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Preface

This documentation presents information specific to Nexenta products. The information is for reference purposes and is subject to change.

Intended Audience

This document is intended for storage administrators and assumes that you have a working knowledge of data storage concepts such as:

- Pools, snapshots, clones, and datastores
- VMware vSphere
- VVOL, and vCenter; basic networking configuration
- Linux and Windows OS operations.

References

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<tr>
<td>ns-5.2-VVOLadminguide-RevA</td>
<td>November, 2018</td>
<td>5.2 GA version</td>
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Comments

Your comments and suggestions to improve this documentation are greatly appreciated. Send any feedback to doc.comments@nexenta.com and include the documentation title, number, and revision. Refer to specific pages, sections, and paragraphs whenever possible.
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Introduction

Overview

Virtual Volumes (VVOLs) abstracts or virtualize physical hardware resources (SAN and NAS devices) into logical pools of storage capacity (Virtual Volumes datasstores) that can be configured on the fly without disruption. VVOLs enable a more efficient operational model in a virtualized environment because they are centered around the VM or VMDKs, rather than the physical infrastructure. The diagram below illustrates the VVOL ecosystem with NexentaStor storage arrays.

- **NexentaStor** is a software-based storage appliance that supports file and block services and several advanced storage features such as replication, snapshots, and clones.
- **Nexenta vSphere Storage APIs – Storage Awareness (VASA) Provider** is a software component that mediates out-of-band communication between vCenter Server and ESXi hosts on one side, and NexentaStor on the other side. VVOL also supports NexentaStor appliances set up in a clustered environment for high availability. The NexentaStor High Availability (HA) cluster is an enterprise-proven cluster product that manages the availability of critical storage pools. Leveraging the VASA framework, operations are offloaded to storage arrays.
- **ESXi hosts and vCenter Server** connect to the VASA Provider and obtain information about available NexentaStor topology, capabilities, and status.
- **vCenter Server in turn provides this information to vSphere clients**, exposing the NexentaStor capabilities around which the administrator may construct storage policies. NexentaStor responds with an individual storage container that precisely maps to application requirements and boundaries.

Figure 1: NexentaStor VVOL Architecture
About This Admin Guide

This admin guide describes the NexentaStor Virtual Volume (VVOL) solution. It provides instructions on how to deploy VVOL, integrate it with VMware vSphere, and enumerate storage operations it supports.

This document applies to the following product versions:

- NexentaStor 5.2
- NexentaStor vCenter Plugin 5.2
- vSphere 6.0.x, 6.5
- vCenter 6.0, 6.0 U1, 6.0 U2, 6.5
2 Deploying the VVOL Solution

Deployment of the NexentaStor VVOL solution follows the setup process in Figure 2.

Figure 2: Deployment Process for the NexentaStor VVOL solution

Downloading NexentaStor VVOL Components

Deployment of VVOL on NexentaStor starts with downloading the files below from the download site.

- NexentaStor VASA Provider OVA file (Nexenta_VASA_Server.ova)
- VASA Installer for Windows vCenter Server 6.0 for Windows (Nexenta_VASA_Installer-5.x.xxx.msi) or for Linux-based VCSA (Nexenta_VASA_Installer-5.x.xxx.tar). These installer files perform the following tasks:
  - Enables the VASA flag in the Nexenta vCenter plugin
  - Deploys the latest VASA Provider updates, avoiding the need to re-deploy a new VASA Provider OVA template during maintenance release upgrades
  - Performs checks (for example, time synchronization) to verify that the NexentaStor VVOL is set up correctly

System Requirements

Use the following pre-installation checklist to verify that your environment meets the system requirements.

