



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

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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](#).

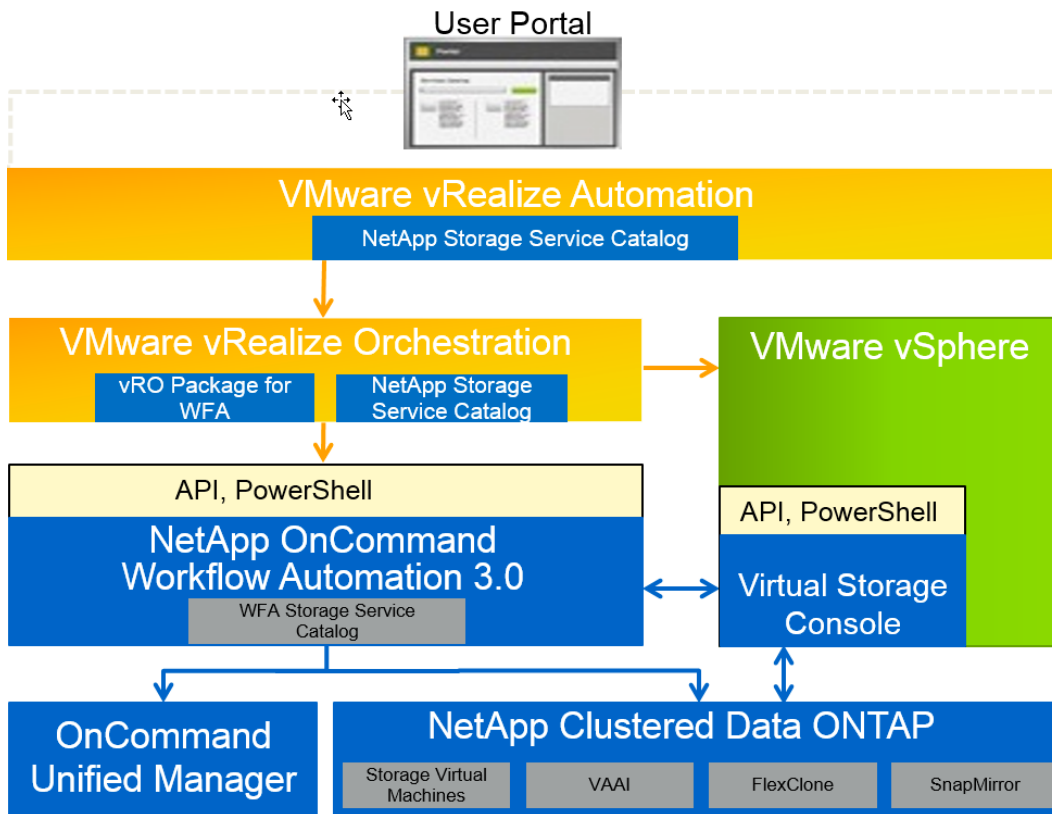
1.2 Target Audience

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.

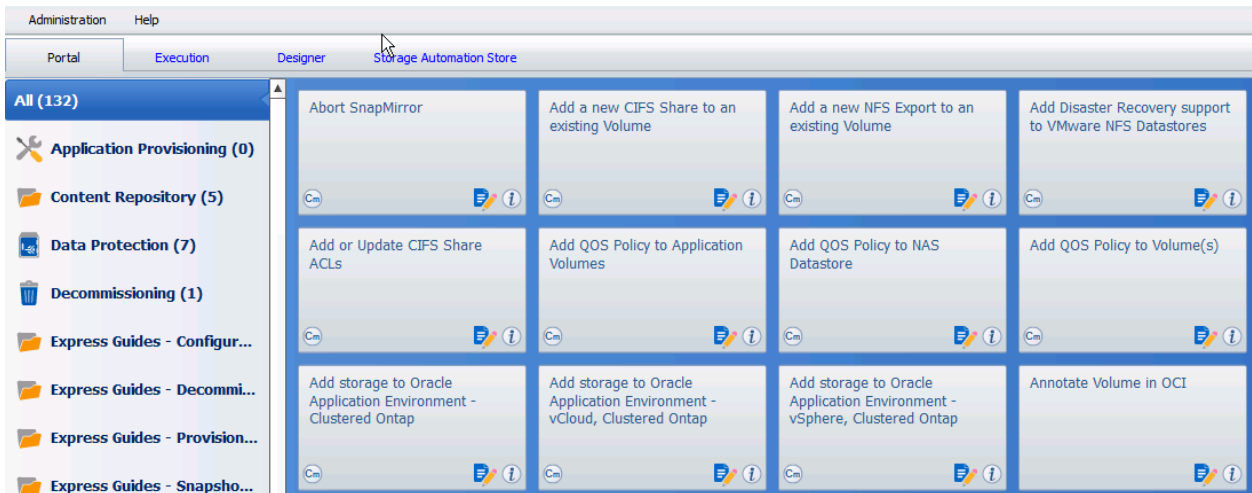
Note: OnCommand Workflow Automation 3.0 must be installed before beginning these procedures. For information about the initial installation and setup of OnCommand Workflow Automation, refer to the [OnCommand Workflow Automation 3.0 Installation and Setup Guide](#).

2.1 Import Workflows into WFA

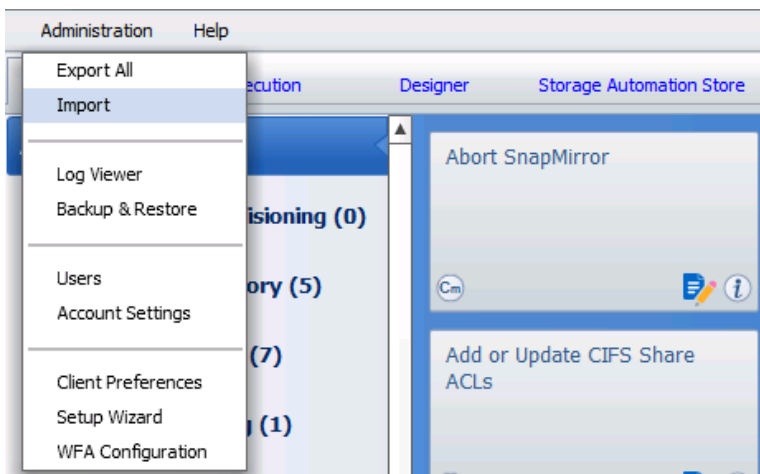
To configure a software-defined storage environment, you can use the current workflows that cover most of the basic storage and provisioning needs, or you can download a package of workflows from the NetApp community site. The NetApp community regularly creates workflows and shares them with the public.

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.

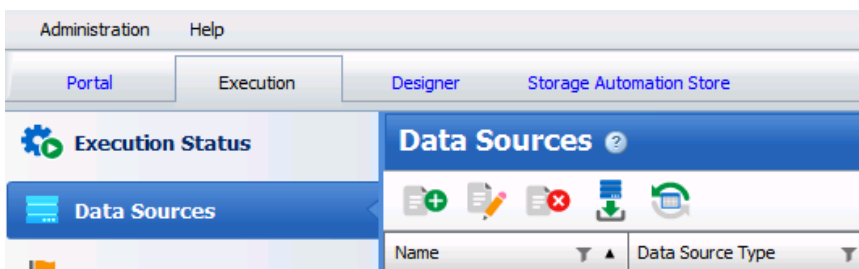


5. Select one of the compressed disk archive (DAR) files and open it.
6. Repeat steps 4 and 5 until all files are restored.

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.

Data Source Configuration

Name:

Data source type:

Host name:

Port:

User name:

Password:

Timeout (sec):

Scheduler configuration

Scheme	Interval (minutes)
vc	10

Reset Scheme Save Cancel

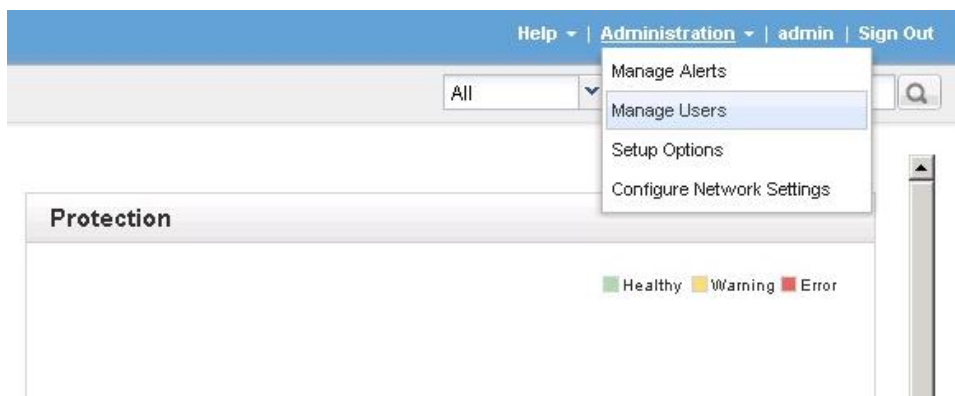
6. Enter the desired time interval. In the example in step 5, the interval is set to 10 minutes.
7. Click Save.
8. In the Data Sources table, select the data source and click Actions > Acquire Now.
9. In the History table, verify that the data acquisition status is listed as Completed.

2.3 Set Up OCUM Database User

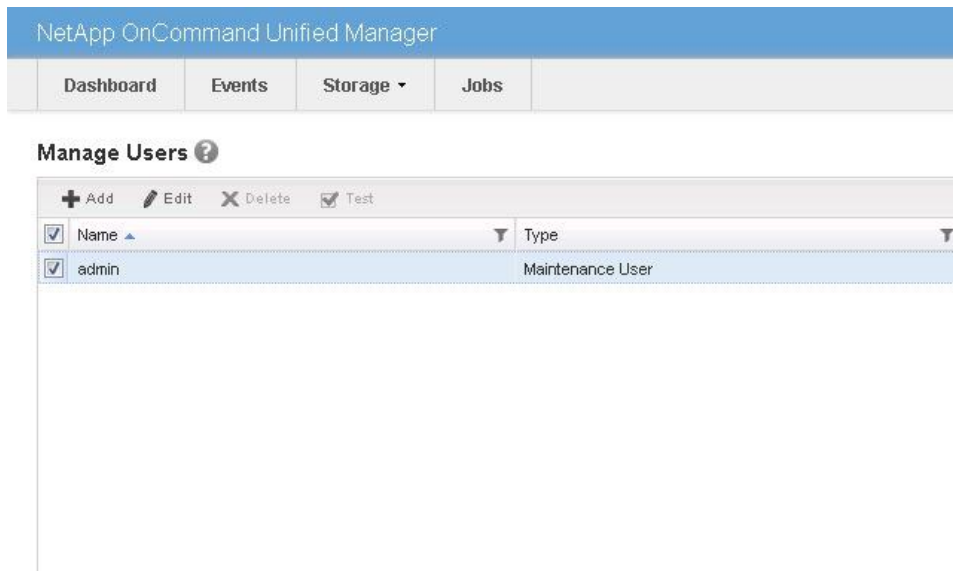
To set up the OCUM database user, complete the following steps:

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.

Add User ?

⚠ Database users are mainly for integration with OnCommand Workflow Automation, and provide access to the database views but not general access to OnCommand Unified Manager.

Type: Database User

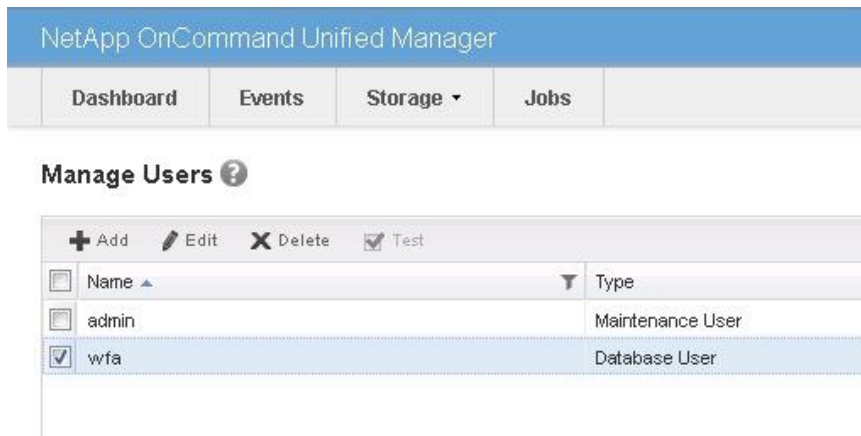
Name: wfa

Password:

Confirm Password:

Add Cancel

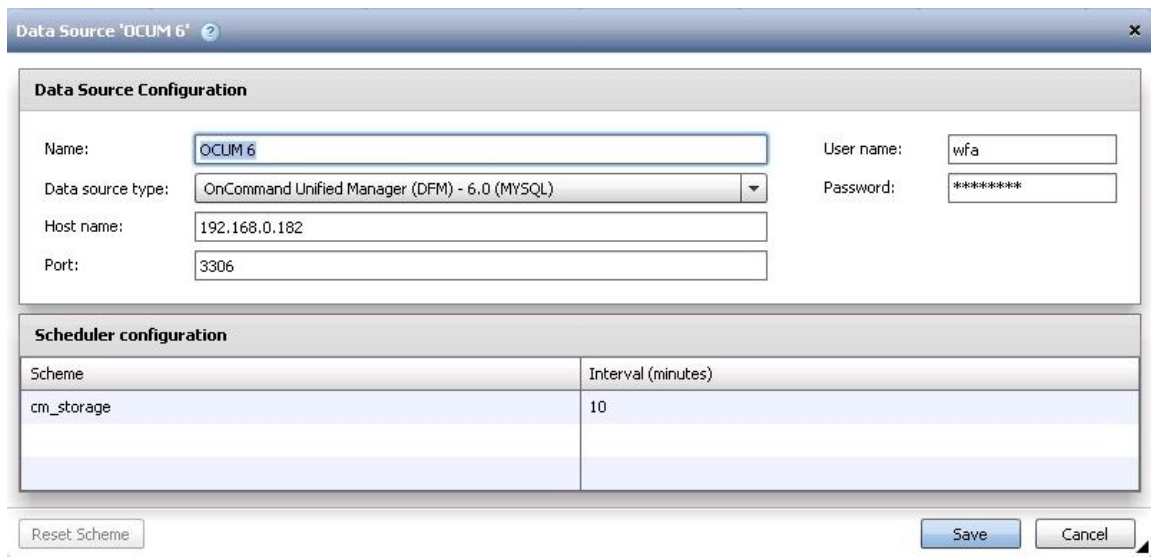
5. Verify that the new user is visible on the NetApp OnCommand Unified Manager page.



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.

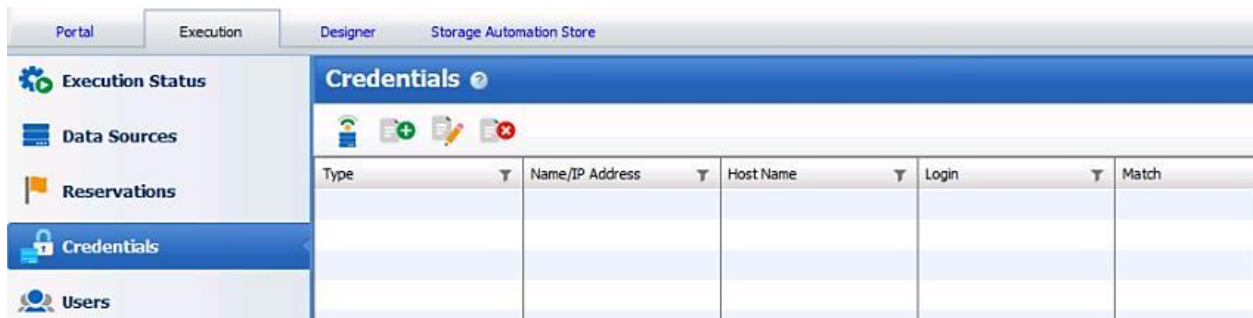


9. Click Save.
10. Right-click the new data source and select Acquire Now.

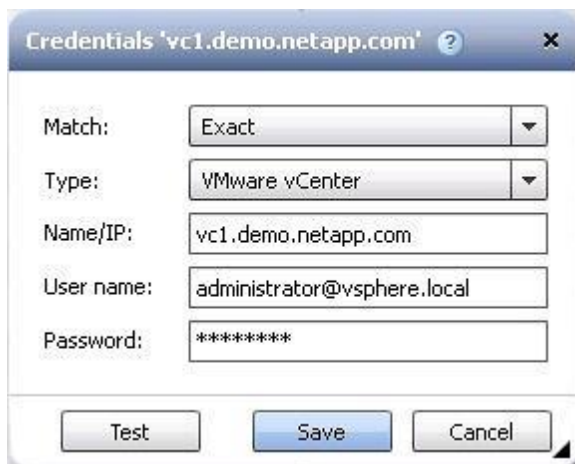
2.5 Set Up Credentials for vCenter and OCUM

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.

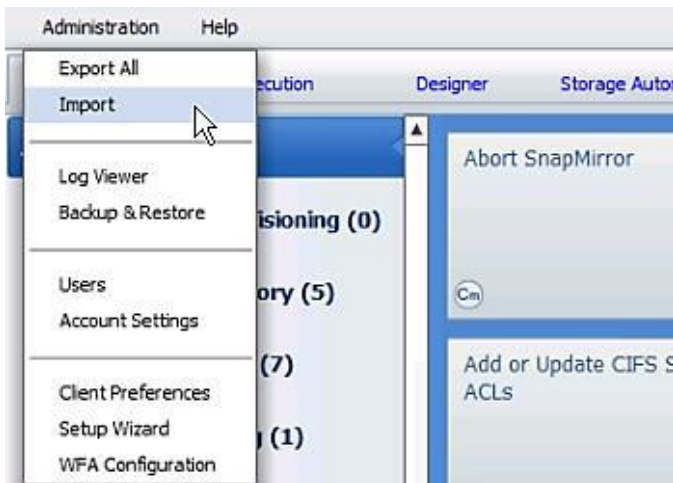
A screenshot of a 'Credentials' dialog box for the host 'ocum.demo.netapp.com'. The dialog has a title bar with a question mark icon and a close button. It contains five input fields: 'Match' (set to 'Exact'), 'Type' (set to 'OnCommand Unified Manager'), 'Name/IP' (containing 'ocum.demo.netapp.com'), 'User name' (containing 'admin'), and 'Password' (containing seven asterisks). At the bottom are three buttons: 'Test', 'Save', and 'Cancel'.

8. Click Save.

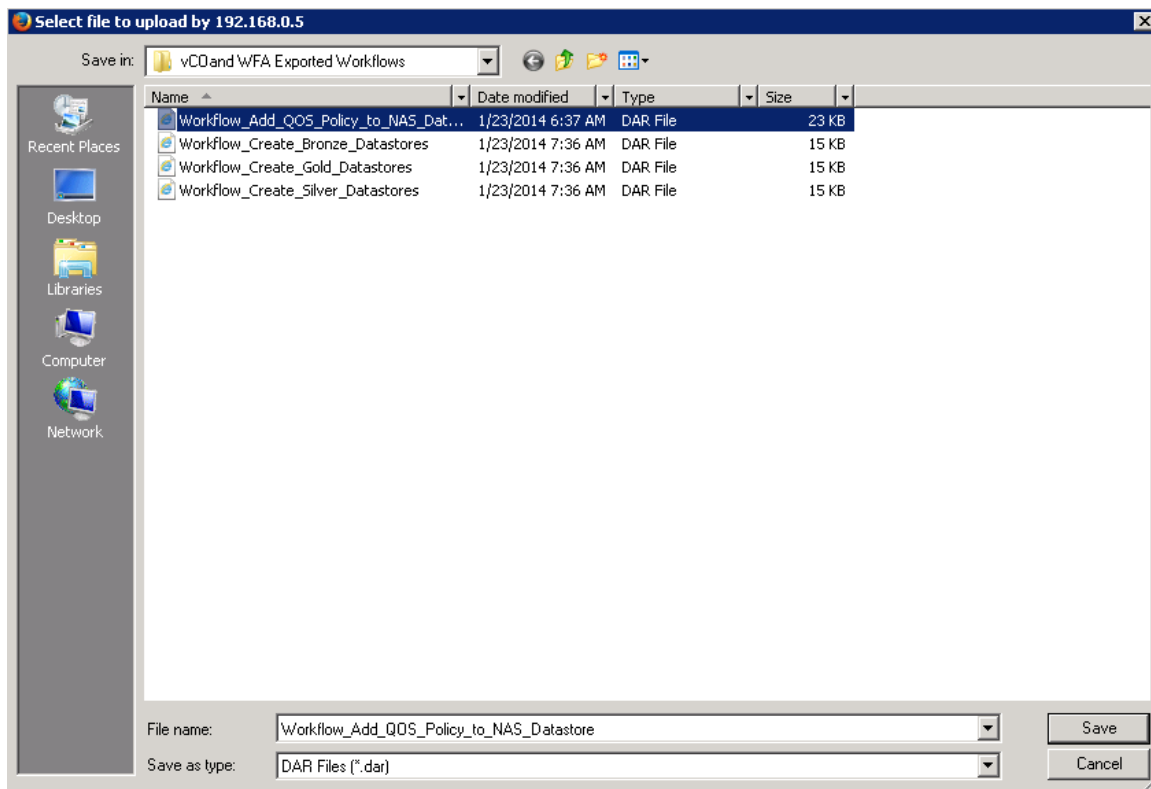
2.6 Import Storage Orchestration Workflows into WFA

To import an existing workflow, complete the following steps:

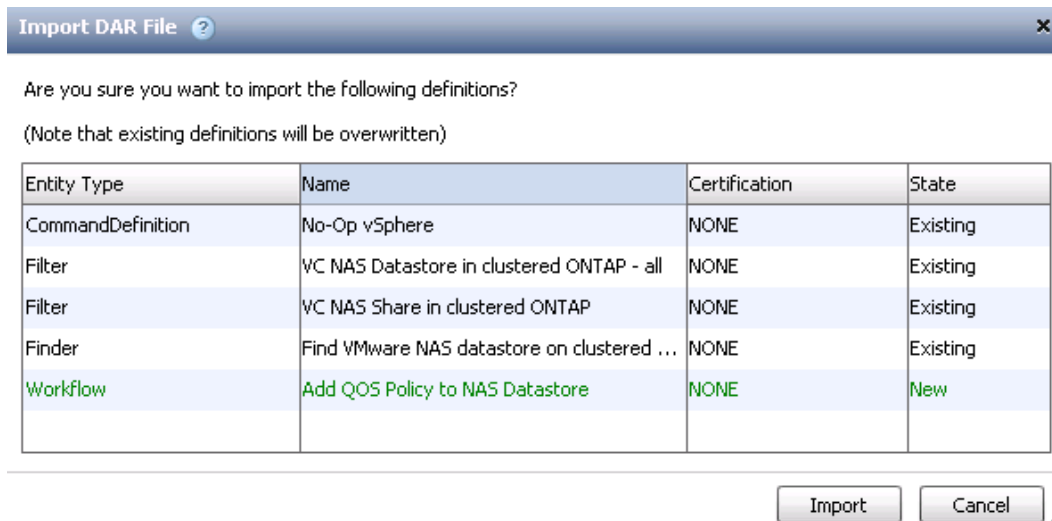
1. Using a web browser, log in to WFA.
2. Click Administration > Import.



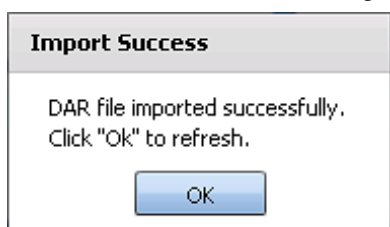
3. Browse to the folder that contains existing workflows and click Save.



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.

Execute Workflow 'Add QoS Policy to NAS Datastore' ?

vSphere

vCenter Ip Address*: 192.168.0.31

Esx Cluster Name*: OTB Cluster 1

Volume Set*: partial

vSphere Volumes

Volume List :

Search

☐ infotech

☐ qa

☐ setup_test

☒ templates

QoS Policy Group Details

Name of the QoS Policy Group*: otb_test_policy

Throughput Limit*: 11MB/s

Options

☒ Execute now:

☐ Choose date and time for execution:

Preview Execute Cancel

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



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

Execution Status						
Job ID	Name	Start Time	End Time	Status	Completed	
168657	Add QoS Policy to Volume(s)	03/16/15 10:36:36 AM	03/16/15 10:36:47 AM	Completed	4/4	
160487	Create SnapMirror	03/13/15 10:47:45 AM	03/13/15 10:48:07 AM	Completed	6/6	
160480	Update Snapshot Policy for Volume	03/13/15 10:44:14 AM	03/13/15 10:44:22 AM	Completed	2/2	
160447	Update Snapshot Policy for Volume	03/13/15 10:27:53 AM	03/13/15 10:28:02 AM	Completed	2/2	

- 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](#).

Volumes						
Name	Aggregate	Status	Thin Provisioned	Storage QoS	Protect by	Refresh
OTB_root	aggr1_gold	online	No	5		18.88 MB
del_test	aggr2_silver	online	Yes	0		1022.34 MB
development	aggr2_silver	online	Yes	0		100 GB
infotech	aggr1_gold	online	Yes	0		100 GB
qa	aggr1_gold	online	Yes	0		20 GB
setup_test	aggr1_gold	online	Yes	0		10 GB
templates	aggr2_silver	online	Yes	4		28.54 GB

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

Quality of Service Details

☒ Manage Storage Quality of Service

Limit throughput for the volume by assigning it to a policy group and specify the maximum throughput. Storage objects assigned to the same policy group will share the maximum throughput.

[Tell me more about Storage Quality of Service](#)

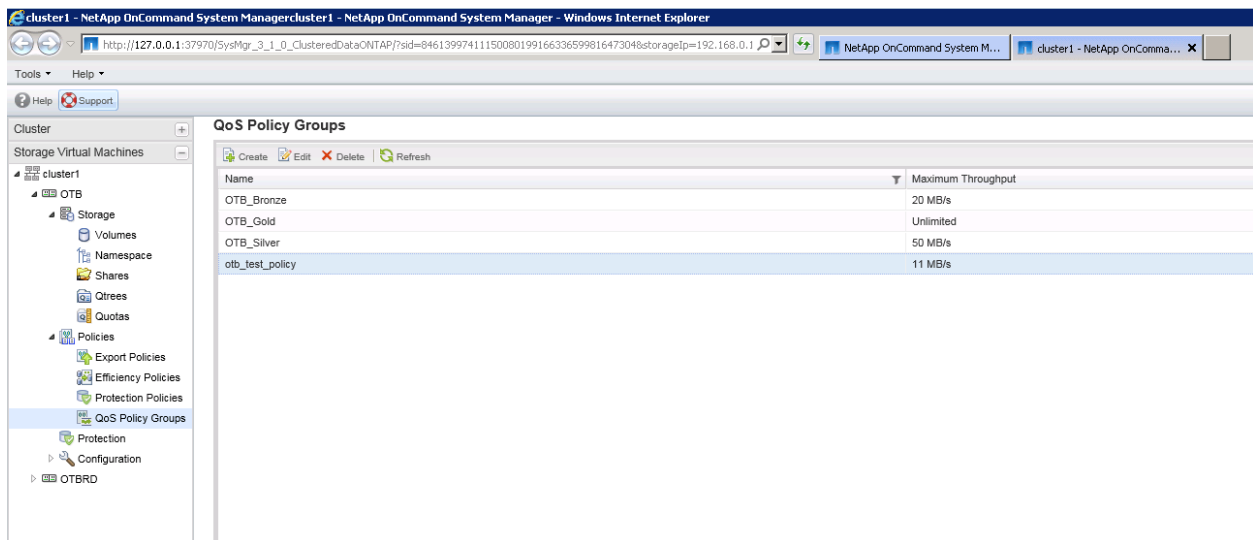
Assign to: ☐ New Policy Group ☒ Existing Policy Group

Policy Group Name:

Maximum Throughput:

i Throughput is shared by the assigned storage objects.

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 stlxc250s1-a3.srveng.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.

VMware vRealize™ Orchestrator™

Welcome

Enter your username and password to login in VMware vRealize Orchestrator Configuration

Username:

Password:

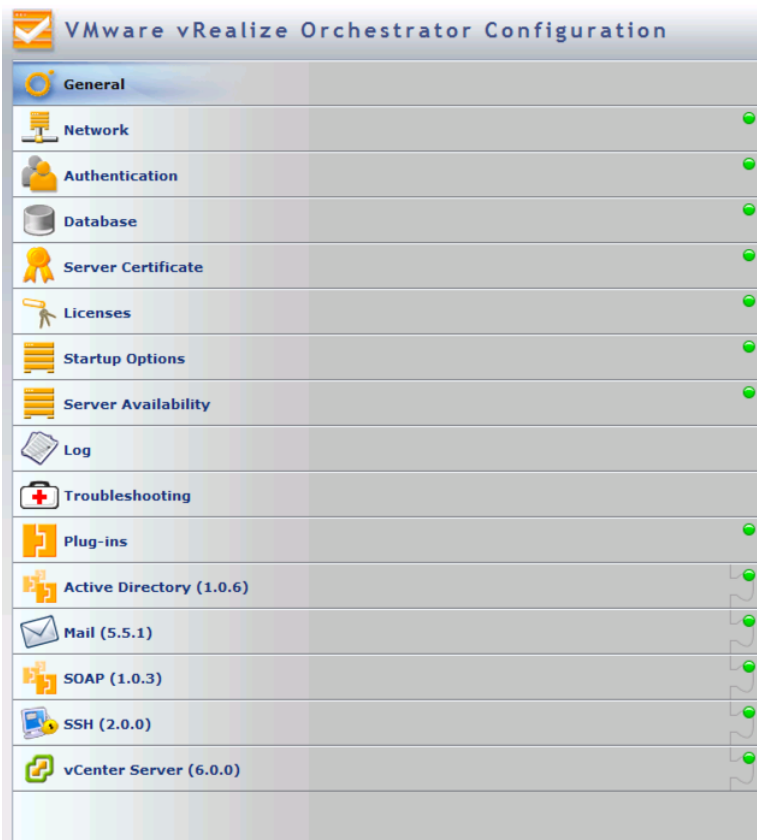
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vmware

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



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

Network SSL Trust Manager

SSL Trust Manager

Imported SSL certificates

Common name	Subject alternative names	Organization	Valid from	Valid until
No certificate installed.				

