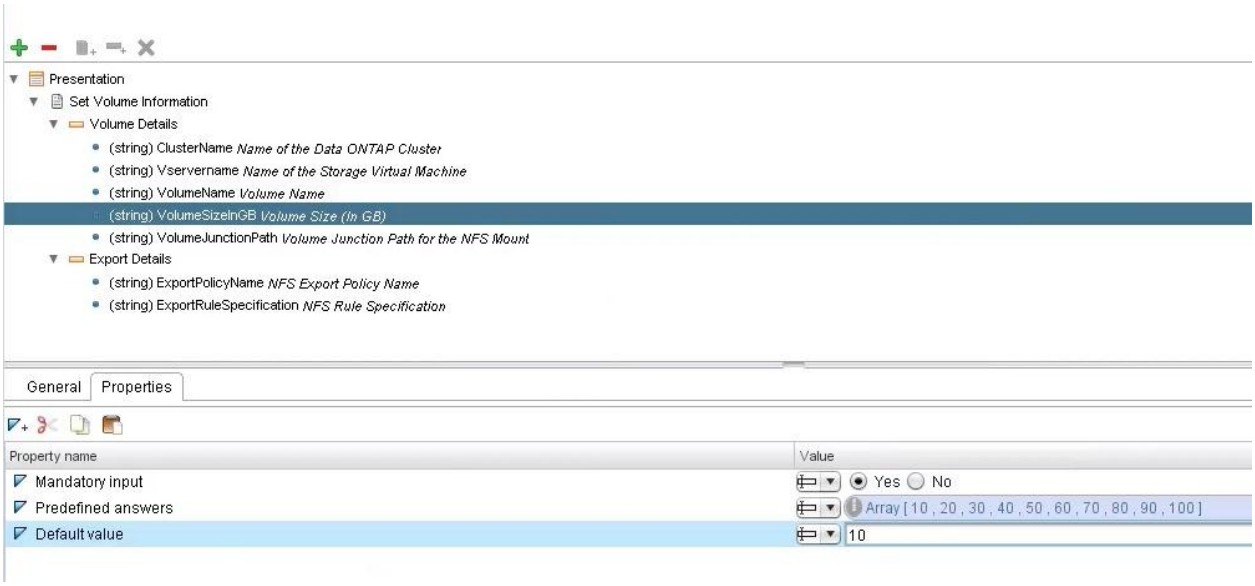




4. Add the desired property for each input in the steps. The examples show other properties added to the inputs.



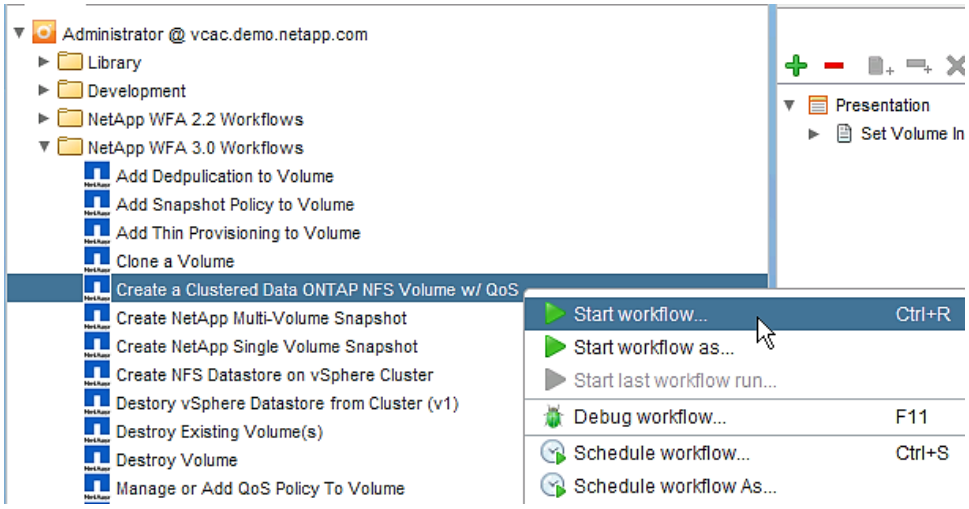




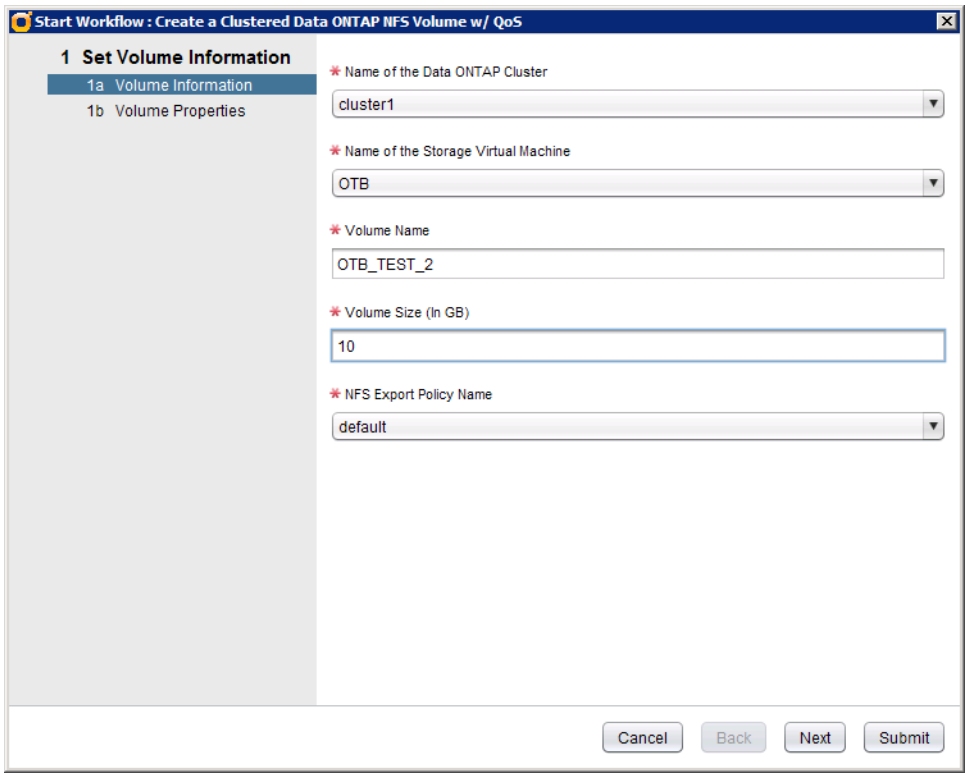
4.8 Run Newly Created Workflow

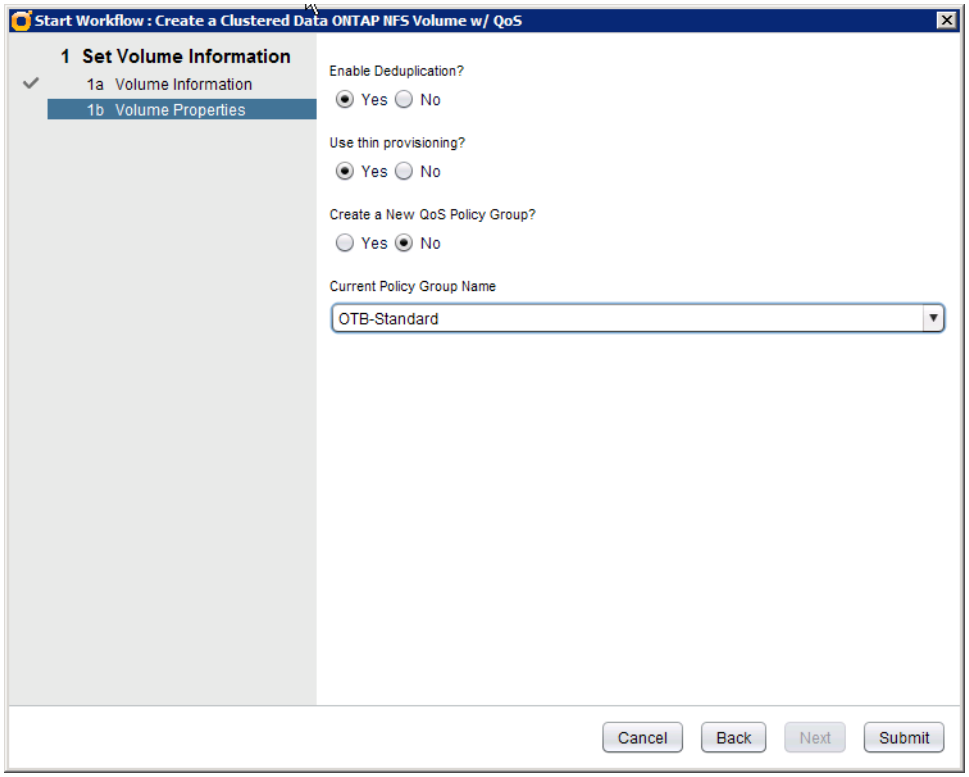
To run the newly created workflow, complete the following steps:

1. Save the newly created workflow.
2. From the Workflow page, right-click the newly created workflow and select Start Workflow.

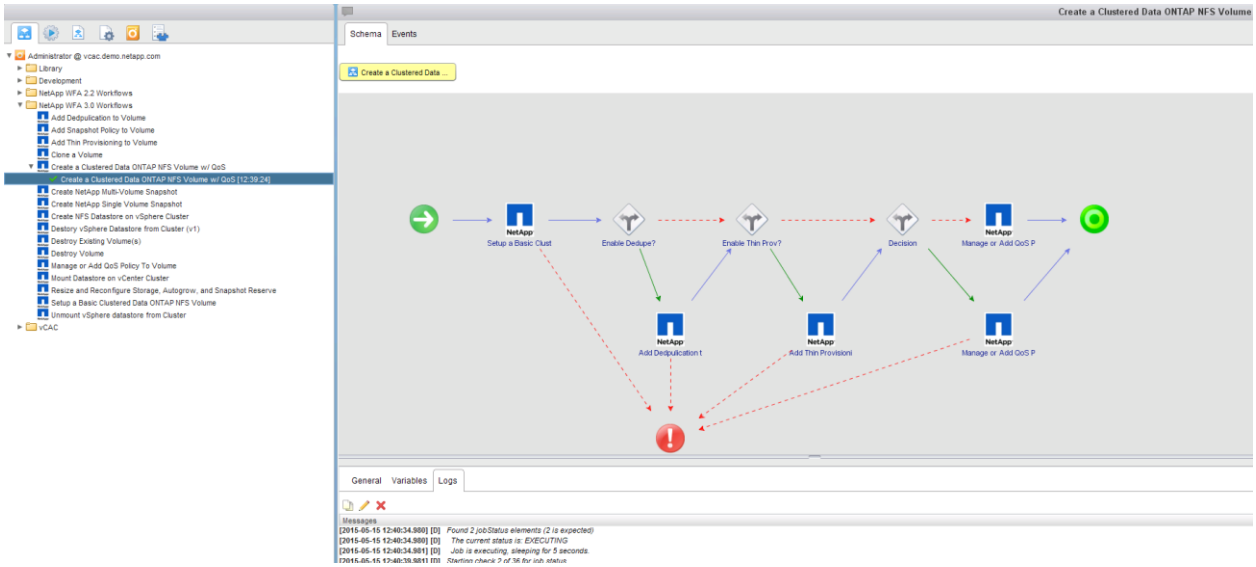


3. Select or enter the desired values for the new workflow and click Submit. In the example, a new volume is being created.





4. Verify that the workflow ran successfully.



5 Create vRO Wrapper Workflow

In the following sections, creating a VMware datastore is given as an example to show how to use smaller, more specific workflows to create a larger, more complex workflow. In this example, the goal for the larger workflow is to have a datastore with the following characteristics:

- NFS enabled
- 10GB size
- Deduplication enabled
- QoS of 13MB/sec enabled
- NetApp Snapshot® policy added to each host in the cluster

To accomplish this, the following small storage workflows must be created:

- Create a clustered Data ONTAP NFS volume.
- Add deduplication to volumes.
- Add QoS policy to a volume.
- Create a Snapshot policy for the volume.
- Add the volume to the vSphere environment.

Figure 2 shows a series of workflows that NetApp developed as part of a sample pack. Notice that the first four workflows previously listed are also listed in the NetApp Software-Defined Storage Workflows Validated folder shown in Figure 2.

Figure 2) Sample workflows.

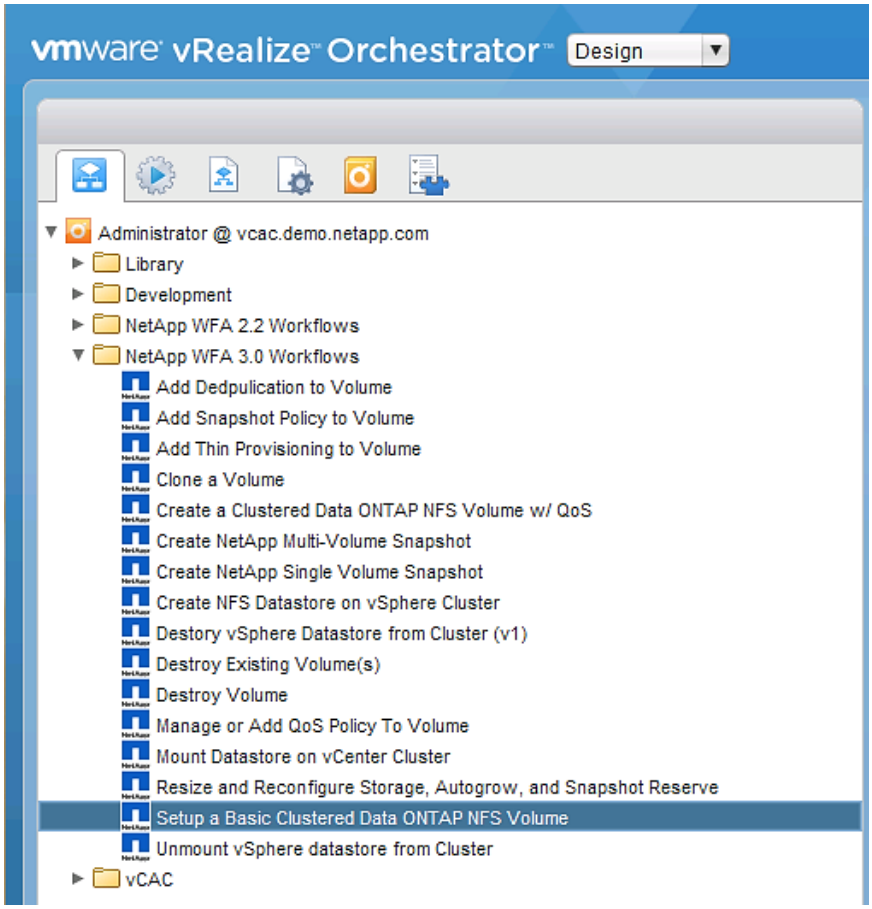
5.1 Set Up Smaller Workflows for Wrapper

Use the steps in the “Integrate vRO with OnCommand WFA” section to build the smaller, individual workflows in vRO from the corresponding WFA workflows. After these are built, place them into a wrapper workflow.

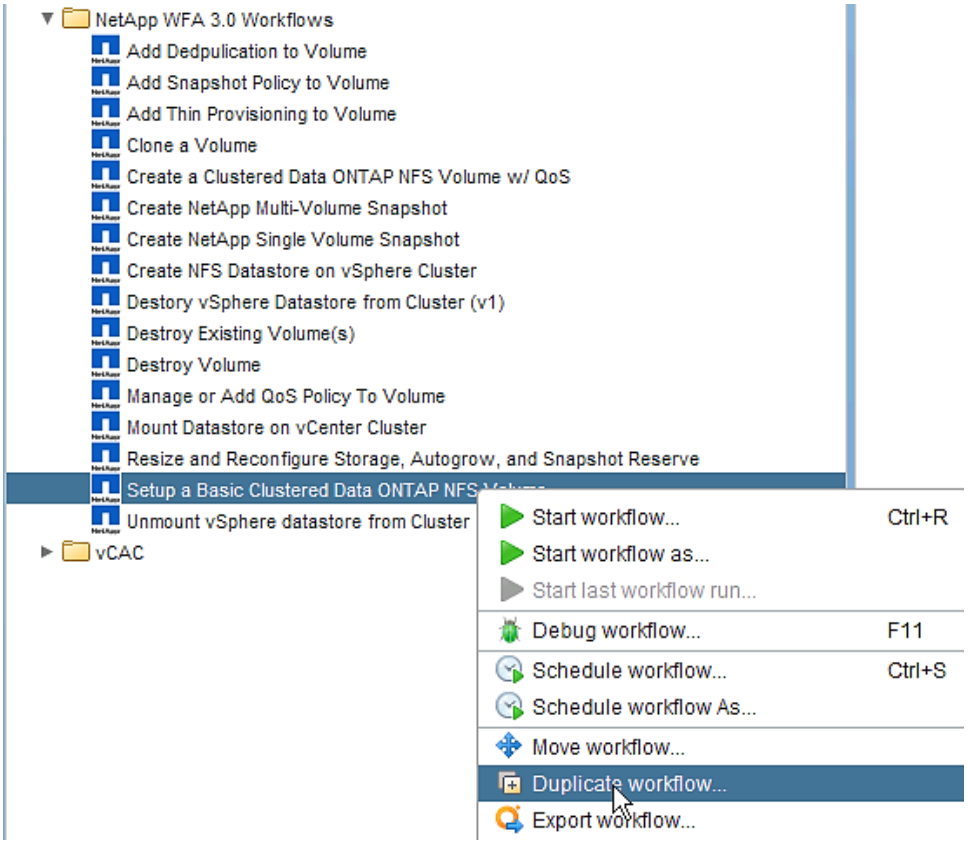
5.2 Build Wrapper Workflow

To build a wrapper workflow, complete the following steps:

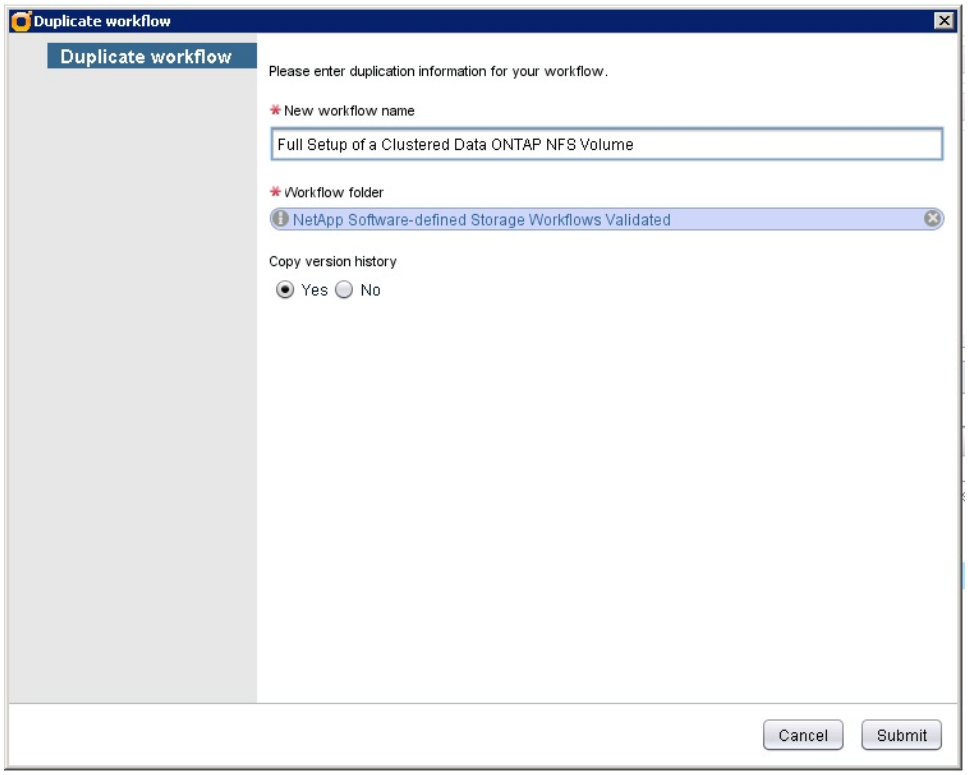
1. Right-click a baseline workflow and select Edit. In the example, select Setup a Basic Clustered Data ONTAP NFS Volume. This workflow creates a new NFS volume and either uses a default QoS policy or creates a new QoS policy.



