Virtual Storage Console for VMware vSphere 6.5

October 2017 | SL10327 Version 1.0.2
# TABLE OF CONTENTS

1 **Introduction...........................................................................................................................................** 3

1.1 **Lab Objective and Agenda...........................................................................................................** 3

1.2 **Prerequisites...............................................................................................................................** 3

2 **Lab Environment...............................................................................................................................** 4

3 **Lab Activities - non-VVOL features...............................................................................................** 6

3.1 **Accessing the NetApp Virtual Storage Console Unified Appliance........................................** 6

3.2 **Explore the VSC Performance Dashboard, Reporting Page, and Related Objects Panels in vCenter............................................................................................................................** 17

3.3 **Provision Datastores Using NetApp Best Practices................................................................** 23

3.4 **VM Backup and Recovery Management using SnapCenter...................................................** 31

4 **Lab Activities - VVOL specific features.......................................................................................** 57

4.1 **Register the VASA Provider Extension.......................................................................................** 57

4.2 **Use Datastore Provisioning Wizard for NAS Backed VVOL Creation.......................................** 67

4.3 **Use the Datastore Provisioning Wizard for SAN Backed VVOL Creation................................** 77

4.4 **Create a VM Storage Policy.........................................................................................................** 87

4.5 **Assign a VVOL to a Default Storage Policy................................................................................** 92

4.6 **Review FlexVols in vSphere Interface.........................................................................................** 94

4.7 **Review FlexVols in OnCommand System Manager....................................................................** 98

4.8 **Deploy a VM from a Template to a VVOL................................................................................** 103

4.9 **Perform a VM Snapshot................................................................................................................** 107

4.10 **Confirm Storage Efficiency Details on FlexVol.......................................................................** 109

5 **Lab Limitations.................................................................................................................................** 112

6 **References........................................................................................................................................** 113

7 **Version History...............................................................................................................................** 114
1 Introduction

The Virtual Storage Console (VSC), VASA Provider, and Storage Replication Adapter (SRA) for VMware vSphere is a virtual appliance, and is a NetApp product suite with capabilities of VSC, VASA Provider, and SRA. The product suite includes SRA and VASA Provider as plug-ins for vCenter Server, which provides end-to-end virtual machine lifecycle management for VMware virtual server environments running on NetApp storage, and the VMware vSphere Web Client.

The virtual appliance for VSC, VASA Provider, and SRA integrates smoothly with the VMware vSphere Web Client and enables you to use single sign-on (SSO) services. It also enables you to perform the following tasks:

• Manage and monitor storage and ESXi host by using VSC
• Provision datastores by using VSC
• Provision virtual volume (VVol) datastores by using VASA Provider
• Create storage capability profiles and set alarms by using VASA Provider
• Configure disaster recovery setup by using SRA (not covered in this lab)

This lab is designed to familiarize you with all aspects of the virtual appliance for VSC and VASA Provider. (Please consider the SRA specific lab for more information on that aspect of the virtual appliance.)

The lab specifically illustrates how easy it is to integrate the virtual appliance for VSC and VASA Provider with VMware Virtual Volumes (VVOLs), and how you can use the appliance to simplify deployment and management of VMware Virtual Volumes (VVOLs).

1.1 Lab Objective and Agenda

After completing this lab, you will be able to demonstrate the full integration and ease of management available to NetApp Storage customers who also run VMware vSphere 6.5. This lab demonstrates the key components of the VVOL framework using the virtual appliance for VSC and VASA Provider. Additionally, it demonstrates how to deploy NetApp Flexible Volumes (FlexVols) using a NetApp wizard fully integrated into the VMware vCenter web client. Lastly, you will be able to demonstrate the VASA Provider interface, and perform some basic troubleshooting steps to examine the API communication that occurs between the VMware software and the NetApp software through the Virtual Storage Console.

1.2 Prerequisites

In order to use this lab successfully, the following are the recommended prerequisites:

• Familiarity with clustered Data ONTAP®.
• Basic understanding of VMware Virtualization.
## 2 Lab Environment

The following illustration depicts the various components of this lab.