Import from URL

URL from which to import a certificate: ?

Import from file

Select a file to import:

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

VMware vRealize Orchestrator Configuration

General Network Authentication Database Server Certificate Licenses

Network SSL Trust Manager

SSL Trust Manager

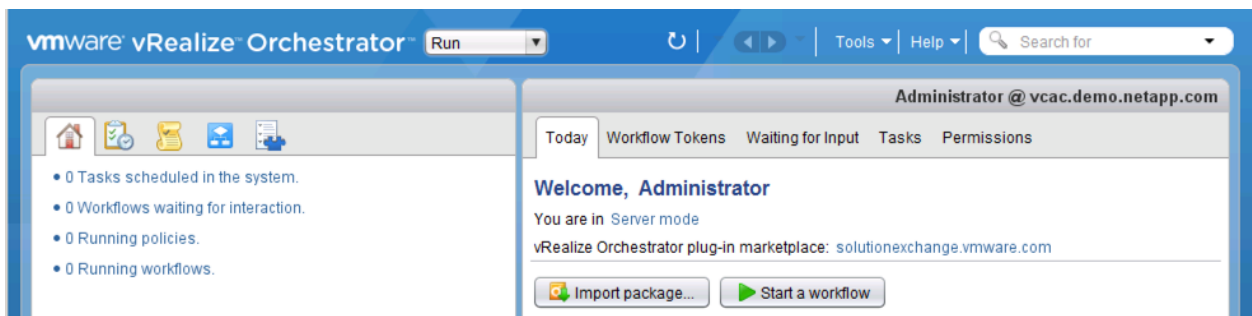
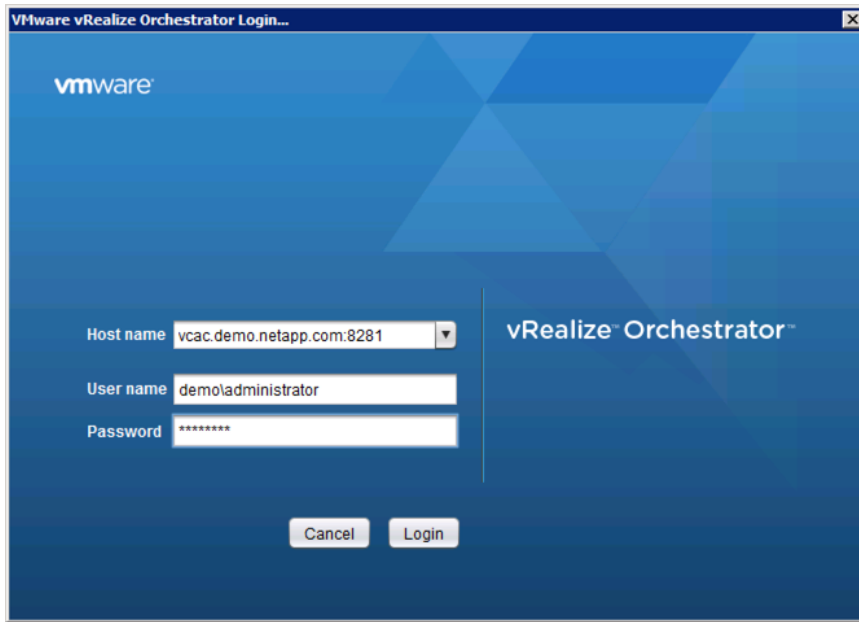
Imported SSL certificates

Common name	Subject alternative names	Organization
WFA.demo.netapp.com		NetApp
JUMPHOST.demo.netapp.com		NetApp
IAAS.demo.netapp.com		

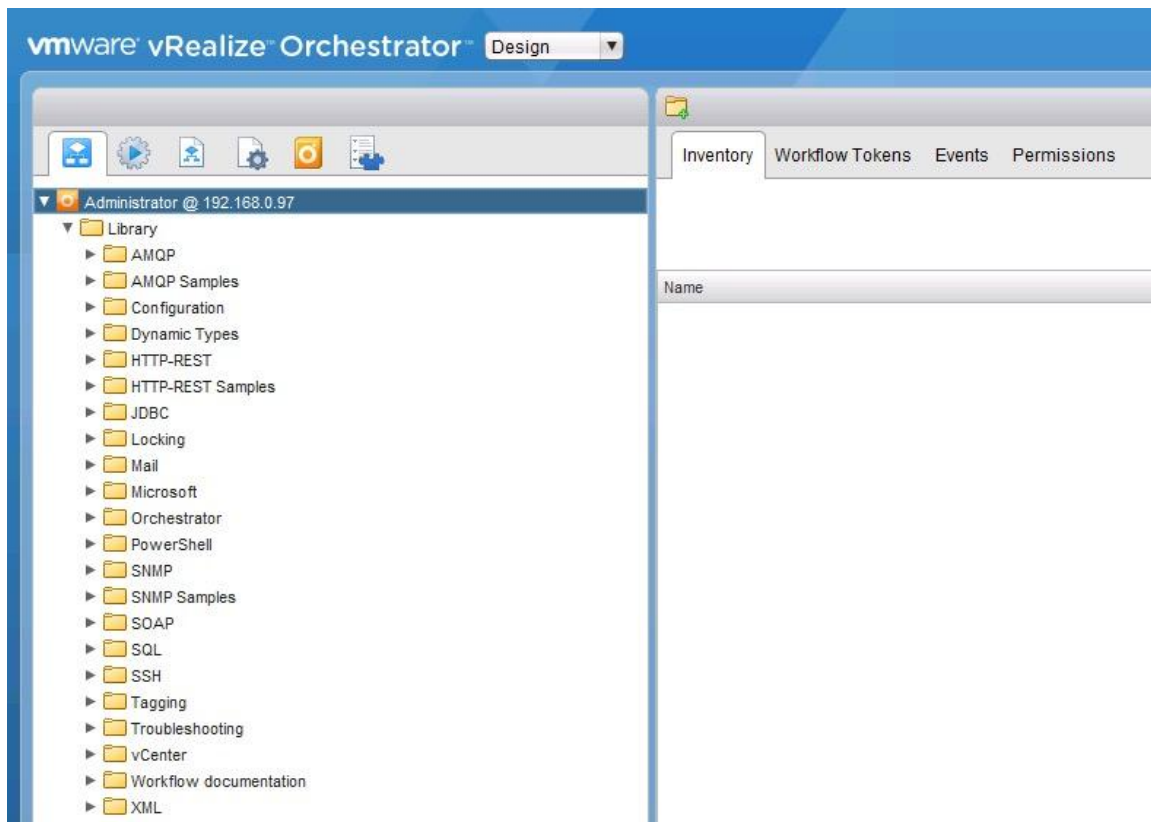
3.2 Install and Configure NetApp vRealize Integration Package for OnCommand WFA

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

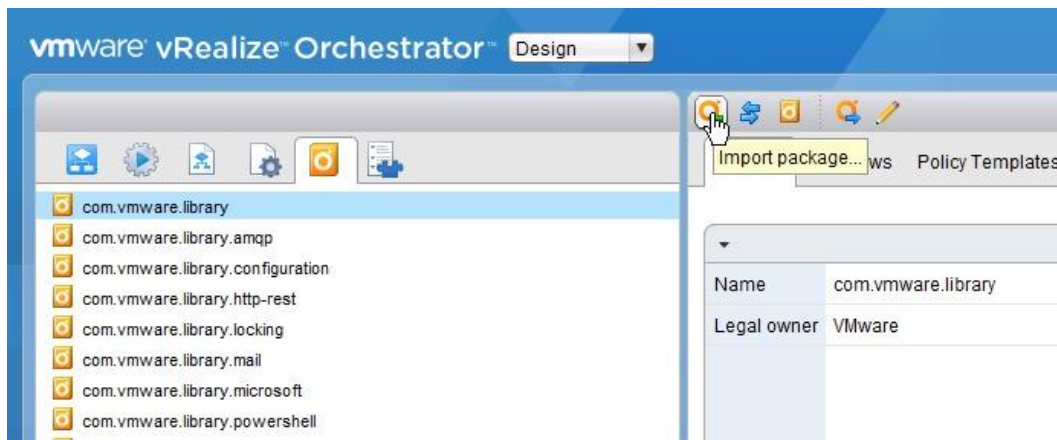
- Download the [NetApp vRealize Integration Package for OnCommand WFA](#) from the NetApp Community site.
- Start the vRO client and click Import Package.



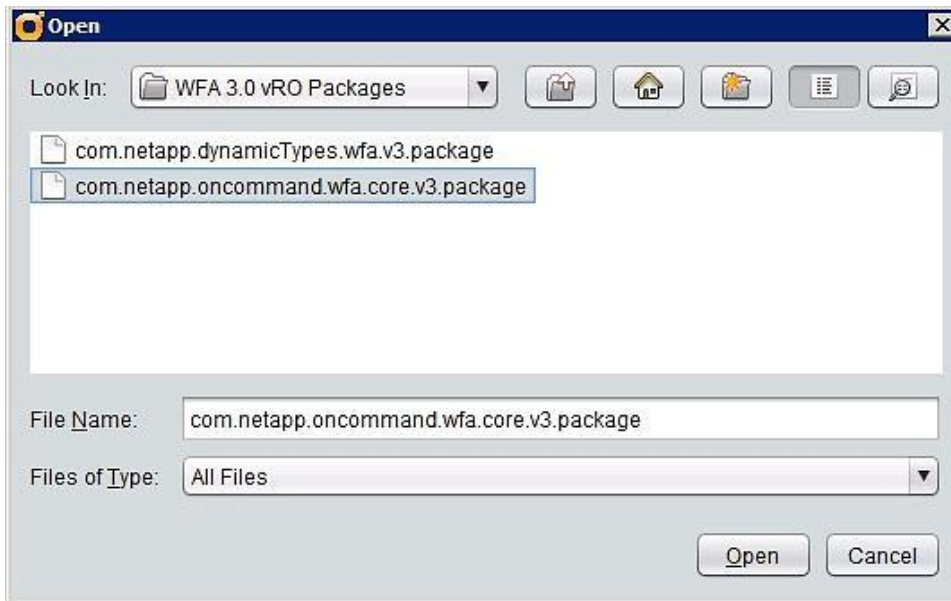
3. Log into vRealize Orchestrator and select Design.



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



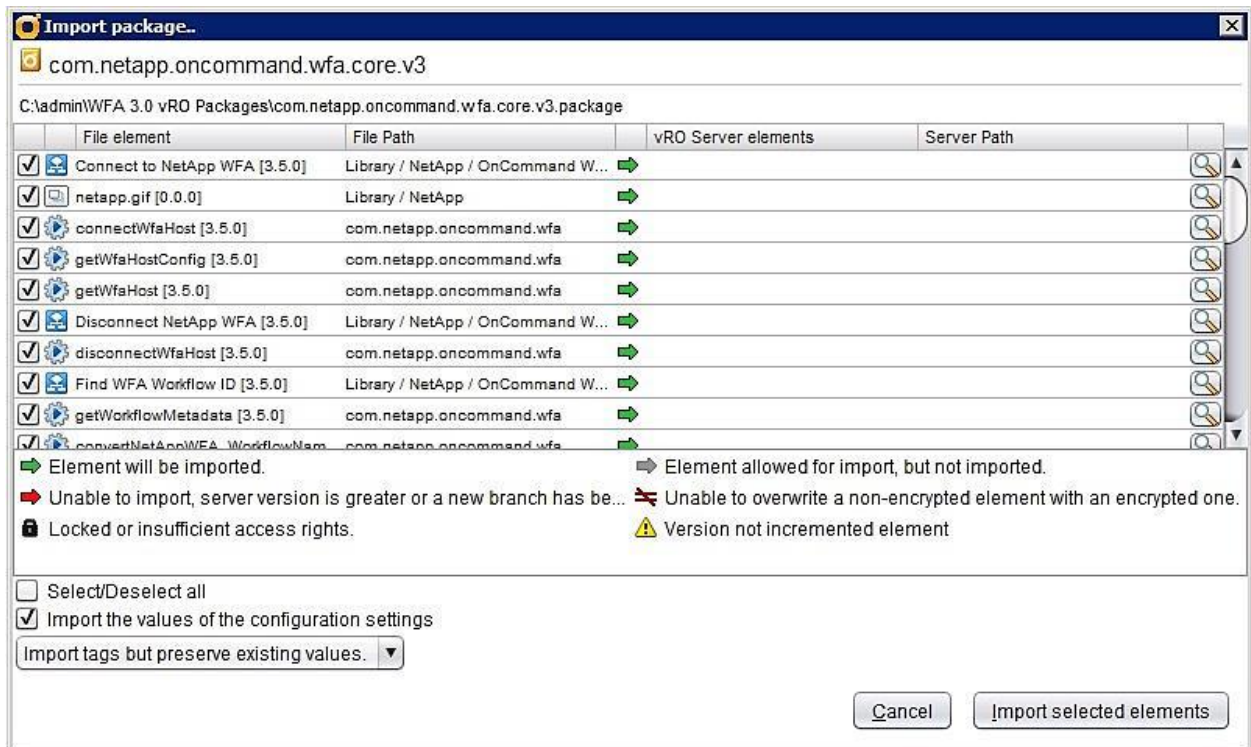
5. Select `com.netapp.oncommand.wfa.core.v3.package` from the location to which you saved the downloaded package. Click Open.



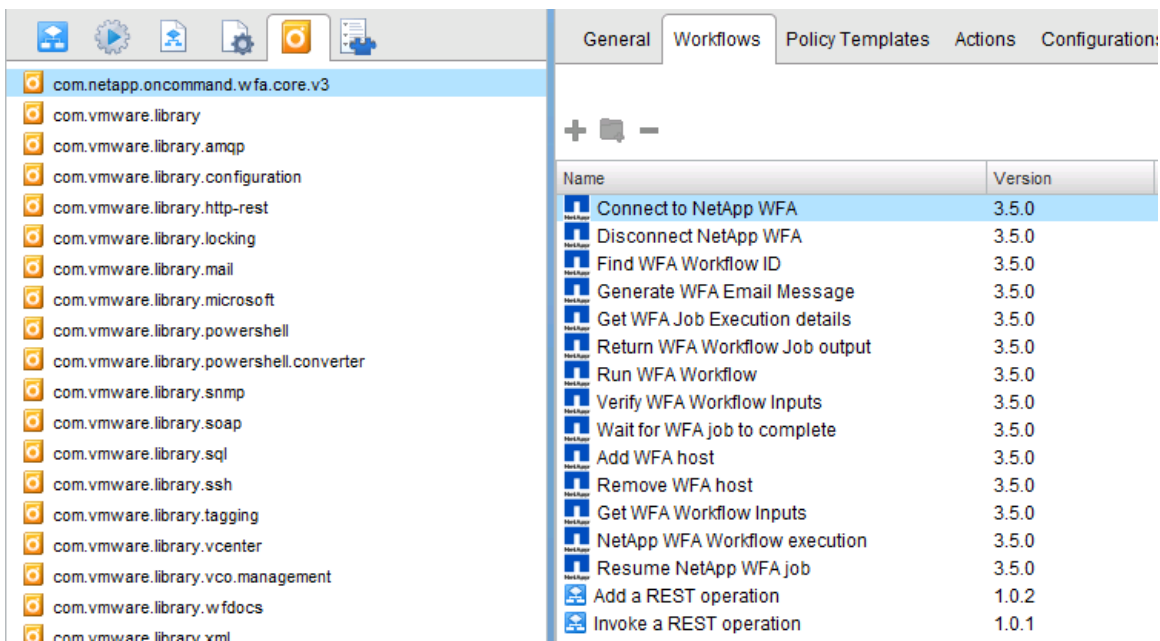
6. At the Package Import Information window, click Import.



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.

General Workflows Policy Templates Actions Configurations Resources Used Plug-Ins Permissions				
+ -				
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.

General Workflows Policy Templates Actions Configurations Resources				
+ -				
<ul style="list-style-type: none"> com.netapp.oncommand.wfa.core.v3 com.vmware.library com.vmware.library.amqp com.vmware.library.configuration com.vmware.library.http-rest com.vmware.library.locking 				
Name	Version	Folder		
Default WFA Job Email	3.5.0	NetApp / OnCommand WFA		
WFA Host	3.5.0	NetApp / OnCommand WFA		

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.

The screenshot shows the vRealize Operations interface. On the left, the 'Library' tree is expanded to 'NetApp' > 'OnCommand WFA Workflows' > 'Configuration'. The 'Add WFA host' item is selected. A context menu is open over this item, showing options like 'Start workflow...', 'Start workflow as...', 'Debug workflow...', 'Schedule workflow...', and 'Schedule workflow As...'. The 'Start workflow...' option is highlighted, and its keyboard shortcut 'Ctrl+R' is visible. The background shows the 'Add WFA host' item in the 'Configuration' folder.

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.

Start Workflow : Add WFA host

1 Create or Reuse

2 WFA Host Details

2a Create a New Host

Use an existing REST host connection?

☐ Yes ☒ No

Cancel Back Next Submit

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.

Start Workflow: Add WFA host

✓ 1 Create or Reuse
2 WFA Host Details
2a Create a New Host

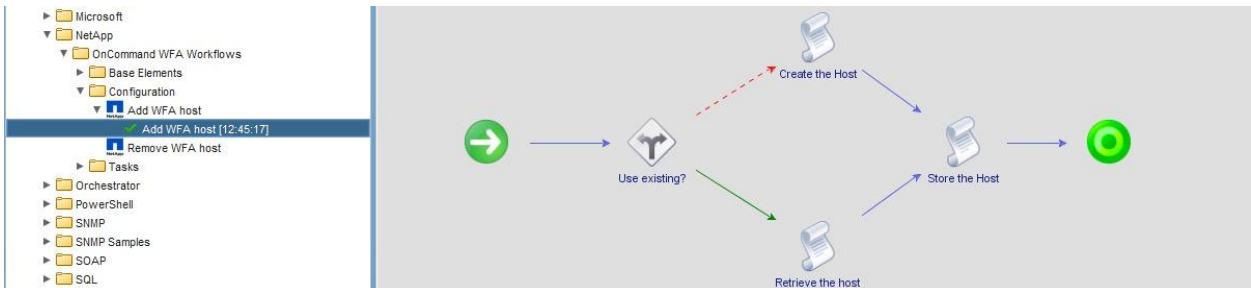
WFA hostname or IP address
wfa.demo.netapp.com

WFA username
admin

WFA password

Cancel Back Next 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:

Administrator @ 192.168.0.97

Library

NetApp

OnCommand WFA

Default WFA Job Email

WFA Host

General Attributes Events Permissions

Name	Type	Value
wfaHost	REST.RESTHost	Stored WFA Host: https://wfa.demo.netapp.com/rest

- 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.

General Attributes Events Permissions			
Name	Type	Value	Description
customHeader	string	vRO Package for WFA Information Report	Default Header introduction for Email Body
customContactName	string	WFAAdmin	Default Administration Contact Name
customContactEmail	string	smtp@demo.netapp.com	Default Administration Contact Email
customDisclaimer	string	This email is intended for internal use of the demo environment for NetApp. Any o	Default disclaimer for email content

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

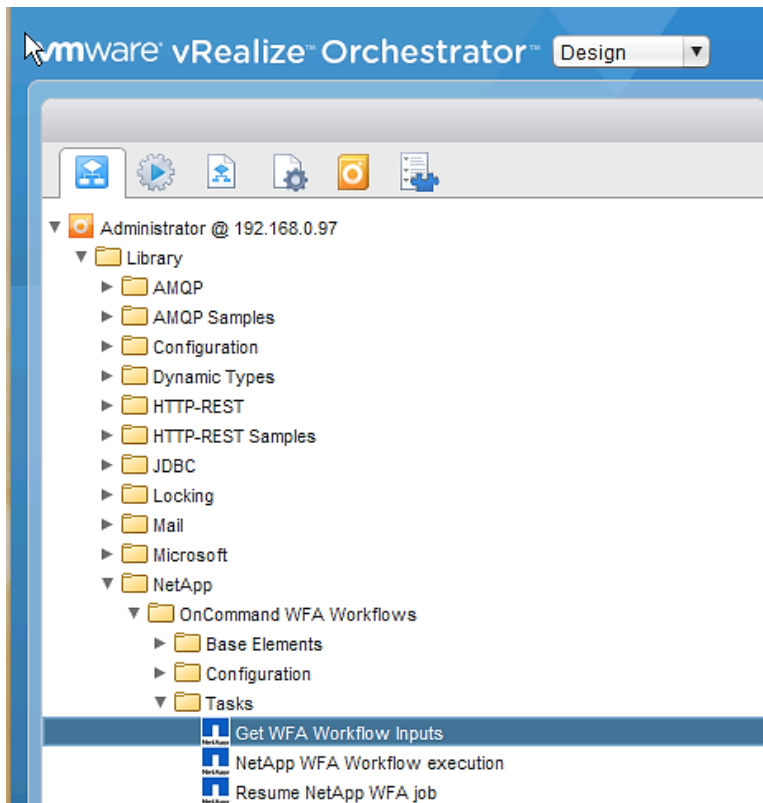
4 Integrate vRO with OnCommand WFA

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:

- 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.



- 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.

```

[2014-03-06 08:07:13.319] [I] Mandatory=true
[2014-03-06 08:07:13.319] [I] -----
[2014-03-06 08:07:13.320] [I] User Input #5
[2014-03-06 08:07:13.321] [I] Name=VolumeJunctionPath
[2014-03-06 08:07:13.322] [I] Type=String
[2014-03-06 08:07:13.323] [I] Mandatory=false
[2014-03-06 08:07:13.323] [I] -----
[2014-03-06 08:07:13.323] [I] User Input #6
[2014-03-06 08:07:13.324] [I] Name=ExportPolicyName
[2014-03-06 08:07:13.325] [I] DefaultValue=
[2014-03-06 08:07:13.326] [I] Type=Query
[2014-03-06 08:07:13.327] [I] Mandatory=true
[2014-03-06 08:07:13.335] [I] -----
[2014-03-06 08:07:13.336] [I] User Input #7
[2014-03-06 08:07:13.337] [I] Name=ExportRuleSpecification
[2014-03-06 08:07:13.338] [I] Type=Table
[2014-03-06 08:07:13.339] [I] Mandatory=false
[2014-03-06 08:07:13.339] [I] -----
[2014-03-06 08:07:13.949] [I] REST host removed: DynamicWrapper (Instance) : [RESTHost]-[class com.vmware.o11n.plugin.rest.RESTHost] -- VALUE

```

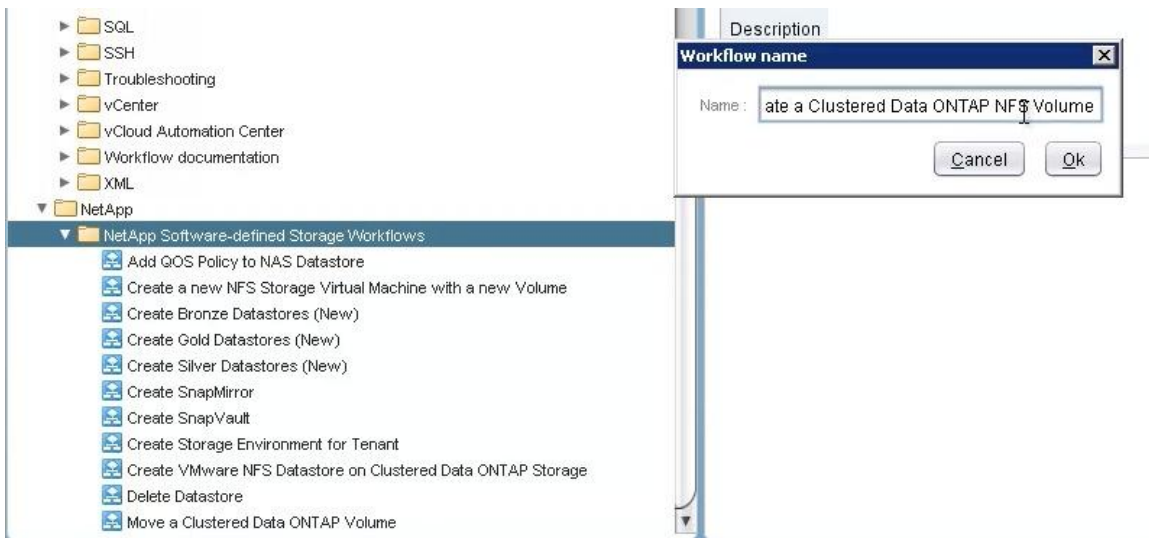
4.2 Create New Workflow

To create a new workflow, complete the following steps:

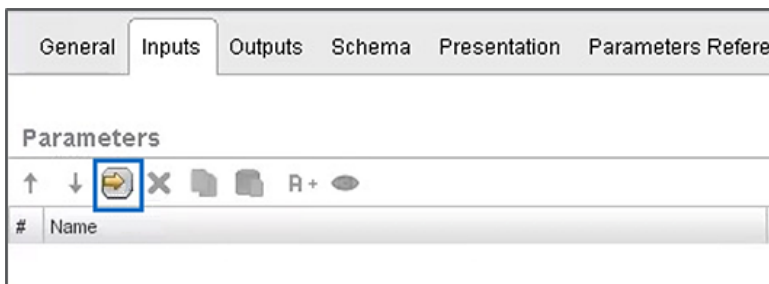
1. Right-click the folder in which the workflows will be stored and select New Workflow.



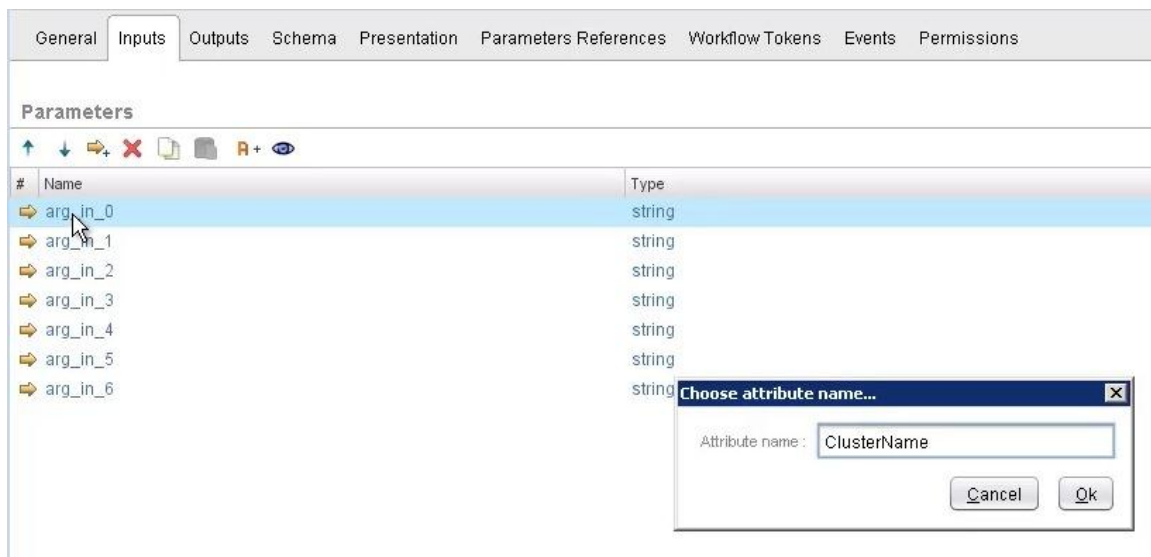
2. Enter the name of the workflow and click OK. For simplicity, NetApp recommends that you name the workflow the same as the WFA workflow.



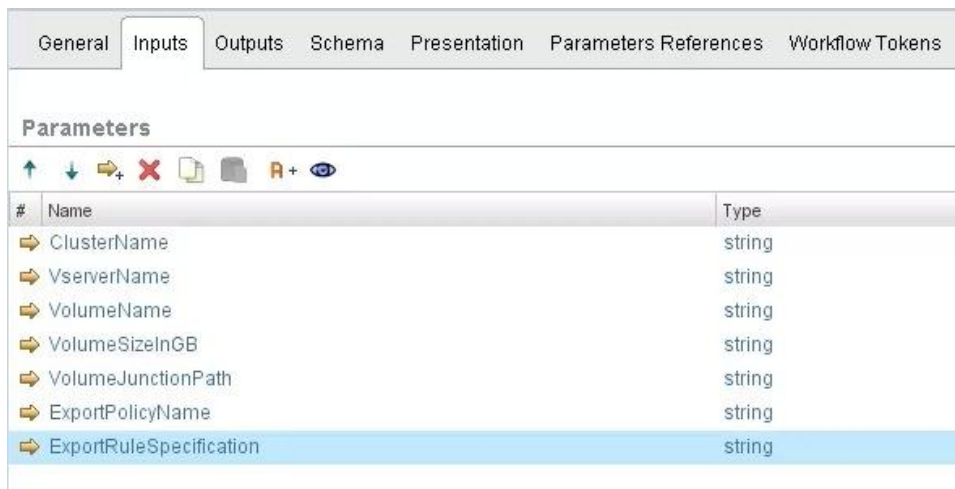
3. After the new workflow is created, an Edit Workflow page is displayed. Click the Inputs tab and click Add Inputs (the button featuring the gold right-direction arrow). Create as many inputs as are shown after running the Get WFA Workflow Inputs workflow in vRO.