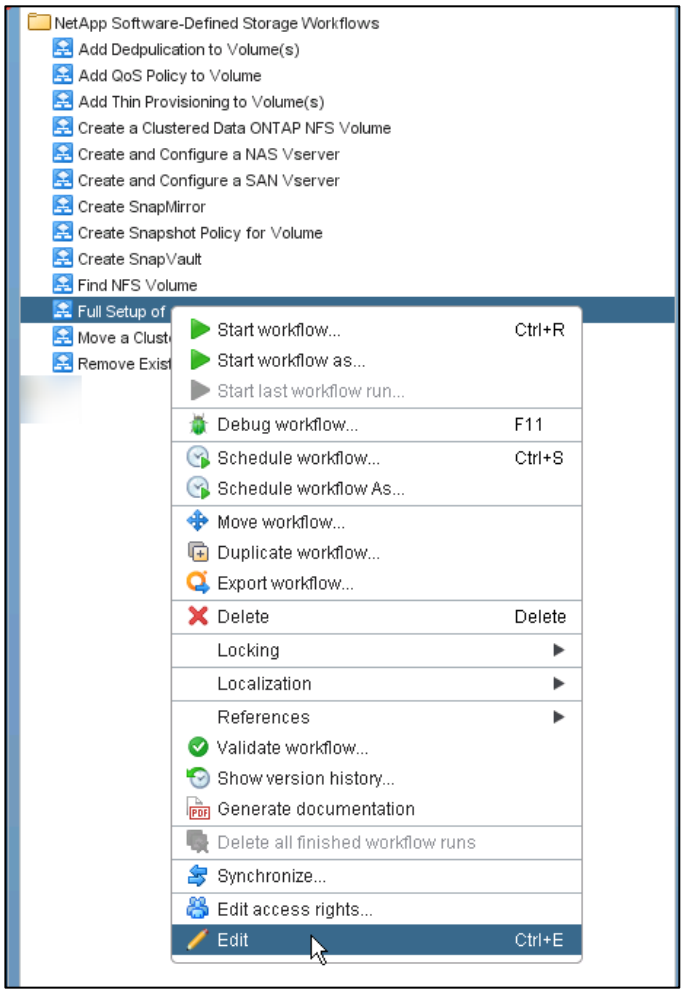
2. NetApp recommends making a copy of the baseline workflow to work with instead of using the actual workflow. Right-click the selected workflow and select Duplicate Workflow.



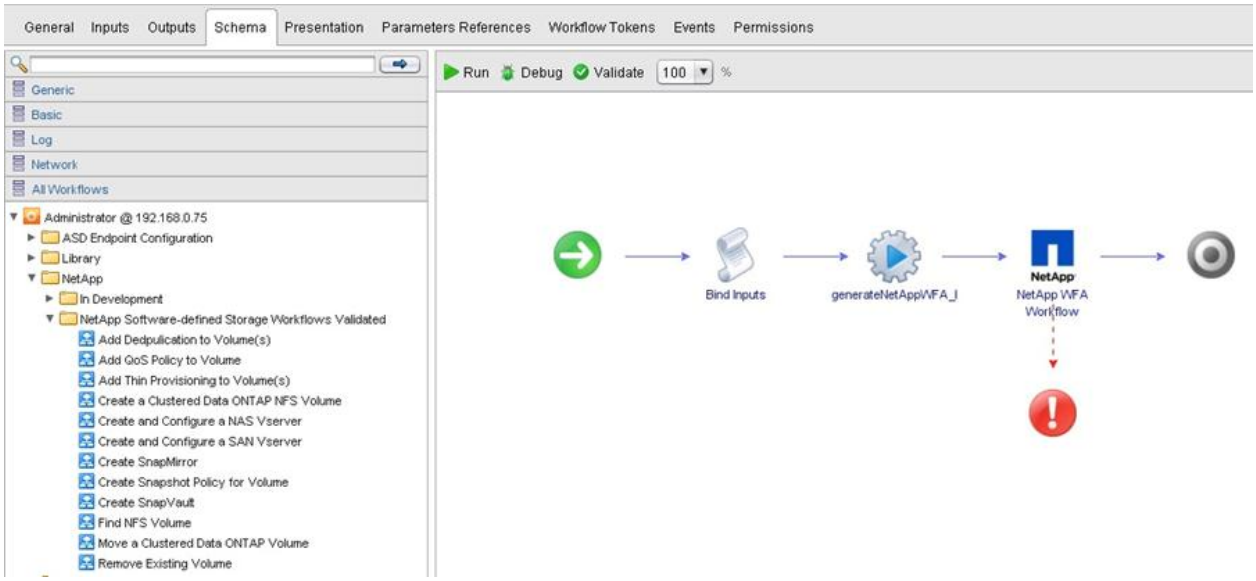
3. On the Duplicate Workflow page, rename the workflow and place it in the appropriate folder.



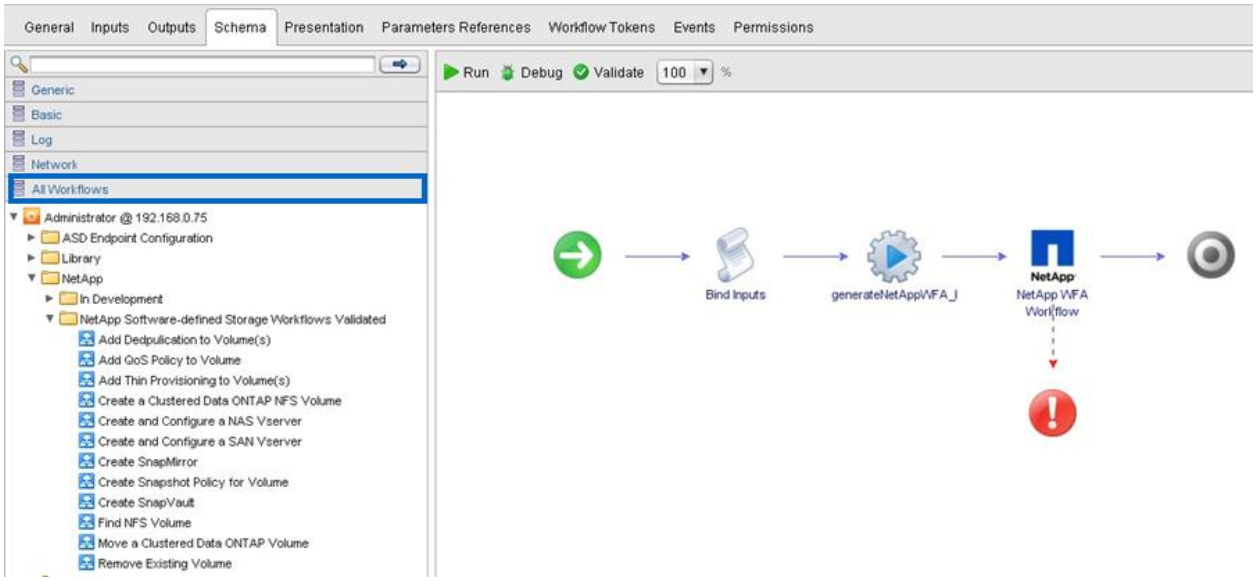
4. Right-click the duplicated workflow and select Edit.



5. Click the Schema tab.

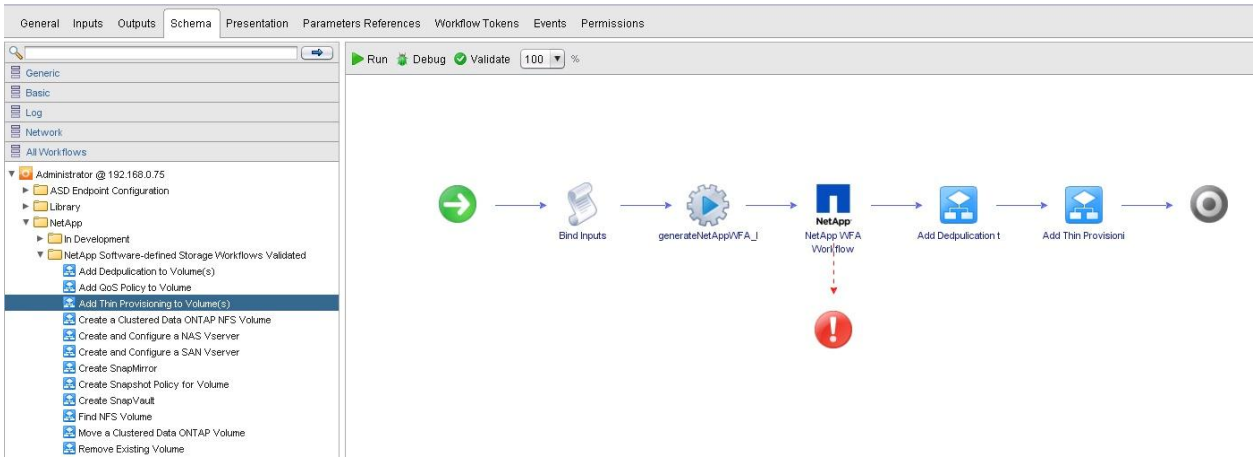


6. From the left pane, click All Workflows.

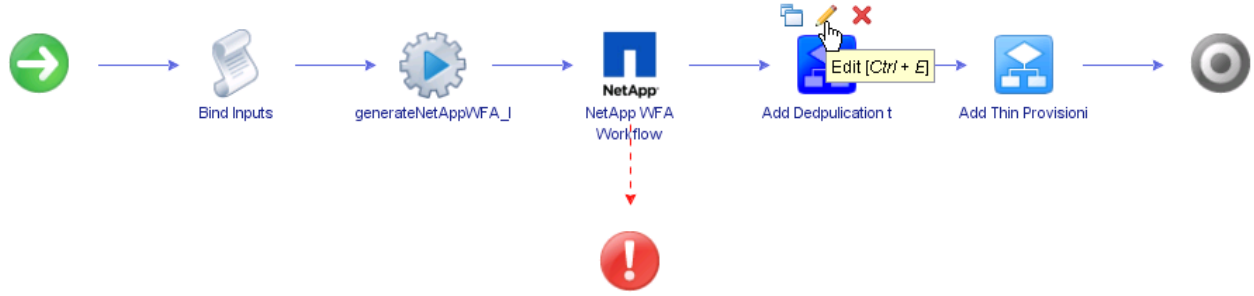


7. Select Add Deduplication to Volume(s) and Add Thin Provisioning to Volume(s). Drag them to the right pane to the right of NetApp WFA Workflow.

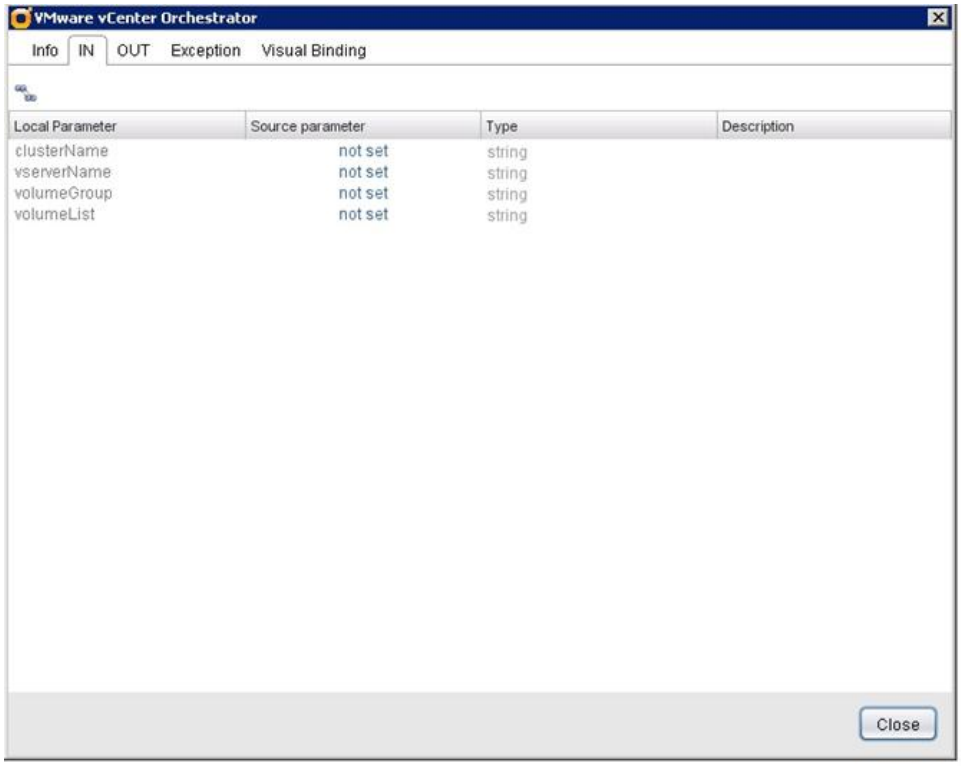
   Note: Ignore the prompt that appears when you do this.



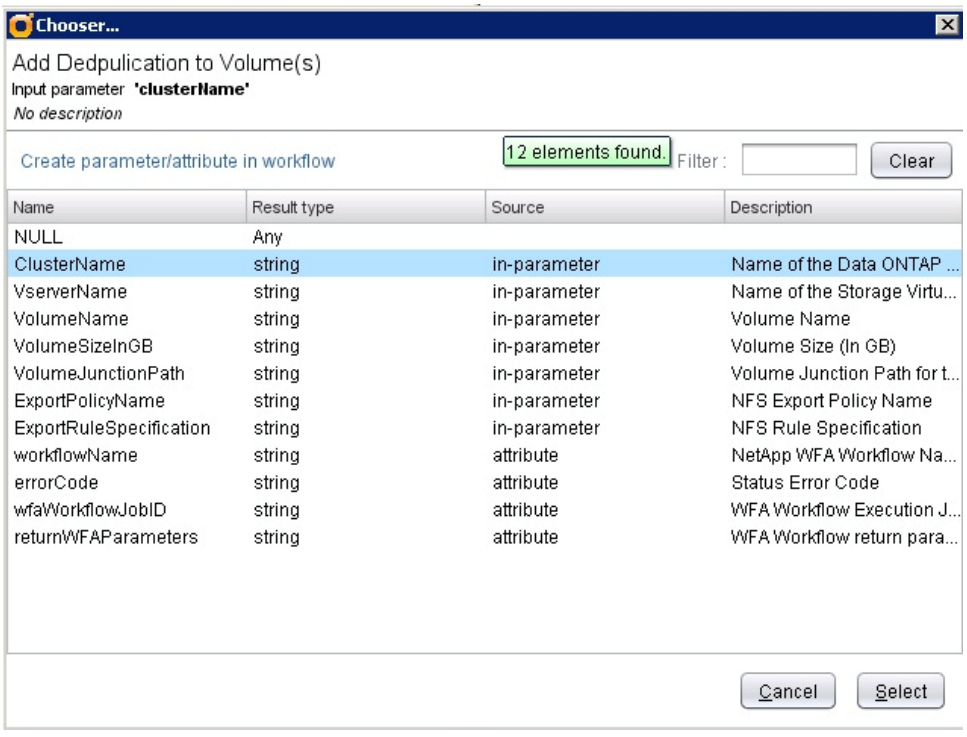
8. Point to Add Deduplication to Volume(s) and click the pencil icon.