![Lab Environment Diagram](image)

**Figure 2-1:**

The following tables contain host information that is used for this lab:

### Table 1: OS and IP addresses for the lab

<table>
<thead>
<tr>
<th>Hostname</th>
<th>Operating System</th>
<th>Role/Function</th>
<th>IP address</th>
</tr>
</thead>
<tbody>
<tr>
<td>dc1</td>
<td>MS Windows 2008 R2</td>
<td>Domain Controller</td>
<td>192.168.0.253</td>
</tr>
<tr>
<td>jumphost</td>
<td>MS Windows 2012 R2</td>
<td>Jump Host</td>
<td>192.168.0.5</td>
</tr>
<tr>
<td>vc1</td>
<td>MS Windows 2012 R2</td>
<td>VMware vCenter 6.5 Server</td>
<td>192.168.0.31</td>
</tr>
<tr>
<td>vsc7-ua1</td>
<td>Linux virtual appliance</td>
<td>NetApp VSC 7.0 Unified appliance</td>
<td>192.168.0.35</td>
</tr>
<tr>
<td>snapctr</td>
<td>MS Windows 2012 R2</td>
<td>NetApp SnapCenter 3.0 Server</td>
<td>192.168.0.75</td>
</tr>
<tr>
<td>esx1</td>
<td>ESXi 6.5.0</td>
<td>Nested VMware Hypervisor</td>
<td>192.168.0.51</td>
</tr>
<tr>
<td>esx2</td>
<td>ESXi 6.5.0</td>
<td>Nested VMware Hypervisor</td>
<td>192.168.0.52</td>
</tr>
<tr>
<td>cluster1</td>
<td>ONTAP</td>
<td>Cluster management IP</td>
<td>192.168.0.101</td>
</tr>
<tr>
<td>cluster2</td>
<td>ONTAP 9.1</td>
<td>Cluster management IP</td>
<td>192.168.0.102</td>
</tr>
<tr>
<td>cluster1-01</td>
<td>ONTAP 9.1</td>
<td>Cluster node 1</td>
<td>192.168.0.111</td>
</tr>
<tr>
<td>cluster2-02</td>
<td>ONTAP 9.1</td>
<td>Cluster node 2</td>
<td>192.168.0.121</td>
</tr>
<tr>
<td>Hostname</td>
<td>Operating System</td>
<td>Role/Function</td>
<td>IP address</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>svm1</td>
<td>ONTAP 9.1</td>
<td>Storage Virtual Machine Management LIF</td>
<td>192.168.0.130</td>
</tr>
<tr>
<td>Svr2012-SQL1</td>
<td>Windows Server 2012</td>
<td>nested VM (B&amp;R/space relaim demo)</td>
<td>192.168.0.91</td>
</tr>
<tr>
<td>RHEL1</td>
<td>Red Hat Ent. Linux</td>
<td>nested VM (linux cloning demo)</td>
<td>192.168.0.61</td>
</tr>
<tr>
<td></td>
<td>Windows 2008R2</td>
<td>template (windows cloning demo)</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Red Hat Ent. Linux</td>
<td>template (large linux cloning demo)</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Debian Linux</td>
<td>template (small linux cloning demo)</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 2: Table 2: User IDs and passwords

<table>
<thead>
<tr>
<th>Hostname</th>
<th>User ID</th>
<th>Password</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>domain</td>
<td>DEMO\Administrator</td>
<td>Netapp1!</td>
<td>Domain Administrator</td>
</tr>
<tr>
<td>vc1</td>
<td><a href="mailto:administrator@vsphere.local">administrator@vsphere.local</a></td>
<td>Netapp1!</td>
<td>Local vCenter Admin</td>
</tr>
<tr>
<td>cluster1</td>
<td>admin</td>
<td>Netapp1!</td>
<td>Cluster administrator</td>
</tr>
<tr>
<td>svm1</td>
<td>vsadmin</td>
<td>Netapp1!</td>
<td>SVM administrator</td>
</tr>
<tr>
<td>vsc</td>
<td>maint or vpserver</td>
<td>Netapp1!</td>
<td>Maintenence Admin and Admin</td>
</tr>
<tr>
<td>rhel</td>
<td>root</td>
<td>Netapp1!</td>
<td>linux root administrator</td>
</tr>
</tbody>
</table>

2 NetApp Featured Products

- NetApp Virtual Storage Console 7.0 for VMware vSphere®
- NFS Plug-in for VMware VAAI version 1.1.2
- ONTAP 9.1
- NetApp SnapCenter 3.0

2 Lab Preparation

Because of the complexity of the nested VMware components and timing related to provisioning, a post-provisioning script is necessary to prepare the environment for initial use. This script reconnects the nested hypervisors to vCenter to essentially wake them up from their dormant state in order for vCenter (and VSC) tasks to work.