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



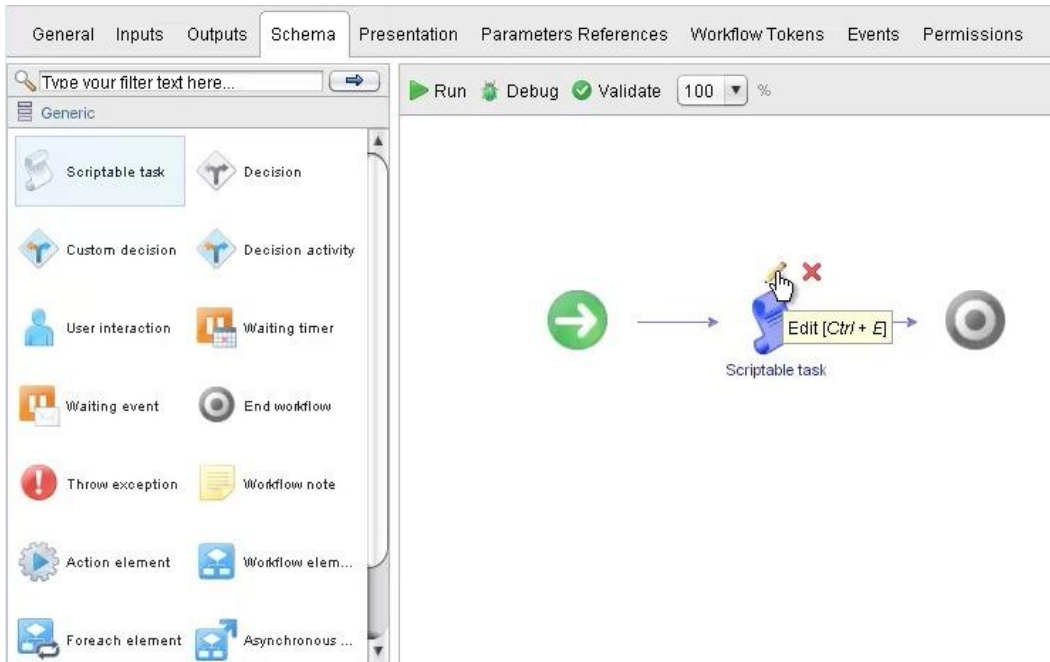
5. Rename each of the inputs added in step 4.



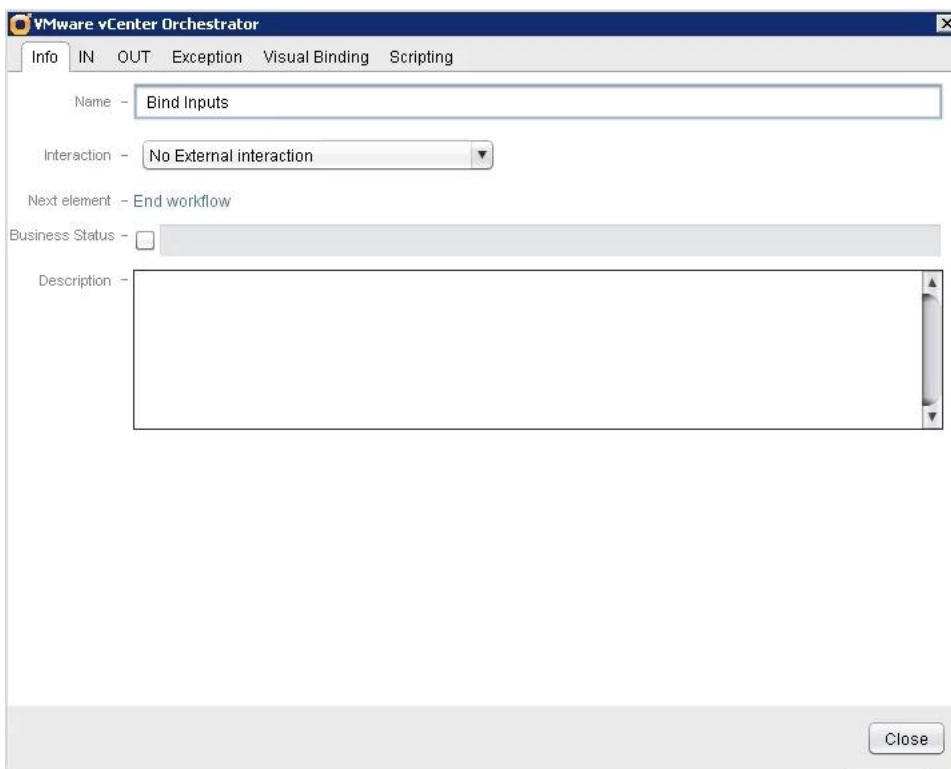
4.3 Create Scriptable Task for vRO Workflow

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

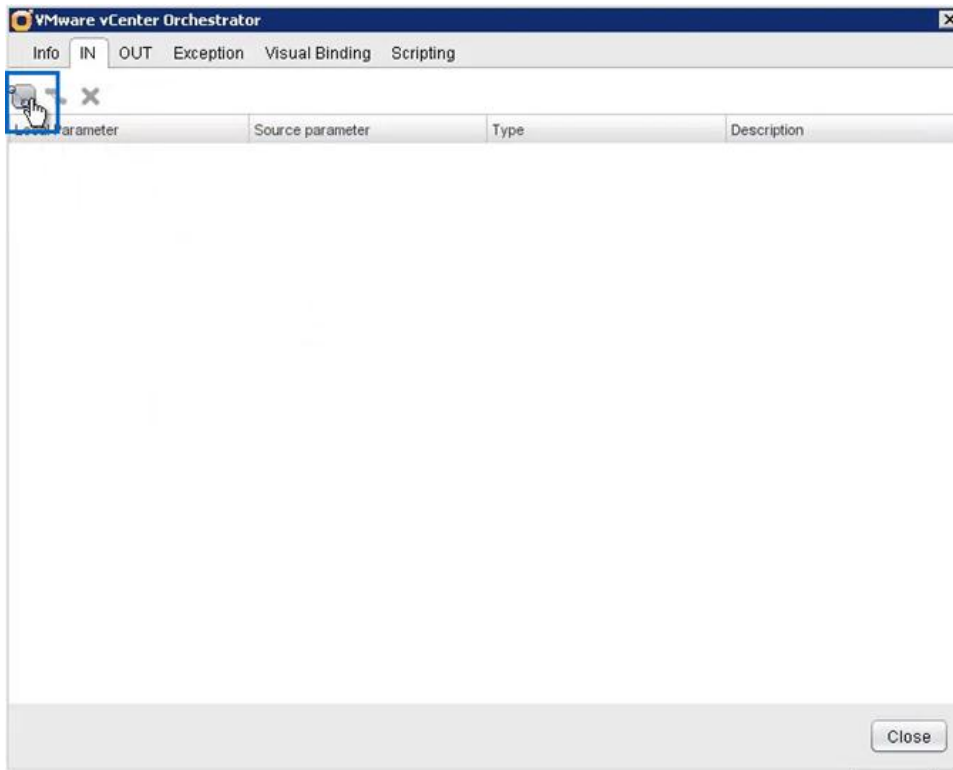
1. Click the Schema tab, select Scriptable Task from the left pane, and drag it to the right pane. In the right pane, point to the Scriptable Task and click the pencil icon.



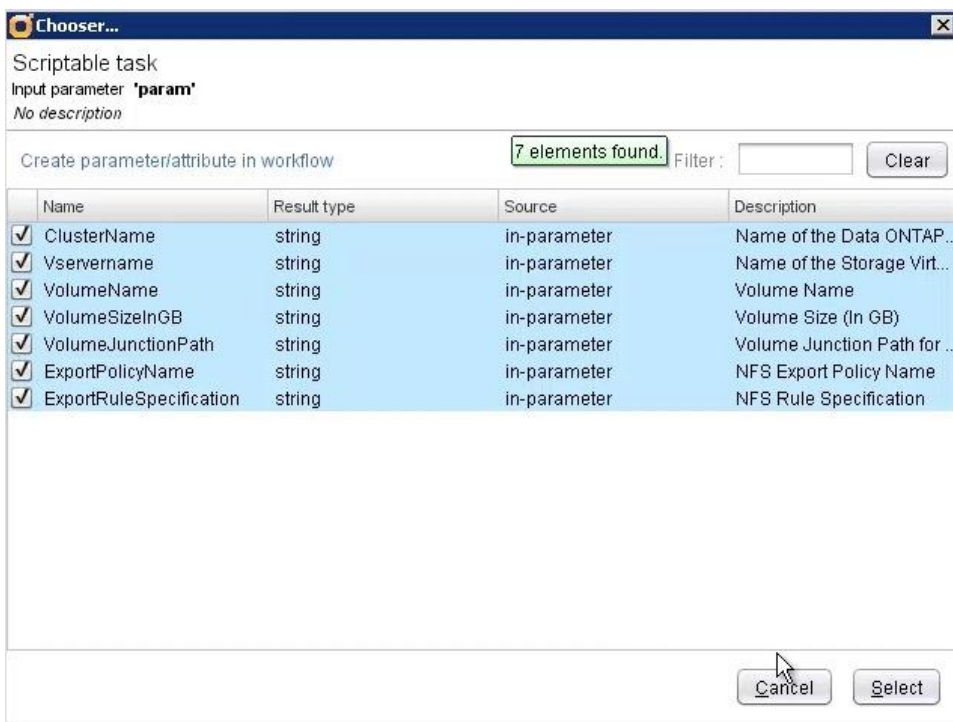
The following page is displayed:



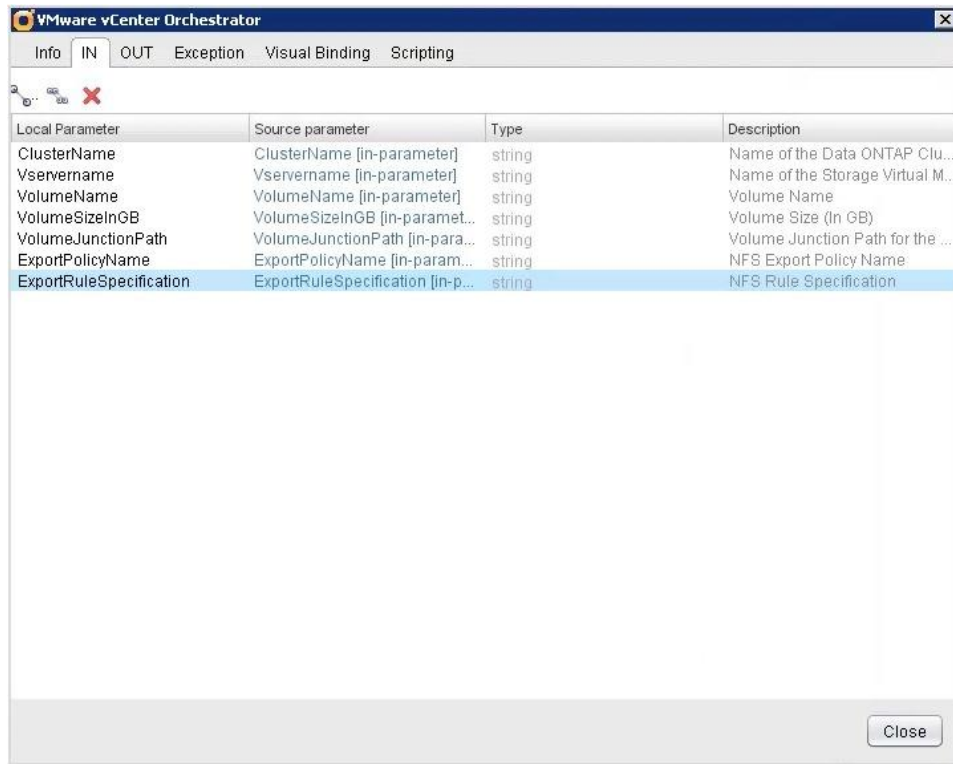
2. Click the In tab and click Bind to Workflow Parameter/Attribute.



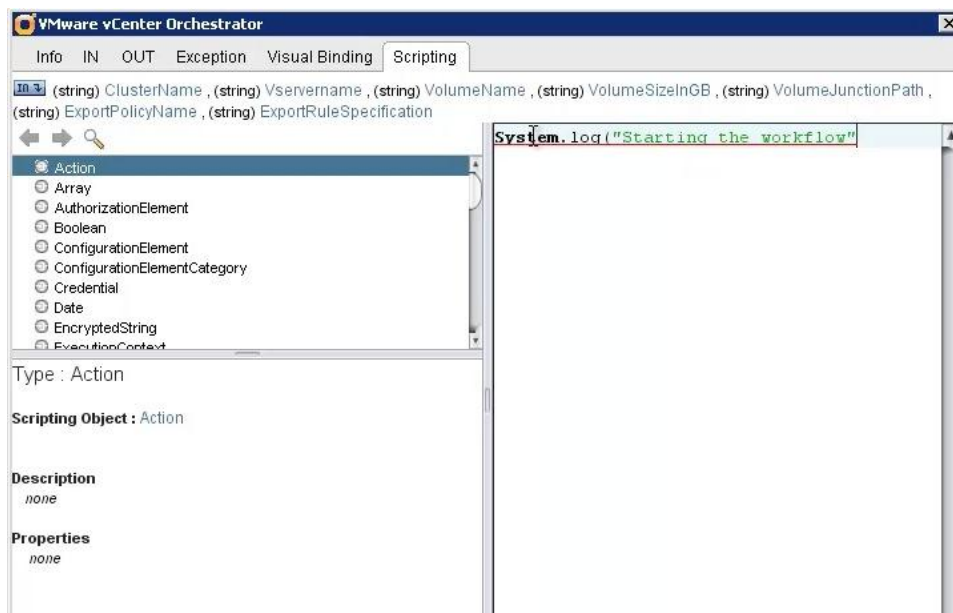
3. Select the checkbox for each parameter on this page and click Select.



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



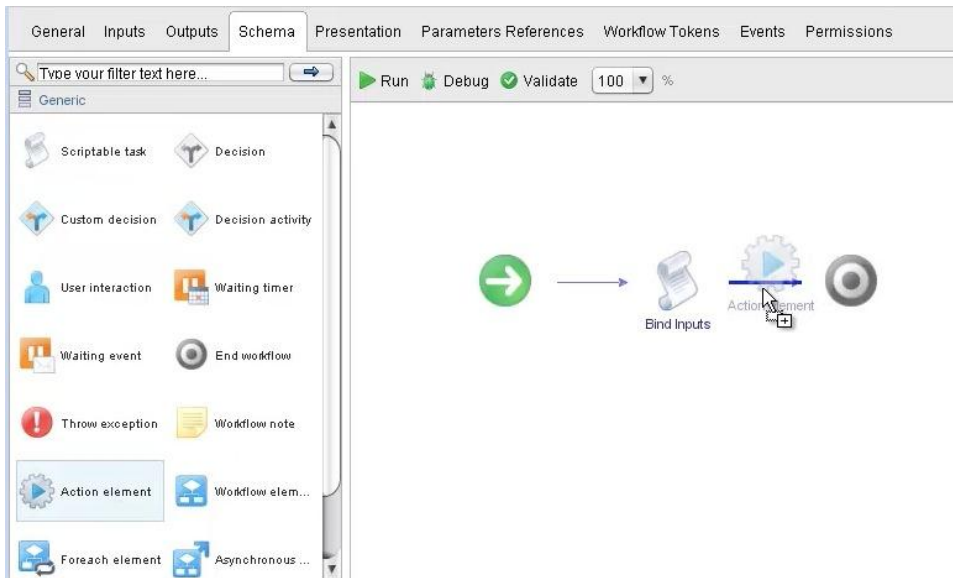
- Click the Scripting tab and enter `System.log("Starting the workflow")` in the right pane. Click Close.



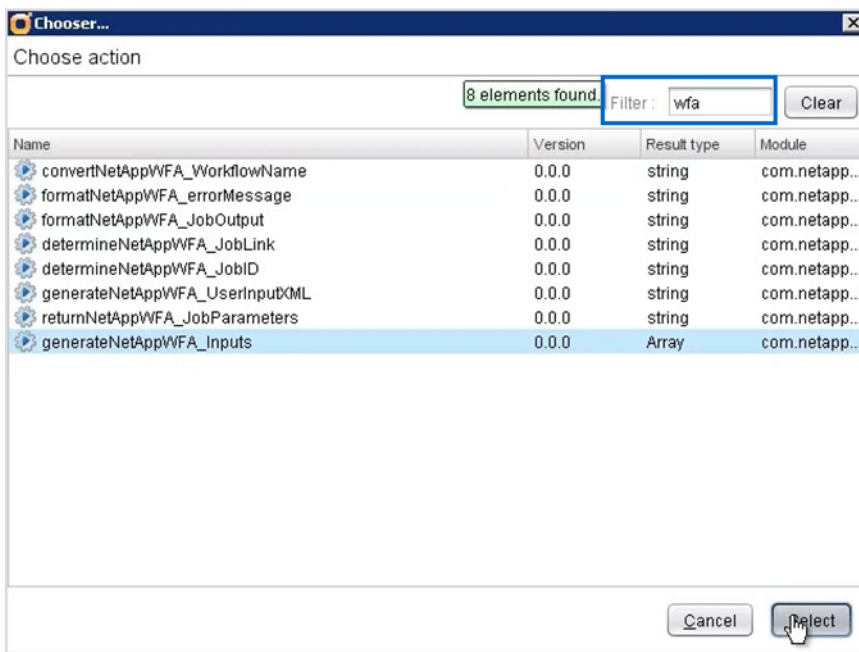
4.4 Create GenerateWFA_Inputs Action Element

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

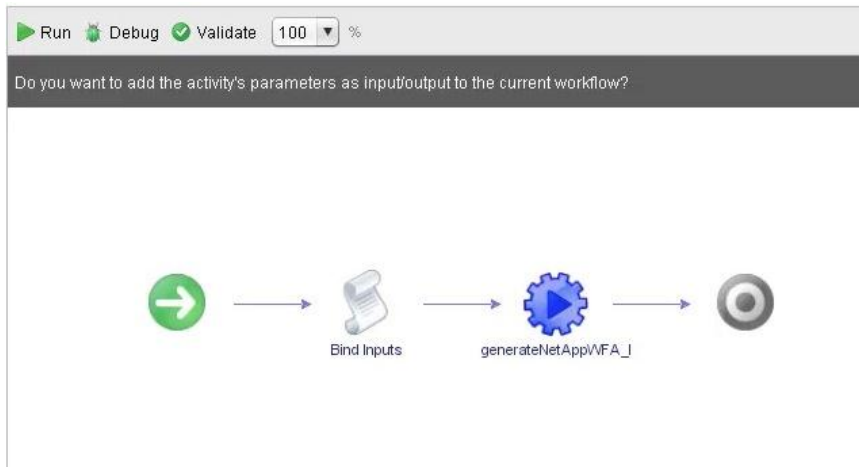
- From the Schema tab, select Action Element in the left pane and drag it to the right of the Bind Inputs icon to open the Choose Action page.



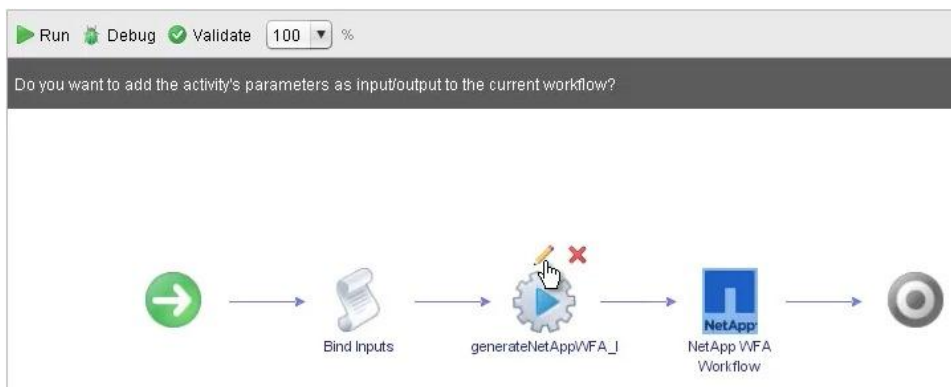
2. On the Choose Action page, enter `wfa` in the Filter field. From the list of actions, click `generateNetAppWFA_Inputs` and click Select.



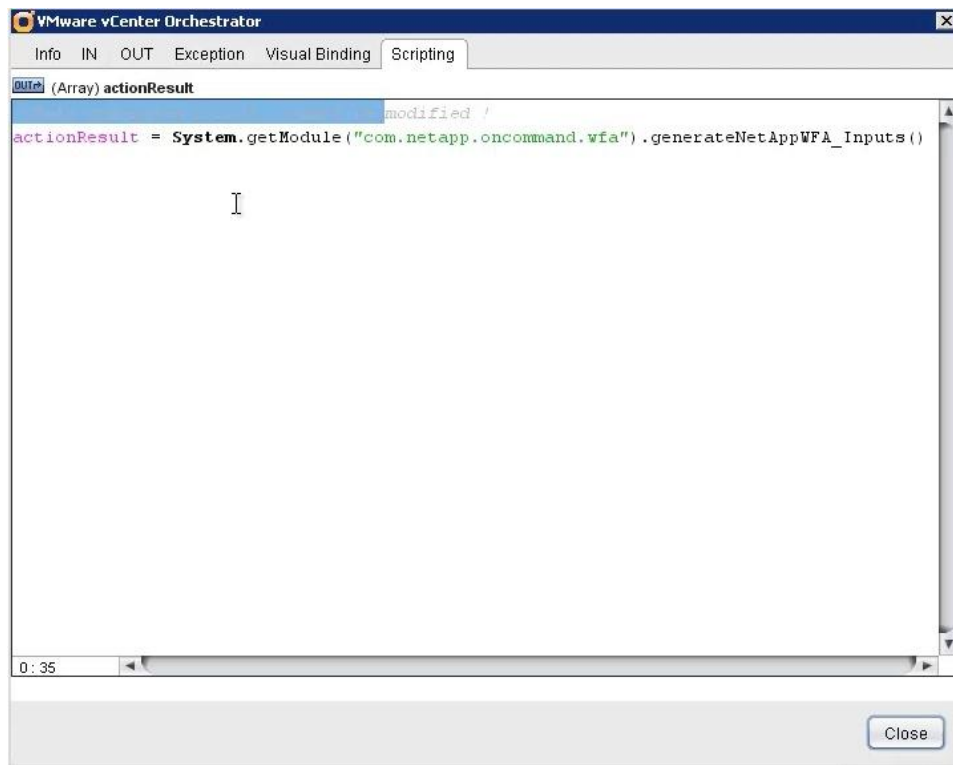
3. On the Schema tab, verify that the `generateNetAppWFA_Inputs` action was created.



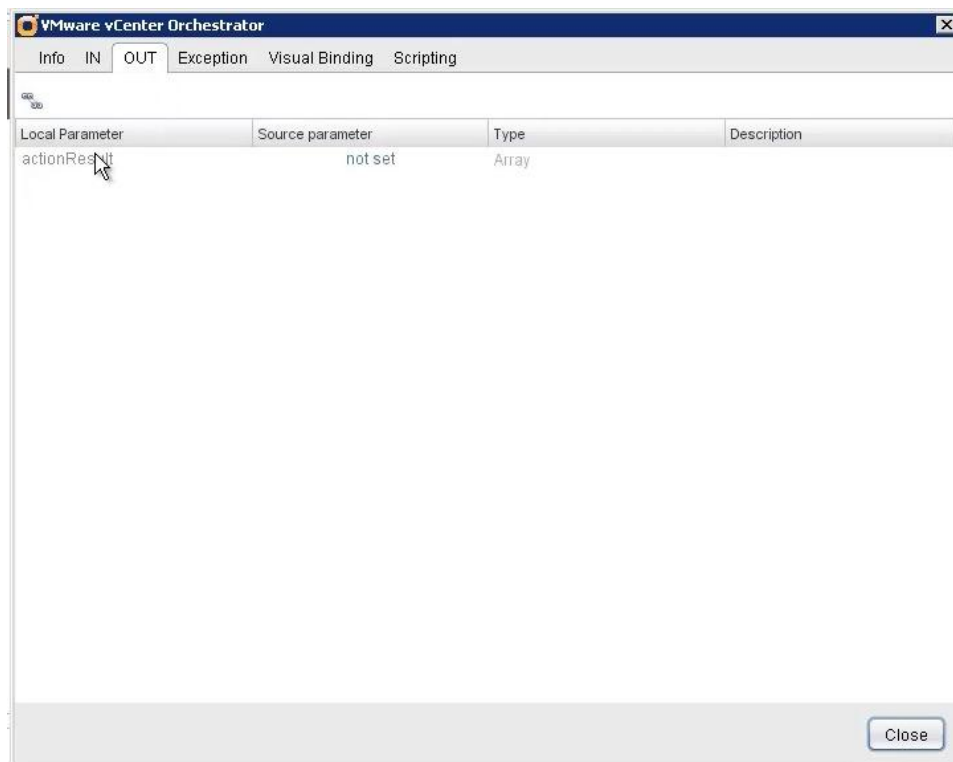
4. From the Schema tab, point to generateNetAppWFA_Inputs and click the pencil icon.



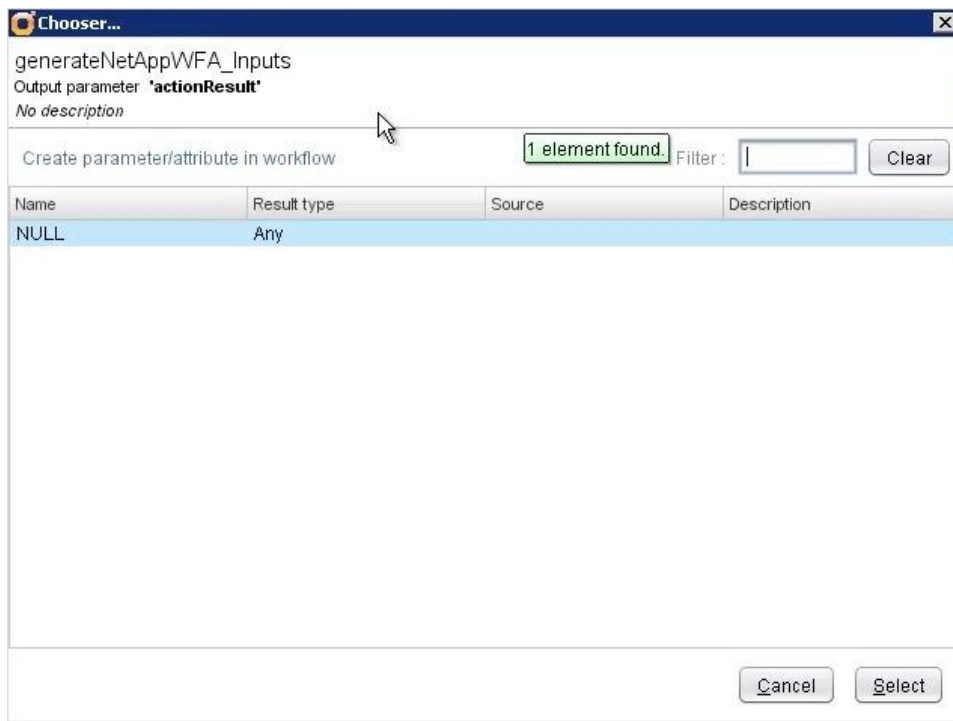
5. Click the Scripting tab to review the page.



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.

Create parameter [X]

Parameter information

Name -

Description -

Type ☒ -

1 element found. Filter:

Array Of ☐ -

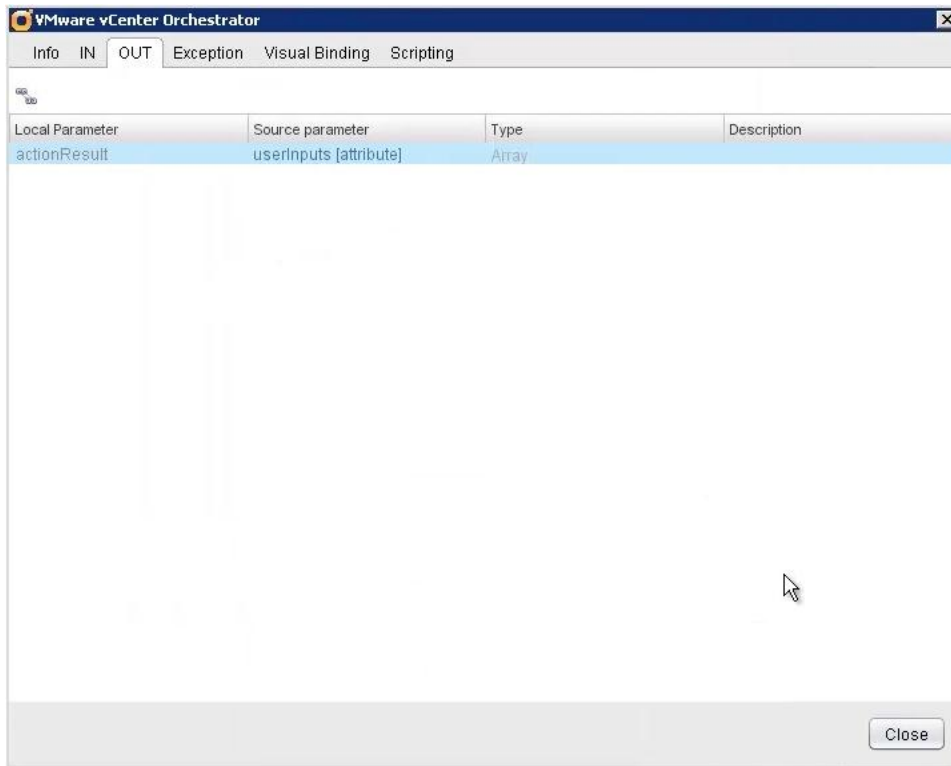
Type

Array

Create - ☐ Create workflow OUTPUT PARAMETER with the same name ☒ Create workflow ATTRIBUTE with the same name

Value -

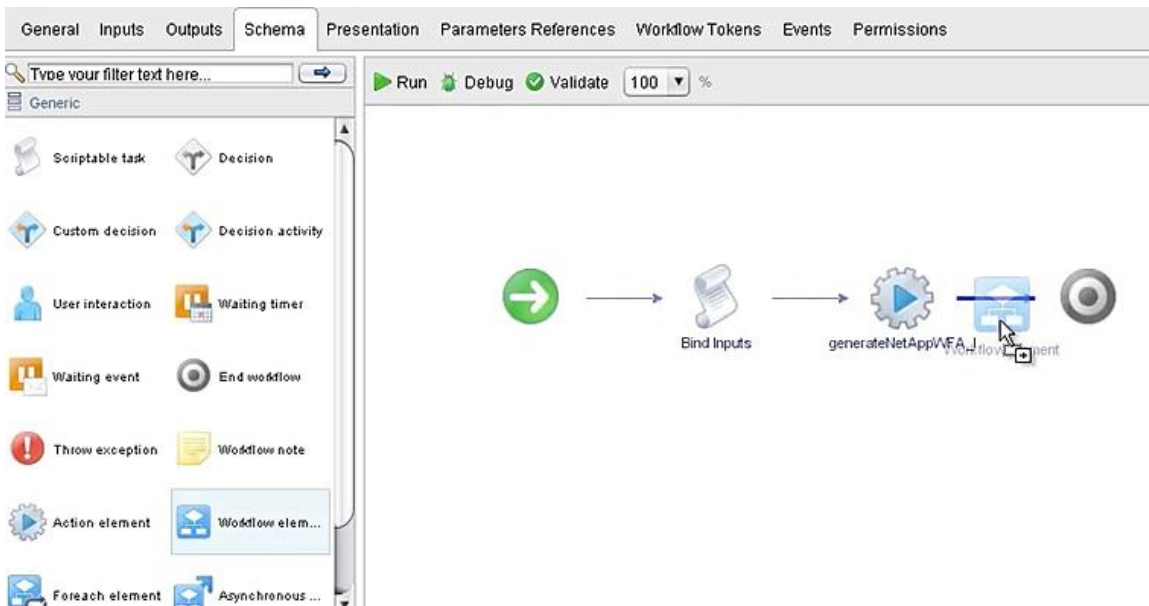
9. From the Out tab, click Close.