9. Click the In tab. Next to ClusterName, click Not Set in the Source Parameter column.

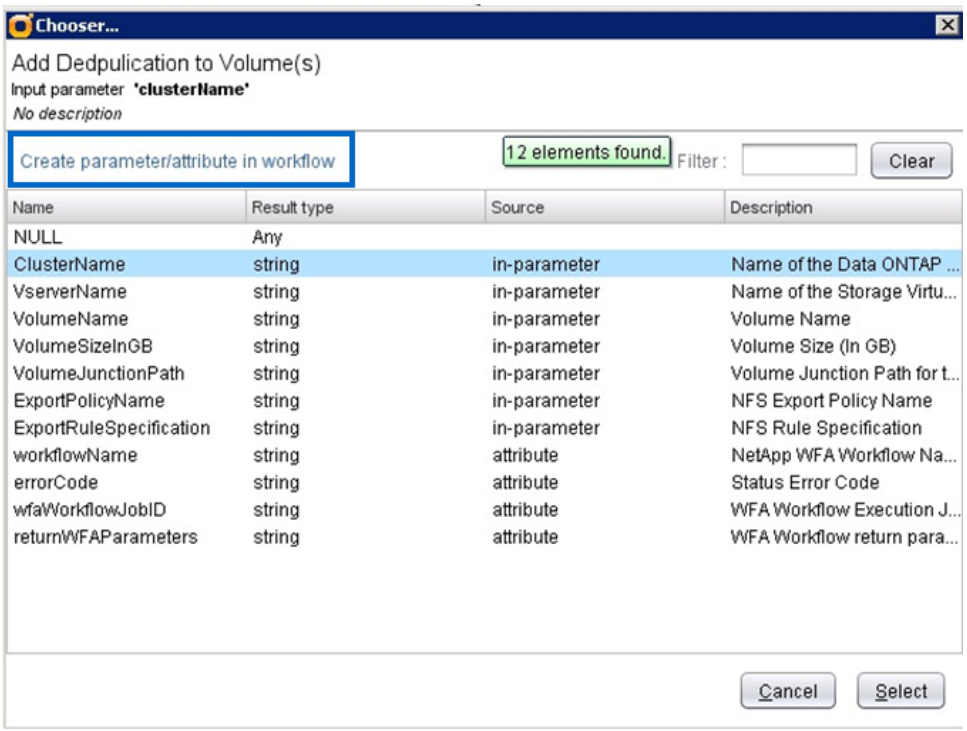


10. On the Chooser page, select ClusterName and click Select.

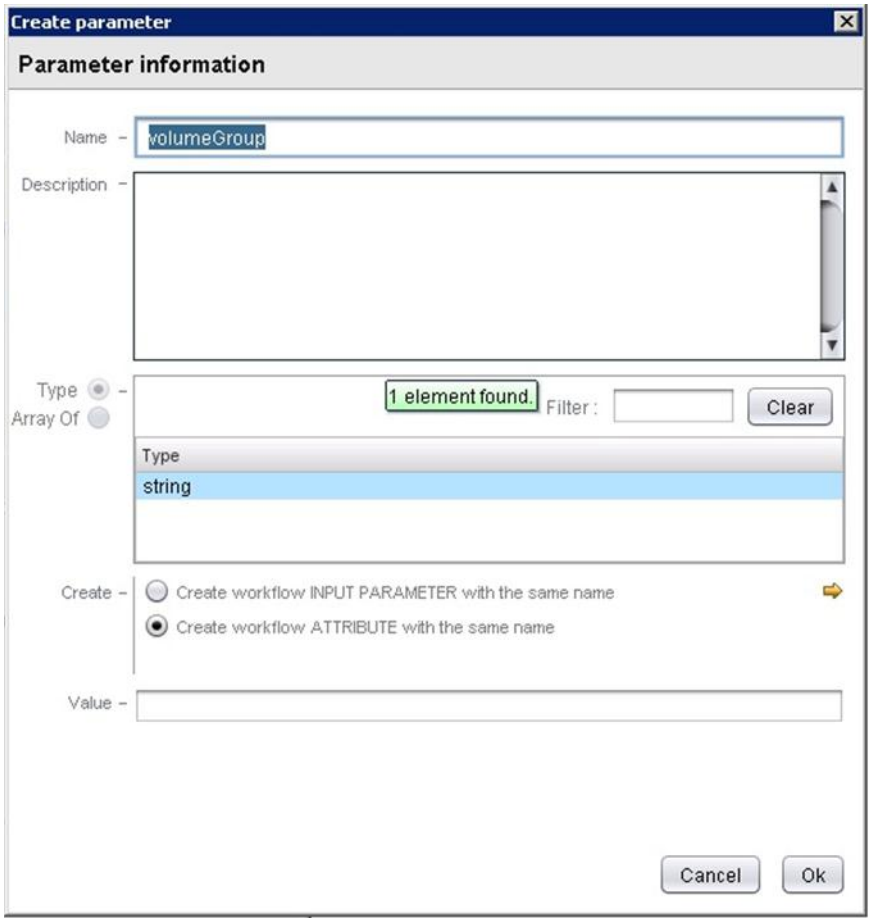


11. On the In tab next to vServerName, click Not Set in the Source Parameter column.
12. On the Chooser page, select VserverName and click Select.

13. On the In tab next to volumeGroup, click Not Set in the Source Parameter column.
14. On the Chooser page, click Create Parameters/Attribute in Workflow.



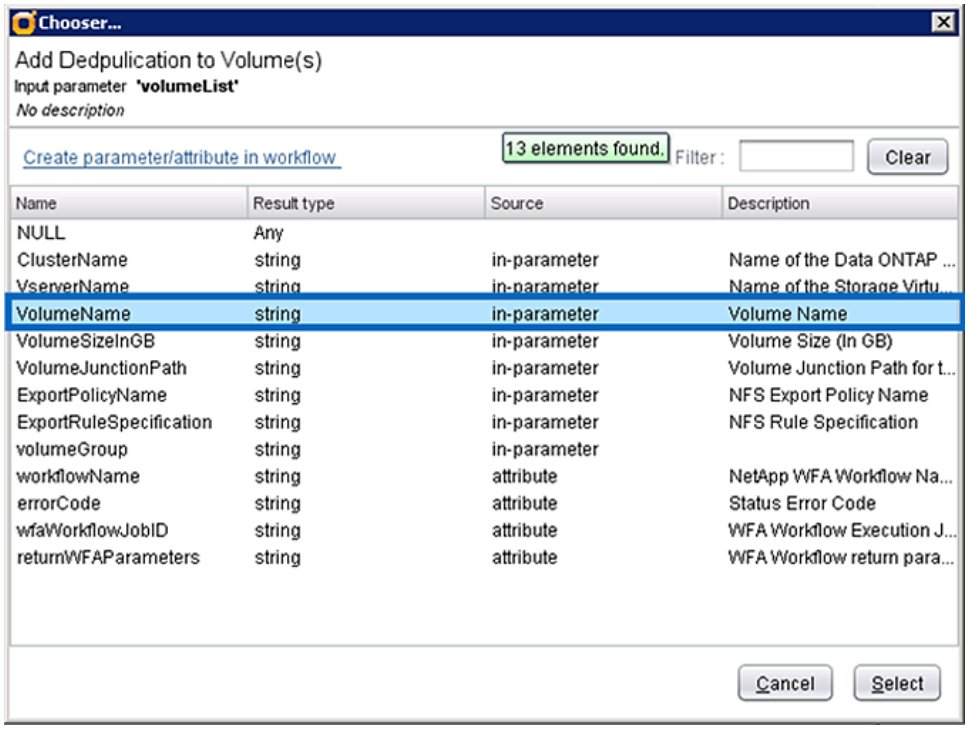
15. On the Parameter Information page, verify that `volumeGroup` is listed in the Name field and click OK.



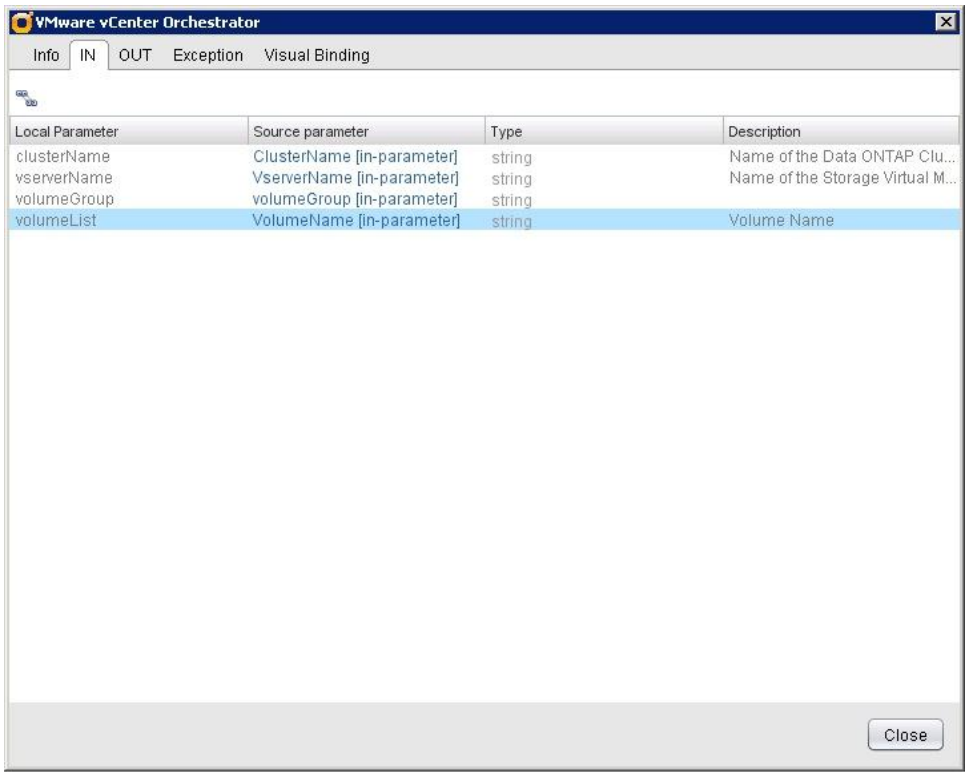
16. On the In tab next to volumeList, click Not Set in the Source Parameter column.

    Note: VolumeList is found in both of the new workflows that are being wrapped as part of the larger workflow. VolumeList refers to and is equal to VolumeName.

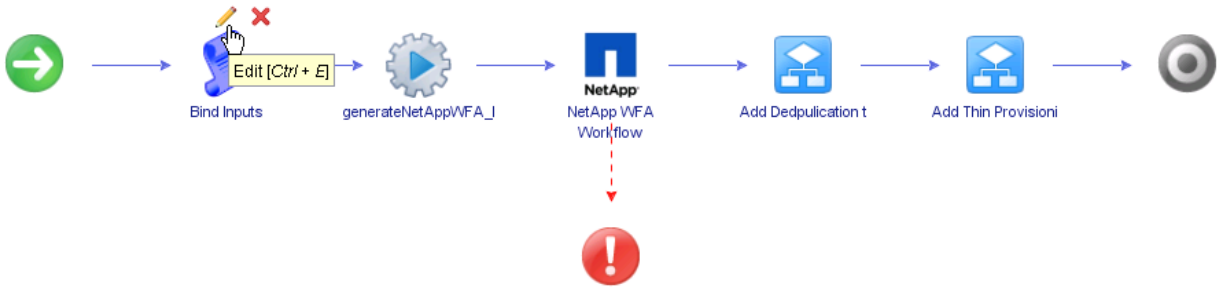
17. On the Chooser page, select VolumeName and click Select.



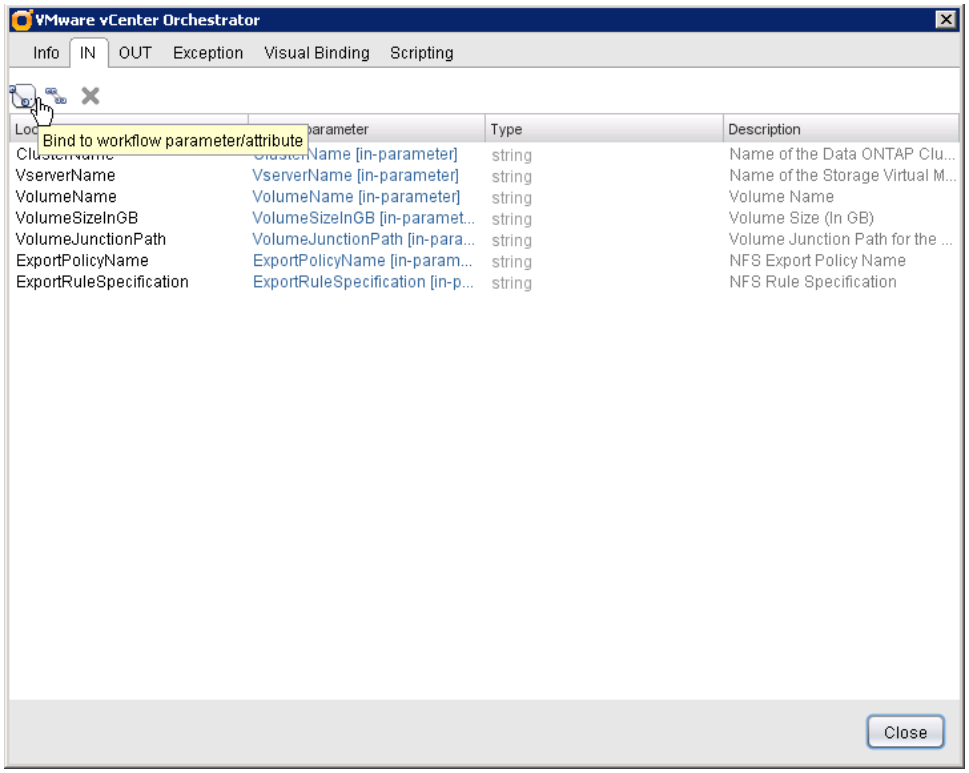
18. After the final local parameter has been mapped, click Close.



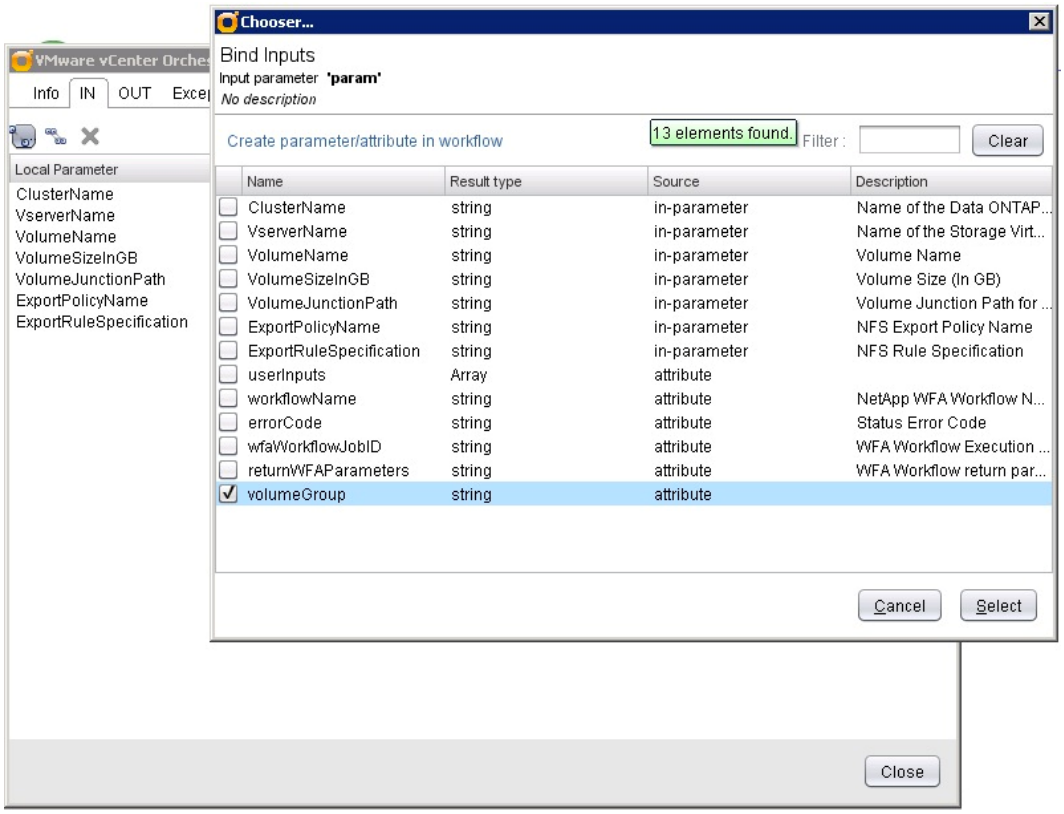
19. From the Schema page, point to Bind Inputs and click the pencil icon.



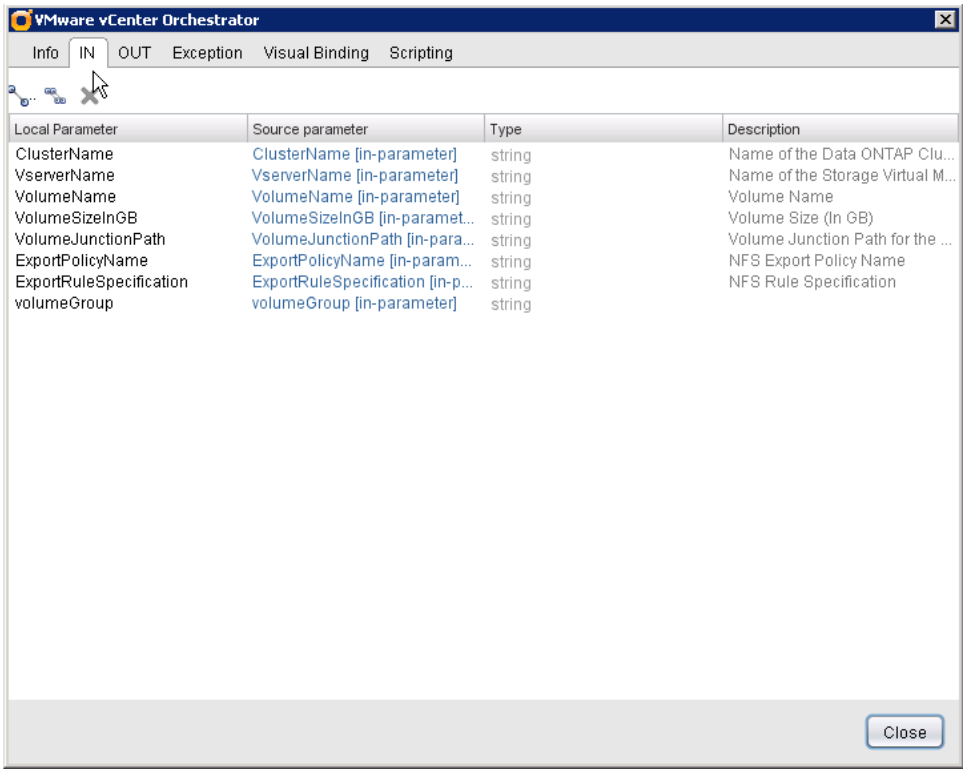
20. Click the In tab and then click the Bind to Workflow Parameter/Attribute icon.