This lab uses a preparation script that automatically runs when you first log in to the lab. Please wait for the script to complete and the window to close before you proceed.
3 Lab Activities - non-VVOL features

Key NetApp capabilities will be highlighted below. If you prefer to just focus on Virtual Volumes, you should complete the first section of “Accessing the VSC Unified Appliance to enable the VASA Provider Extension”, then skip to Lab Activities - VVOL specific features on page 57

- The following lab activities examine the features and functionality of NetApp Virtual Storage Console for VMware
  - Accessing the NetApp Virtual Storage Console Unified Appliance on page 6
  - Explore the VSC Performance Dashboard, Reporting Page, and Related Objects Panels in vCenter on page 17
  - Provision Datastores Using NetApp Best Practices on page 23
  - VM Backup and Recovery Management using SnapCenter on page 31

3.1 Accessing the NetApp Virtual Storage Console Unified Appliance

This section illustrates the various ways to interact with the NetApp VSC 7 Unified Appliance. Using SSH Access allows some command line functionality such as starting and stopping services, rebooting and configuring some basic configuration. However, some additional advanced command line tasks such as upgrades and advanced diagnostics must be done from the direct vm console. Plug-in registration is done from a web UI.

Later in this guide the Web Control Panel access is explored for the VASA Provider operations.

3.1 SSH Access (Required steps before connecting to Vcenter)

1. Launch PuTTy.

![PuTTy](putty.png)

Figure 3-1:

2. Open session with vsc-ua1.
3. Log in as user **maint**, and password **Netapp1!**.

4. **Press 1** to look at the Application Configuration.
5. **Press 1** to display server status summary.
6. Press **Enter**.
Figure 3-5:

7. Press b (or x).
8. Press x.

3.1 Direct Console Access

1. Go to vCenter.
2. Login as user `demo\administrator`, and password `Netapp1!`.

3. Navigate to `VMs > Templates`.
4. Right-click on `vsc-ua1`.
5. Select `Open Console`.
6. Click **Advanced**.

![Figure 3-10](image)

**Figure 3-10:**

7. Click **Add Exception**.

![Figure 3-11](image)

**Figure 3-11:**
8. Click **Confirm Security Exception**.

![Add Security Exception dialog box](image)

**Figure 3-13:**

9. When presented with a black browser screen, click the cursor in the screen and press the **backspace** key.

10. Log in with maint and Netapp1!

12. Observe that you have option 3 to Enable remote diagnostic access.
13. Press x to exit.
3.1 Plugin Registration URL

1. Open a browser.
3. Click Advanced.
4. Click Add Exception.
Figure 3-18:

5. Click **Confirm Security Exception**.

Figure 3-19:

6. Review, but do not change the settings.
7. Close the browser tab.
3.2 Explore the VSC Performance Dashboard, Reporting Page, and Related Objects Panels in vCenter

This activity explores enhancements that the Virtual Storage Console 7.0 for VMware vSphere® adds to storage reporting in various sections of vCenter.

1. Launch the shortcut for *vCenter*.

   ![vSphere Plugin Registration](image)

   Figure 3-20:

2. Log into vCenter as user `demo\administrator`, and password `Netapp1!`.

   ![vSphere Plugin Registration](image)

   Figure 3-21:
3. Hover over the **Home** icon, click on **Virtual Storage Console**.

4. Click on **Storage Systems**.
5. Click **Update All**.

6. Click **OK**.
7. Click **OK**.

---

8. Click the **refresh** icon.

---

9. Ensure that the Storage Virtual Machines appear alongside the Clusters.  
10. Navigate to **Storage** by hovering over **Home > Storage**.
12. Select the **datastore nfs1**.
13. Click on the **Summary** tab for nfs1.

![Figure 3-30:](image)

14. Scroll down to see the NFS Details and Storage Details tiles added information.
15. Return to the VSC.

![Figure 3-31:](image)

16. Click on **Reports**.
17. At this point there should be some data in the Datastore Summary Report, review then click on Virtual Machine Summary Report.

Figure 3-33:

18. While on the Virtual Machine Summary Report page, take note that there is a button to Export to CSV file.
19. Click Back to return to the Summary page of the VSC.
20. Data should now be populated in the Summary, explore the tiles and storage related information.

3.3 Provision Datastores Using NetApp Best Practices

This lab activity demonstrates how to use the VSC integration with vCenter to provision a datastore on NetApp Storage that conforms to NetApp best practices.

1. Go to Storage view.
2. Select then right-click on virtual datacenter demo.netapp.com.
3. Select the NetApp VSC option.
4. Click on Provision Datastore.
5. Name the datastore `temp_datastore`.
6. Click **Next**.
7. Select a cluster.
8. Click Next.

9. Enter size of **10 GB**.
10. Ensure that **aggr1_01** is selected.
11. **Click Next.**

![](image1)

**Figure 3-39:**

12. **Click Finish.**

![](image2)

**Figure 3-40:**

13. **Click OK.**
14. Examine the Recent Tasks pane and see that the new datastore has been created and mounted.
15. Optionally, go to OCSM for cluster1 to see what was done in ONTAP.

16. To cleanly remove the datastore from vCenter, ESX and ONTAP, return to the VSC > Storage Systems.
17. Click **Update All**.