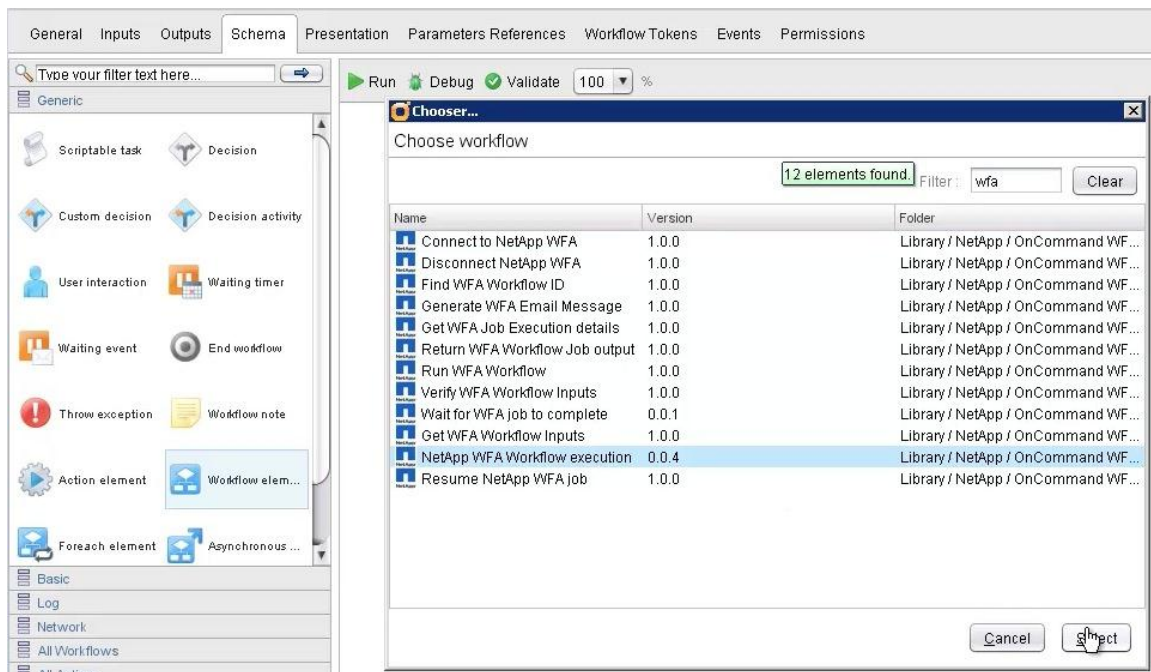
4.5 Create NetApp WFA Workflow Element

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

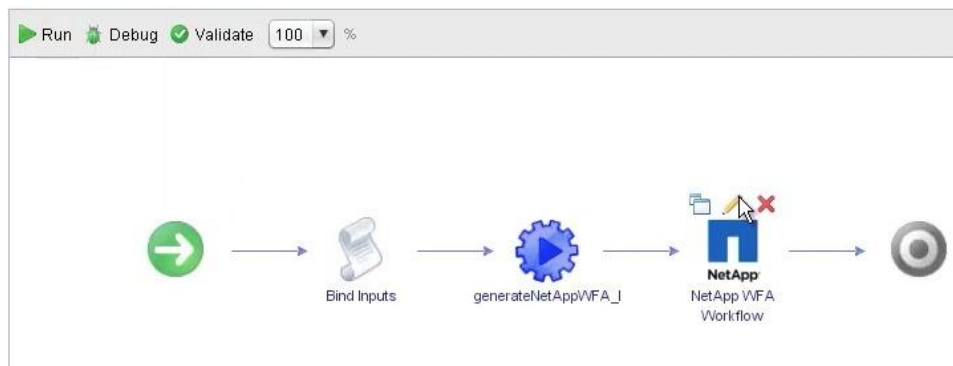
1. From the left pane of the Schema tab, select Workflow Elements and drag it to the right of the generateNetAppWFA_Inputs action icon.



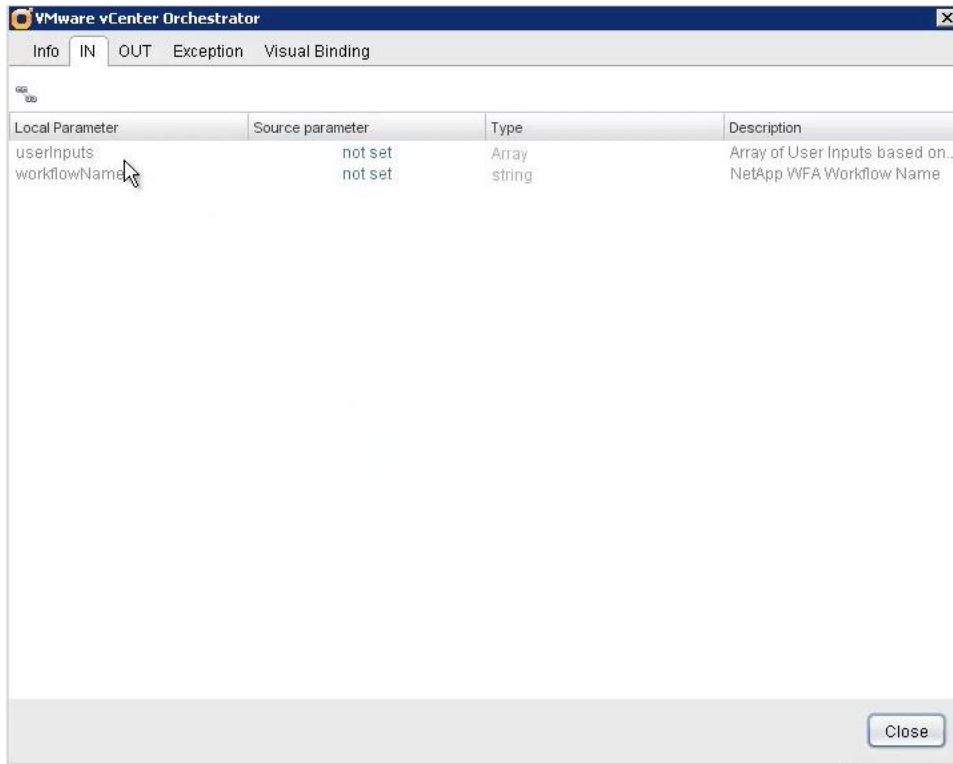
2. On the Choose Workflow page, click NetApp WFA Workflow Execution and click Select.



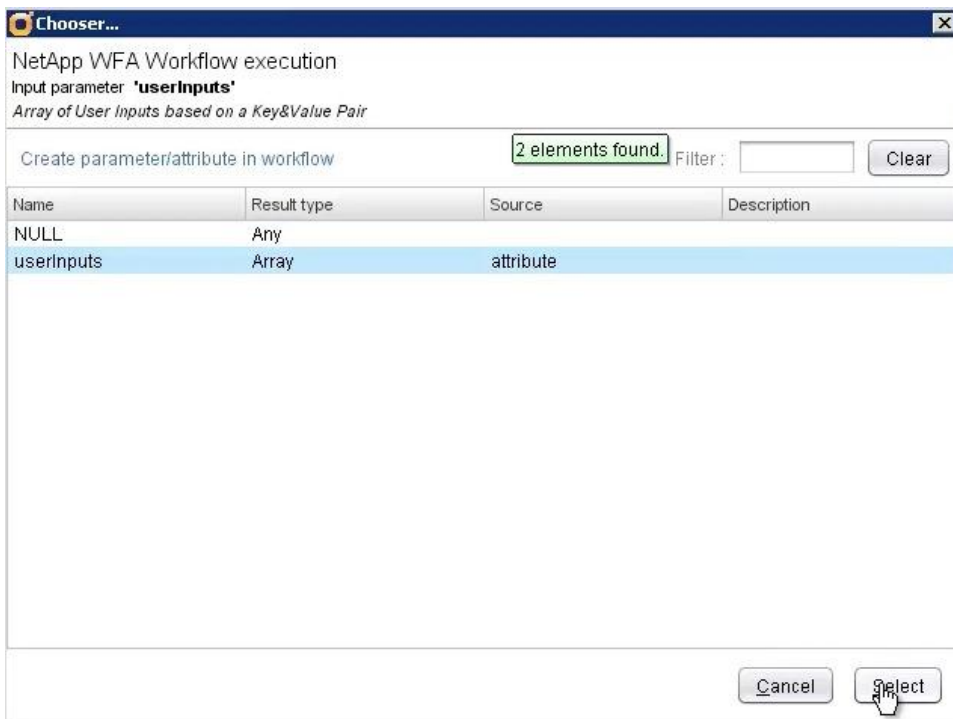
3. From the Schema tab, point to NetApp WFA Workflow and click the pencil icon.



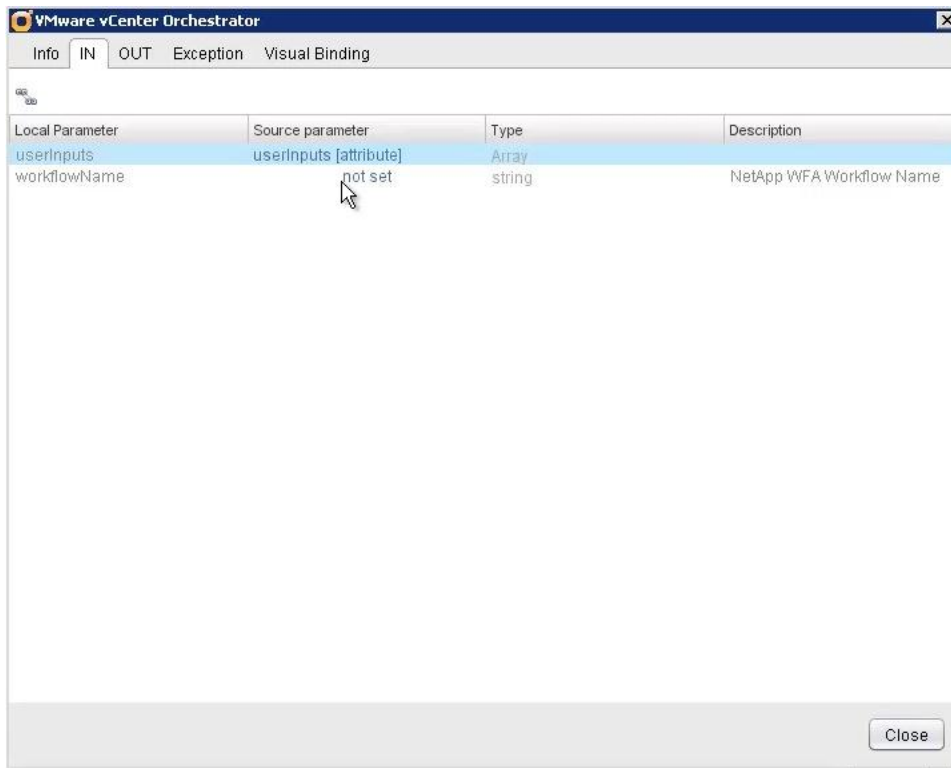
4. Click the In tab. Next to UserInputs, click Not Set in the Source Parameter column.



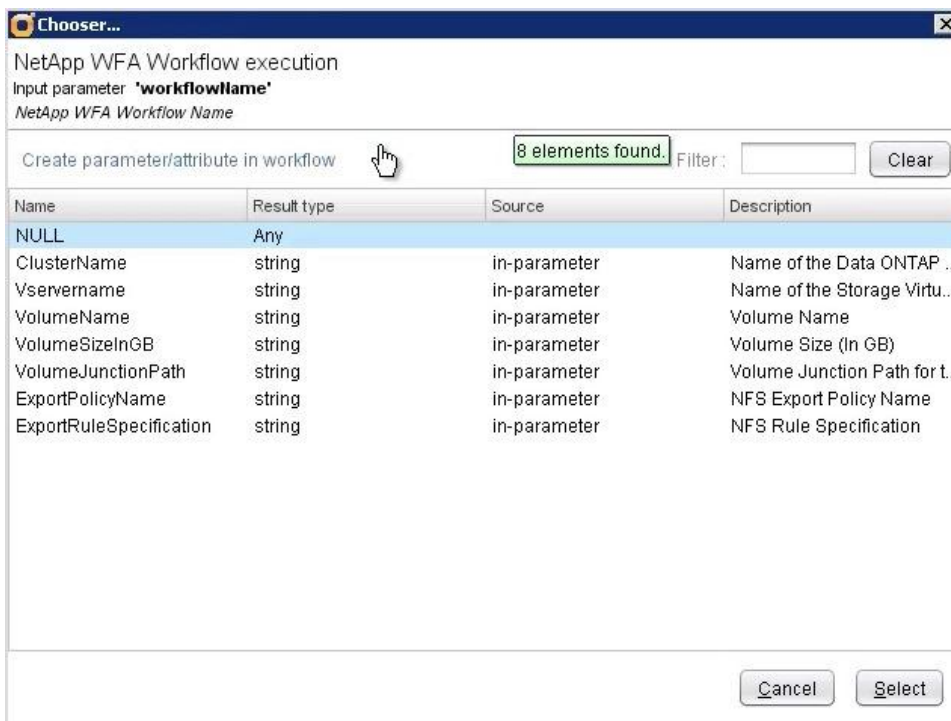
5. Click UserInputs and then click Select.



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.

Create parameter

Parameter information

Name - workflowName

Description - NetApp WFA Workflow Name

Type - 1 element found. Filter: Clear

Array Of ☐

Type

string

Create - ☐ Create workflow INPUT PARAMETER with the same name ☒ Create workflow ATTRIBUTE with the same name

Value - Create a Clustered Data ONTAP Volume

Cancel Ok

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

Chooser...

NetApp WFA Workflow execution

Input parameter **'workflowName'**

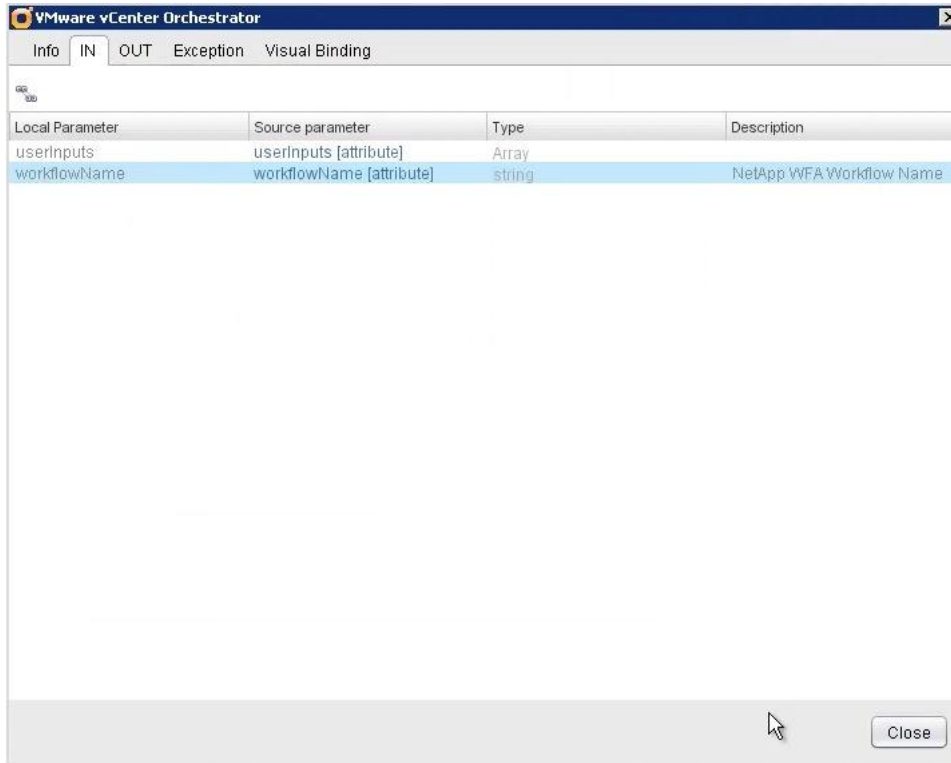
NetApp WFA Workflow Name

Create parameter/attribute in workflow 8 elements found. Filter: Clear

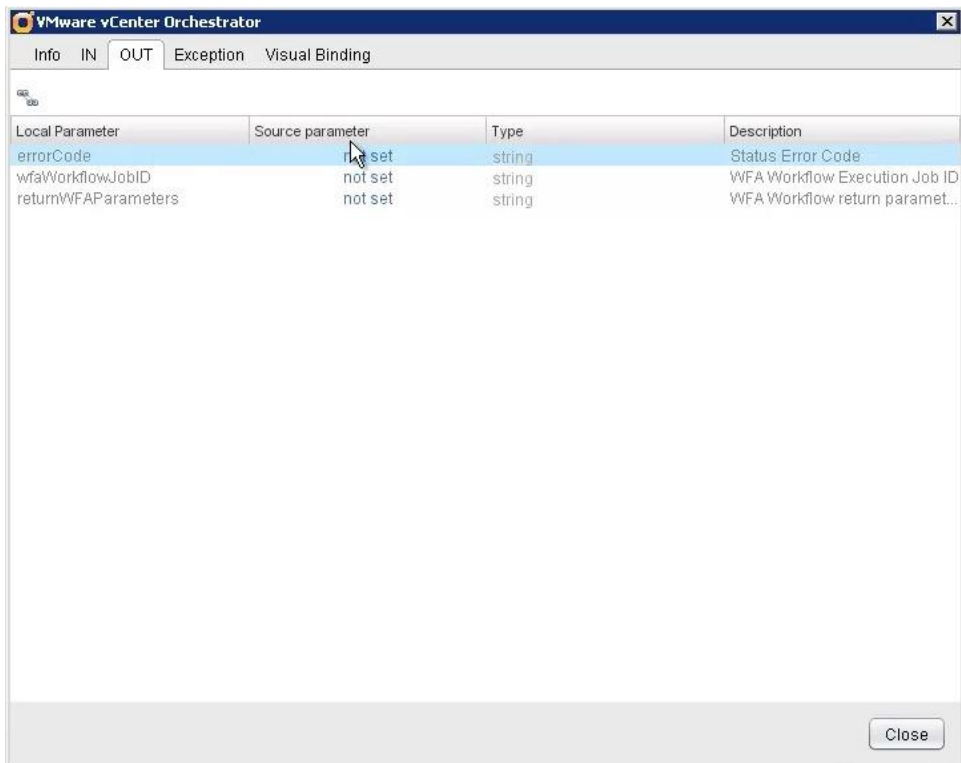
Name	Result type	Source	Description
NULL	Any		
ClusterName	string	in-parameter	Name of the Data ONTAP ...
Vservername	string	in-parameter	Name of the Storage Virtu...
VolumeName	string	in-parameter	Volume Name
VolumeSizeInGB	string	in-parameter	Volume Size (In GB)
VolumeJunctionPath	string	in-parameter	Volume Junction Path for t...
ExportPolicyName	string	in-parameter	NFS Export Policy Name
ExportRuleSpecification	string	in-parameter	NFS Rule Specification

Cancel Select

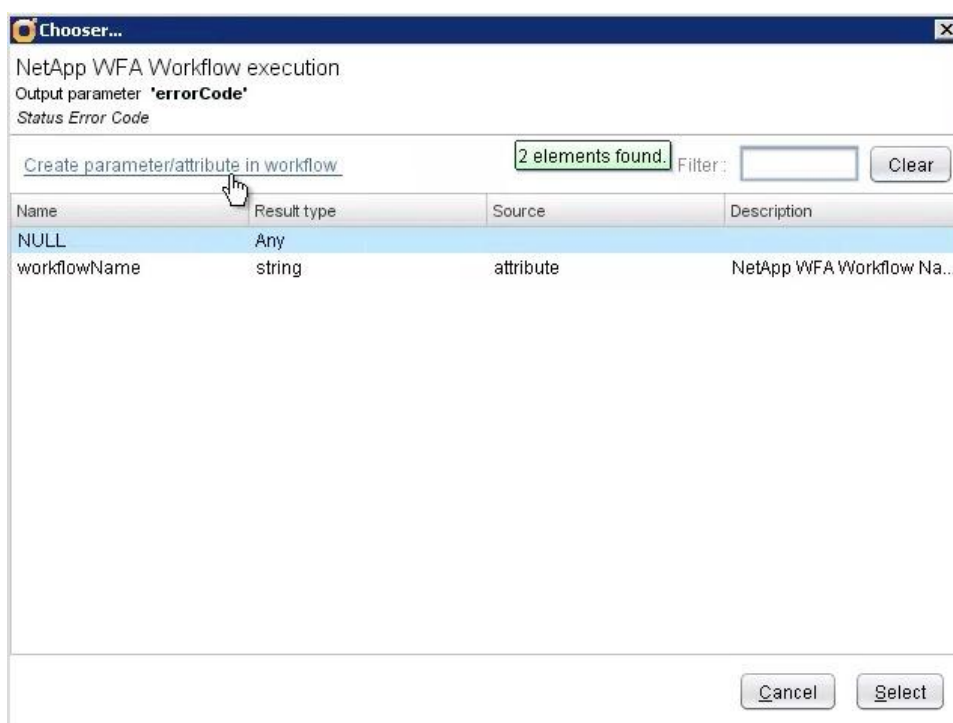
10. From the In tab, verify that local and source parameters similar to those shown in the example are listed.



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.

Create parameter [X]

Parameter information

Name -

Description -

Type ☒ Type
 Array Of ☐ Filter: Clear

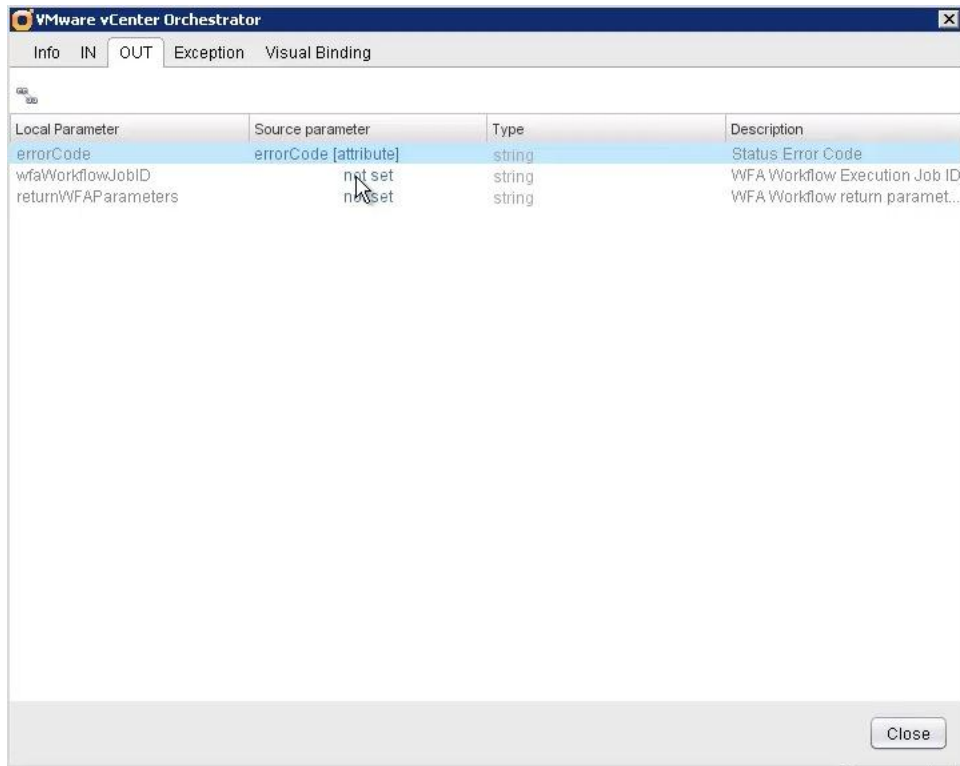
Type
string

Create - ☐ Create workflow OUTPUT PARAMETER with the same name ☒ Create workflow ATTRIBUTE with the same name [OUT](#)

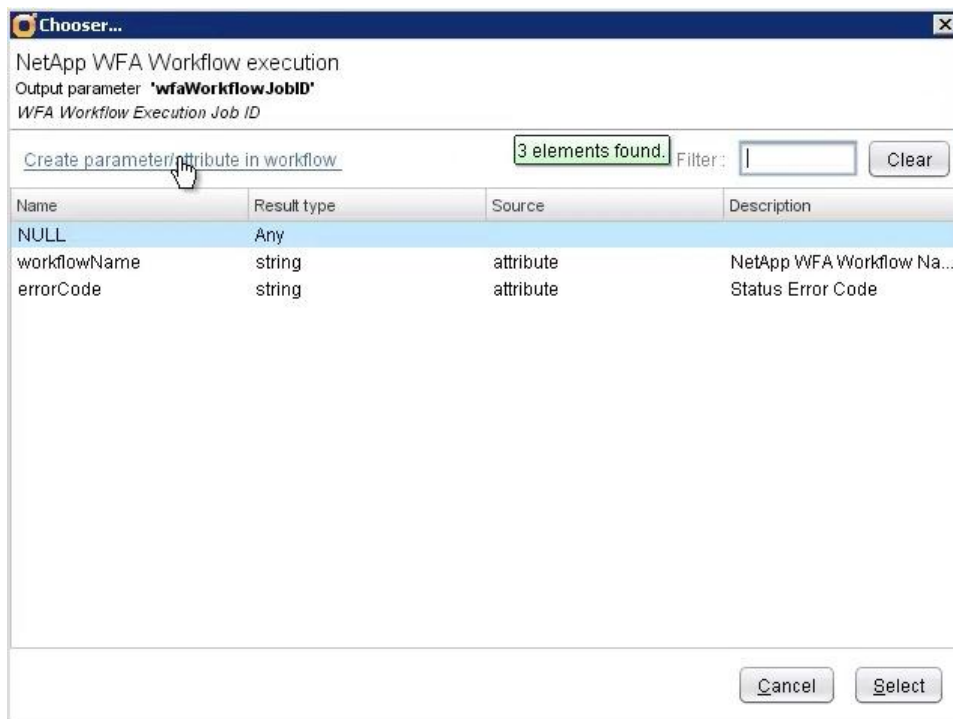
Value -

Cancel 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.

Create parameter [X]

Parameter information

Name -

Description -

Type - ☒ 1 element found. Filter:

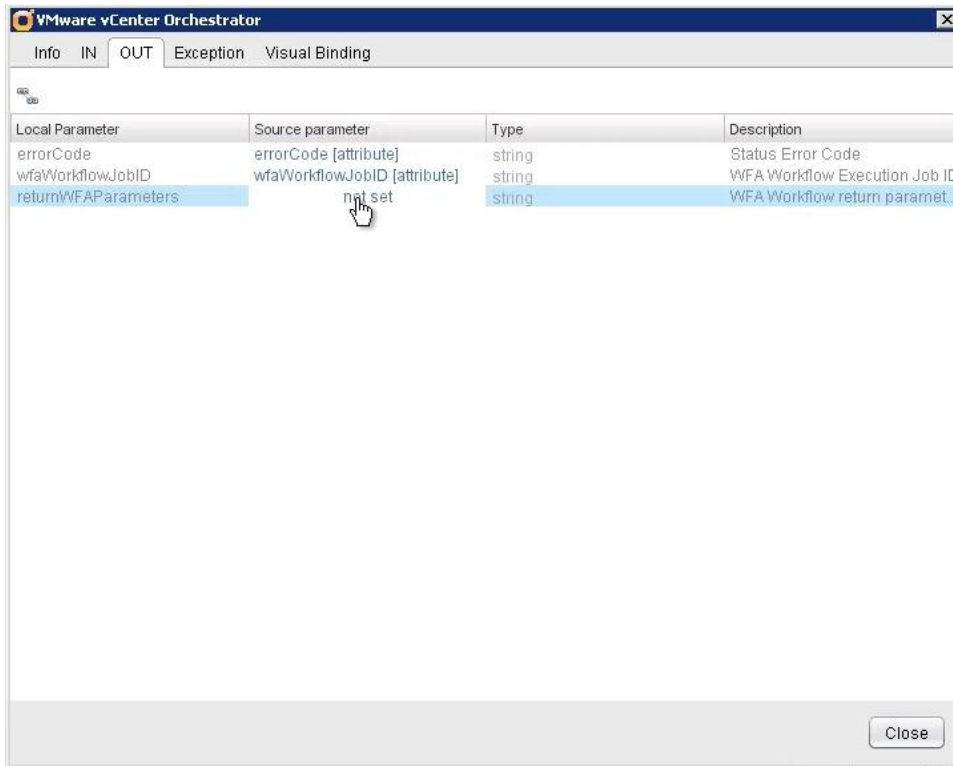
Array Of ☐

Type
string

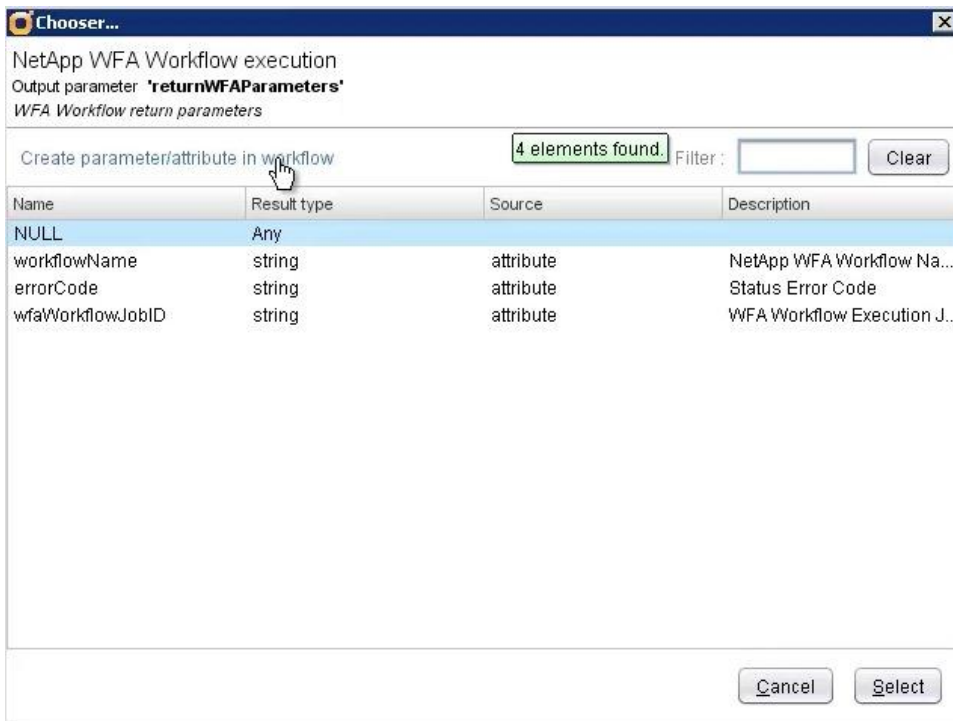
Create - ☐ Create workflow OUTPUT PARAMETER with the same name
☒ Create workflow ATTRIBUTE with the same name

Value -

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.