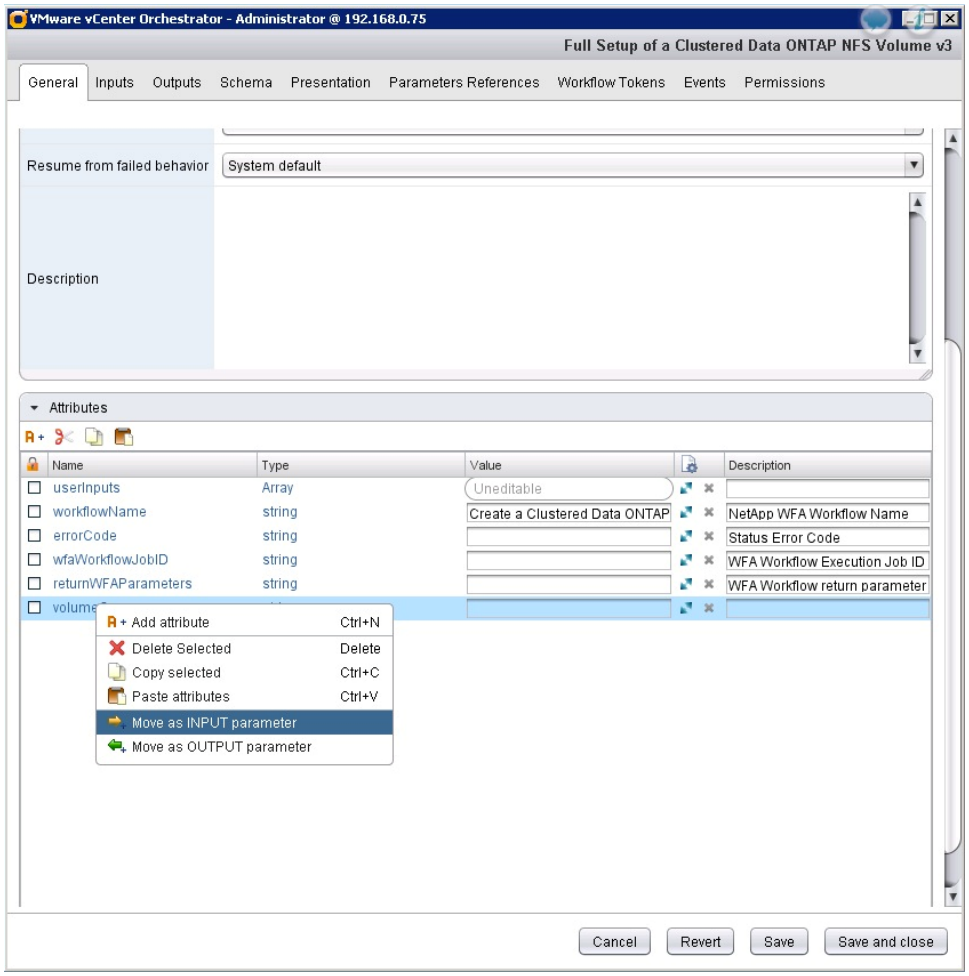
21. On the Chooser page, select VolumeGroup and click Select.



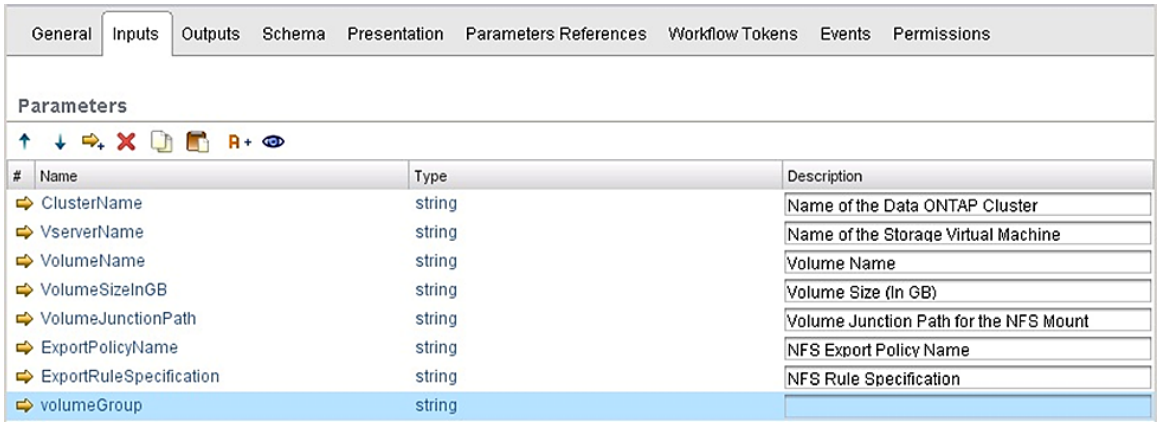
22. On the In tab, verify that volumeGroup is listed as a parameter.



23. Click the General tab. Under Attributes, right-click VolumeGroup and select Move as INPUT Parameter.



24. Click the Inputs tab and verify that volumeGroup has been moved.



The workflow should now be ready to test.

6 Configure vRA to Manage Deployment of Software-Defined Storage

vRealize Automation (vRA) must be installed prior to starting these procedures. A number of preliminary steps must be completed to prepare for the VMware vRealize Automation 6.2 installation, including:

- DNS and host name must be resolved.
- Hardware and virtual machine (VM) requirements must be identified.
- PostgreSQL database requirements must be met.
- Microsoft Windows Server requirements must be met.
- Port requirements must be met.
- User credentials for installation must be available.
- Time synchronization must be complete.
- Security must be available.

For more information about vRealize Automation 6.2, refer to the Installation and Configuration guide. For information about VMware product interoperability, refer to the VMware Product Interoperability Matrixes. Additional information is available on the VMware vRealize Automation Documentation website.

6.1 Configure Tenant

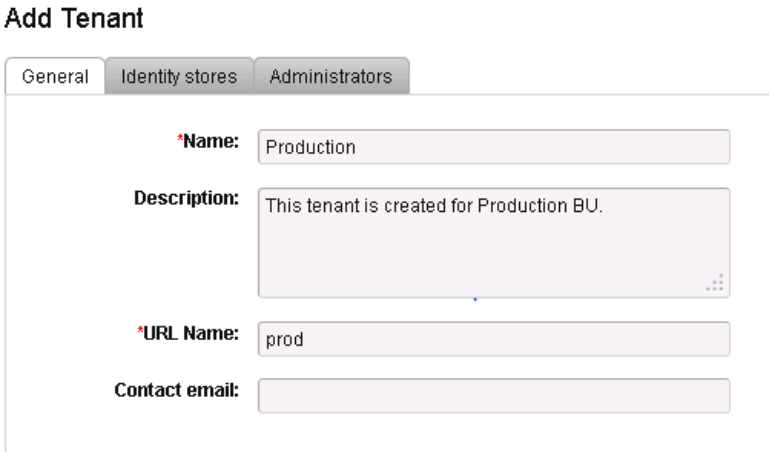
To configure a tenant in vRA, complete the following steps:

1. In the vRA console interface, at the URL for tenants (`http://<vRA-hostname>/shell-ui-app`), log in as administrator by using the `administrator@vsphere.local` account and a single-sign-on password.

   Note: When you log in to vRA, the default tenant `vsphere.local` is already created. You can continue to use the default tenant to configure vRA, or you can create a new tenant. The example in this procedure shows the creation of a new tenant, `Production`, and a new identity store, `NetApp-Prod`.

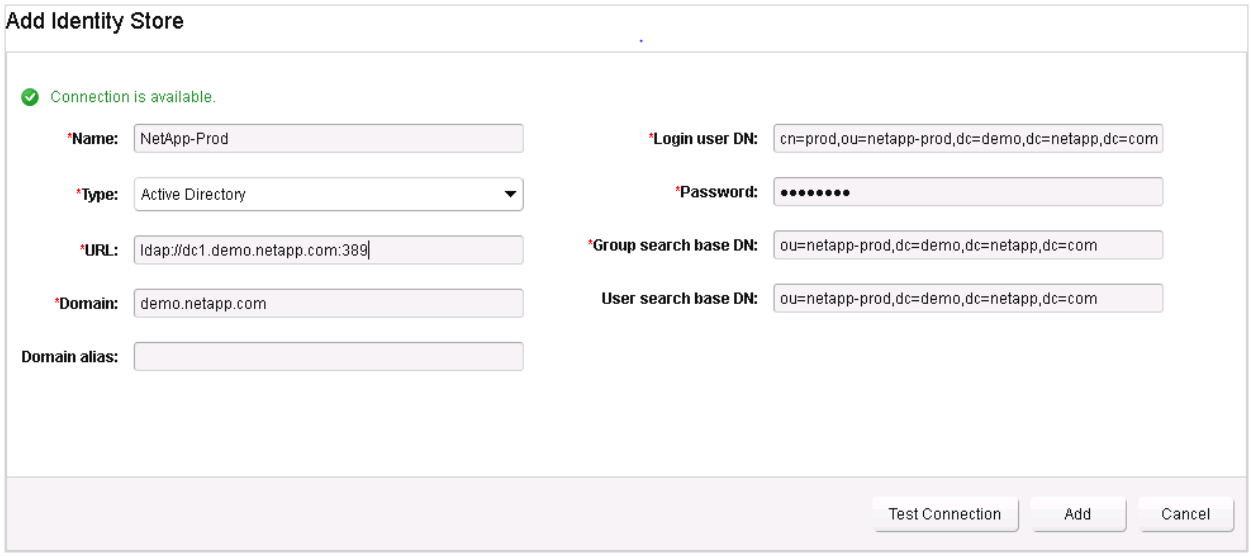
2. Navigate to Administration > Tenants and click the green plus icon (+) to open the Add Tenant dialog box.
3. In the dialog box, provide a name, a description, and a URL name for the new tenant. Click Submit and Next.

   Note: The URL name must be unique for each tenant because it is used to access tenant-specific information in vRA.

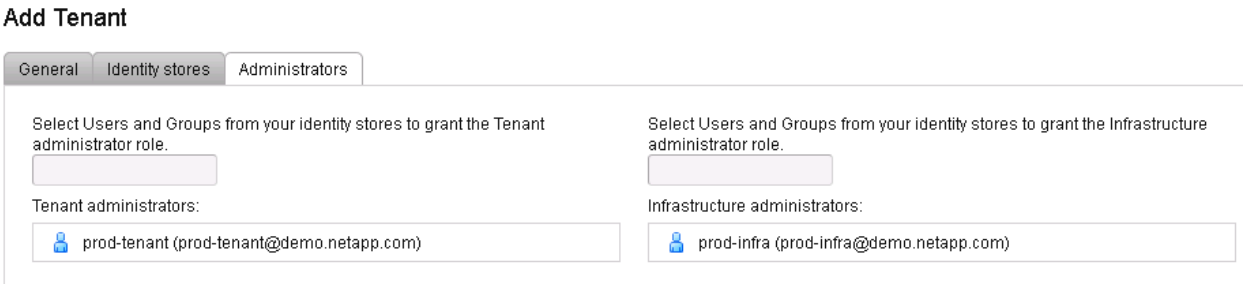


4. In the Identity Stores tab, click the green plus icon (+) to create a new identity store for this tenant:

a. Enter a name for the identity store.
b. Select either Active Directory (AD) or OpenLDAP as the identity store type.
c. Enter the URL for the existing Active Directory server.
d. Provide the FQDN.
e. Enter the DN for the AD login user.
f. Enter the password for the AD login user.
g. Enter the group search base DN that was created in the AD server.



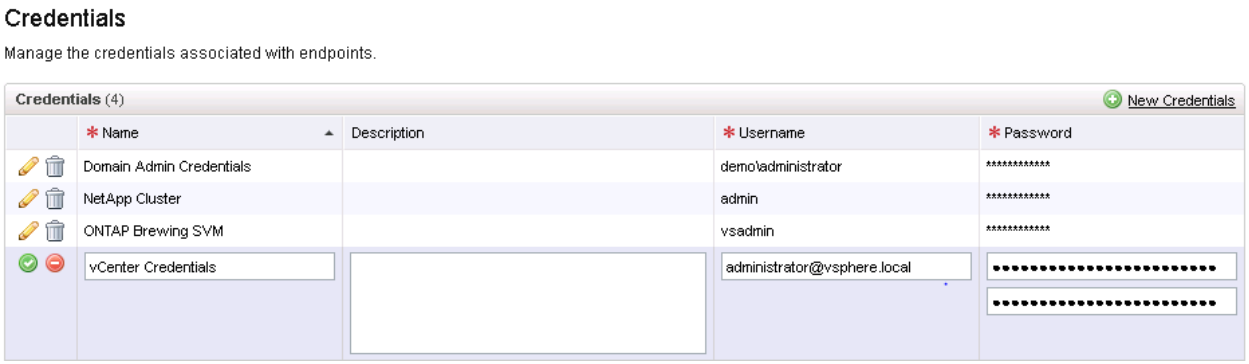
5. Click Test Connection to verify the connection and click Add to add the identity store.
6. Verify that the identity store has been added successfully and click Next.
7. After creating an identity store, click the Administrators tab and specify a user or a group (or both) to be the tenant and the infrastructure administrators allowed to perform administrative tasks.
8. Enter the user accounts in the Tenant Administrators and Infrastructure Administrators fields. Click Add to complete the tenant setup.



6.2 Create vCenter Administrator Credentials

To create credentials for the vCenter Administrator user account (`administrator@domain.com`) or for any other endpoint (such as vRealize Orchestrator), complete the following steps:

1. Navigate to Infrastructure > Credentials > New Credentials.
2. Specify a name for this credential. This name will be used in addition to the user name and password to access vCenter Server.

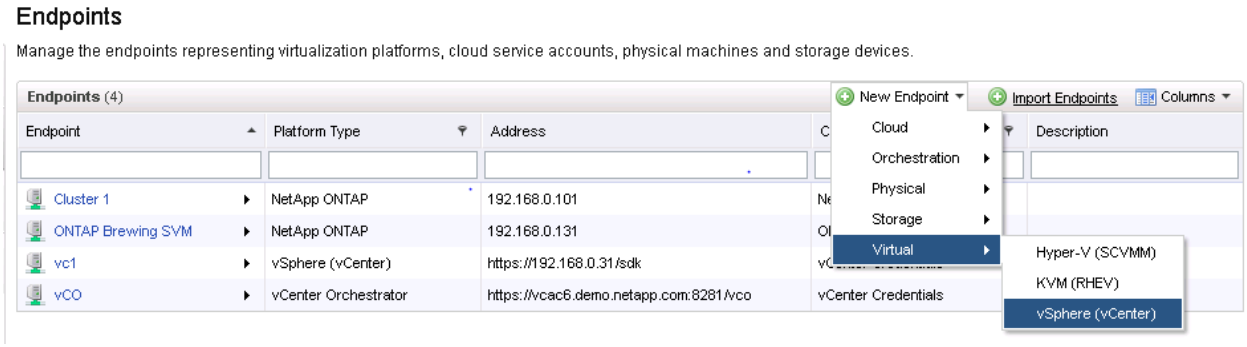


3. Similarly, create credentials for vRealize Orchestrator and other endpoints.

6.3 Create vCenter Endpoint

To create a new vCenter endpoint, complete the following steps:

1. At the production tenant URL (`https://<vRA-hostname>/shell-ui-app/org/prod/`), log in as the infrastructure tenant administrator.
2. Navigate to Infrastructure > Endpoints > New Endpoint > Virtual > vSphere (vCenter).

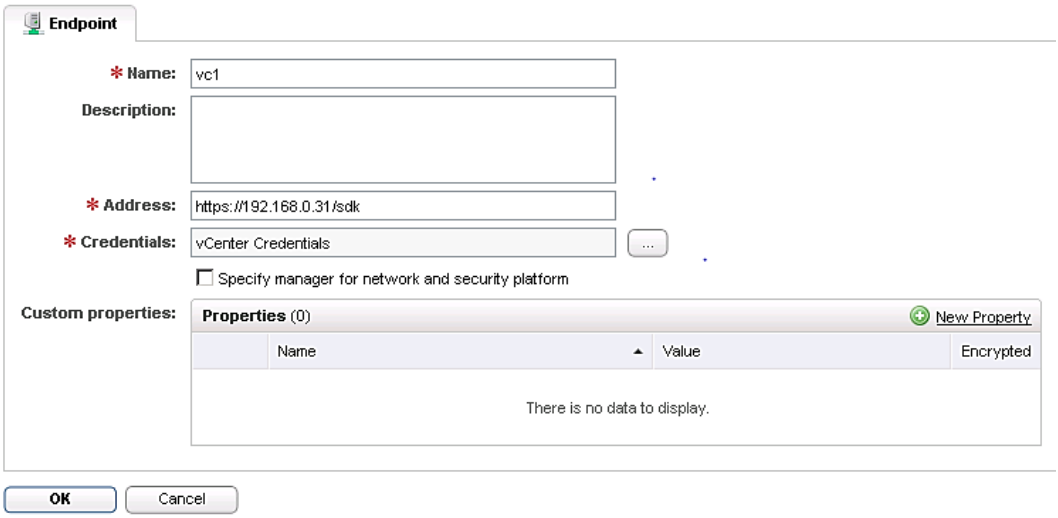


3. Enter the name of the vCenter endpoint.

   Note: This name should match the endpoint name used for installing infrastructure-as-a-service (IaaS) components.

4. Specify the vCenter Server URL using the IP address or FQDN of the vCenter Server.
5. Select the vCenter credential created earlier and click OK.

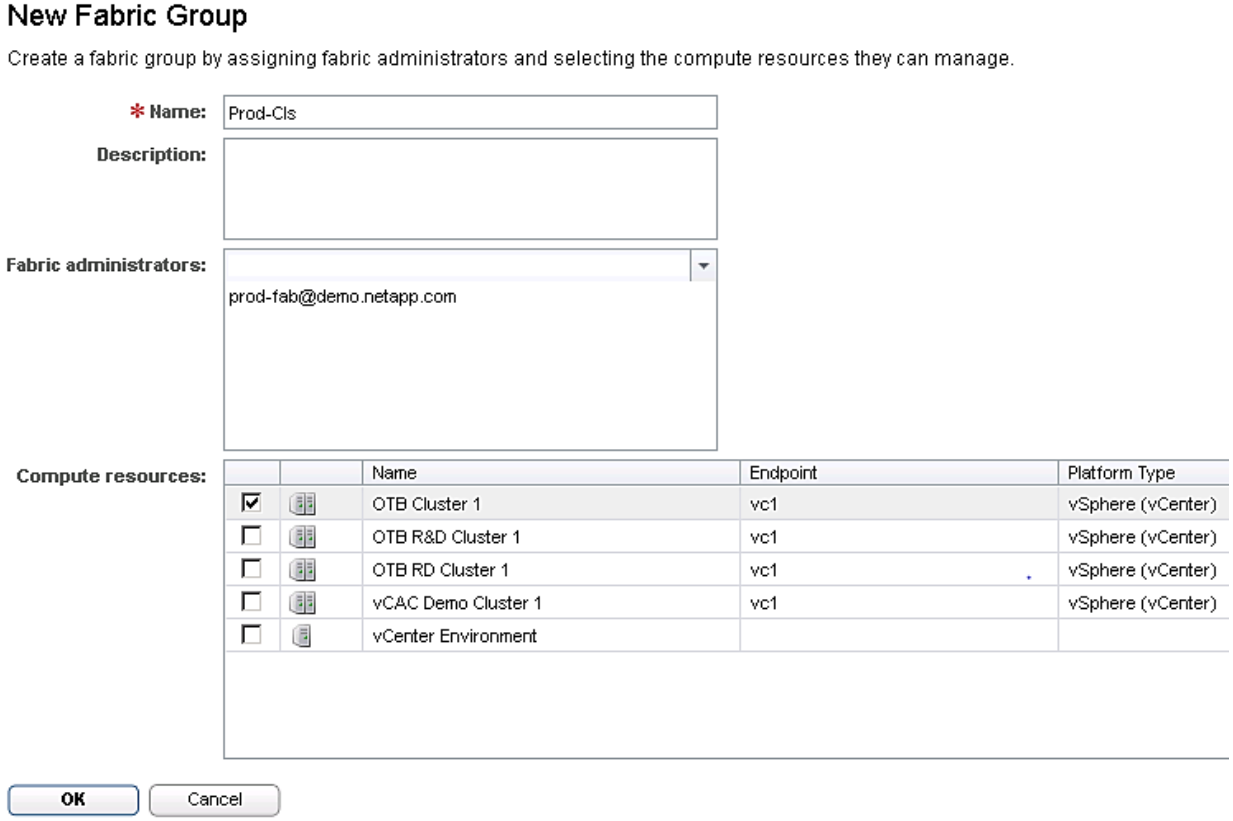
   Note: Do not select the checkbox labeled Specify Manager for Network and Security Platform unless you want to use vCloud Networking and Security or NSX.