18. Click **OK**.
19. Click OK.

20. Click Back to return to the Storage navigation view.
21. Right-click on temp_datastore.
22. The NetApp VSC option should now be visible. Navigate to Destroy (note the option to Resize is also present).
Figure 3-47:

23. Click OK.
3.4 VM Backup and Recovery Management using SnapCenter

This activity demonstrates how to manage backups for a VMware guest VM running Microsoft SQL using the SnapCenter Plug-in for Microsoft SQL Server. It also demonstrates the SnapCenter Plug-in for VMware vSphere along with SnapCenter 3.0

Note: If you are accessing this section directly without completing the preceding sections of this guide, be sure to launch the shortcut to vCenter's web UI, and login as user demo\administrator, and password Netapp1!.

3.4 Taking a Backup using the SnapCenter Plug-in for VMware vSphere

1. Go to Home > SnapCenter Plug-in for VMware vSphere.
2. Since this is your first time using the SnapCenter Plug-in for VMware vSphere, you are presented with the “Getting Started” tab. In this lab environment the first two steps, Configure SnapCenter Server and Add storage system, have already been completed. During this task you will complete the other two steps, which are to create a backup policy and a resource group. From this point forward you will be presented with the “Status” page. Click Status now.
3. The “Status” page shows you the SnapCenter Server and the SnapCenter Plug-in versions in the top right. It also gives you quick access to the online help center, as well as plug-in logs. Below you can see the Job Monitor area. This is empty now, but as jobs are run the status and detail can be seen from this page.

4. On the left hand navigation bar of the Plug-in interface, click **Storage Systems**. Notice that an SVM has already been added. SnapCenter uses the SVM storage object and not the cluster.

5. In this lab there are two SVMs already added.

6. Click **Back**.
7. Go to Policies.

8. Click New Policy.

9. Enter a name of On Demand Only Policy.
10. Enter a description of Demonstration of a Backup Policy.
11. Set the “Retention to Days” to keep with the value of 1. This will keep one day’s worth of On Demand backups, no matter how many backups you take.
12. Change the “Frequency” to On demand only.

   Note: You can click the “Advanced” button to see the advanced options, but do not make any changes at this time.

13. Click Add.
14. Click OK.

Figure 3-54:

15. Go to Home > VMs and Templates.

Figure 3-55:
16. Expand the virtual datacenter, then right-click on Svr2012-SQL1. Go to NetApp SnapCenter, and select Create Resource Group.
17. Enter name **Database Servers RG**.
18. Enter description **Demonstration of a Resource Group**.
19. Click **Next**.

![Figure 3-58: Creating a Resource Group](image)

20. Click **Next**.

![Figure 3-59: Creating a Resource Group with specific settings](image)
21. Select the Policy you created earlier.
22. Click Next.

Figure 3-60:

23. In this step, you configure the schedule for the backup job to run. Since you selected a policy with an On Demand schedule, the options here are greyed out and you do not need to make any changes. The schedule listed is determined by the policy, so if you select a policy with a frequency of Hourly, then you will have the option to select the frequency, and the starting date and time for that schedule. Click Next.
Figure 3-61:

24. Click Finish.

Figure 3-62:

25. Click OK.
26. Go back to SnapCenter Plug-in for VMware vSphere, and navigate to **Resource Group**.

27. Select the **Database Servers RG** resource group that you just created, then click **Run Now**.
   
   **Note:** You created the Resource Group earlier directly from the VM menu, but you can also create new Resource Groups from this menu.

28. Click **OK**.
29. Click Back.
30. Go to the Dashboard Status “Job Monitor”.
31. Observe the status, as well as the Recent Tasks.

32. Return to VMs and Templates, right click on Svr2012-SQL1 vm, go to NetApp SnapCenter > Restore option.
33. Explore the available backup list and associated information, and also note that there is a search option. You will perform a restore in a separate activity. Press **Cancel** to close the window without mounting the backup.
34. Right-click Svr2012-SQL1 again, and go to NetApp SnapCenter > Attach Virtual Disk.
35. Press **Cancel** after seeing the backup and the VMDK disk are accessible, and can be used to perform a single file restore.
3.4 Demonstrate restore of SQL database files from a backup of SQL VM running on VMDK

This activity demonstrates how to perform a single file restore by mounting a backup and attaching virtual disk file to copy out files from within the VMDK. This operation will mount a NetApp SnapShot backup to view files that were backed up inside of a VMDK operating system file. This demonstrates that from the same backup that can restore an entire VM to a point in time it is also possible to access a particular virtual disk allowing for quick and flexible restore options.