Create parameter [X]

Parameter information

Name -

Description -

Type ☒ Array Of ☐ 1 element found. Filter: Clear

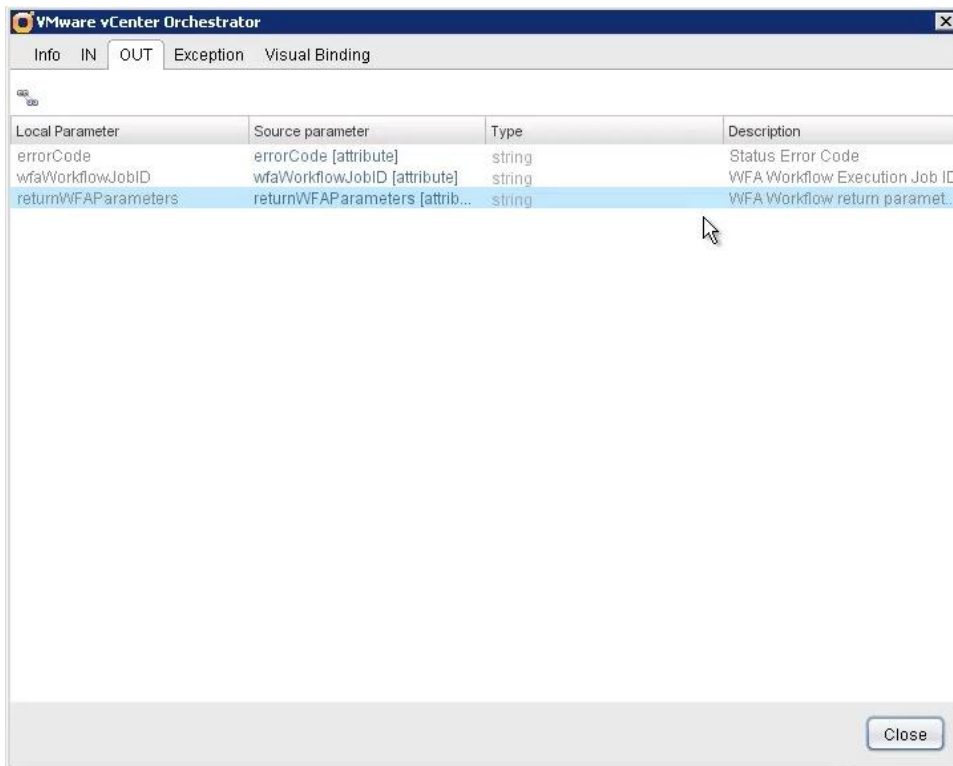
Type
string

Create - ☐ Create workflow OUTPUT PARAMETER with the same name OUT+
☒ Create workflow ATTRIBUTE with the same name

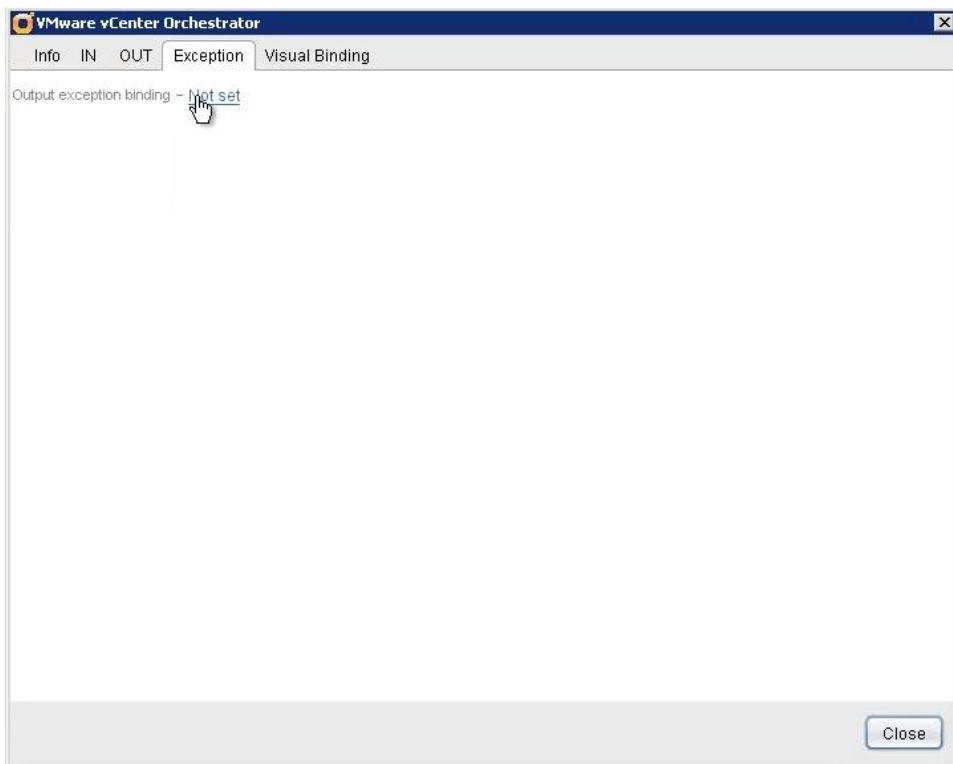
Value -

Cancel Ok

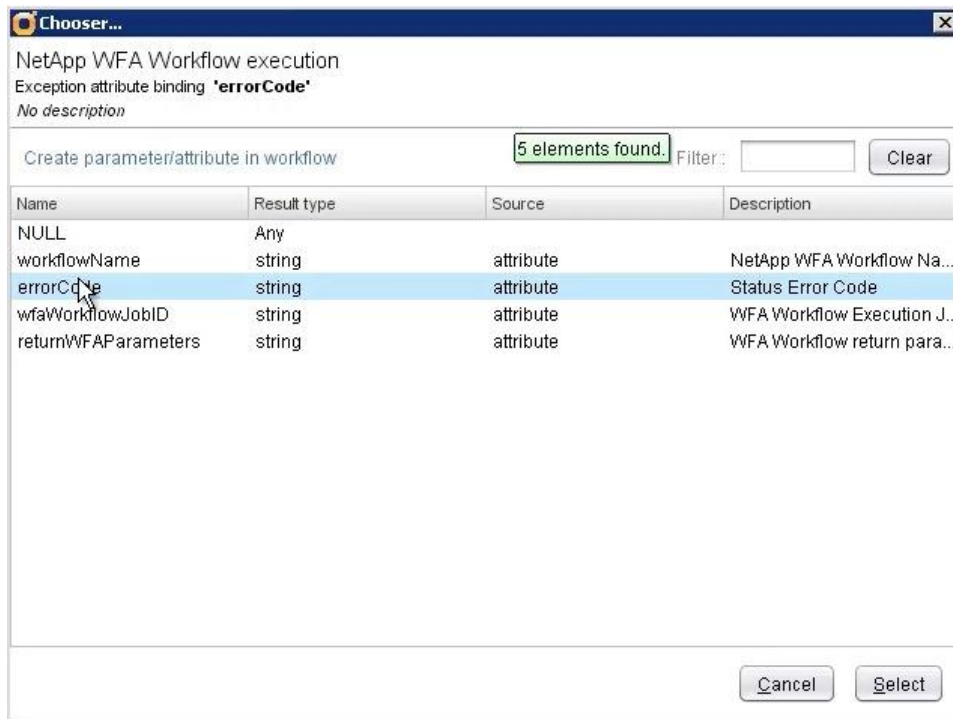
20. From the Out tab, verify that local and source parameters similar to those shown in the example are listed and click the Exception tab.



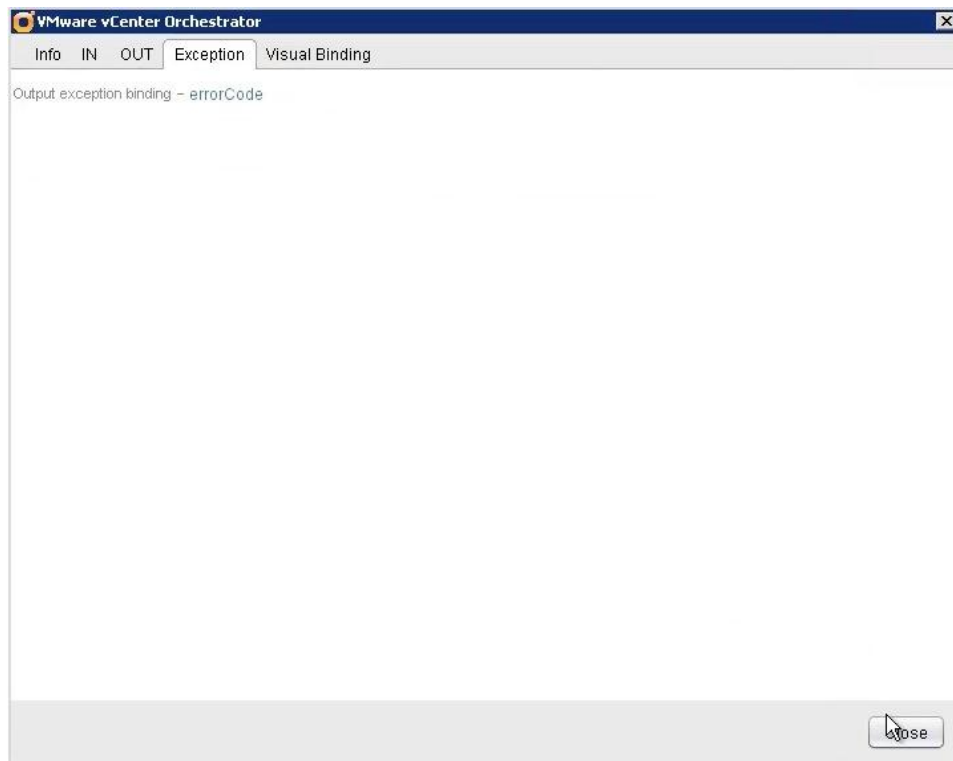
21. From the Exception tab, click Not Set.



22. Click ErrorCode and click Select.



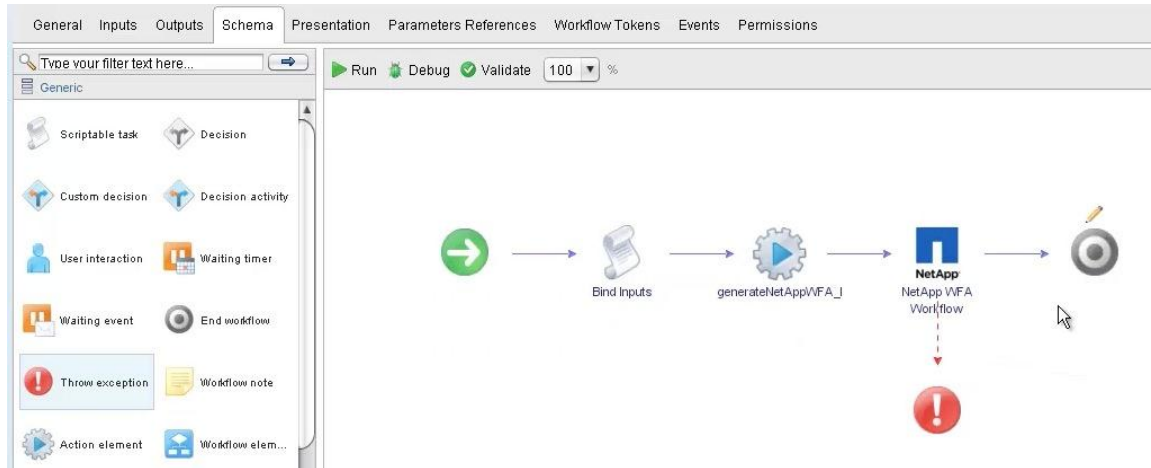
23. Verify that the information on the Exception tab is similar to the example and click Close.



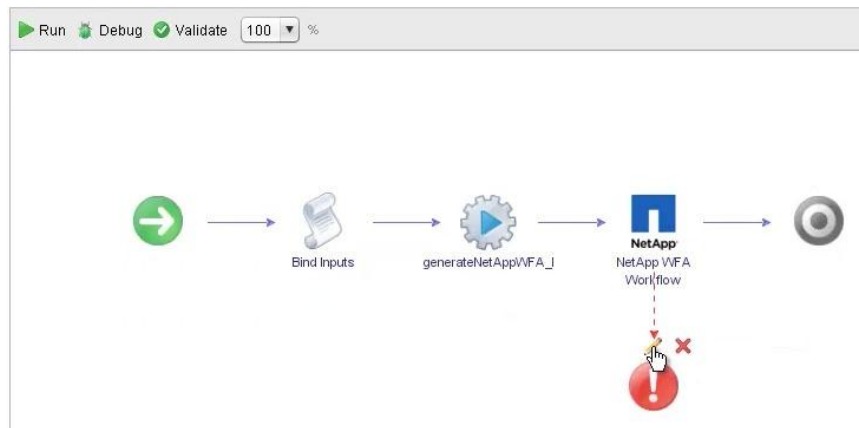
4.6 Create Throw Exception for Workflow

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

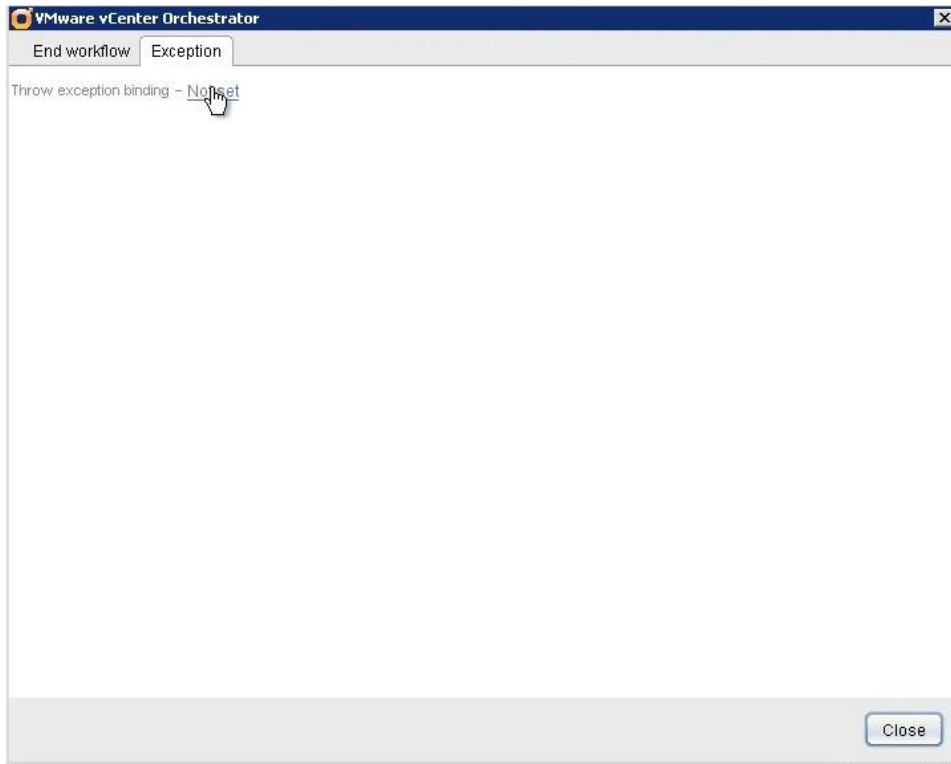
1. From the Schema tab, select Throw Exception and drag it into the right pane under NetApp WFA Workflow.



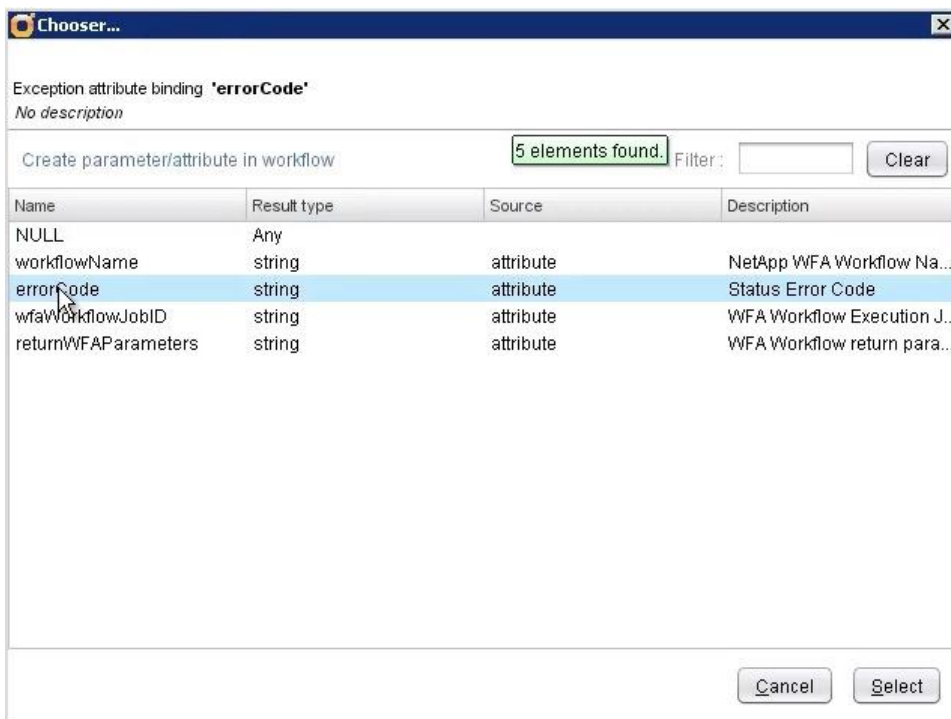
2. Point to Throw Exception and click the pencil icon.



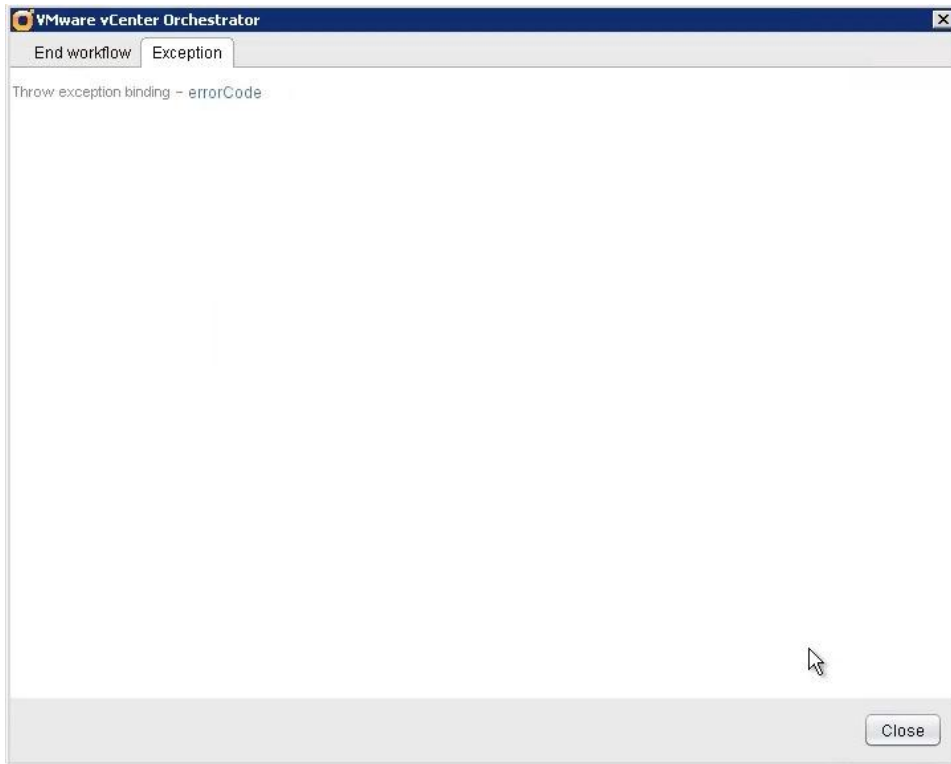
3. From the Exception tab, click Not Set.



4. Click ErrorCode and click Select.



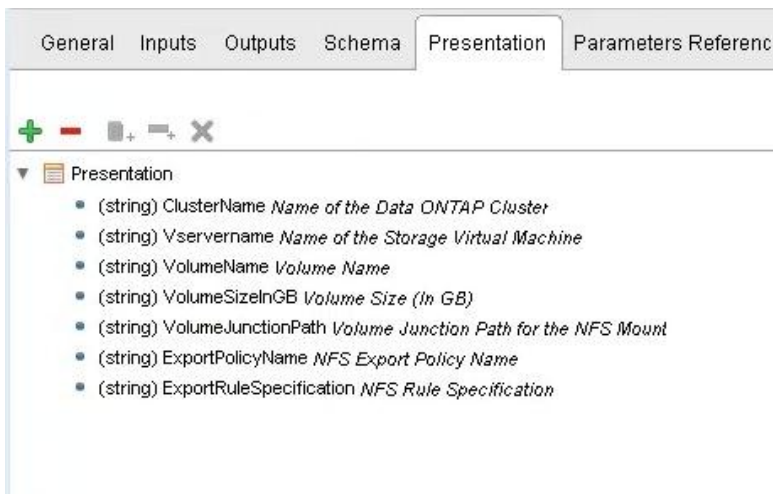
5. Verify that the information on the Exception tab is similar to the example and click Close.



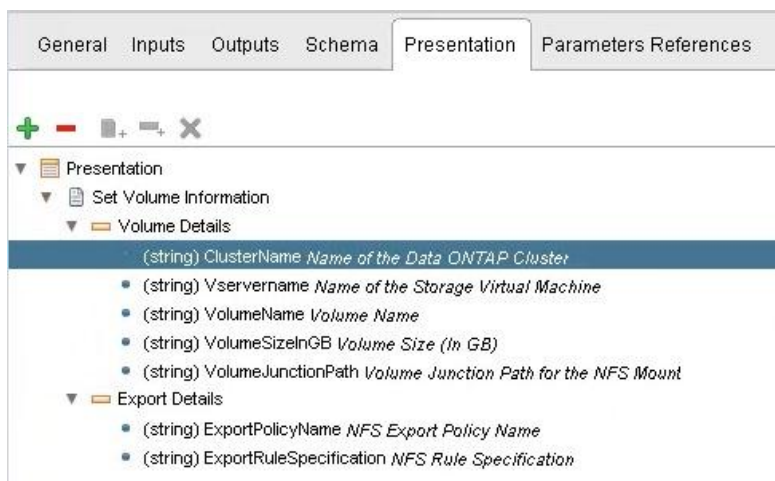
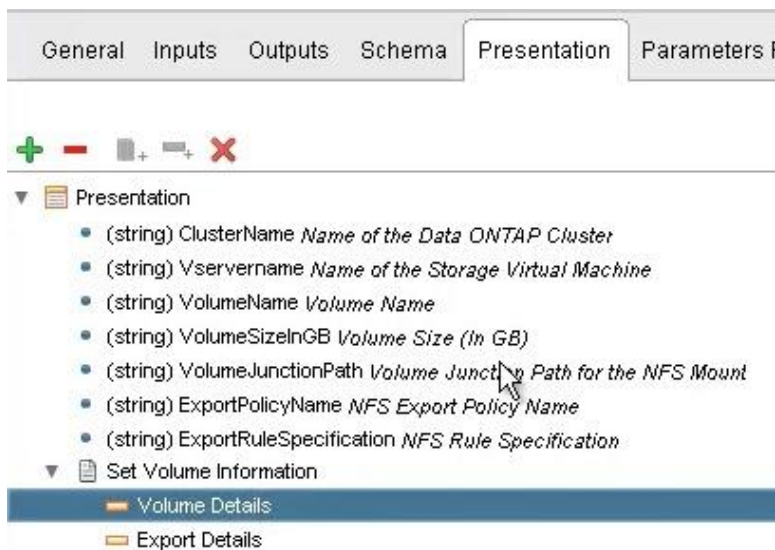
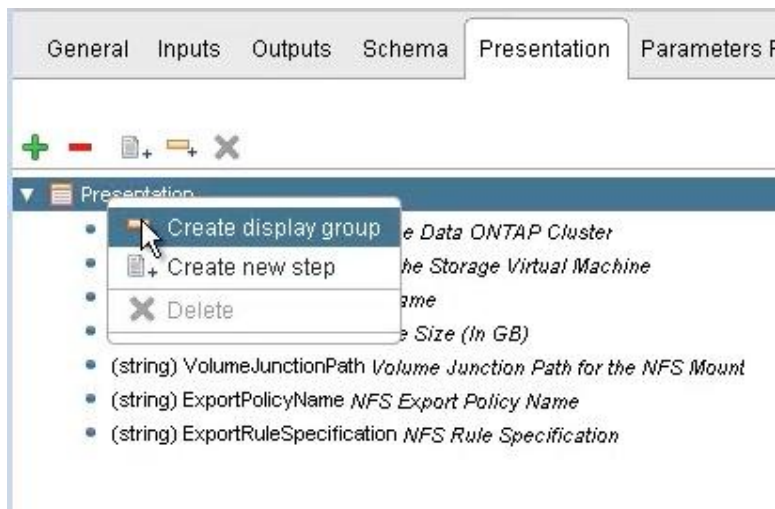
4.7 Edit Presentation of Workflow

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

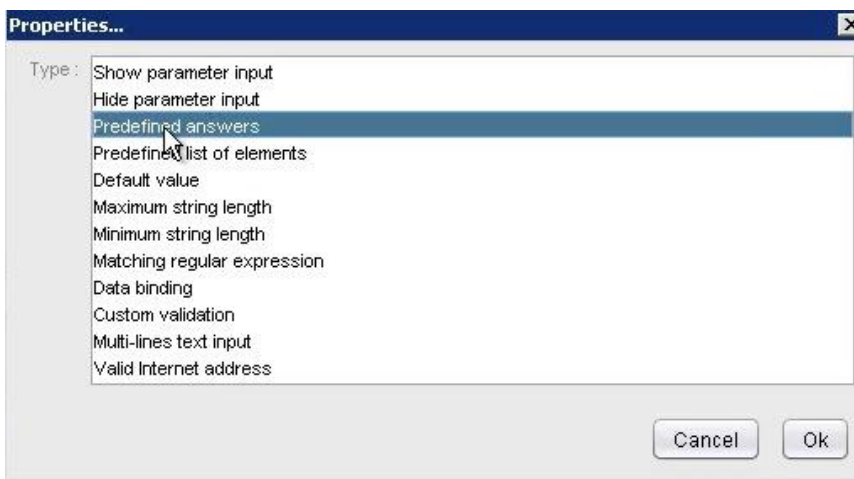
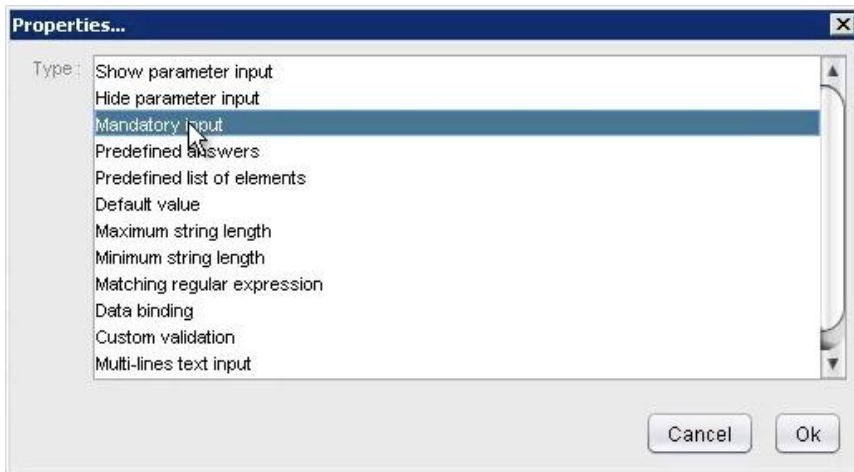
1. Click the Presentation tab.