6.4 Create Fabric Group

To create a fabric group, complete the following steps:

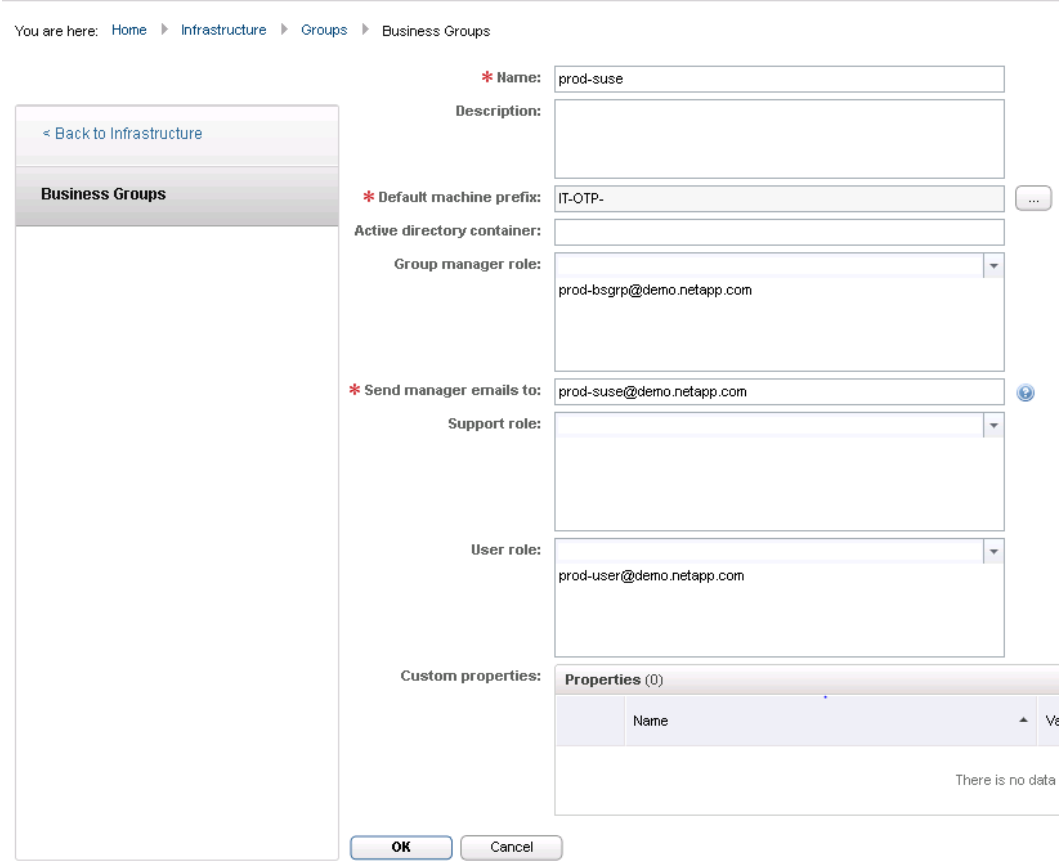
1. At the production tenant URL (`https://<vRA-hostname>/shell-ui-app/org/prod/`), log in as the infrastructure administrator.
2. Navigate to Infrastructure > Groups > Fabric Groups > New Fabric Group.
3. Enter a name for this fabric group.
4. Add an individual user or group as the fabric administrator.
5. Select the vCenter resource to map to this fabric group and click OK to add the fabric group.



6.5 Create Business Group

To create a business group, complete the following steps:

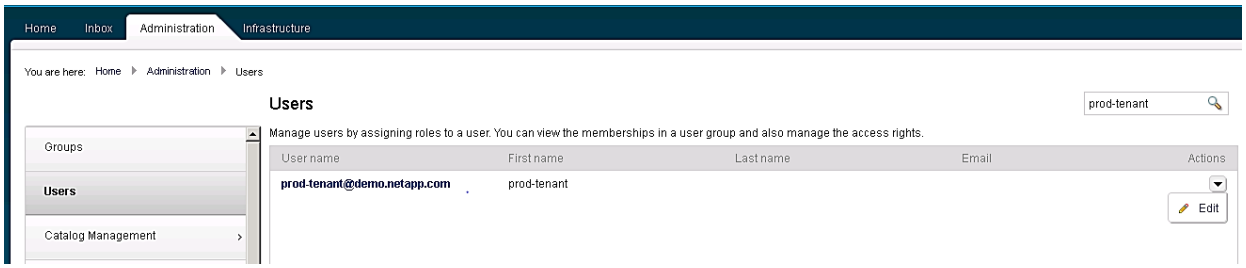
1. Log in to vRA as tenant administrator.
2. Navigate to Infrastructure > Groups > Business Groups > New Business Group.
3. Enter the name of this business group.
4. Select a default machine prefix for the VM created in this business group.
5. Enter a user or group name to be assigned the group manager role.
6. Add the support role and the user role by entering the user or group name.



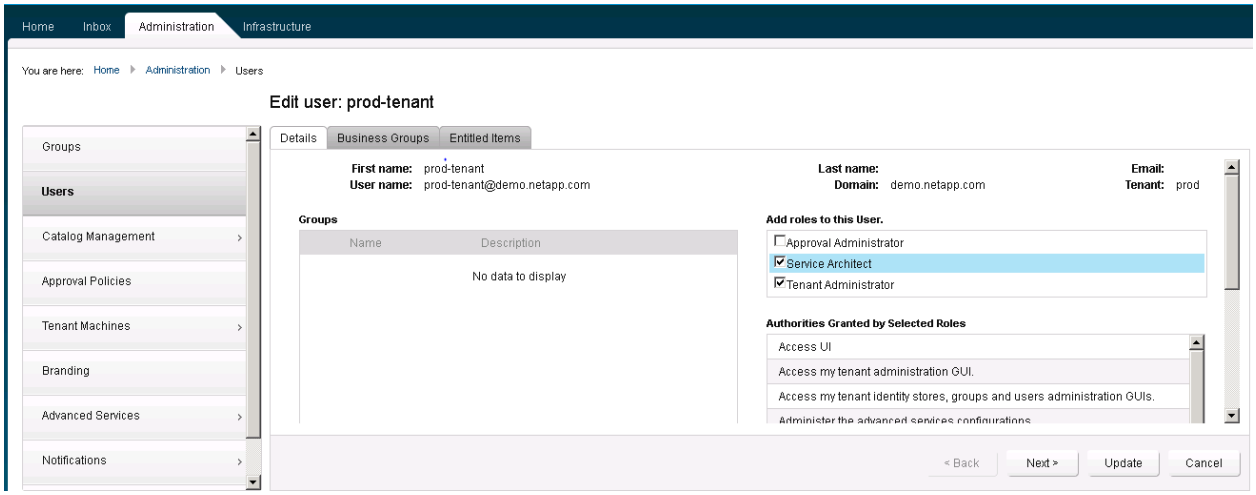
6.6 Assign Service Architect Role to User

To assign the service architect role to a user, complete the following steps:

1. Log in to vRA as tenant administrator.
2. Navigate to Administration > Users.
3. Enter the name of the user in the search field and click Enter.
4. When the user name is displayed, click Edit in the Actions drop-down list.



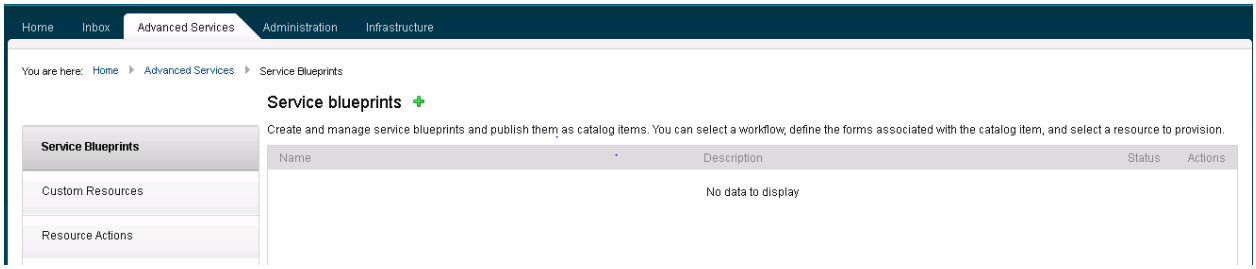
5. In the Edit User pane, select Service Architect to assign this role to the user.
6. Click Update.



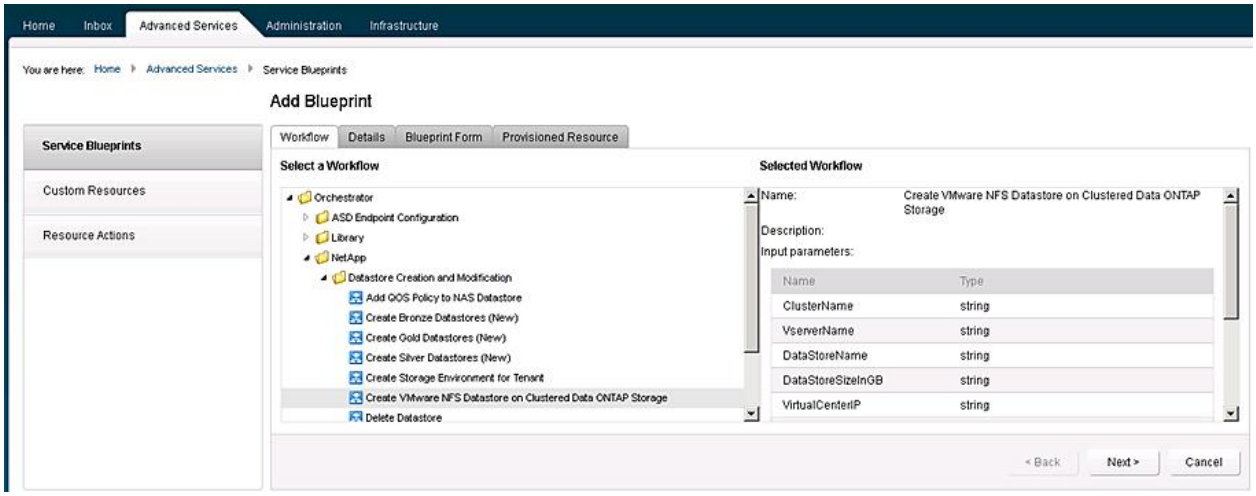
6.7 Create Service Blueprint

To create a service blueprint, complete the following steps:

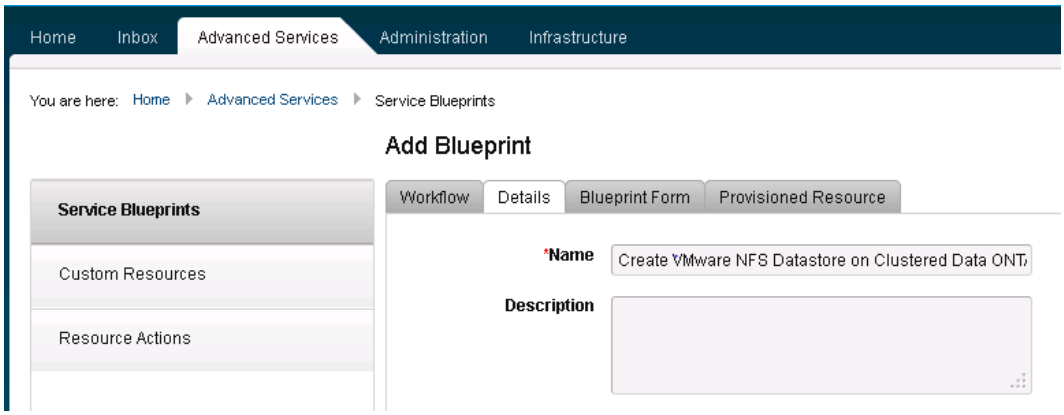
1. Log in to vRA as service architect.
2. Navigate to Advanced Services > Service Blueprints and click the green plus icon (+) to add a service blueprint.



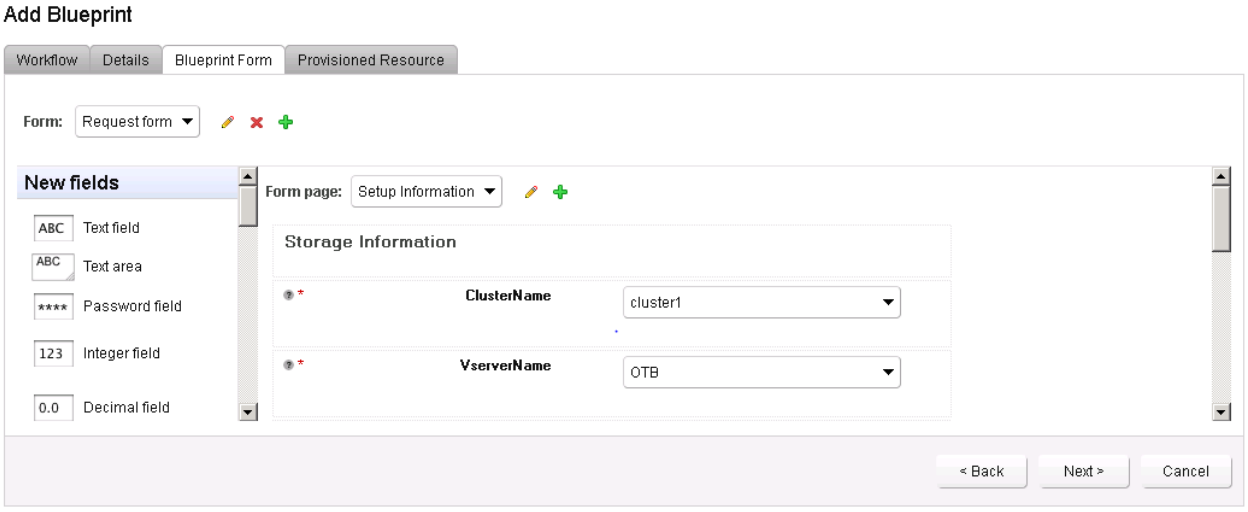
3. Select a workflow to include in the service blueprint and click Next.



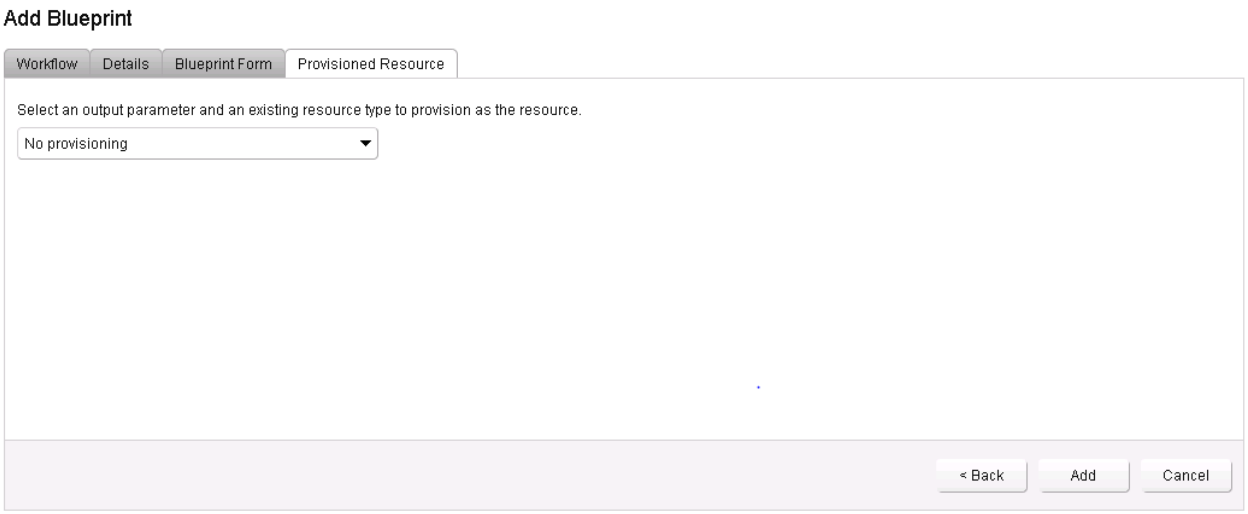
4. Enter a description for this workflow and click Next.



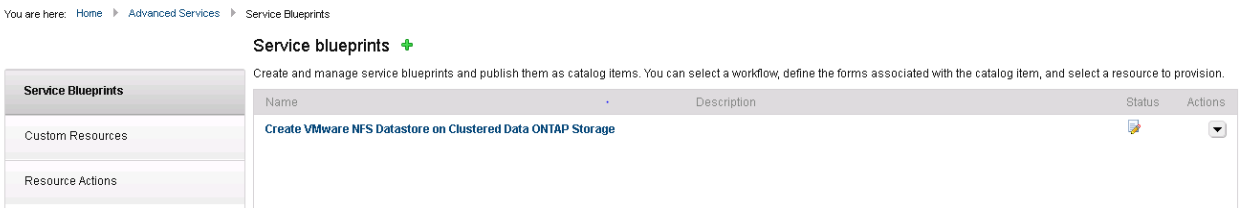
5. Enter the setup information for this workflow and click Next.



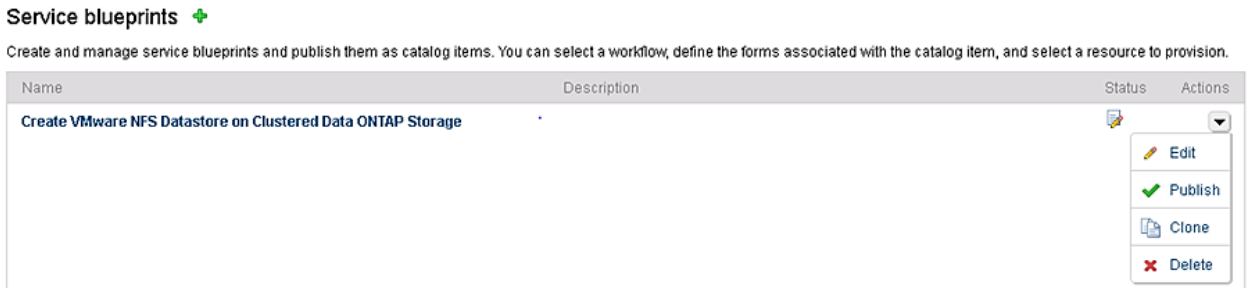
6. Click Add to complete the setup.