1. Click on the Microsoft Remote Desktop Connection Manager shortcut.

2. RDP to “Svr2012-SQL1”.
3. Login with the password `Netapp1!`, and click **OK**.

4. Open **Windows Explorer** on the SQL server.
5. Navigate to confirm the database files are on C:\LOD\. Browse the folders to see that they contain mdf and ldf (sql database and log) files.

6. Return to the Jumphost browser for VC1, click Home > VMs and Templates, right-click on the VM, go to NetApp SnapCenter > Attach Virtual Disk.
7. The virtual disk from the backup is selected by default.
8. Click **Attach**.
9. Click OK.

10. Go to the VM, Datastores tab, and observe the backup is mounted.
11. Return to the RDP session on the SQL server
12. Right click on the Computer, and go to Manage.
13. From the “Windows Server Manager” dashboard, click on **Tools**.
14. Launch **Computer Management**.

15. Go to **Disk Management**.
16. Find Disk 1, and click on the **box for Disk 1** to make it online.
Figure 3-83:

17. Windows will assign a drive letter.
18. Use Windows Explorer to navigate to the MDF/LDF files from the mounted backup. The files are now available to be copied to the local drive (C:\), or mounted as a second instance on the same database server using Microsoft SQL Server Management Studio, or they can be configured for another server.
19. Return to vCenter, right click on VM, go to **NetApp SnapCenter > Detach Virtual Disk.**
20. Select **disk**.
21. Confirm the action by adding a check next to **Detach the selected disk(s)**.
22. Click **Detach**.
23. Click OK.

![Success Message]

**Figure 3-87:**

24. Return to the RDP to the SQL, and navigate to **Computer Management > Disk Management** to see that the mounted backup is gone.

![Detach Virtual Disk(s)]

**Figure 3-88:**
Figure 3-89:
4 Lab Activities - VVOL specific features

This lab contains the following activities and tasks:

- Virtual Volumes (VVOL) Specific Activities
  - Register the VASA Provider Extension on page 57
  - Use Datastore Provisioning Wizard for NAS Backed VVOL Creation on page 67
  - Use the Datastore Provisioning Wizard for SAN Backed VVOL Creation on page 77
  - Create a VM Storage Policy on page 87
  - Assign a VVOL to a Default Storage Policy on page 92
  - Use Datastore Provisioning Wizard for NAS Backed VVOL Creation on page 67
  - Use the Datastore Provisioning Wizard for SAN Backed VVOL Creation on page 77
  - Create a VM Storage Policy on page 87
  - Assign a VVOL to a Default Storage Policy on page 92
  - Review FlexVols in vSphere Interface on page 94
  - Review FlexVols in OnCommand System Manager on page 98
  - Deploy a VM from a Template to a VVOL on page 103
  - Perform a VM Snapshot on page 107
  - Confirm Storage Efficiency Details on FlexVol on page 109

4.1 Register the VASA Provider Extension

This activity demonstrates how to enable the VASA Provider features in order to enable VVOLs.

1. From vCenter Home, navigate to the Virtual Storage Console plugin.
2. Click on Configuration.

3. Note that the VASA Provider is disabled.
4. Click on Manage Extensions.

Figure 4-1:
5. Click the checkbox for **Enable VASA Provider**.
6. Ensure the IP is set to 192.168.0.35.
7. Enter the password **Netapp1!**.
8. Click **Apply** (this may take a little while).
9. Click OK.

10. Log out of vCenter.
Figure 4-5:

11. Log back into vCenter.

Figure 4-6:

12. Navigate to the Virtual Storage Console plugin.
13. Click on the new option labeled VASA Provider for ONTAP.
14. Click on Storage Mapping.
15. Once the Objects pane loads you should see “Associated Storage Capability” Profiles.
16. Optionally, you can generate new SCPs for all datastores by pressing **Global auto-generate profiles**.
17. Return to the previous menu for the VASA Provider for ONTAP.

18. Click on **Storage Capability Profiles**.
19. Observe the available SCPs, and the options to create or clone new ones.
20. Return to the previous menu for the VASA Provider for ONTAP.

21. Click on **Settings**.
22. Observe two optional thresholds that can be set for Volume and Aggregate alarms.
4.1 Web CLI and Control Panel

1. Open a browser tab.

3. Click Advanced.

4. Click Add Exception.

5. Click Confirm Security Exception.
6. Log in with User Name `administrator`, and Password `Netapp1!`, and click **OK**.

7. Explore the operations that you can perform.

8. When you are done, click **Logout**.
4.2 Use Datastore Provisioning Wizard for NAS Backed VVOL Creation

Virtual volumes in vSphere enable hypervisors to offload storage related operations to the underlying storage layer. When combined with NetApp's ONTAP, the Virtual Storage Console allows management of storage related functionality from the vSphere Client to offload cloning operations and storage creation eliminating overhead in the vSphere layer. This lab activity demonstrates how to set up virtual volume storage on the NFS protocol.