Table 1: Pre-Installation Checklist

<table>
<thead>
<tr>
<th>Area</th>
<th>System Requirements</th>
</tr>
</thead>
</table>
| NexentaStor Appliance     | • The NexentaStor 5.x appliance is installed, licensed, and with pools created. To manage a cluster in VVOL, HA must be pre-configured in NexentaStor with a VIP address for the cluster and HA cluster and HA service set up too.  
  • The NexentaStor 5.x vCenter Plugin is installed.  
  • The NexentaStor VVOL files are downloaded (VASA Provider OVA template, installer file for vCenter Server 6.0, 6.5 for Windows or VCSA for Linux). |
| VMware Infrastructure     | • vCenter Server 6.0, 6.5 for Windows or VCSA 6.0, 6.5 is available, licensed and configured.  
  • vSphere 6.0, 6.5 (vCenter 6.0/6.0 U1/6.0 U2/6.5, ESXi 6.0, 6.5).  
  • ESXi hosts are registered with vCenter Server or VCSA. |
| Networking                 | • One pre-allocated IP address for the VASA Provider. |
For ICMPv4 Protocol
Add “All Ports” for Windows firewall exception.

Deploying Nexenta VASA Provider
Initial setup of Nexenta’s VASA provider involves:
- Deployment of Nexenta VASA OVA on top of management ESXi cluster
- Configuring IP address for the VASA provider VM

Deploying Nexenta VASA Provider OVA
To deploy the VASA Provider OVA, follow these steps:
1. Log in to the VMware vCenter server where the NexentaStor vCenter plugin is installed.
2. From the vSphere Web Client Home page, click **VMs and Templates**.
3. Right click on the datacenter where you want to deploy the VASA provider file. (Nexenta_VASA_Server.ova) you downloaded earlier
4. Select **Deploy OVA template**.
5. Follow the wizard through the process of installing the Nexenta VASA Provider.
6. Browse to the location of the .ova file or provide a URL.
7. Review the OVA template details and click **Next**.
8. Specify a name and location for the virtual machine.
Select a host on which to run the virtual machine.
Specify a datastore on which to store the virtual machine files.
Select the network port group.
On the Ready to complete screen, click Finish.
After installation completes, right-click on the virtual machine and select Power On.

At this point, VASA VMs, vCenter, and every ESX host on the network must be able to see each other.

Best Practices for Running VVOL in Production

- Backup vCenter regularly.
- Run VASA provider as a VM with VMware vSphere High Availability (HA) enabled.
- Any NFS storage must also support HA for VASA provider with snapshots and remote backups enabled.

VMware vSphere HA for VASA

Use VMware vSphere HA in the following scenario:
- For the VASA provider to fail over to the other hosts in case one fails.

Refer to the KB article (https://kb.vmware.com/) for information on enabling VMware vSphere HA.

Configuring a Static IP Address for a Nexenta VASA Provider

To assign an IP address to the Nexenta VASA Provider VM, you can use a management port group that has DHCP, or you can set up a static IP address.

To configure a static IP address using the VMware vSphere Web Client:

1. In the Inventory tree, select the virtual machine.
2. Click the Summary tab.
3. Click Launch Console.
4. In the Post-Install wizard, click Configure Network Interface.
5. In the Setup Hostname dialog box, select the hostname of the appliance.
6. Type the static IP address for VASA.
7. Assign a network mask address, a gateway, and a domain name server(s).
8. Click OK after consulting with your network administrators for the correct values.

Running the Nexenta VASA Installer

After the OVA template is deployed, the next step is to run the installer file appropriate to your Windows vCenter Server or Linux VCSA environment. The installer file configures and updates both the Nexenta VASA Provider and vCenter plugin. For a successful deployment, synchronize the time among the storage components in your vCenter Server and ESXi hosts.

Running the Nexenta VASA Installer on the VMware vCenter Windows Server

Follow these steps to run the installer on the Windows vCenter Server where the Nexenta vCenter plugin resides:

1. Run the Nexenta_VASA_Installer-5.x.xxx.msi using the local or domain administrator account.
2. In the Welcome screen, click Next.
3. Accept the terms of the License Agreement.
4. In the Custom Setup screen, click Next.
5. In the VMware vCenter Credentials screen, type credentials for a VMware vCenter Server user with administrative privileges.
Running the Nexenta VASA Installer on the VCSA
For Linux environments, you must have the following available to install Nexenta VASA Provider on your VCSA:

- Enabled SSH service on the VCSA
- User credentials of the root account for VCSA
- An SSH client, such as PuTTY, to connect to the VCSA
- User credentials of the administrative account for VMware vCenter

Note: You must have vSphere administrator privileges to install the Nexenta vCenter plugin.