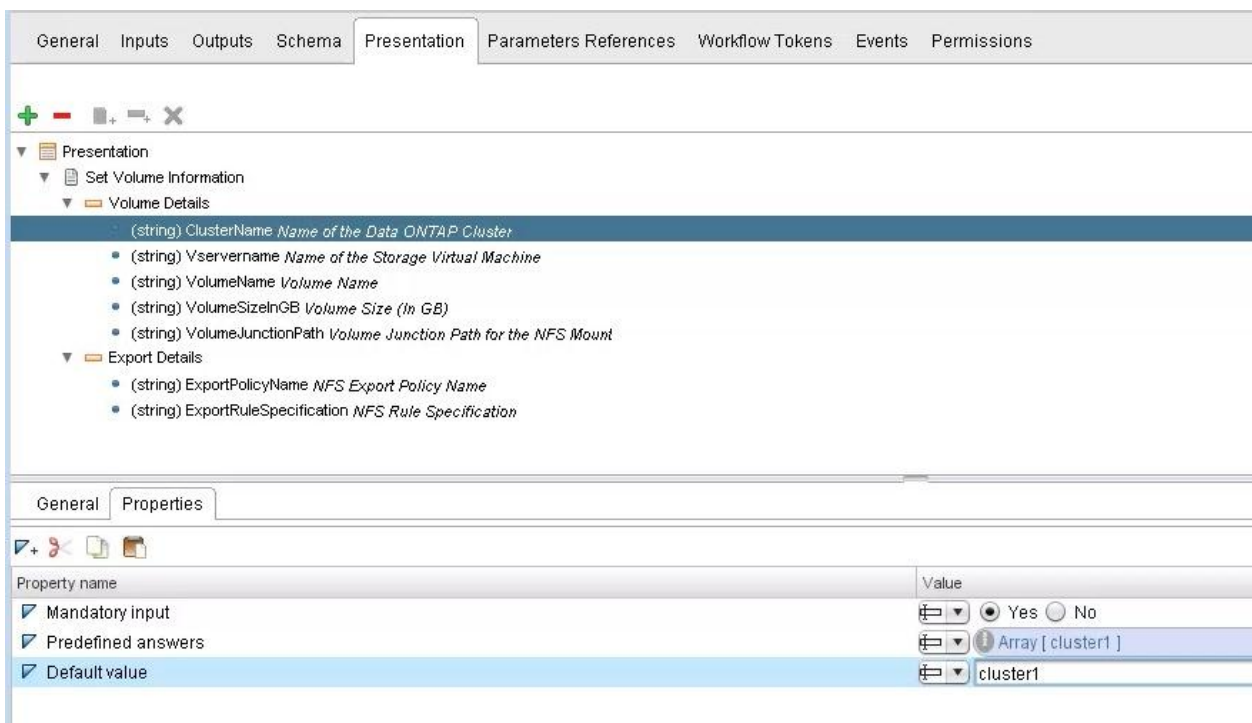
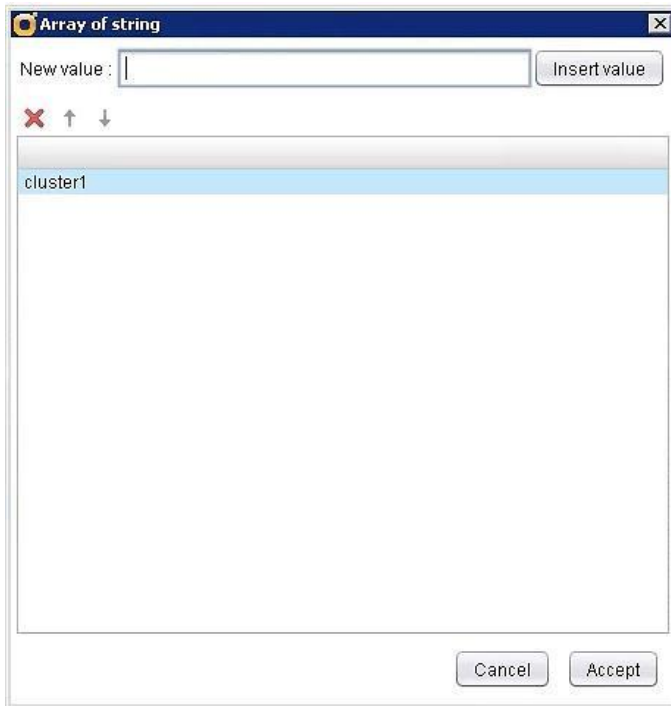


2. Set up the presentation of the workflow according to your preferences. In the examples, the Volume Details and Export Details inputs are set up under the Set Volume Information display group.



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.

General Inputs Outputs Schema **Presentation** Parameters References Workflow Tokens Events Permissions

+ - + - X

▼ Presentation

▼ Set Volume Information

▼ Volume Details

- (string) ClusterName *Name of the Data ONTAP Cluster*
- (string) Vservername *Name of the Storage Virtual Machine*
- (string) VolumeName *Volume Name*
- (string) VolumeSizeInGB *Volume Size (In GB)*
- (string) VolumeJunctionPath *Volume Junction Path for the NFS Mount*

▼ Export Details

- (string) ExportPolicyName *NFS Export Policy Name*
- (string) ExportRuleSpecification *NFS Rule Specification*

General Properties

Property name Value

☒ Predefined answers

☒ Mandatory input ☐ Yes ☐ No

☒ Default value

General Inputs Outputs Schema **Presentation** Parameters References Workflow Tokens Events Permissions

+ - + - X

▼ Presentation

▼ Set Volume Information

▼ Volume Details

- (string) ClusterName *Name of the Data ONTAP Cluster*
- (string) Vservername *Name of the Storage Virtual Machine*
- (string) VolumeName *Volume Name*
- (string) VolumeSizeInGB *Volume Size (In GB)*
- (string) VolumeJunctionPath *Volume Junction Path for the NFS Mount*

▼ Export Details

- (string) ExportPolicyName *NFS Export Policy Name*
- (string) ExportRuleSpecification *NFS Rule Specification*

General Properties

Property name

☒ Mandatory input

☒ Predefined answers

Array of string

New value :

X ↑ ↓

10

20

30

40

50

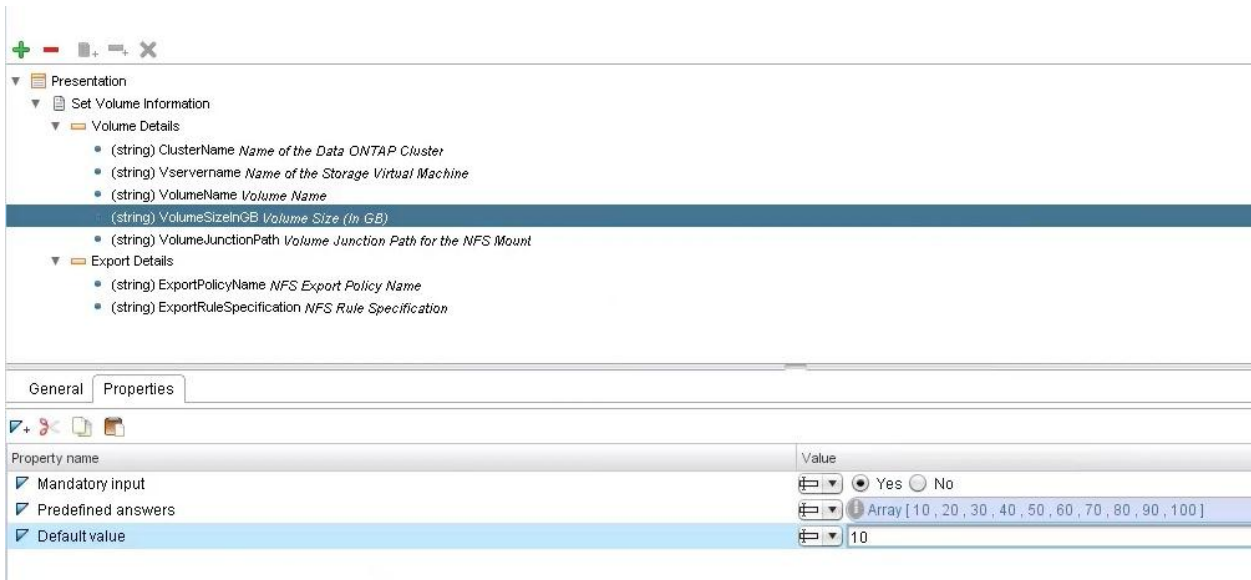
60

70

80

90

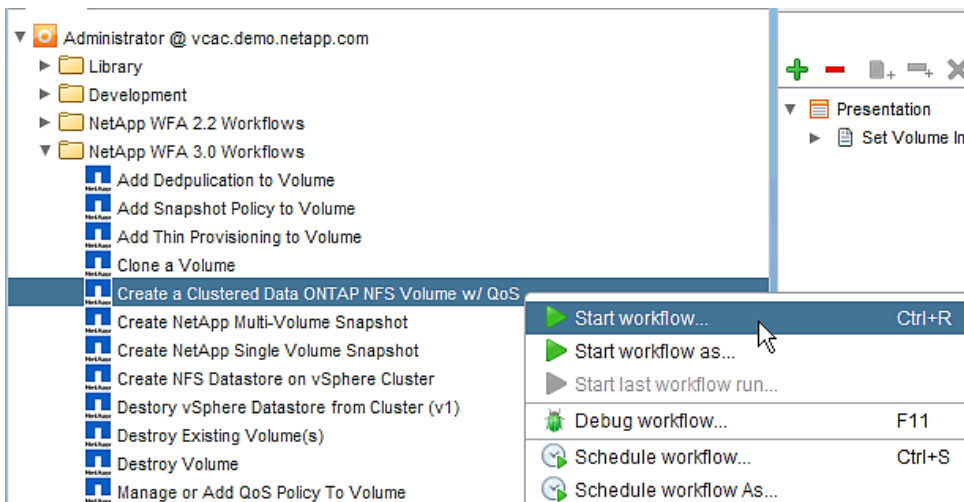
100



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.

Start Workflow : Create a Clustered Data ONTAP NFS Volume w/ QoS

1 Set Volume Information

1a Volume Information

1b Volume Properties

* Name of the Data ONTAP Cluster
cluster1

* Name of the Storage Virtual Machine
OTB

* Volume Name
OTB_TEST_2

* Volume Size (In GB)
10

* NFS Export Policy Name
default

Cancel Back Next Submit

Start Workflow : Create a Clustered Data ONTAP NFS Volume w/ QoS

1 Set Volume Information

✓ 1a Volume Information

1b Volume Properties

Enable Deduplication?
☒ Yes ☐ No

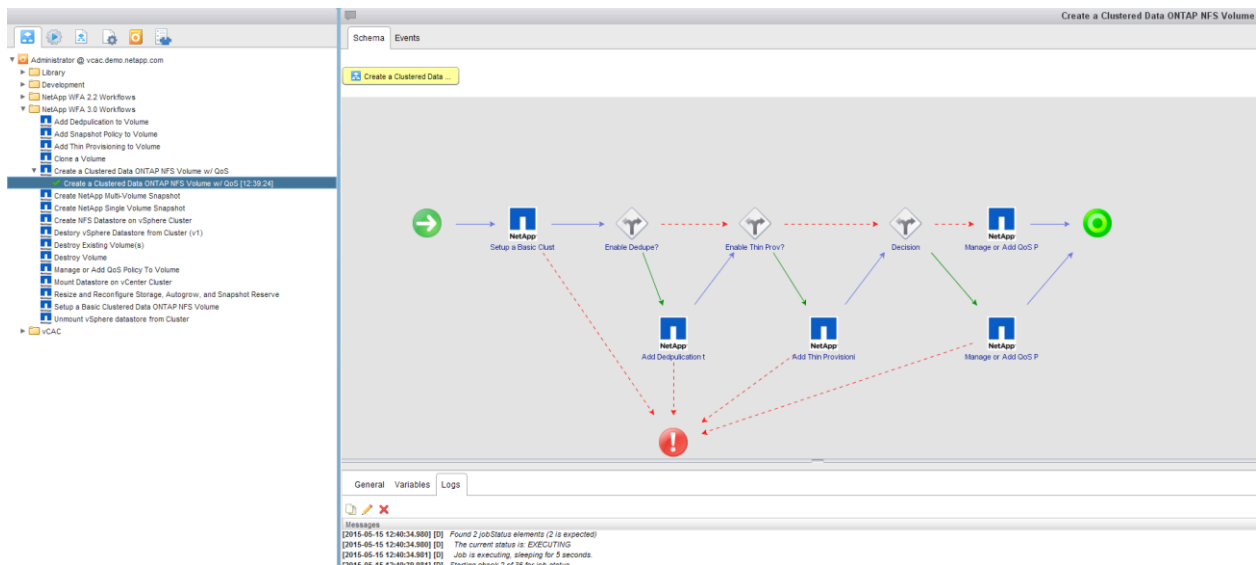
Use thin provisioning?
☒ Yes ☐ No

Create a New QoS Policy Group?
☐ Yes ☒ No

Current Policy Group Name
OTB-Standard

Cancel Back Next Submit

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.



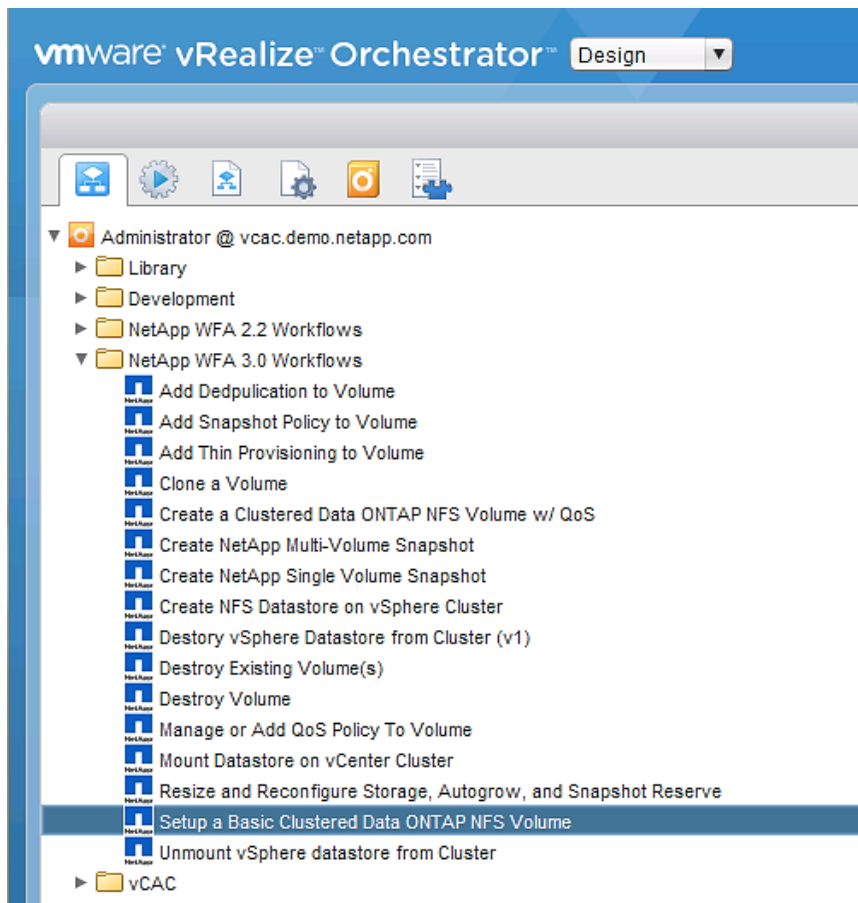
5.1 Set Up Smaller Workflows for Wrapper

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.

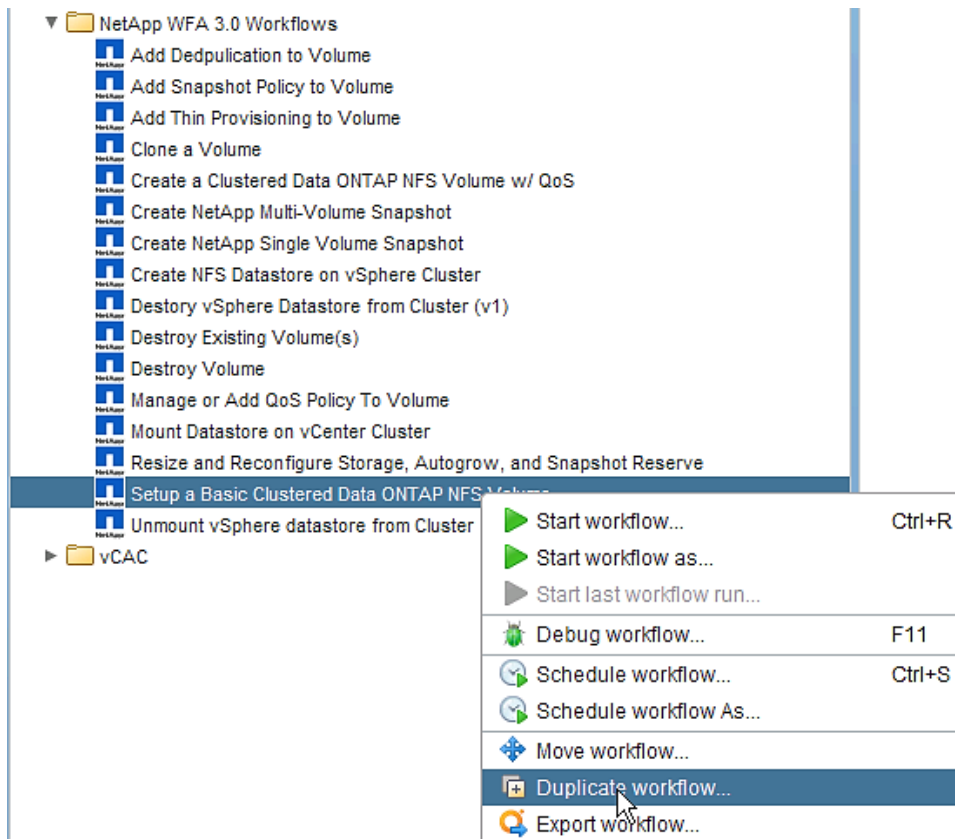
5.2 Build Wrapper Workflow

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.

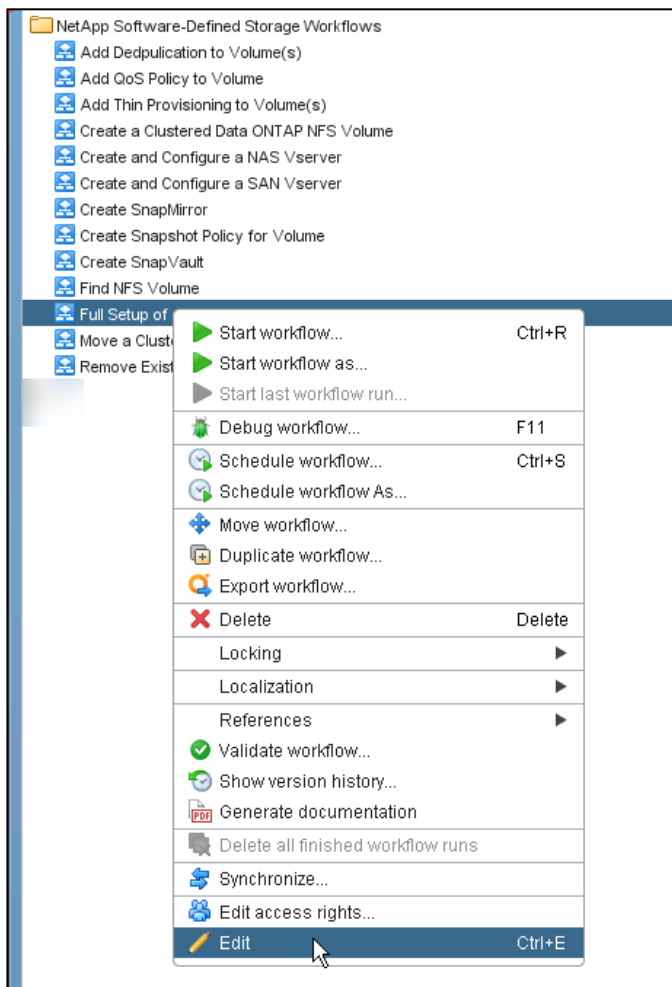


3. On the Duplicate Workflow page, rename the workflow and place it in the appropriate folder.

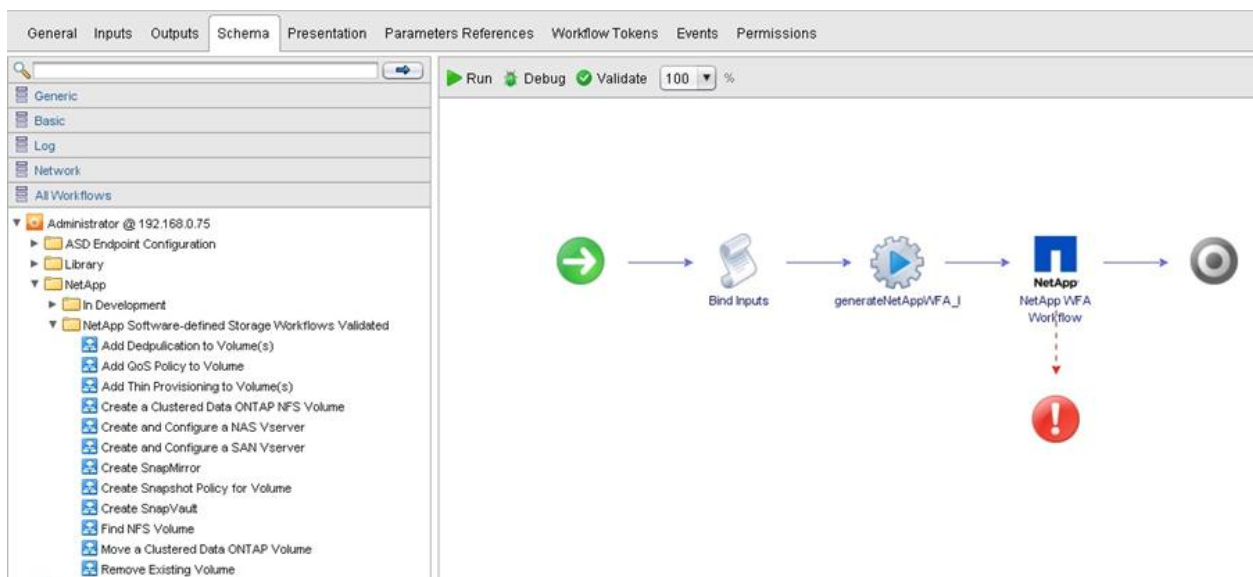
The 'Duplicate workflow' dialog box is shown. It contains the following fields and options:

- Duplicate workflow** (tab)
- Please enter duplication information for your workflow.
- * New workflow name**: Full Setup of a Clustered Data ONTAP NFS Volume
- * Workflow folder**: NetApp Software-defined Storage Workflows Validated
- Copy version history**:
 - ☒ Yes
 - ☐ No
- Buttons**: Cancel, Submit

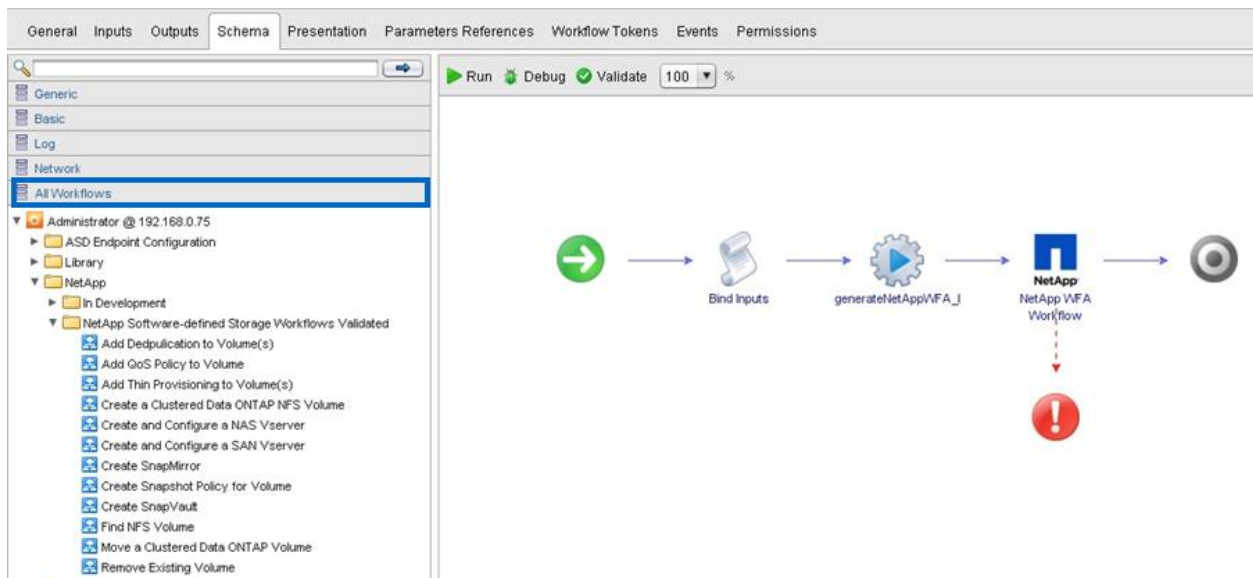
4. Right-click the duplicated workflow and select Edit.



5. Click the Schema tab.

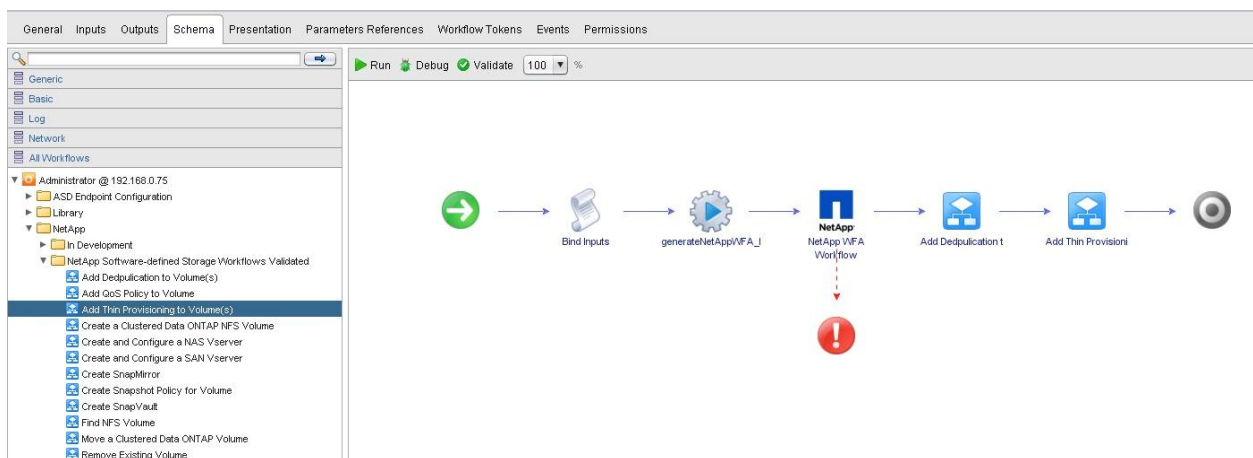


- From the left pane, click All Workflows.

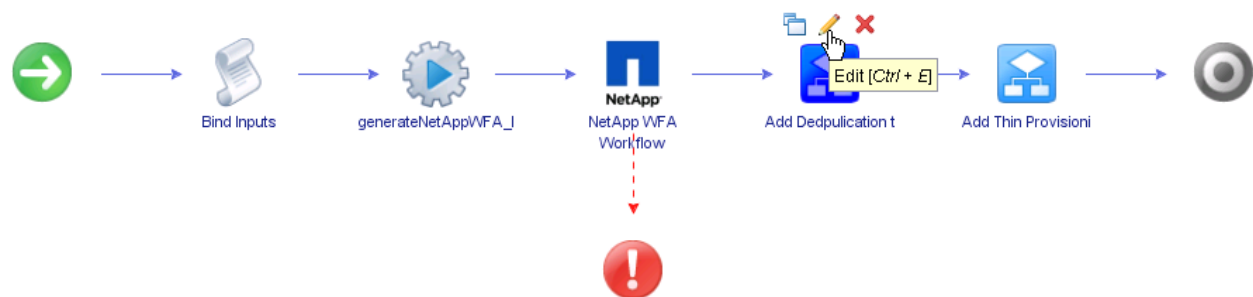


- Select Add Deduplication to Volume(s) and Add Thin Provisioning to Volume(s). Drag them to the right pane to the right of NetApp WFA Workflow.

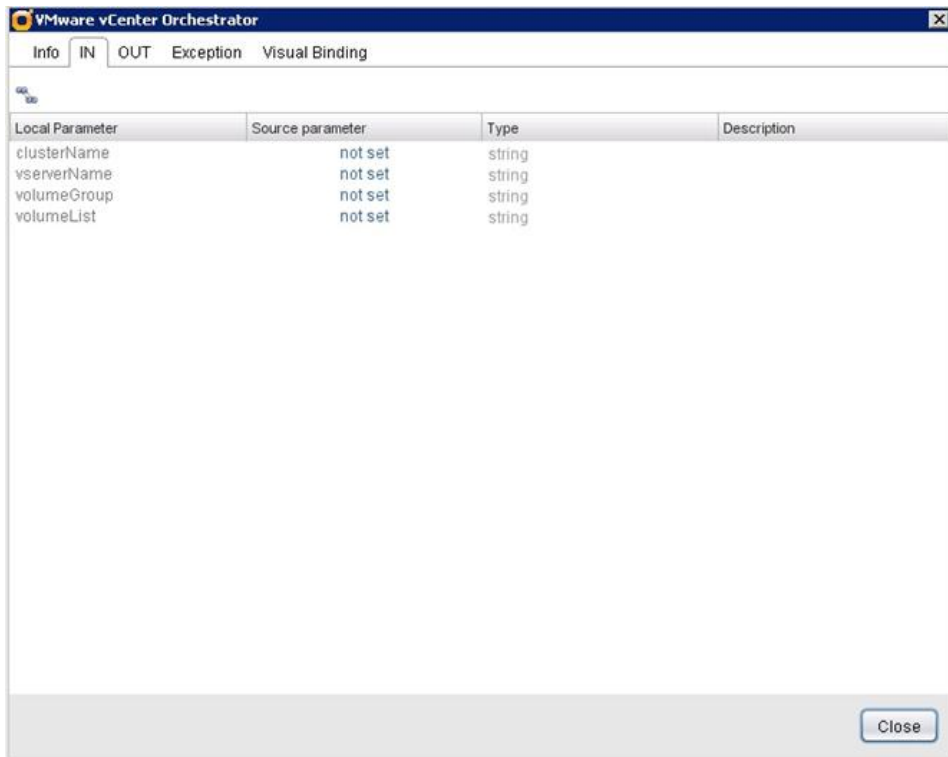
Note: Ignore the prompt that appears when you do this.