1. In the Storage navigation pane, expand the datacenter, demo.netapp.com.
2. Right-click on the datacenter, and scroll down to VASA Provider for ONTAP > Provision VVOL Datastore.
3. Enter “Name:” nfs_vvol_test1.
4. Enter “Description:” NFS VVOL Datastore Demo.
5. Select the Protocol NFS.
6. Click Next.
7. Select the **Storage Capability Profile** named **NFS_SAS_Dedup**.
8. Click **Next**.

9. Confirm that the Storage System selected is **cluster1**, and the SVM is **svm1**, then click **Next**.
10. Since there is no FlexVol created, click **Next** to create them in the following step.

11. Click **Add**.
12. Enter “Name” `nfs_vvol_fv1`.
15. For “Size (GB)” enter `20GB`.
16. Keep the aggregate: `aggr1_01`.
17. Click `OK`.

**Figure 4-25:**
Figure 4-26:

18. Click **Add** again, and repeat the steps above to create “nfs_vvol_fv2”.
19. After entering the data, click **OK**.
20. Click **Next**.
21. Keep the “Default Storage Capability” set to **NFS_SAS_Dedup**.
22. Click **Next**.

23. Review the screen for accuracy, then click **Finish**.
24. Wait for FlexVol to finish provisioning.

25. Click OK to confirm completion.

26. Click on the Refresh icon while on the Storage section in the Navigation pane.
27. Select the VVOL named **nfs_vvol_test1**.
28. Click on the **More Objects** tab.
29. Click on the **Backing Storage** to see the flexvols in ONTAP, and the option to expand or decrease.

---

4.3 Use the Datastore Provisioning Wizard for SAN Backed VVOL Creation

Virtual volumes in vSphere enables hypervisors to offload storage related operations to the underlying storage layer. When combined with NetApp ONTAP, the Virtual Storage Console allows management of storage related functionality from the vSphere Client to offload cloning operations and storage creation, eliminating overhead in the vSphere layer. This activity demonstrates how to set up virtual volume storage on the iSCSI protocol.

1. In the Storage navigation pane, expand the datacenter, **demo.netapp.com**.
2. Right-click on the datacenter and scroll down to **VASA Provider for ONTAP > Provision VVOL Datastore**.
3. Enter “Name:” `iscsi_vvol_test1`.
4. Enter “Description:” `iSCSI VVOL Datastore Demo`.
5. Select the `Protocol iSCSI`.
6. Click `Next`. 
7. Select the **Storage Capability Profile** named **iSCSI_SAS_Dedup**.
8. Click **Next**.

9. Confirm that the Storage System selected is **cluster1**, and the SVM is **svm1**, then click **Next**.
10. Since there is no FlexVol created, click **Next** to create one in the following step.

11. Click **Add**.
12. Enter “Name:” `iscsi_vvol_fv1`.
13. Keep the Storage Capability Profile `iSCSI_SAS_Dedup`.
15. For “Size (GB)” enter `20GB`.
16. Keep the “Aggregate:” `aggr1_01`.
17. Click OK.
Figure 4-42:

18. Click Add.
Figure 4-43:

19. Repeat the steps above to create "iscsi_vvol_fv2", then click OK.
20. Click Next.
22. Click Next.

23. Review the screen for accuracy, then click Finish.
24. Wait for FlexVol to finish provisioning.

25. Click OK to confirm completion.

26. Wait for the Recent Tasks to be done for the hbas to rescan.

27. Click on the Refresh icon while on the Storage section in the Navigation pane.
28. Select the VVOL named iscsi_vvol_test1.
29. Click the More Objects tab.
30. Click the Backing Storage button to see the flexvols in ONTAP, and the option to expand or decrease.

4.4 Create a VM Storage Policy

Through the use of VMware Storage Policy Based Management Administrators define and optimize the virtual machine provisioning process by provisioning datastores at scale and eliminating the need to provision virtual
machines on a case-by-case basis. This activity demonstrates how to create a Storage Policy for the NetApp backed VVOLs.

1. From the Home location on the Navigation, click on **VM Storage Policies**.

![Figure 4-52:](image)

1. Click on the icon with the **small green plus + and a yellow scroll** picture to create a new VM storage policy.

![Figure 4-53:](image)

2. Name the policy **DEMO VM Storage Policy**.
3. Enter a description for the VM **Storage Policy for Demonstration**.
4. Click **Next**.
Figure 4-54:

6. Take note that the Common Rules option is for the hosts, while the Rule-set options are data services provided by the datastores. Click Next.