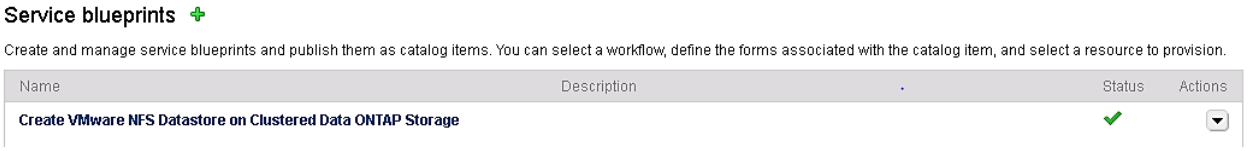
7. Verify that the name of the new service blueprint appears in the Service Blueprints list to confirm that it was created successfully.



8. From the Actions drop-down list, click Publish to publish the newly created blueprint as a catalog item.



9. Confirm that the blueprint is published, as indicated by a green checkmark in the Status column.

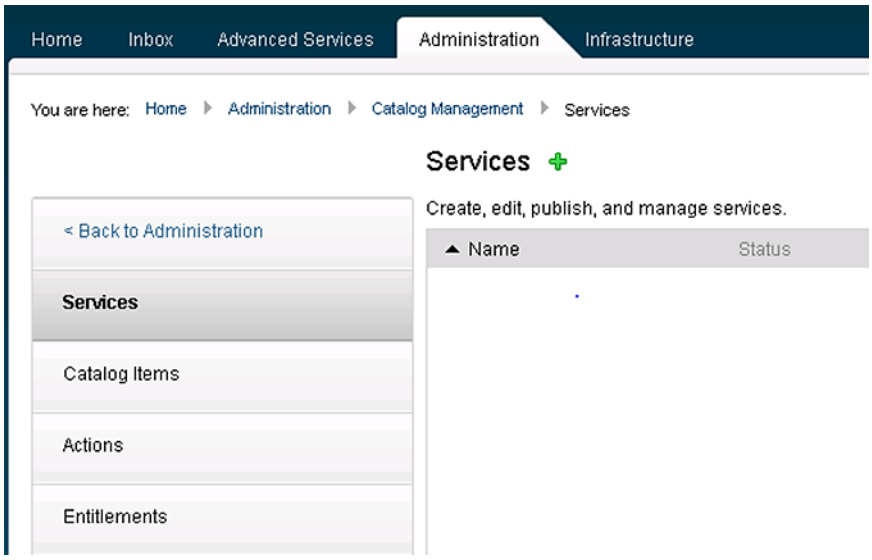


6.8 Create Service and Add Blueprint

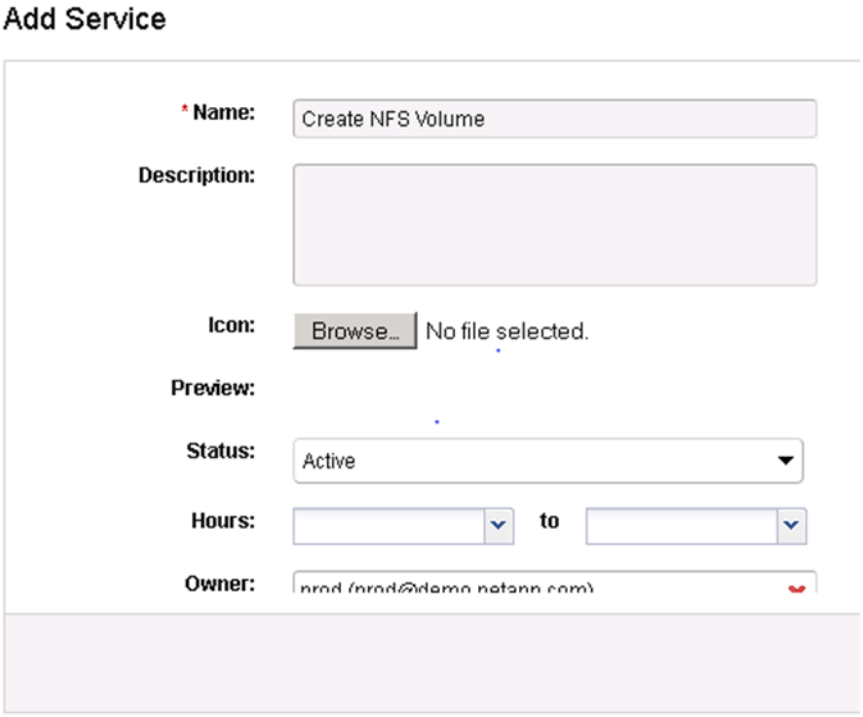
To create a service and add a blueprint, complete the following steps:

1. Log in as tenant administrator, business group manager, or service architect.
2. Navigate to Administration > Catalog Management > Services.

3. Click the green plus icon (+) to create a new service.



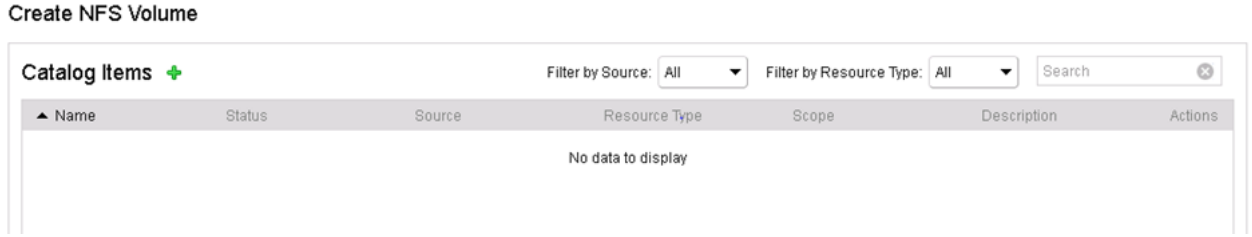
4. Enter the following information:
   a. Enter a name for this service and provide a description.
   b. Verify that the status of the service is `Active`.
   c. Optional: Enter the time when the support service team will be available.
   d. Specify a user as the owner of this service.
   e. Specify a user as part of the support team for this service.
   f. In the Change Window field, select a day and time for any scheduled maintenance.



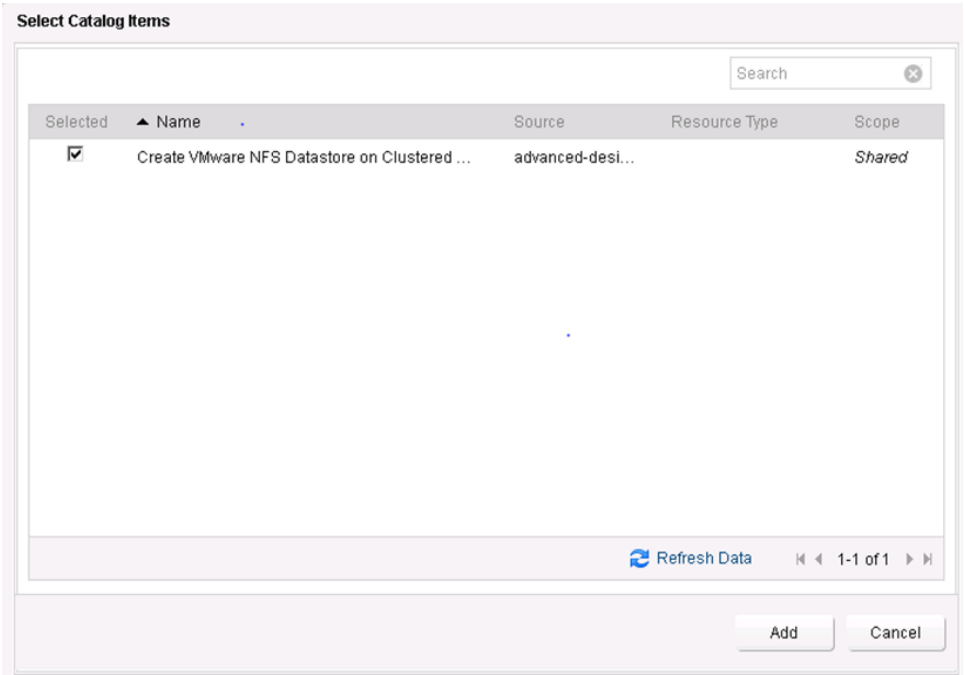
5. Click Add and confirm that the service name appears in the list of services.

6. In the Actions drop-down list, select Manage Catalog Items.

7. Click the green plus icon (+) to add catalog items.



8. Select catalog items to add to the service.

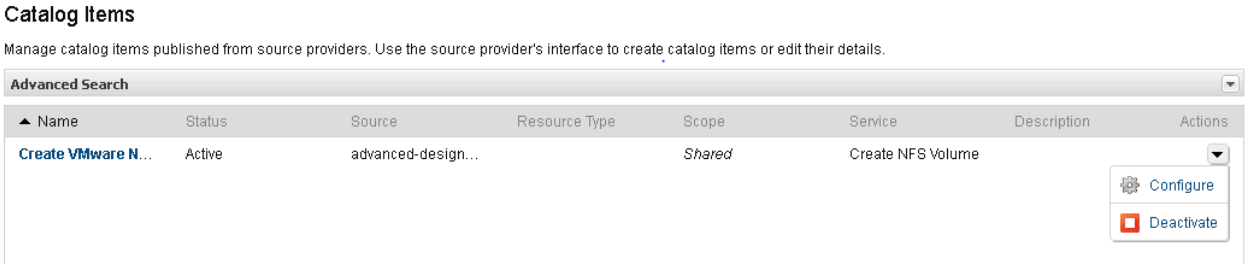


6.9 Configure Catalog Items

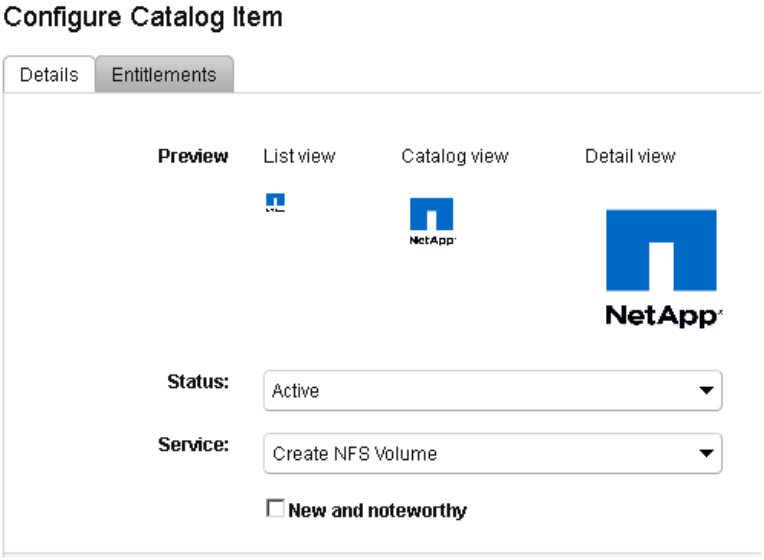
To configure the selected catalog items, complete the following steps:

1. Remain signed in as tenant administrator and continue to use the same session that was used to create services.
2. Navigate to Administration > Catalog Management > Catalog Items.

   Note: The list of catalog items includes all available blueprints.
3. In the Actions drop-down list, click Configure to configure the catalog item.



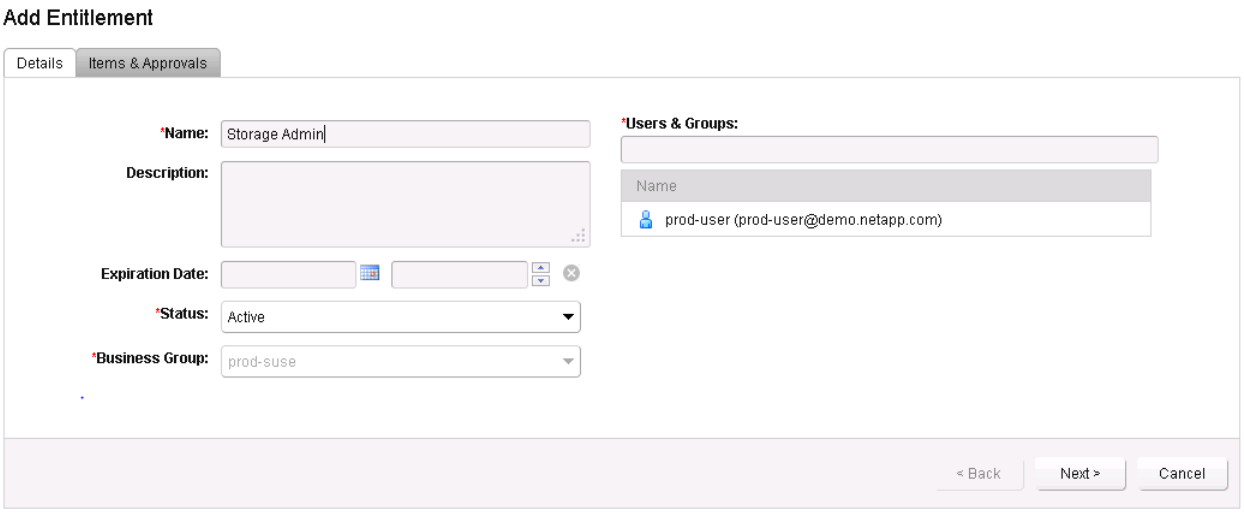
4. Add a logo for the catalog item.
5. Select a service for the catalog item.



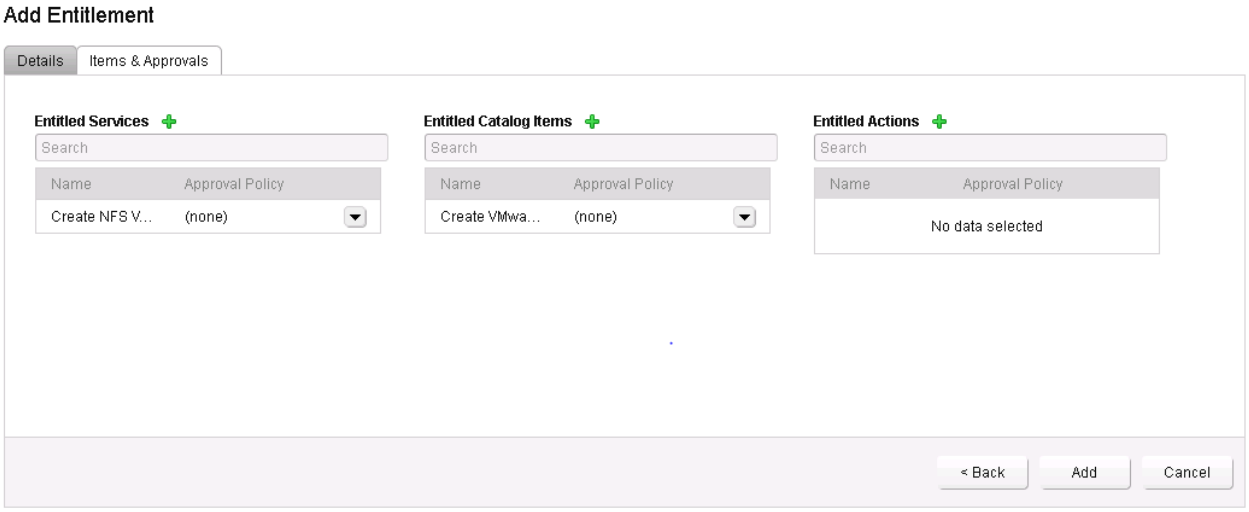
6.10 Add Entitlement

To add an entitlement, complete the following steps:

1. Log in to vRA as tenant administrator.
2. Navigate to Administration > Catalog Management > Entitlements.
3. Click the green plus icon (+) to add entitlements.
4. Enter the name for the entitlement.
5. Make sure that the state is set to `Active`.
6. Select the business group.
7. Enter the user or group name and click Next.



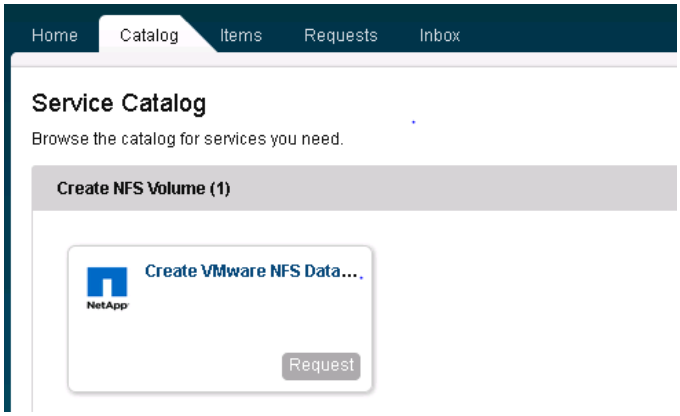
8. In the Items & Approvals tab, select the appropriate services and catalog items for the user or group added in step 7. Click Add.