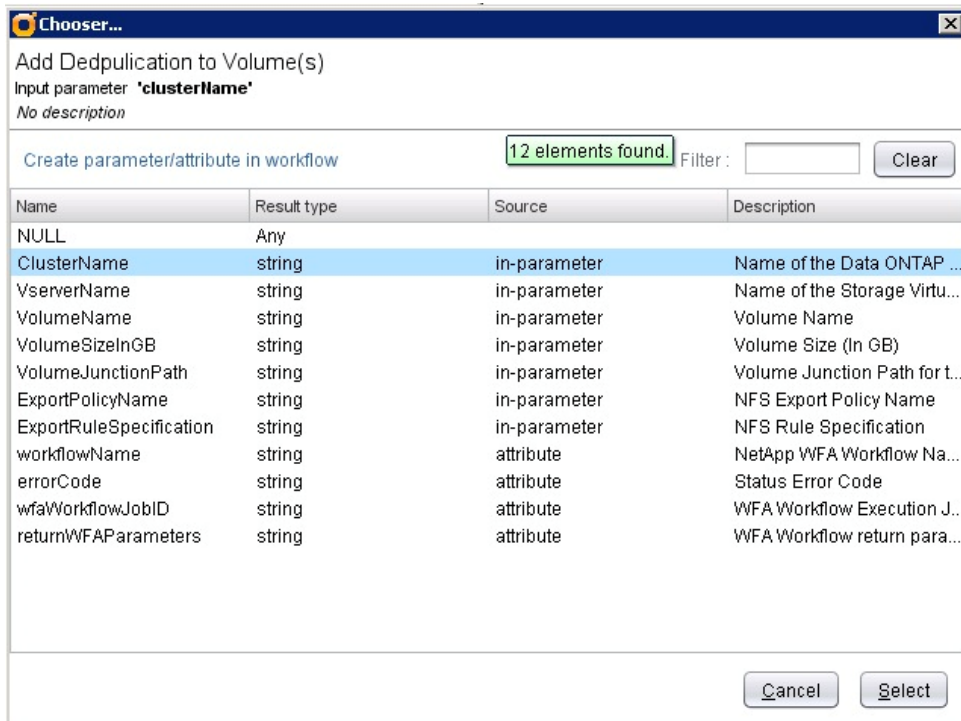
- Point to Add Deduplication to Volume(s) and click the pencil icon.



- 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.

Chooser...

Add Deduplication to Volume(s)

Input parameter **'clusterName'**

No description

Create parameter/attribute in workflow 12 elements found. Filter: Clear

Name	Result type	Source	Description
NULL	Any		
ClusterName	string	in-parameter	Name of the Data ONTAP ...
VserverName	string	in-parameter	Name of the Storage Virtu...
VolumeName	string	in-parameter	Volume Name
VolumeSizeInGB	string	in-parameter	Volume Size (In GB)
VolumeJunctionPath	string	in-parameter	Volume Junction Path for t...
ExportPolicyName	string	in-parameter	NFS Export Policy Name
ExportRuleSpecification	string	in-parameter	NFS Rule Specification
workflowName	string	attribute	NetApp WFA Workflow Na...
errorCode	string	attribute	Status Error Code
wfaWorkflowJobID	string	attribute	WFA Workflow Execution J...
returnWFAParameters	string	attribute	WFA Workflow return para...

Cancel Select

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

Create parameter

Parameter information

Name -

Description -

Type ☒ ☐ Array Of Clear

Type

string

Create - ☒ Create workflow INPUT PARAMETER with the same name ☐ Create workflow ATTRIBUTE with the same name

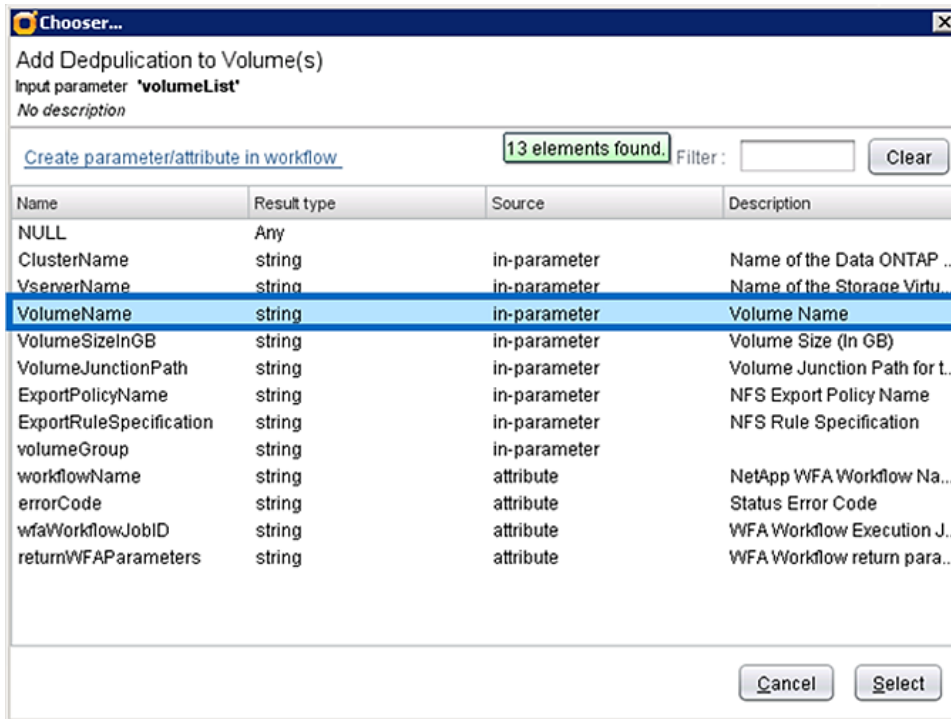
Value -

Cancel Ok

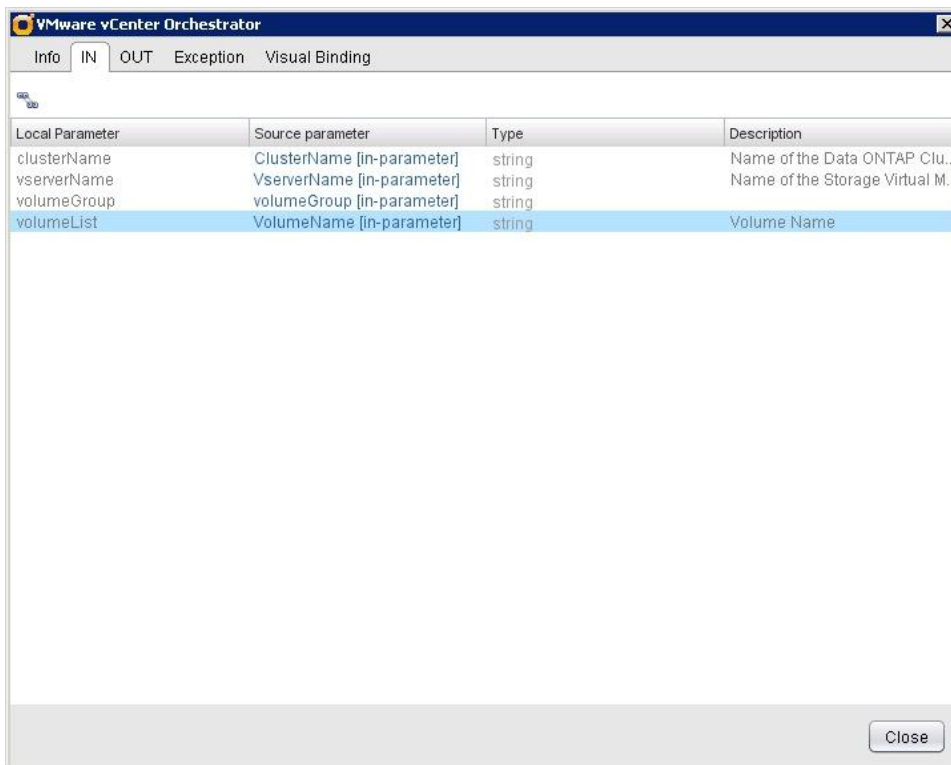
16. On the In tab next to volumeList, click Not Set in the Source Parameter column.

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.

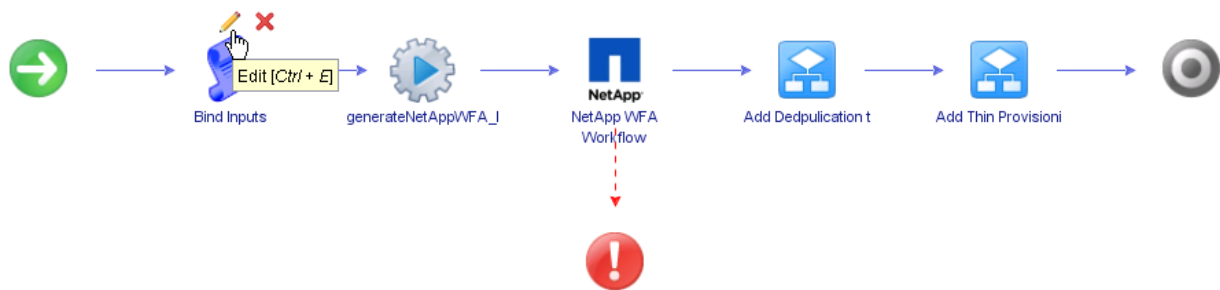
17. On the Chooser page, select VolumeName and click Select.



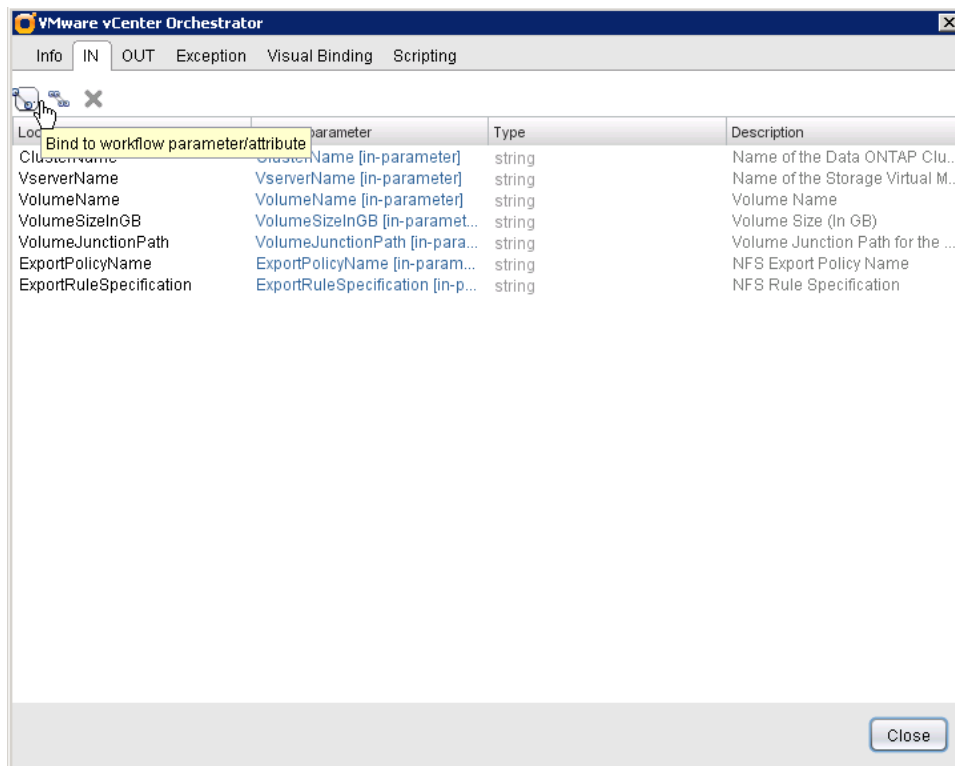
18. After the final local parameter has been mapped, click Close.



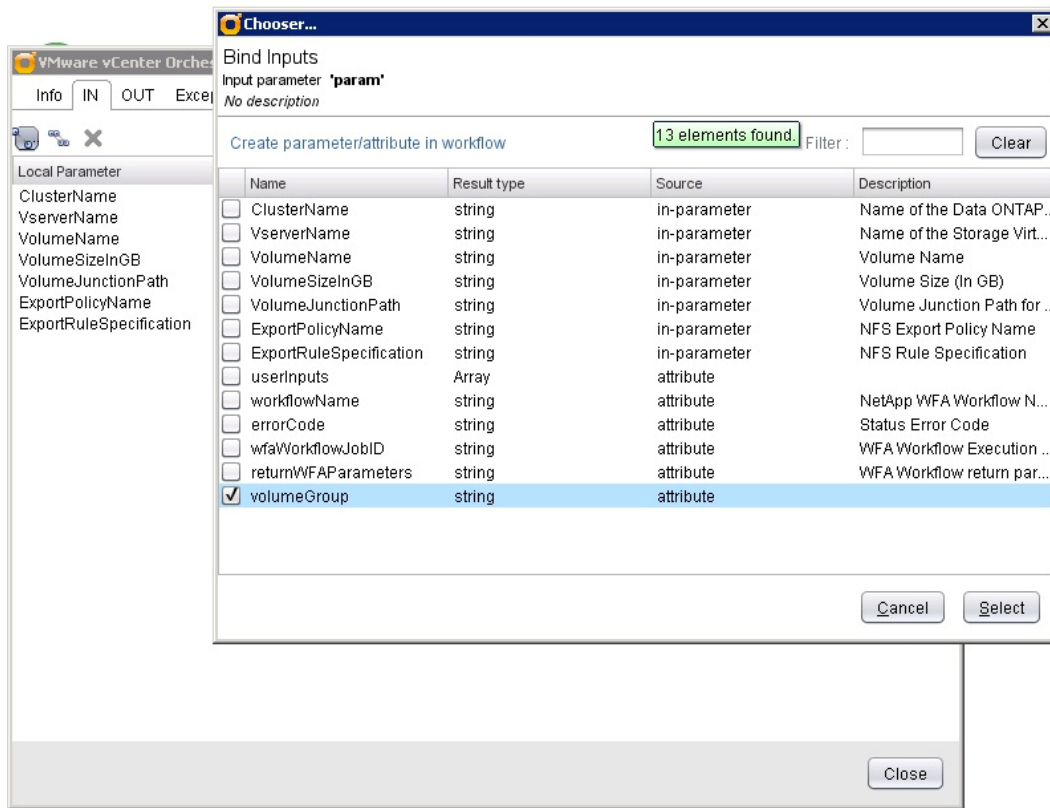
19. From the Schema page, point to Bind Inputs and click the pencil icon.



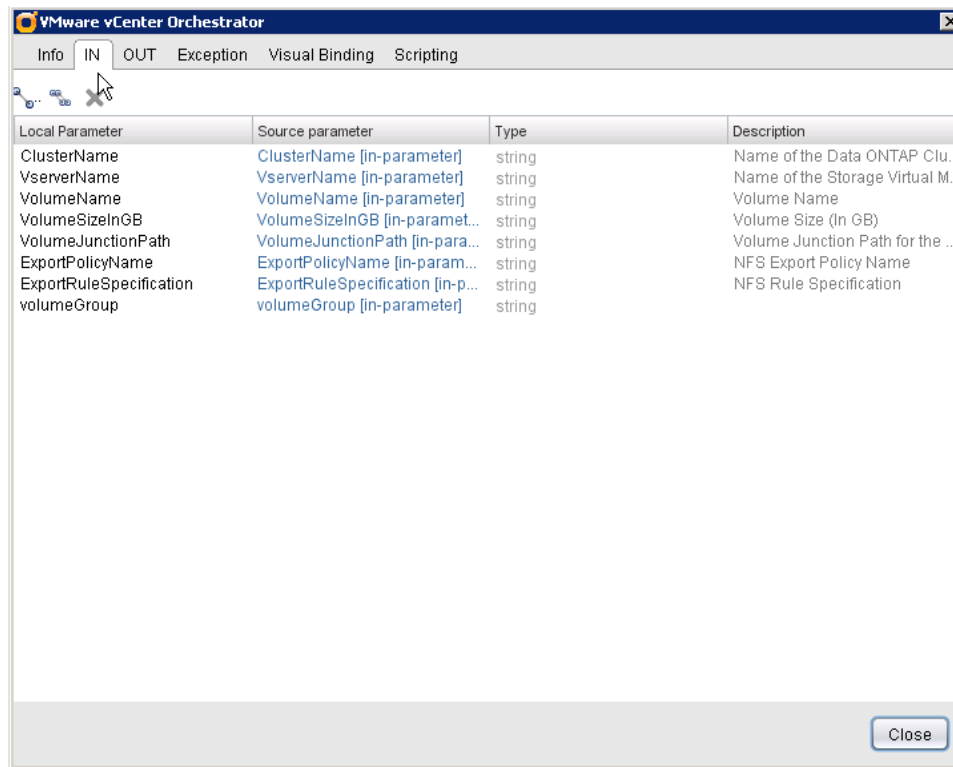
20. Click the In tab and then click the Bind to Workflow Parameter/Attribute icon.



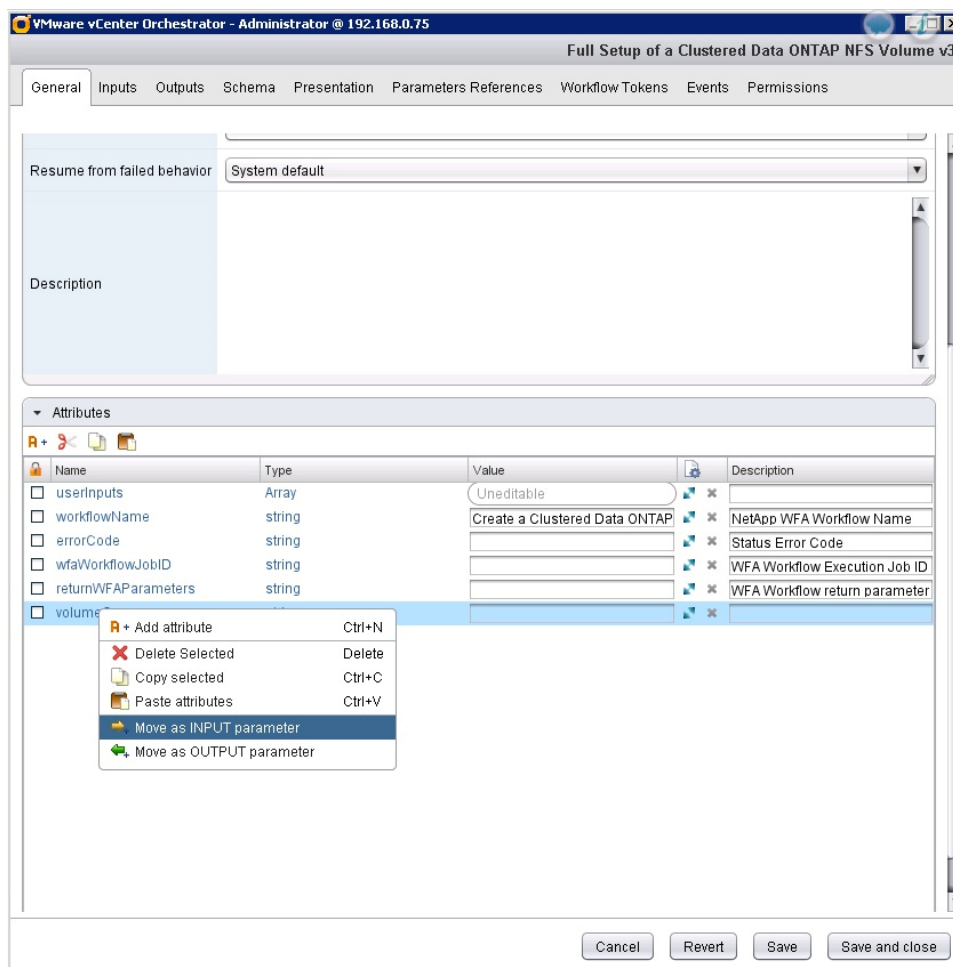
21. On the Chooser page, select VolumeGroup and click Select.



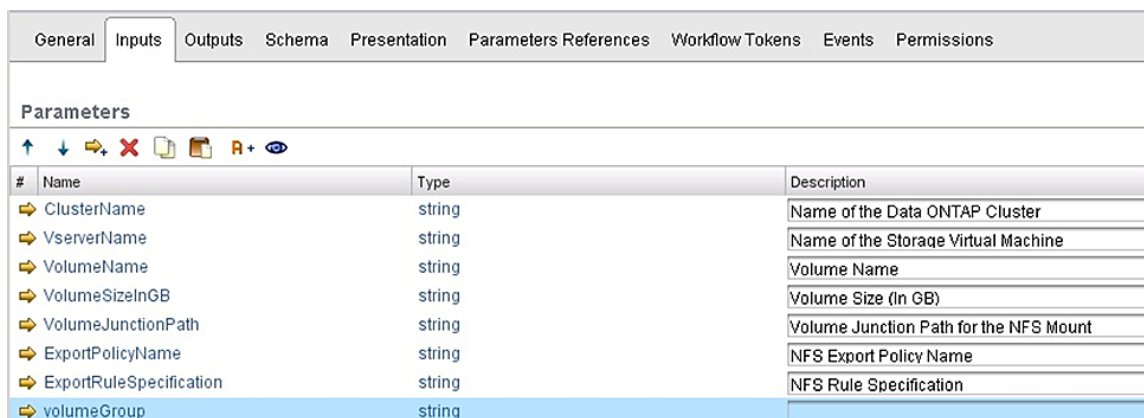
22. On the In tab, verify that volumeGroup is listed as a parameter.



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.

Add Tenant

General Identity stores Administrators

***Name:** Production

Description: This tenant is created for Production BU.

***URL Name:** prod

Contact email:

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

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

Add Identity Store

✓ Connection is available.

*Name: <input type="text" value="NetApp-Prod"/>	*Login user DN: <input type="text" value="cn=prod,ou=netapp-prod,dc=demo,dc=netapp,dc=com"/>
*Type: <input type="text" value="Active Directory"/>	*Password: <input type="password" value="*****"/>
*URL: <input type="text" value="ldap://dc1.demo.netapp.com:389"/>	*Group search base DN: <input type="text" value="ou=netapp-prod,dc=demo,dc=netapp,dc=com"/>
*Domain: <input type="text" value="demo.netapp.com"/>	User search base DN: <input type="text" value="ou=netapp-prod,dc=demo,dc=netapp,dc=com"/>
Domain alias: <input type="text"/>	

- Click Test Connection to verify the connection and click Add to add the identity store.
- Verify that the identity store has been added successfully and click Next.
- 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.
- Enter the user accounts in the Tenant Administrators and Infrastructure Administrators fields. Click Add to complete the tenant setup.

Add Tenant

General Identity stores Administrators

Select Users and Groups from your identity stores to grant the Tenant administrator role.

Tenant administrators:

prod-tenant (prod-tenant@demo.netapp.com)

Select Users and Groups from your identity stores to grant the Infrastructure administrator role.

Infrastructure administrators:

prod-infra (prod-infra@demo.netapp.com)

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:

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

Credentials

Manage the credentials associated with endpoints.

Credentials (4) New Credentials			
* Name	Description	* Username	* Password
Domain Admin Credentials		demo\administrator	*****
NetApp Cluster		admin	*****
ONTAP Brewing SVM		vsadmin	*****
vCenter Credentials		administrator@vsphere.local	*****

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).

Endpoints

Manage the endpoints representing virtualization platforms, cloud service accounts, physical machines and storage devices.

Endpoints (4) New Endpoint Import Endpoints Columns			
Endpoint	Platform Type	Address	Description
Cluster 1	NetApp ONTAP	192.168.0.101	
ONTAP Brewing SVM	NetApp ONTAP	192.168.0.131	
vc1	vSphere (vCenter)	https://192.168.0.31/sdk	
vCO	vCenter Orchestrator	https://vcac6.demo.netapp.com:8281/vco	

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.

Endpoint

* Name: vc1

Description:

* Address: https://192.168.0.31/sdk

* Credentials: vCenter Credentials

Specify manager for network and security platform

Custom properties:

Properties (0)

New Property

Name	Value	Encrypted
There is no data to display.		

OK

Cancel

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.

New Fabric Group

Create a fabric group by assigning fabric administrators and selecting the compute resources they can manage.

* Name: Prod-Clis

Description:

Fabric administrators:

prod-fab@demo.netapp.com

Compute resources:

		Name	Endpoint	Platform Type
<input checked="" type="checkbox"/>		OTB Cluster 1	vc1	vSphere (vCenter)
<input type="checkbox"/>		OTB R&D Cluster 1	vc1	vSphere (vCenter)
<input type="checkbox"/>		OTB RD Cluster 1	vc1	vSphere (vCenter)
<input type="checkbox"/>		vCAC Demo Cluster 1	vc1	vSphere (vCenter)
<input type="checkbox"/>		vCenter Environment		

OK

Cancel

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.

< Back to Infrastructure

Business Groups

* Name:

prod-suse

Description:

* Default machine prefix:

IT-OTP-

Active directory container:

Group manager role:

prod-bsgrp@demo.netapp.com

* Send manager emails to:

prod-suse@demo.netapp.com

Support role:

User role:

prod-user@demo.netapp.com

Custom properties:

Properties (0)

Name	Value
There is no data	

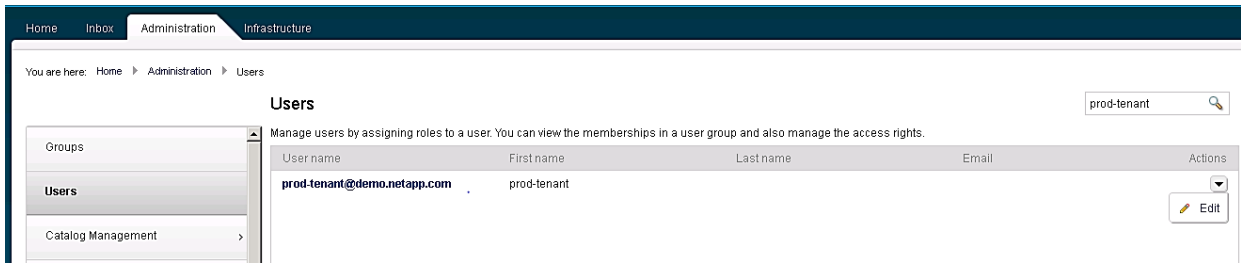
OK

Cancel

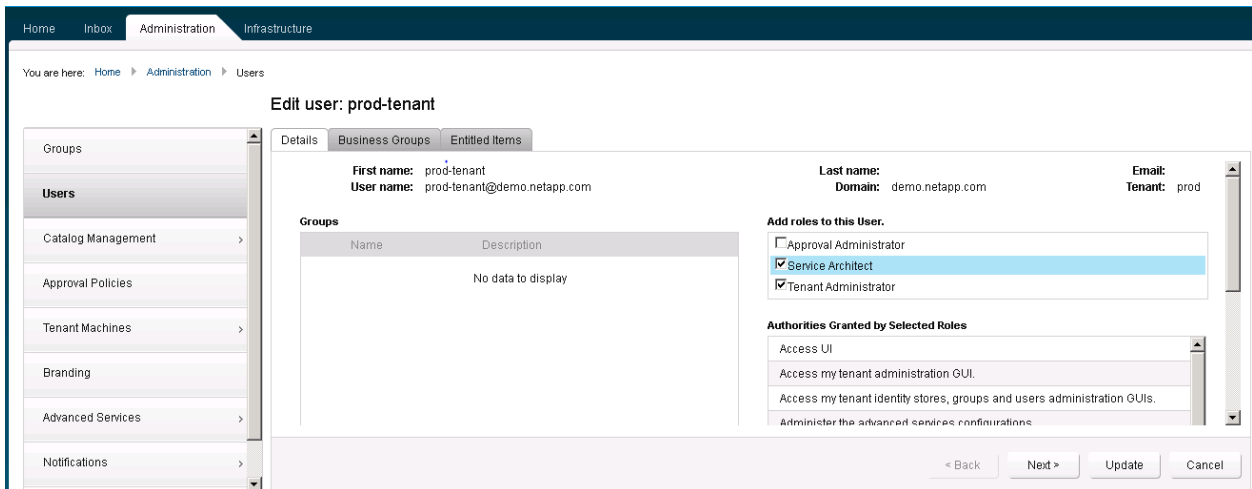
6.6 Assign Service Architect Role to User

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.



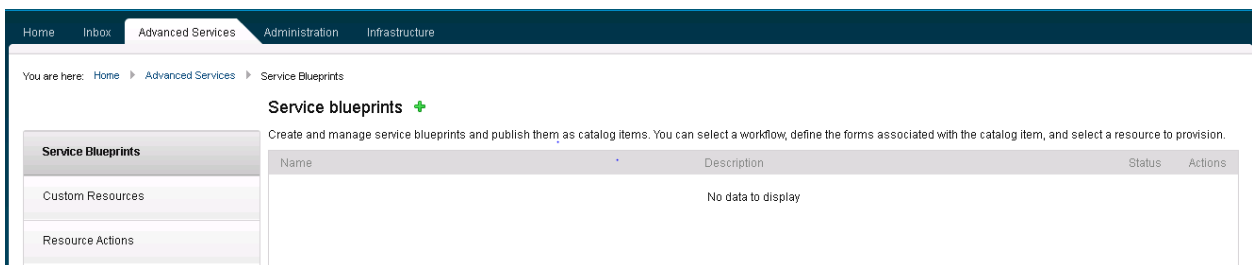
5. In the Edit User pane, select Service Architect to assign this role to the user.
6. Click Update.



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.