Figure 4-55:

7. Leave unchecked the option for “Use common rule in the VM storage policy”.
8. Click Next.
9. Select **Use rule-sets in the storage policy**.
10. In the dropdown for Rules based on data services, select `NetApp.clustered.Data.ONTAP.VP.vvol`
11. Select **Add rule** from the dropdown menu, and pick **Profile Name**. (Examine the other options.)
12. Select **NFS_SAS_Dedup**.
13. Click **Next**.
14. Observe the “Compatible” line, and the VVOL created in the previous steps should be listed below.
15. Click Next.

16. Click Finish.
4.5 Assign a VVOL to a Default Storage Policy

Once the VVOL(s) and VM Storage Policy is created, the VVOL must be assigned to the Storage Policy. This activity demonstrates how to perform this action.

1. Click on Refresh (white clockwise arrow) at the top of the Web Client UI.
2. Click on Storage in the Navigation pane.
3. Select a VVOL datastore created in a previous step in this guide.
4. Click on the Configure tab on the right side of the page.
5. Click the General option.
6. Click the Edit button to the right of the Default Storage Policy option.
7. Select the **DEMO VM Storage Policy**.
8. Click **OK**.

![Figure 4-61:](image)

9. Explore additional options available (i.e., Capability sets, Default profiles, Connectivity with Hosts, Protocol Endpoints).
4.6 Review FlexVols in vSphere Interface

This activity will explore how to find which NetApp ONTAP FlexVols are being used to back a VMware Virtual Volume. Since the backing storage is managed using the VASA Provider, the VSC will present information about the volumes to vCenter for management using the vCenter UI.

1. From the “Storage” view in the Navigation pane, right click on the VVOL `nfs_vvol_test1`.
2. Go to Manage Storage Providers.
3. Explore the options available to see how the VVOL is mounted to the ESX hosts.
4. Select a VVOL datastore created in a previous step in this guide.
5. Click on the More Objects tab on the right side of the page.
6. Click the Backing Storage button.
7. Observe the FlexVols that are associated to this VVOL, then double-click on one of the FlexVols.

8. Observe the storage details supplied to vCenter from the NetApp VASA Provider APIs, then click Start in the “Deduplication Details” window.
9. Select **Scan Entire Volume**.
10. Click **OK**.

![Figure 4-66:](image1)

9. **Scan Entire Volume**
10. **OK**

![Figure 4-67:](image2)

11. Click **OK**.

![Figure 4-68:](image3)
4.7 Review FlexVols in OnCommand System Manager

VMware Administrators use the Virtual Storage Console to manage NetApp storage creation that easily conforms to best practices, enables quick creation, and takes full advantage of the NetApp Flexible Volumes (FlexVols). This activity demonstrates the storage operations completed by the VSC.

1. From the Jumphost, click the shortcut on the desktop called NetApp OnCommand System Manager Cluster1.

   ![Figure 4-69: NetApp OnCommand System Manager Cluster1](image)

   2. Click Advanced.

   ![Figure 4-70: Your connection is not secure](image)

   3. Click Add Exception.

   ![Figure 4-71: Add Exception...](image)
4. Click **Confirm Security Exception**.

5. Enter the credentials, username *admin*, password *Netapp1!*.

6. Click **Sign In**.
7. Navigate to SVMs.
8. Double-click on svm1.

9. Click Volumes.
10. Optionally, filter the Name column for “vvol”, observe the Flexible Volumes that were created with the Datastore Provisioning Wizard.
Figure 4-75:

11. Examine the Namespace created for you.
12. Examine the LUNs created for you.

<table>
<thead>
<tr>
<th>Name</th>
<th>Container Path</th>
<th>Space Reservation</th>
<th>Available Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>iscsi1</td>
<td>/vol/iscsi1</td>
<td>Disabled</td>
<td>25.22 GB</td>
</tr>
<tr>
<td>vvolPE.15018759555707</td>
<td>/vol/iscsi_vvol_vf1</td>
<td>Disabled</td>
<td>4 MB</td>
</tr>
<tr>
<td>vvolPE.15018759553878</td>
<td>/vol/iscsi_vvol_vf2</td>
<td>Disabled</td>
<td>4 MB</td>
</tr>
</tbody>
</table>

13. Click on SVM Settings, and examine the Export Policies created for you under Assigned Objects.
4.8 Deploy a VM from a Template to a VVOL

Using standard hypervisor based cloning on a standard datastore, the hypervisor and vCenter take on the overhead for the cloning operation. When cloning on a VVOL backed by NetApp storage, the clone creation is offloaded to the storage, and there is no overhead on the hypervisor of vCenter when the entire operation is offloaded. This activity demonstrates how to deploy a VM from a template to a NetApp backed VVOL.