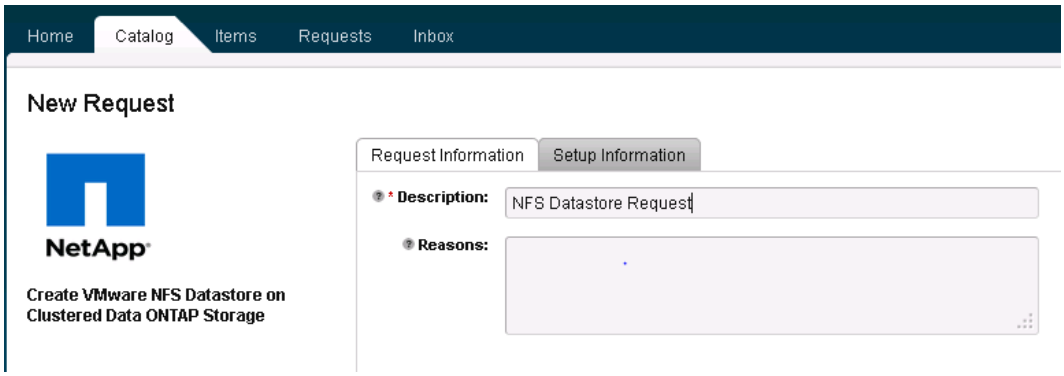
6.11 Request Catalog Items

To request a catalog item, complete the following steps:

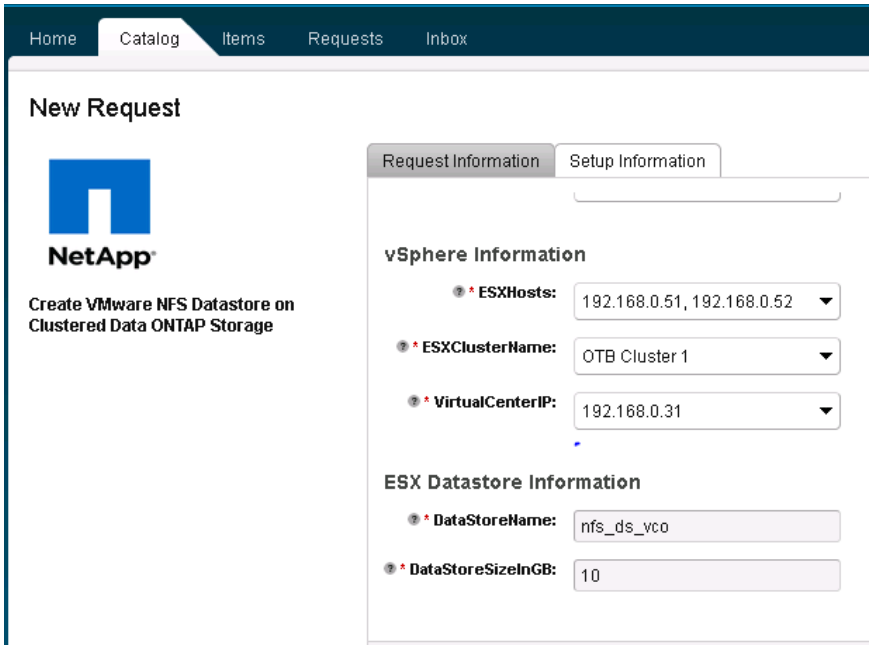
1. Log in to vRA using the user name that was added in the Users & Groups field in step 7 of the “Add Entitlement” section.
2. Click the Catalog tab and request the catalog item that is available for this user.



3. Enter a name for this request and click Next.



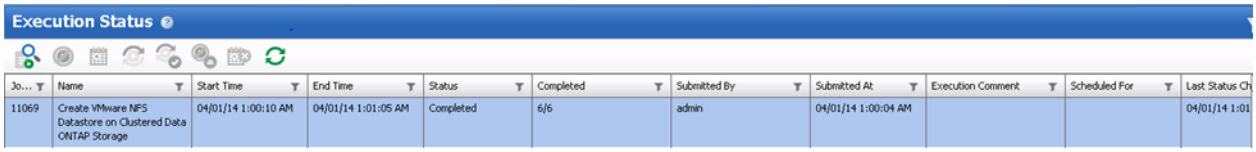
4. Change the setup information according to the requirements and click Submit.



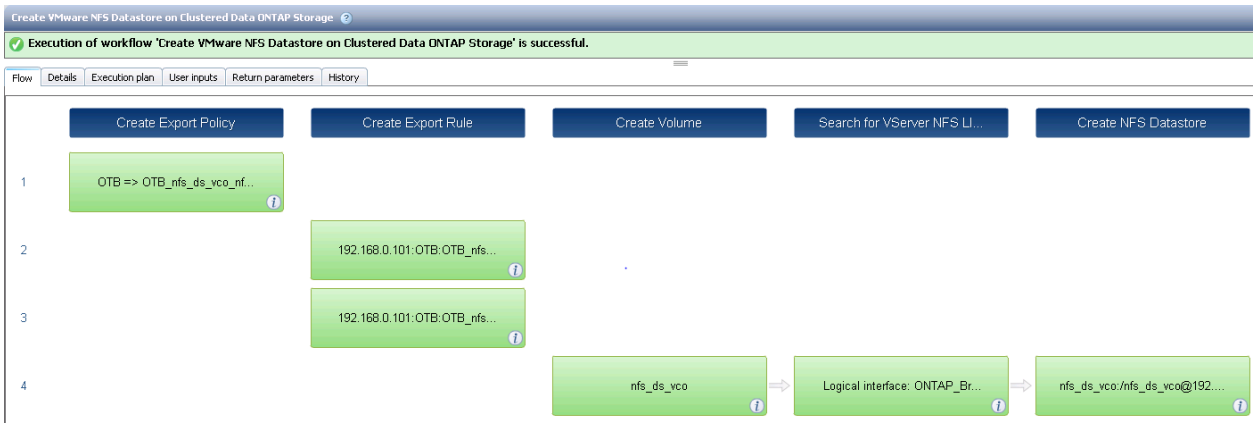
6.12 Validate Catalog Request

To validate a catalog request, complete the following steps:

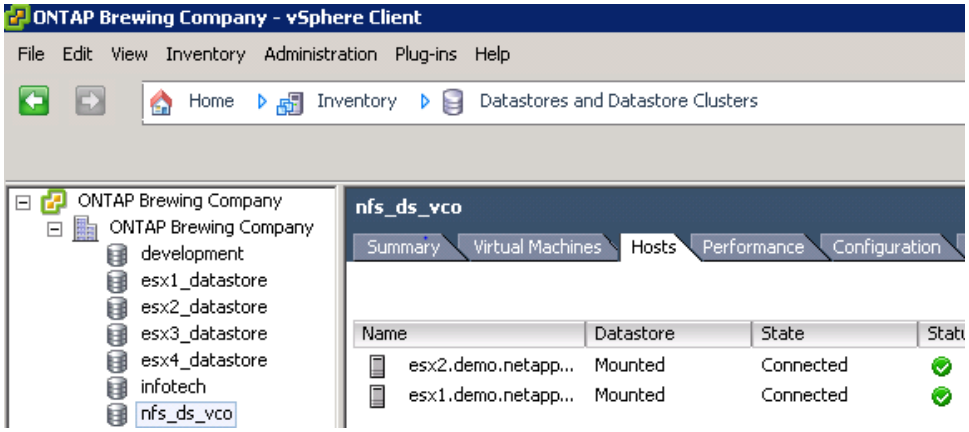
1. Log in to NetApp OnCommand Workflow Automation.
2. Navigate to Execution > Execution Status and confirm that the workflow was successful.



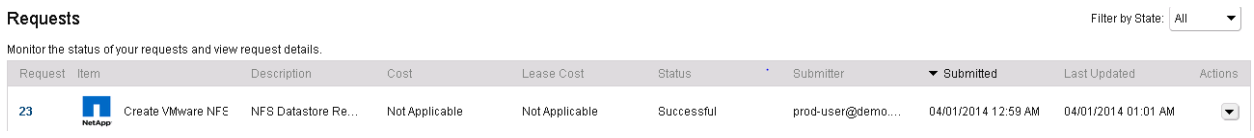
3. Optional: Double-click the job ID to show the execution of the workflow.



4. Log in to the vCenter Server and confirm that the NFS datastore was created and that it was mounted to the VMware ESXi hosts.



5. Log in to vRA as the user requesting the catalog and click the Requests tab to confirm that the request was submitted successfully.

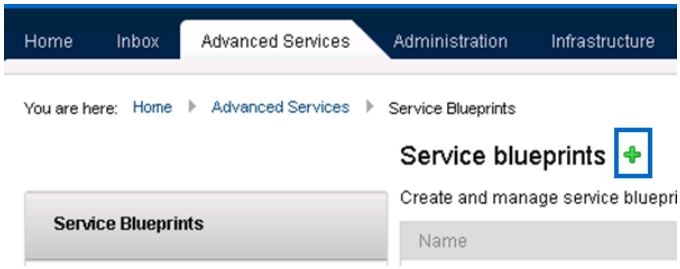


6.13 Build Advanced Service Blueprint

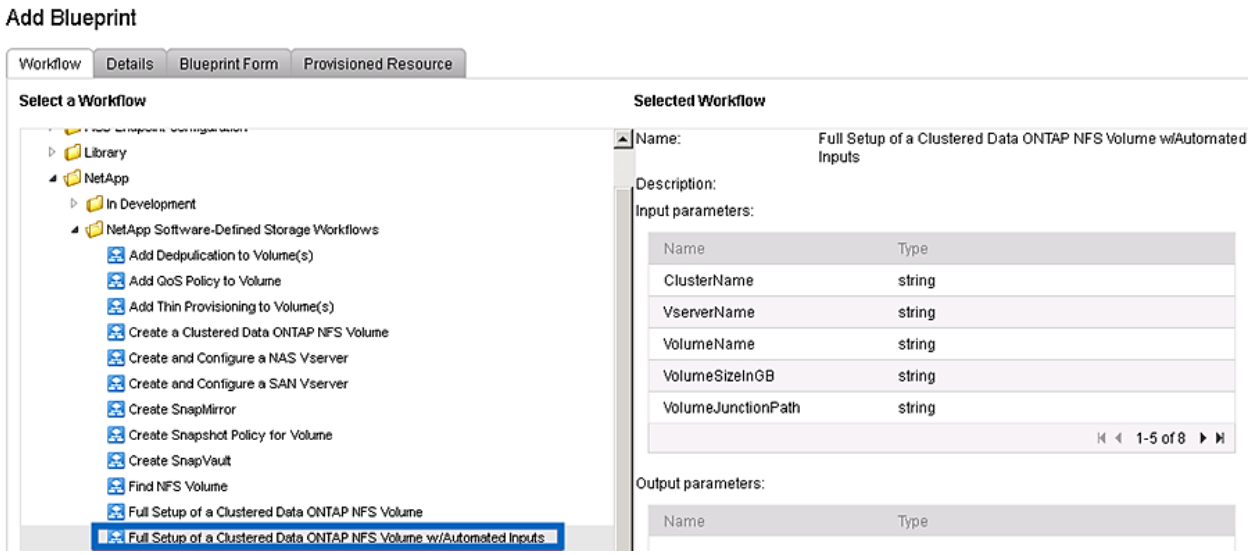
To build an advanced service blueprint from the vRO workflow, complete the following steps:

1. Log in to vRA as the user requesting the catalog.

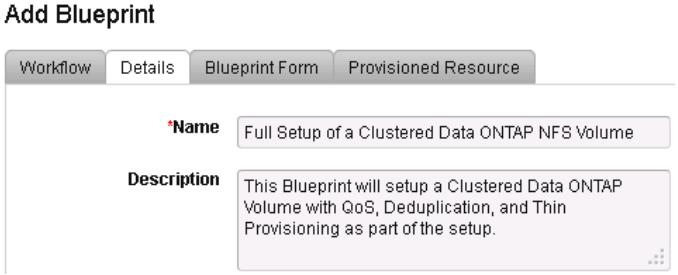
2. Navigate to Advanced Services > Service Blueprints.
3. Click the green plus icon (+) to add a blueprint.



4. Select the vRO workflow to use as the blueprint baseline and click Next.

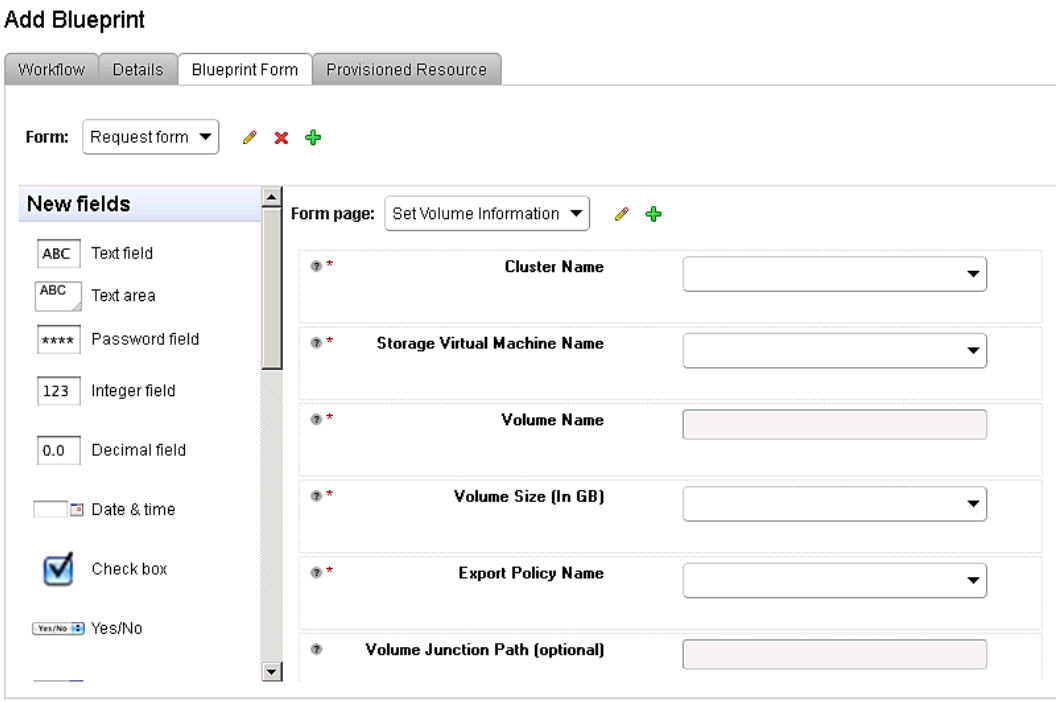


5. Click the Details tab and enter a name for the blueprint.



6. Click the Blueprint Form tab, edit the fields in a way that meets the requirements for your blueprint, and click Next.

   Note: The options on this tab are configurable. For example, you can change the appearance of the items, change the order in which they appear, add additional input steps, and so on.

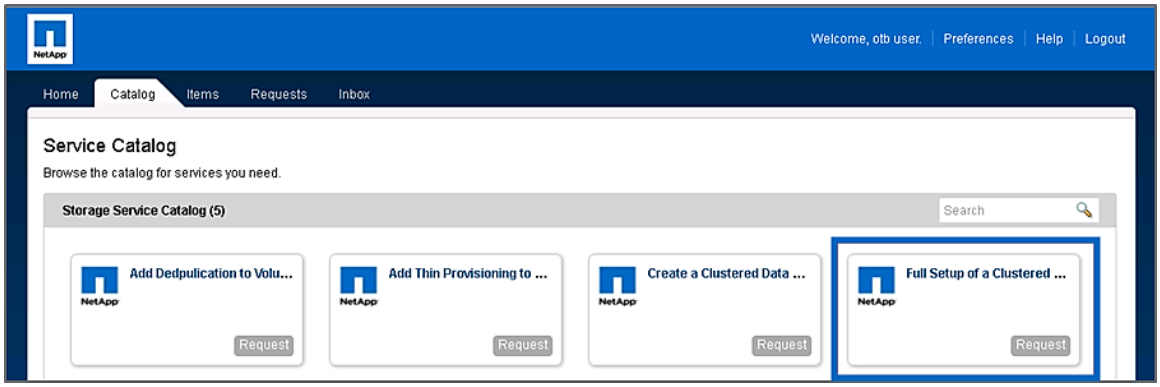


7. On the Provision Resource page, click Add.
8. Add the new blueprint to the storage service catalog and grant permissions to access it.

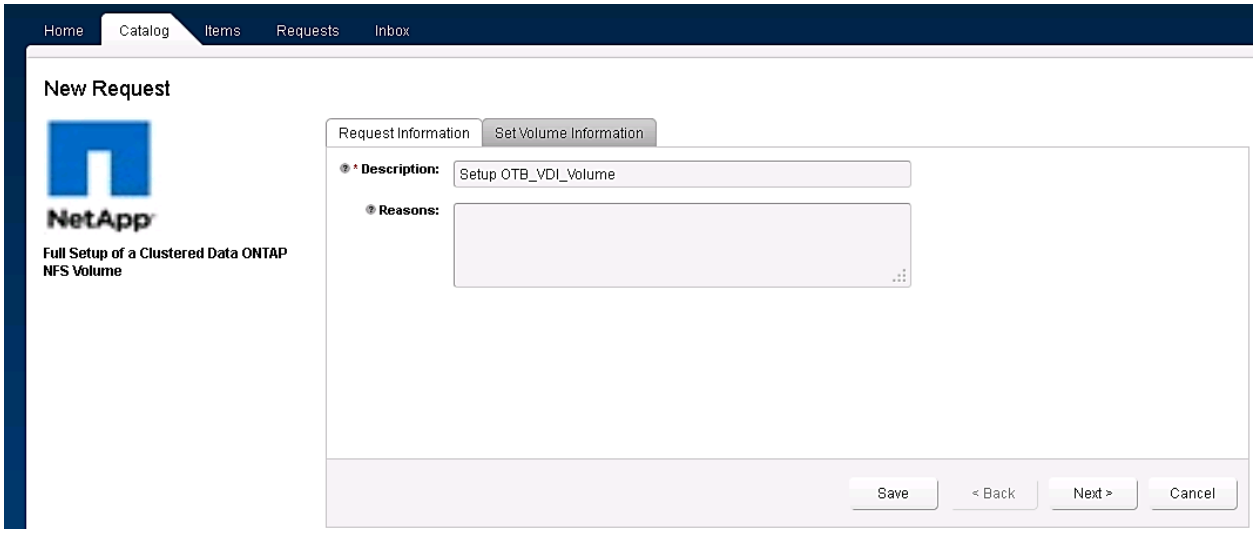
6.14 Test Finished Blueprint Wrapper Workflow

To test the finished blueprint wrapper workflow, complete the following steps:

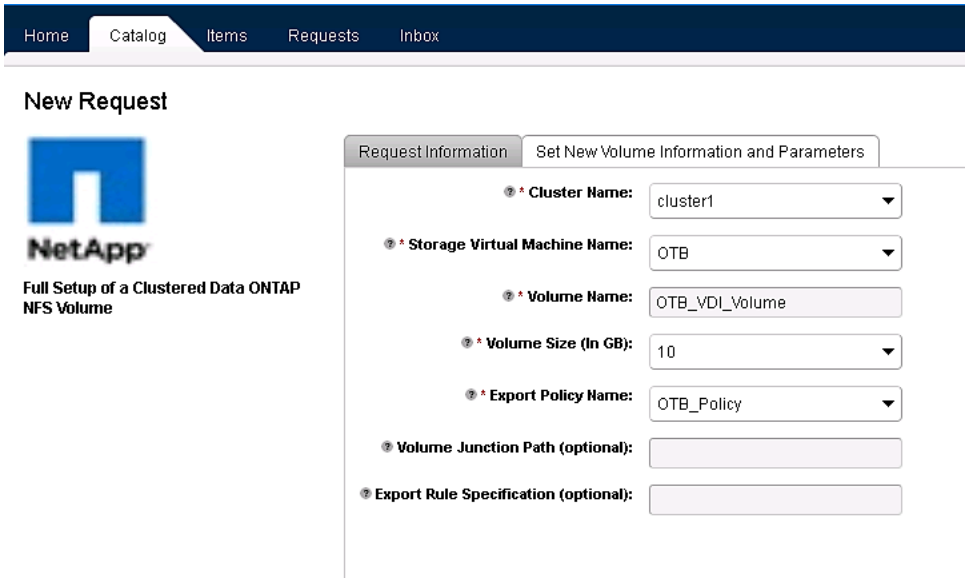
1. Log in to the vRA environment as a user with access to the newly created blueprint.
2. Locate the blueprint and click Request.