Home Inbox **Advanced Services** Administration Infrastructure

You are here: Home > Advanced Services > Service Blueprints

Add Blueprint

Workflow Details Blueprint Form Provisioned Resource

Select a Workflow

- Orchestrator
 - ASD Endpoint Configuration
 - Library
 - NetApp
 - Datastore Creation and Modification
 - Add QOS Policy to NAS Datastore
 - Create Bronze Datastores (New)
 - Create Gold Datastores (New)
 - Create Silver Datastores (New)
 - Create Storage Environment for Tenant
 - Create VMware NFS Datastore on Clustered Data ONTAP Storage
 - Delete Datastore

Selected Workflow

Name: Create VMware NFS Datastore on Clustered Data ONTAP Storage

Description:

Input parameters:

Name	Type
ClusterName	string
VserverName	string
DataStoreName	string
DataStoreSizeInGB	string
VirtualCenterIP	string

< Back Next > Cancel

- Enter a description for this workflow and click Next.

Home Inbox **Advanced Services** Administration Infrastructure

You are here: Home > Advanced Services > Service Blueprints

Add Blueprint

Workflow Details Blueprint Form Provisioned Resource

Name Create VMware NFS Datastore on Clustered Data ONTAP Storage

Description

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

Add Blueprint

Workflow Details **Blueprint Form** Provisioned Resource

Form: Request form

New fields

- Text field
- Text area
- Password field
- Integer field
- Decimal field

Form page: Setup Information

Storage Information

ClusterName cluster1

VserverName OTB

< Back Next > Cancel

- Click Add to complete the setup.

Add Blueprint

Workflow Details **Blueprint Form** Provisioned Resource

Select an output parameter and an existing resource type to provision as the resource.

No provisioning ▼

< Back Add Cancel


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

You are here: [Home](#) > [Advanced Services](#) > [Service Blueprints](#)

Service blueprints +

Create and manage service blueprints and publish them as catalog items. You can select a workflow, define the forms associated with the catalog item, and select a resource to provision.

Service Blueprints
Custom Resources
Resource Actions

Name	Description	Status	Actions
Create VMware NFS Datastore on Clustered Data ONTAP Storage			▼

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

Service blueprints +

Create and manage service blueprints and publish them as catalog items. You can select a workflow, define the forms associated with the catalog item, and select a resource to provision.

Name	Description	Status	Actions
Create VMware NFS Datastore on Clustered Data ONTAP Storage			▼ Edit Publish Clone Delete

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

Service blueprints +

Create and manage service blueprints and publish them as catalog items. You can select a workflow, define the forms associated with the catalog item, and select a resource to provision.

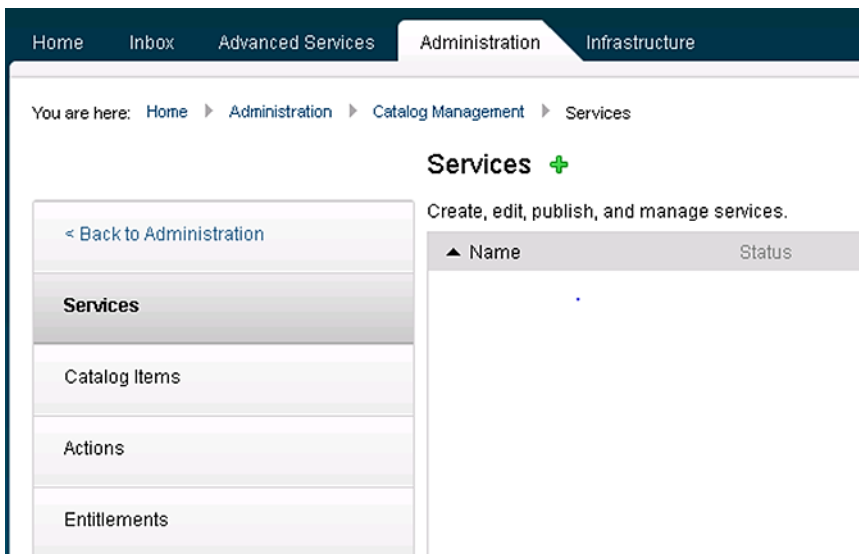
Name	Description	Status	Actions
Create VMware NFS Datastore on Clustered Data ONTAP Storage		✓	▼

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.

Add Service

*** Name:**

Description:

Icon: No file selected.

Preview:

Status:

Hours: to

Owner:

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

Services +

Create, edit, publish, and manage services.

Name	Status	Description	Last Updated On	Last Updated By	Actions
Create NFS Volume	Active		04/01/2014 12:23 AM	prod-tenant	

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

Services +

Create, edit, publish, and manage services.

Name	Status	Description	Last Updated On	Last Updated By	Actions
Create NFS Volume	Active		04/01/2014 12:23 AM	prod-tenant	<div><div>Edit</div><div>Manage Catalog Items</div><div>Copy</div><div>Deactivate</div><div>Delete</div></div>

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

Create NFS Volume

Catalog Items +

Filter by Source: All Filter by Resource Type: All Search

Name	Status	Source	Resource Type	Scope	Description	Actions
No data to display						

8. Select catalog items to add to the service.

Select Catalog Items

Search

Selected	Name	Source	Resource Type	Scope
<input checked="" type="checkbox"/>	Create VMware NFS Datastore on Clustered ...	advanced-desi...		Shared

Refresh Data 1-1 of 1

Add Cancel

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.

Catalog Items

Manage catalog items published from source providers. Use the source provider's interface to create catalog items or edit their details.

Advanced Search							
Name	Status	Source	Resource Type	Scope	Service	Description	Actions
Create VMware N...	Active	advanced-design...		Shared	Create NFS Volume		<div> Configure</div> <div> Deactivate</div>

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

Configure Catalog Item

Details




Entitlements

Preview

List view

Catalog view

Detail view



Status:

Active

Service:

Create NFS Volume

☐ New and noteworthy

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.

Add Entitlement

Details

Items & Approvals

*Name:

Storage Admin

Description:

Expiration Date:

*Status:

Active

*Business Group:

prod-suse

*Users & Groups:

Name

prod-user (prod-user@demo.netapp.com)

< Back

Next >

Cancel

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

Add Entitlement

Details

Items & Approvals

Entitled Services +

Search

Name	Approval Policy
Create NFS V...	(none)

Entitled Catalog Items +

Search

Name	Approval Policy
Create VMwa...	(none)

Entitled Actions +

Search

Name	Approval Policy
No data selected	

< Back

Add

Cancel

6.11 Request Catalog Items

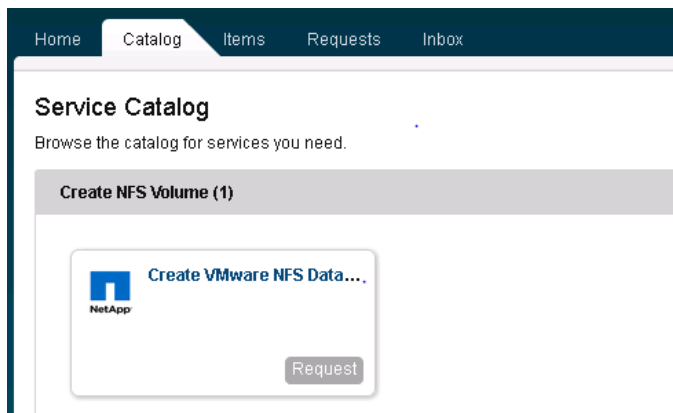
To request a catalog item, complete the following steps:

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.

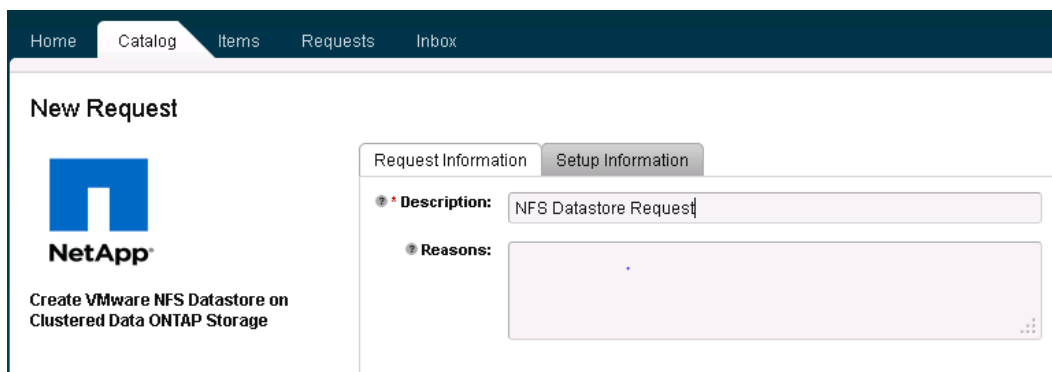
86

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

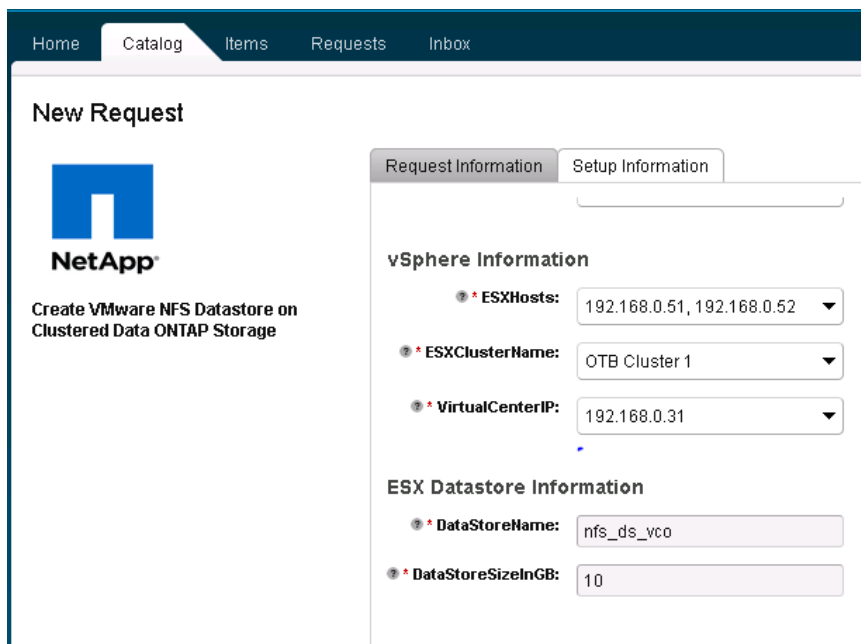
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3. Enter a name for this request and click Next.



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



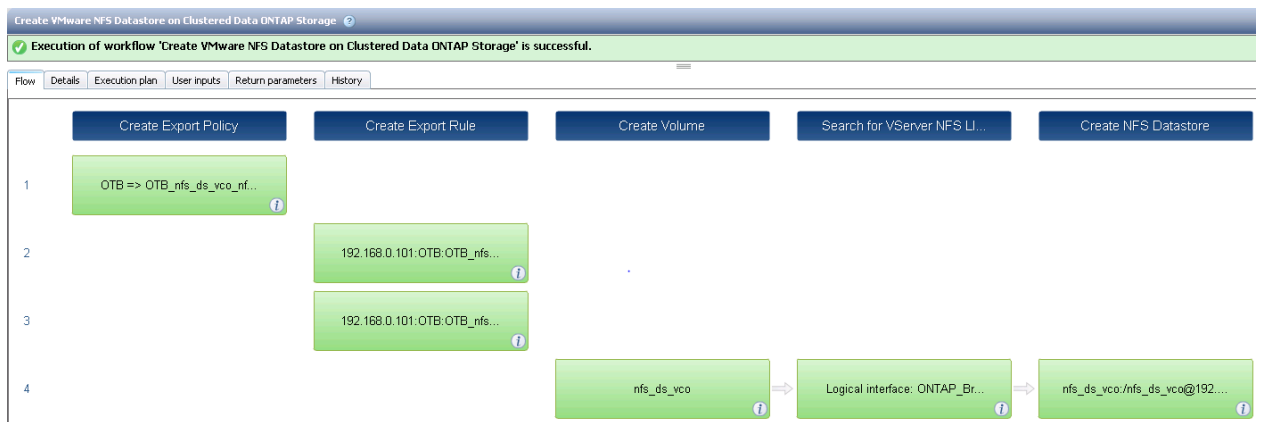
6.12 Validate Catalog Request

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.

Execution Status										
Job ID	Name	Start Time	End Time	Status	Completed	Submitted By	Submitted At	Execution Comment	Scheduled For	Last Status Ch
11069	Create VMware NFS Datastore on Clustered Data ONTAP Storage	04/01/14 1:00:10 AM	04/01/14 1:01:05 AM	Completed	6/6	admin	04/01/14 1:00:04 AM			04/01/14 1:01

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.

ONTAP Brewing Company - vSphere Client			
File Edit View Inventory Administration Plug-ins Help			
Home Inventory Datastores and Datastore Clusters			
ONTAP Brewing Company			
ONTAP Brewing Company			
development			
esx1_datastore			
esx2_datastore			
esx3_datastore			
esx4_datastore			
infotech			
nfs_ds_vco			
nfs_ds_vco			
Summary Virtual Machines Hosts Performance Configuration			
Name	Datastore	State	Status
esx2.demo.netapp...	Mounted	Connected	✓
esx1.demo.netapp...	Mounted	Connected	✓

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

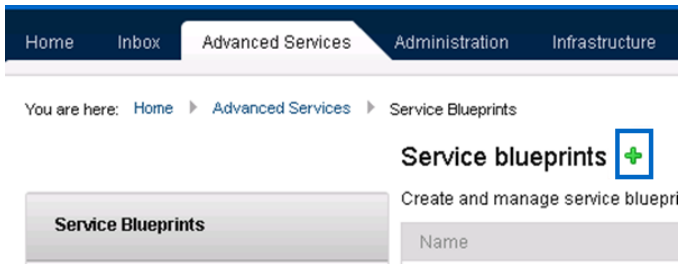
Requests								
Monitor the status of your requests and view request details.								
Request	Item	Description	Cost	Lease Cost	Status	Submitter	Submitted	Last Updated
23	Create VMware NFE	NFS Datastore Re...	Not Applicable	Not Applicable	Successful	prod-user@demo...	04/01/2014 12:59 AM	04/01/2014 01:01 AM

6.13 Build Advanced Service Blueprint

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

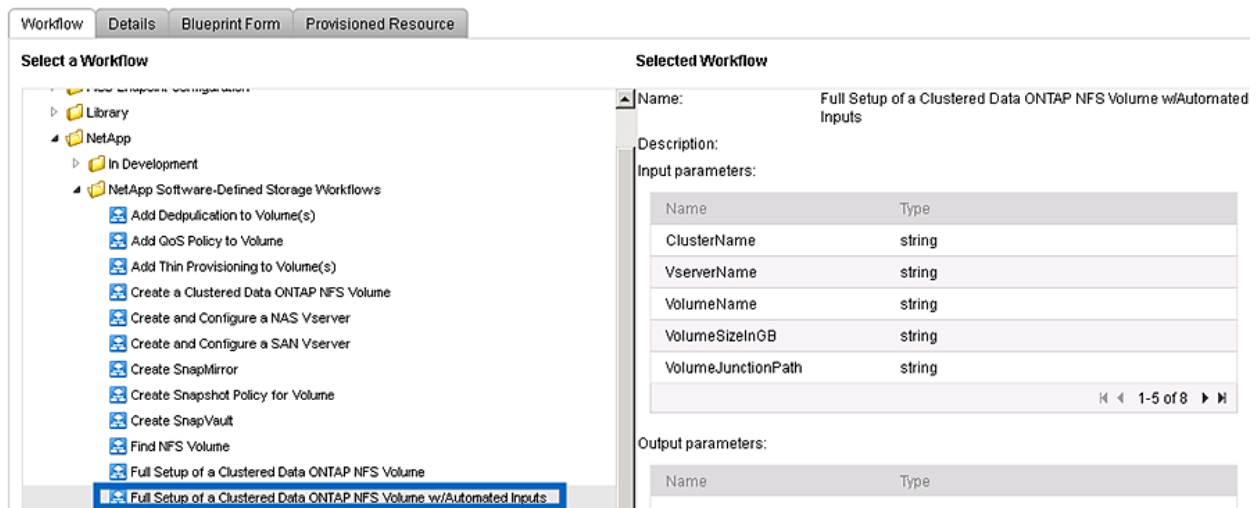
1. Log in to vRA as the user requesting the catalog.

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



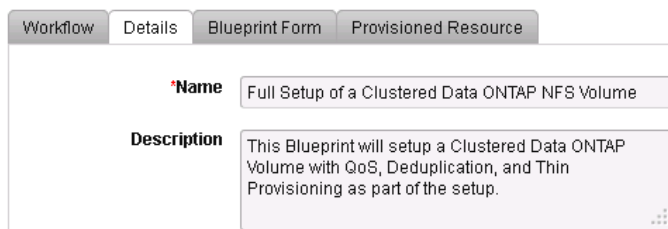
4. Select the vRO workflow to use as the blueprint baseline and click Next.

Add Blueprint



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

Add 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.

Add Blueprint

Workflow Details **Blueprint Form** Provisioned Resource

Form: Request form

New fields

- Text field
- Text area
- Password field
- Integer field
- Decimal field
- Date & time
- Check box
- Yes/No

Form page: Set Volume Information

Cluster Name

Storage Virtual Machine Name

Volume Name

Volume Size (In GB)

Export Policy Name

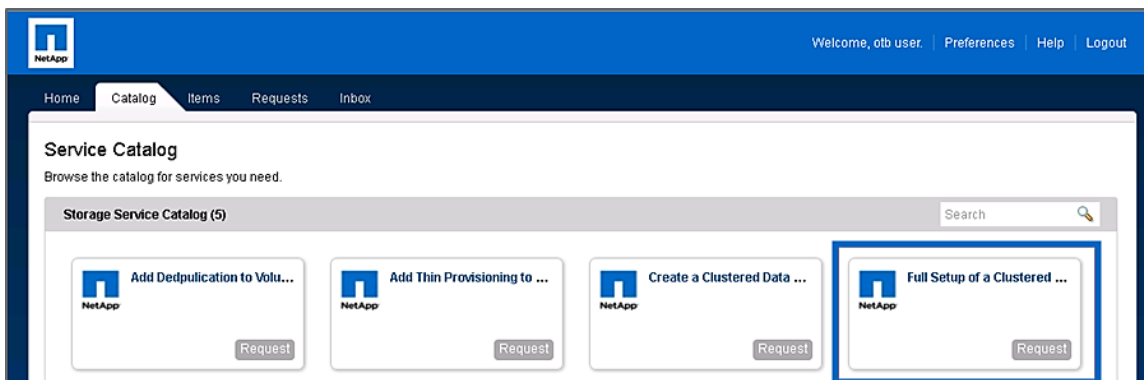
Volume Junction Path (optional)

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.

Home Catalog Items Requests Inbox

New Request

NetApp
Full Setup of a Clustered Data ONTAP NFS Volume

Request Information
Set Volume Information

* **Description:** Setup OTB_VDI_Volume

* **Reasons:**

Save < Back Next > Cancel

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

Home Catalog Items Requests Inbox

New Request

NetApp
Full Setup of a Clustered Data ONTAP NFS Volume

Request Information
Set New Volume Information and Parameters

* **Cluster Name:** cluster1

* **Storage Virtual Machine Name:** OTB

* **Volume Name:** OTB_VDI_Volume

* **Volume Size (In GB):** 10

* **Export Policy Name:** OTB_Policy

* **Volume Junction Path (optional):**

* **Export Rule Specification (optional):**

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

Volumes

Create	Edit	Delete	Clone	Status	Snapshot Copies	Resize	Storage Efficiency	Move	Storage QoS	Protect by
Name	Aggregate	Status	Thin Provisioning	% Used	Available Space	Total Space	Storage Efficiency			
OTB_VDI_Volume	aggr2_silver	online	Yes	5	10 GB	10.53 GB	Enabled			

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.

Execute Workflow 'Add QOS Policy to NAS Datastore'

User Inputs

vSphere

vCenter Ip Address*: 192.168.0.31

Esx Cluster Name*: OTB Cluster 1

Volume Set*: partial

vSphere Volumes

Volume List :

Search

☐ development

☐ infotech

☒ qa

☐ setup_test

QoS Policy Group Details

Name of the QoS Policy Group*: qa_bronze_policy

Throughput Limit*: 11MB/s

Options

☒ Execute now:

☐ Choose date and time for execution:

Preview Execute Cancel

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.

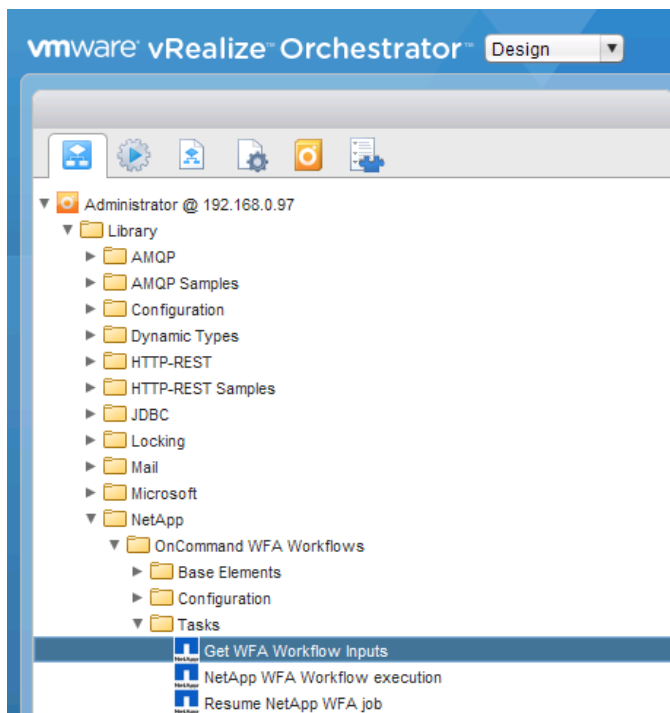


7.2 Verify That WFA Can Connect to vRO

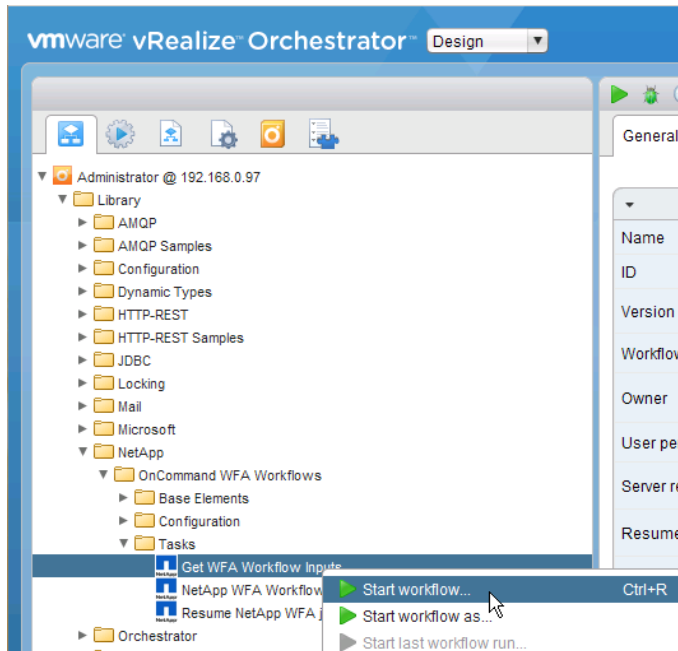
This test verifies that both the NetApp WFA package for vRO and vRO itself are set up and working properly for the environment.

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.

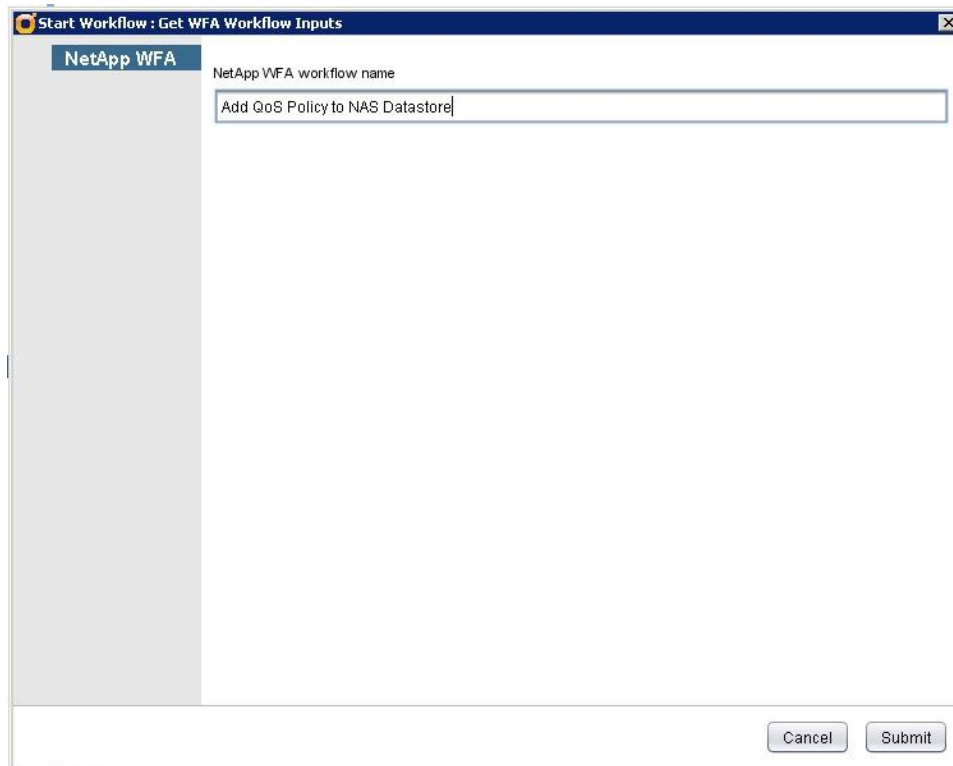


3. Select Start Workflow.



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.

Schema **Events**

Get VFA Workflow Inputs

General Variables Logs

Messages

[2014-04-09 07:13:33.556] [I] Content as string: <?xml version="1.0" encoding="UTF-8" standalone="yes"?><collection xmlns:atom="http://www.w3.org/2005/Atom"><workflow uuid="8f89cc18-82f9-4644-82f9-4644-82f9-4644"><description><certification>NONE</certification><minONTAPVersion>8.2.0</minONTAPVersion><categories><category>Quality of Service</category><category>VMware vSphere</category></categories><userInputList><userInput><name>vcenterip</name><defaultValue></defaultValue><type>Query</type><allowedValues><value>192.168.0.31</value></allowedValues></userInput></userInputList></workflow></collection>

- Create a QoS policy group.
- Create a volume and associate to the newly created or existing QoS policy group.

A new QoS policy group can be created or existing QoS policy group can be used, based on the option selected.</description><defaultValue></defaultValue><type>String</type><mandatory>true</mandatory>

It is specified in terms of IOPS or MB/s, and the range is zero to infinity. There should be no space between the number and the unit. Values are case-insensitive.

The default value for throughput is infinity and the default unit is IOPS. Two reserved keywords, 'None' and 'INF' can be used for a situation that needs to specify the maximum available value.

Examples of valid inputs are:
100B/s, 10KB/s, 1gb/s, 500MB/s, 1tb/s, 100IOPS, None and INF.</description><defaultValue>INF</defaultValue><type>String</type><mandatory>true</mandatory><userInput><userInputList><atom:link rel="

[2014-04-09 07:13:33.623] [I] User Input #1
[2014-04-09 07:13:33.624] [I] Name=vcenterip
[2014-04-09 07:13:33.625] [I] Default Value=
[2014-04-09 07:13:33.625] [I] Type=Query
[2014-04-09 07:13:33.626] [I] Allowed Values
[2014-04-09 07:13:33.626] [I] Value=192.168.0.31
[2014-04-09 07:13:33.627] [I] Mandatory=true
[2014-04-09 07:13:33.627] [I] -----
[2014-04-09 07:13:33.628] [I] User Input #2
[2014-04-09 07:13:33.628] [I] Name=esxClusterName
[2014-04-09 07:13:33.630] [I] Default Value=
[2014-04-09 07:13:33.630] [I] Type=Query
[2014-04-09 07:13:33.631] [I] Mandatory=true
[2014-04-09 07:13:33.631] [I] -----
[2014-04-09 07:13:33.632] [I] User Input #3
[2014-04-09 07:13:33.632] [I] Name=volumeGroup
[2014-04-09 07:13:33.633] [I] Default Value=all
[2014-04-09 07:13:33.634] [I] Type=Enum
[2014-04-09 07:13:33.634] [I] Allowed Values
[2014-04-09 07:13:33.635] [I] Value=all
[2014-04-09 07:13:33.635] [I] Value=partial
[2014-04-09 07:13:33.636] [I] Mandatory=true
[2014-04-09 07:13:33.636] [I] -----
[2014-04-09 07:13:33.636] [I] User Input #4
[2014-04-09 07:13:33.637] [I] Name=volumeList
[2014-04-09 07:13:33.639] [I] Default Value=
[2014-04-09 07:13:33.639] [I] Type=QueryMultiSelect
[2014-04-09 07:13:33.641] [I] Mandatory=false
[2014-04-09 07:13:33.641] [I] -----
[2014-04-09 07:13:33.642] [I] User Input #5
[2014-04-09 07:13:33.643] [I] Name=PolicyGroupName
[2014-04-09 07:13:33.644] [I] Default Value=
[2014-04-09 07:13:33.645] [I] Type=String
[2014-04-09 07:13:33.645] [I] Mandatory=true
[2014-04-09 07:13:33.645] [I] -----
[2014-04-09 07:13:33.645] [I] User Input #6
[2014-04-09 07:13:33.646] [I] Name=ThroughputLimit
[2014-04-09 07:13:33.647] [I] Default Value=INF
[2014-04-09 07:13:33.648] [I] Type=String
[2014-04-09 07:13:33.648] [I] Mandatory=true
[2014-04-09 07:13:33.649] [I] -----
[2014-04-09 07:13:33.703] [I] REST host removed: DynamicWrapper (Instance): [RESTHost]-[class com.vmware.o11n.plugin.rest.RESTHost] -- VALUE : com.vmware.o11n.plugin.rest.RESTHost@2fafa7e

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.

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