1. Navigate to **VMs > Templates**.
2. Right-click on **DEBIAN-SM-TEMPLATE**, and select **New VM from This Template**...
3. Enter the name `vvol-vm-demo`.
4. Click **Next**.
5. Highlight cluster1.
6. Click Next.

Figure 4-81:

7. From the VM Storage Policy drop down menu, select the previously created DEMO VM Storage Policy.
8. Highlight the “Compatible” storage previously created named nfs_vvol_test1.
9. Click Next.

10. Optionally, check Power on virtual machine after creation.
11. Click Next.
12. Click Finish.

Figure 4-84:

4.9 Perform a VM Snapshot

This activity will perform a NetApp-based snapshot backup on a VM from the vCenter UI. While on traditional datastores this same menu action performs a VMware-based snapshot, a VM residing on a VVOL backed by NetApp storage offloads this task to the task.

VMware based snapshots (when virtual machines are on traditional datastores) consume more storage and degrade performance on virtual machines. Using NetApp FlexClone-based snapshots on the VM takes full advantage of space efficiency offered by the NetApp ONTAP storage. Offloading the vCenter operations to the storage does not degrade performance on the VM when NetApp snapshots are used.

When a VM is on a VVOL backed by NetApp storage, a VM Snapshot operation in vCenter performs a backup using VMware vCenter, but it is different from a traditional VMware-based snapshot. Using vSphere Storage APIs Array Integration (VAAI), the task previously performed by the ESX host is now offloaded to the storage. The result of NetApp’s three components VSC, VAAI plugin and VASA Provider working in vCenter is fast and space efficient file clone operation on the NetApp ONTAP storage FlexVol. On a VVOL, the storage can be managed more effectively to meet SLO requirements. Growing or shrinking a VVOL, adding or resizing NetApp backed storage, or using with Storage Profiles, the volumes can be defined to meet various performance characteristics, and are all ways that SLO requirements can be met.

This activity demonstrates how easy a NetApp SnapShot can be taken on a VM using the VSC when running on a VVOL backed by NetApp storage.

1. Right-click on the VM, vvol-vm-demo.
2. Navigate to and select Snapshots > Take Snapshot ....
3. Enter the name `vvol-vm-demo-snapshot1`, and description `Snapshot of VM on VVOL demo`.
4. Click OK.
4.10 Confirm Storage Efficiency Details on FlexVol

Because the VM cloning is offloaded to the storage using FlexClone technology, and deployed on a NetApp Flexible Volume (FlexVol), all the storage efficiencies gained by using NetApp clustered Data ONTAP are realized by vSphere. This activity examines those storage efficiencies.

1. With VM vvol-vm-demo, click the Datastores tab.
2. Double-click on nfs_vvol_test1.
3. Click on More Objects.
4. Go to Backing Storage.
5. Examine the data in the column “No. of VVOLs” to identify which is higher.
6. Open OnCommand System Manager, and find the FlexVolume that increased. Take note of the $\textbf{Used}$ and the $\textbf{Available Space}$.

7. Click on the $\textbf{Storage Efficiency}$ tab, and take note of the “Deduplication Savings” figures. (If you do not see a change you may have previously had this open, and will need to click $\textbf{Refresh}$.)

8. Return to vCenter Web Client, and select $\textbf{Take Snapshot}$ …


10. Return to OnCommand System Manager, after a refresh observe the “Deduplication savings” have increased.

11. However, the “% Used” and “Available Space” remains relatively unchanged.
Figure 4-90:

12. (Optional) Repeat with snapshot 3+, and try taking some with the VM started and running, then continue to see the same results.
5 Lab Limitations

This lab has the following limitations:

- All of the servers and storage controllers presented in this lab are virtual devices. Consequently, any operation that involves moving large quantities of data will not exhibit performance representative of real systems.
6 References

For more information about Virtual Storage Console for VMware 7.x and SnapCenter 3.x see the following references:

## 7 Version History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Document Version History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0.0</td>
<td>August 2017</td>
<td>Initial release</td>
</tr>
<tr>
<td>Version 1.0.1</td>
<td>September 2017</td>
<td>typo correction</td>
</tr>
<tr>
<td>Version 1.0.2</td>
<td>October 2017</td>
<td>typo correction</td>
</tr>
</tbody>
</table>
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.

NetApp provides no representations or warranties regarding the accuracy, reliability, or serviceability of any information or recommendations provided in this publication, or with respect to any results that may be obtained by the use of the information or observance of any recommendations provided herein. The information in this document is distributed AS IS, and the use of this information or the implementation of any recommendations or techniques herein is a customer’s responsibility and depends on the customer’s ability to evaluate and integrate them into the customer’s operational environment. This document and the information contained herein may be used solely in connection with the NetApp products discussed in this document.