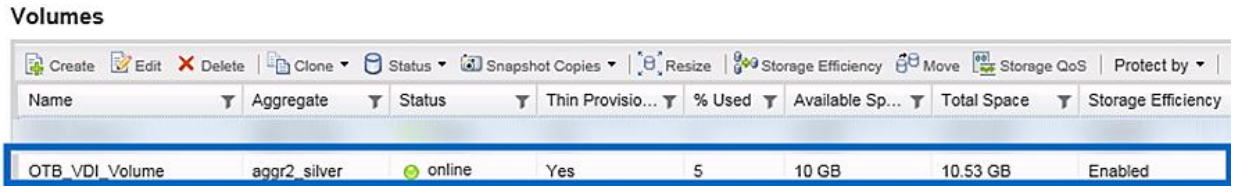
3. Enter a description of the new request and click Next.



4. Click the Set New Volume Information and Parameters tab and enter or select the required values. Click Submit.



5. Open OnCommand System Manager and verify that the blueprint is online and that all of the parameters are correctly set.



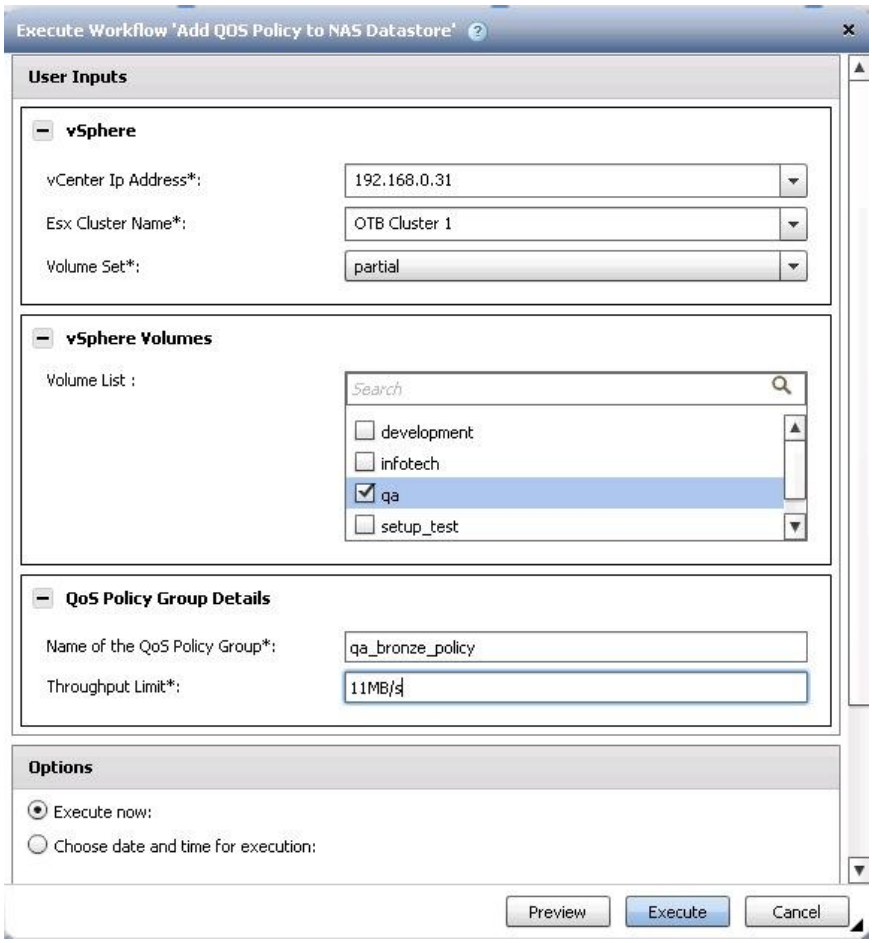
7 Test Procedures

7.1 Verify WFA Workflow Functionality

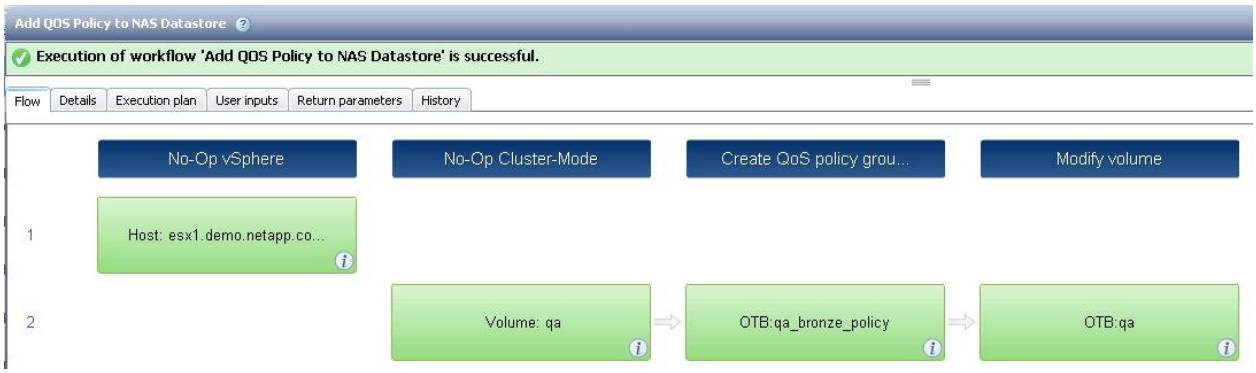
This test is designed to verify whether WFA is communicating with the storage.

Test Procedure

1. Log in to WFA using the administrator user name and password that were created during the initial WFA setup.
2. Double-click the Add QOS Policy to NAS Datastore workflow to run it.
3. In the Execute Workflow 'Add QOS Policy to NAS Datastore' dialog box, fill in all fields. Select Partial for Volume Set, select your datastore from the Volume List drop-down list, and click Execute.



4. As the workflow runs, verify that each workflow stage changes to green. WFA is configured and ready for production when the message Execution of Workflow 'Add QOS Policy to NAS Datastore' Is Successful is displayed at the top of the page.

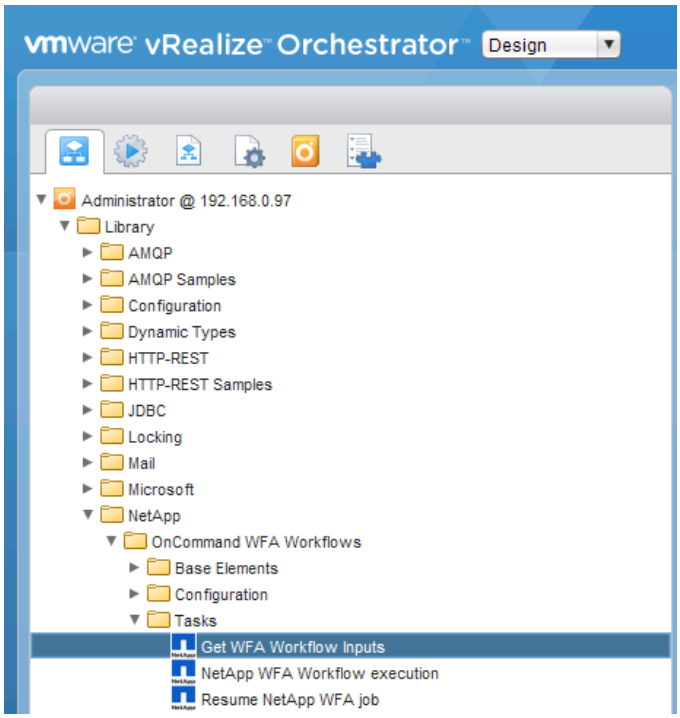


7.2 Verify That WFA Can Connect to vRO

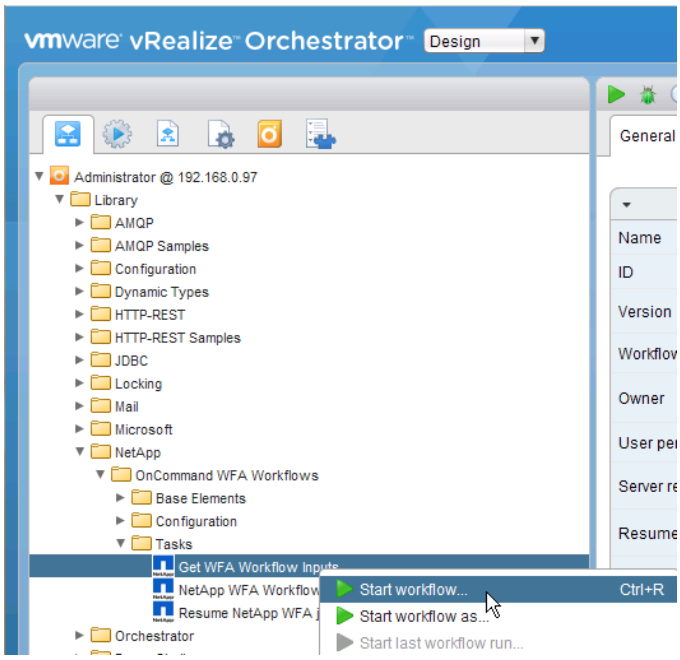
This test verifies that both the NetApp WFA package for vRO and vRO itself are set up and working properly for the environment.

Test Procedure

1. Log in to vRO.
2. Click the Workflows tab, navigate to Library > NetApp > OnCommand WFA > Tasks, and right-click Get WFA Workflow Inputs.

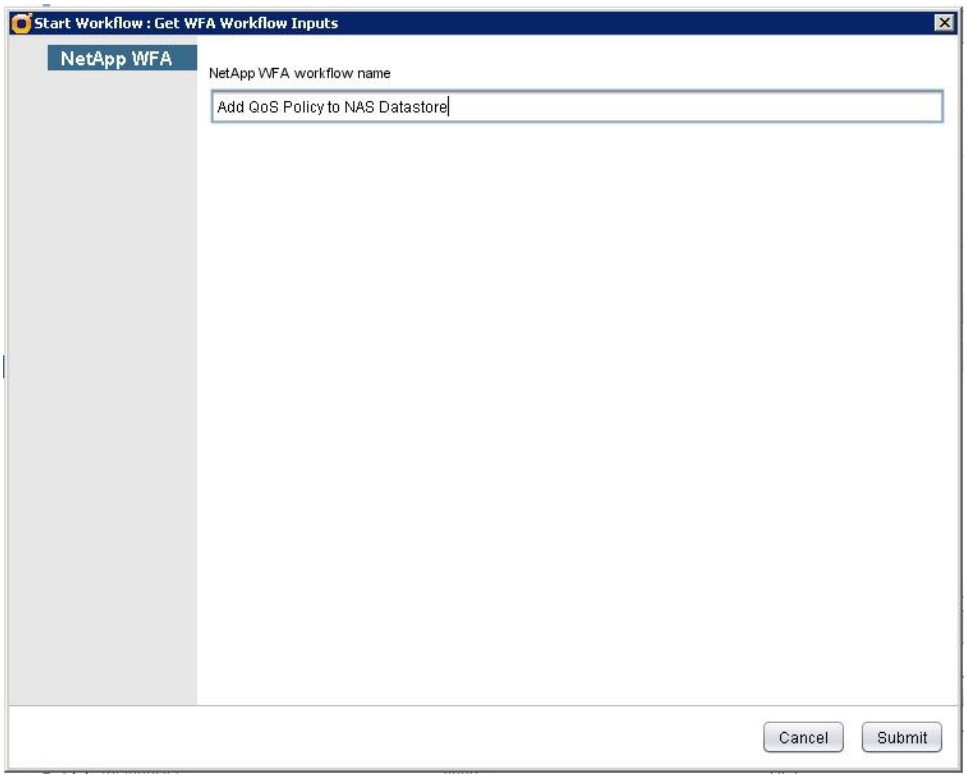


3. Select Start Workflow.

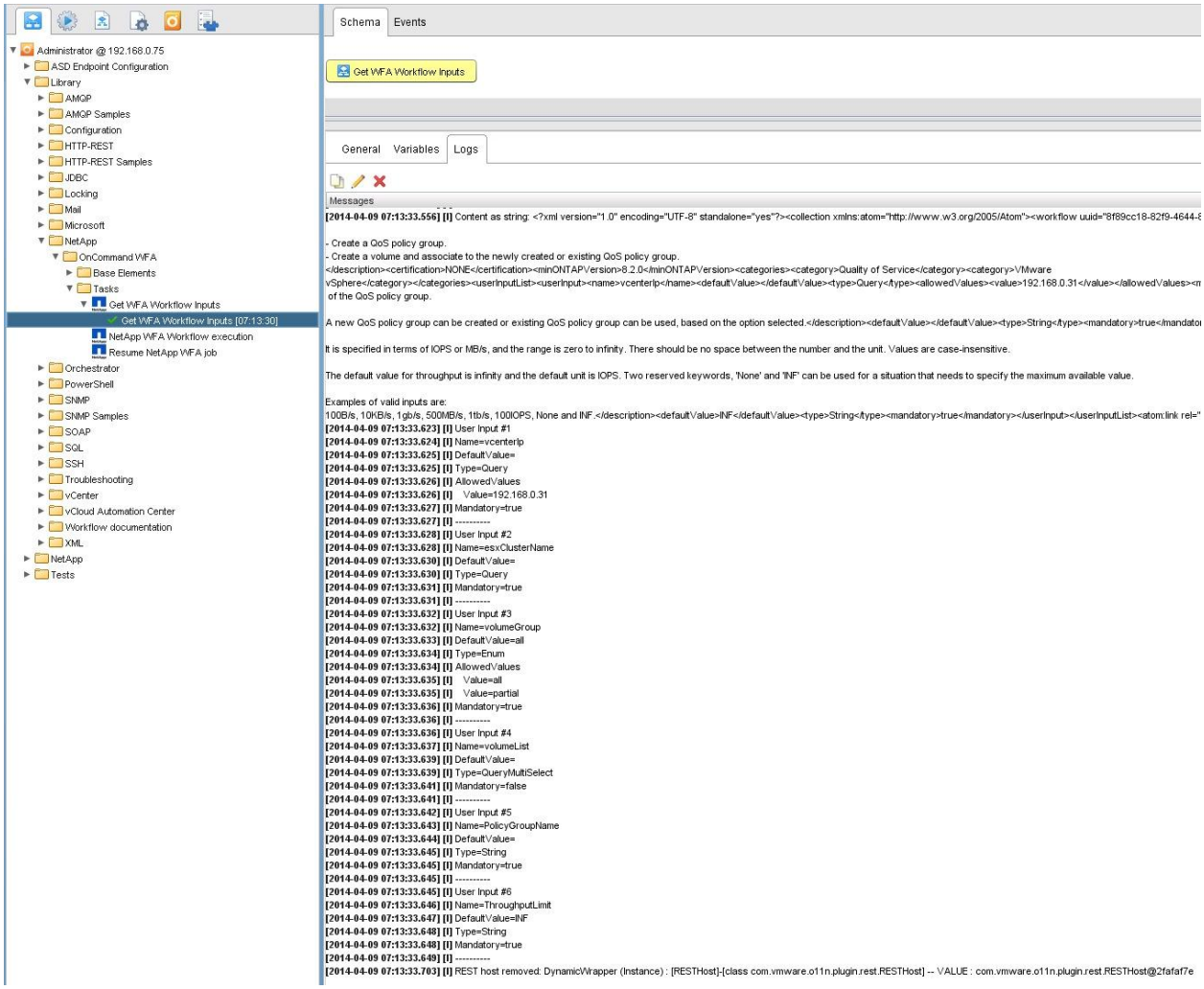


4. Enter the name of the WFA workflow to which you would like to connect and click Submit.

   Note: In the example, Add QoS Policy to NAS Datastore WFA is the workflow used to test connectivity.



5. After the workflow runs, verify that a log is generated with the inputs required to create a vRO workflow. Also check that a green check mark is displayed next to the Get WFA Workflow Inputs job that you just ran.



References

The following resources were referenced in this document:

- Advanced Service Design: vCloud Automation Center 6.2 http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-advanced-service-design.pdf
- Foundations and Concepts: vCloud Automation Center 6.2 http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-foundations-and-concepts.pdf
- IaaS Configuration for Virtual Platforms: vCloud Automation Center 6.2 http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-iaas-configuration-for-virtual-platforms.pdf
- Installation and Configuration: vCloud Automation Center 6.2 http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-installation-and-configuration.pdf
- Foundations and Concepts: vRealize Automation 6.2

  http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-foundations-and-concepts.pdf

- Tenant Administration: vCloud Automation Center 6.2
  http://pubs.vmware.com/vra-62/topic/com.vmware.ICbase/PDF/vrealize-automation-62-tenant-administration.pdf
- NetApp OnCommand System Manager 3.1.1 Installation and Setup Guide
  https://library.netapp.com/ecm/ecm_download_file/ECMP1516146
- Virtual Storage Console 6.0 for VMware vSphere Installation and Administration Guide
  https://library.netapp.com/ecm/ecm_get_file/ECMP12405914
- Software-Defined Storage with NetApp and VMware
  http://www.netapp.com/us/system/pdf-reader.aspx?m=TR-4308.pdf
- OnCommand Unified Manager 6.2 Installation and Setup Guide
  https://library.netapp.com/ecm/ecm_get_file/ECMP1653269
- OnCommand Workflow Automation 3.0 Installation and Setup Guide
  https://library.netapp.com/ecm/ecm_get_file/ECMP1644817
- OnCommand Workflow Automation Community Site
  https://communities.netapp.com/community/products_and_solutions/storage_management_software/workflow-automation
- VMware Product Interoperability Matrixes
  http://partnerweb.vmware.com/comp_guide/sim/interop_matrix.php
- Installing and Configuring VMware vRealize Orchestrator
  http://pubs.vmware.com/vsphere-60/topic/com.vmware.ICbase/PDF/vrealize-orchestrator-60-install-config-guide.pdf
- VMware vRealize Orchestrator Documentation
  https://www.vmware.com/support/pubs/orchestrator_pubs.html
- VMware vRealize Automation Documentation
  https://www.vmware.com/support/pubs/vcac-pubs.html

Version History

Version	Date	Document Version History
Version 1.0	June 2014	Initial release
Version 2.0	May 2015	Update for WFA 3.0, vRA 6.2, vRO 6.0

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.