Follow these steps to run the installer on the VCSA where the Nexenta vCenter plugin resides:

1. Log in to the VCSA as root using SSH.
2. Enable BASH access with `shell.set -enabled True` command.
3. Run `shell` from the command prompt.
4. Create and change directory to upload the installation files:

   ```
   localhost:~ # mkdir vasa && cd vasa
   ```

5. Copy downloaded `vasa-installer-5.x.xxxx.tar` from remote host using scp, wget or curl:

   ```
   localhost:~/vasa # scp remote_host:vasa-installer-5.x.xxxx.tar
   ```

6. Extract the contents from the archive by typing the following command:

   ```
   localhost:~/vasa # tar -xvf vasa-installer-5.x.xxxx.tar
   ```

7. Optionally, run the help command to view the installation command:

   ```
   localhost:~/vasa # ./install.sh -help
   ```

8. Run the following command to install:

   ```
   localhost:~/vasa # ./install.sh -action install -vasa
   VASA_Server_IP_Address -vcenter VCSA_IP_Address -vcuser administrator@vsphere.local
   ```

Registering the Nexenta VASA Provider with vCenter
After you deploy the Nexenta VASA Provider, register it with the vCenter server. Prior to registration, you must have the following details for the VASA Provider account:

- IP address or FQDN for the VASA appliance from https://<VASA Server IP>:8443/vasa/version.xml
- User ID: admin
- Password: nexenta
- Provider name: Nexenta
To register the Nexenta VASA Provider:

1. Log in to the VMware vSphere Web Client.
2. On the Home page, click **Hosts and Cluster**.
3. From the **Inventory** tree, select the vCenter server.
4. Click the Manage tab.
5. Click **Storage Provider** in the right pane.
6. Click the Register a new Storage Provider icon.
7. Enter the necessary information to establish a secure SSL connection then click **OK**.
8. For VASA HA, repeat the previous steps for every VASA Provider.

To check the health status of the VASA Provider, go to Home → NexentaStorageSystems → Configuration.

![Register NexentaStor Storage Provider](image)

**Figure 3: Register NexentaStor Storage Provider**
Registering the NexentaStor Appliance for VASA

After running the installer file, to establish a connection between the vCenter management framework and the storage appliances that you want to manage, the first post-installation step is to register the NexentaStor 5.x nodes with the NexentaStor 5.x vCenter plugin and Nexenta VASA Provider. You can either register a clustered appliance or a single node. To register a clustered appliance, you must have already created a VIP address for the cluster and created HA cluster and HA service too using the NexentaStor CLI beforehand.

To register a single node or a clustered appliance NexentaStor for VASA using the vSphere Web Client Plugin:

1. Log in with the admin account you used to install the VASA provider.
2. On the Home page, click **Nexenta Storage Systems** icon.
3. On the left side menu, go to **NexentaStor → Nexenta Storage Systems**.
4. Click the **Register NexentaStor** icon.
5. In the **Register NexentaStor** window, select the HA cluster check box if you must register a clustered appliance.
6. Click on **Register for VASA** checkbox.
7. Select HTTPS or HTTP protocol from the list.
8. In the MGMT IP Address/Hostname field, type the NexentaStor IP address / Hostname and the NexentaStor REST port number. The default port number for NexentaStor 5.x is 8080 for HTTP and 8443 for HTTPS.
9. In the VVOL Data IP address field, specify a different data interface on the appliance to carry communication traffic between the VASA provider and the NexentaStor appliance. If you want to separate VASA Provider traffic from management traffic specify a different interface.
10. In case you are registering a clustered appliance, provide the IP address of both the nodes in the cluster.
11. Enter the NexentaStor user and password for both nodes for REST API authentication.
   In both cases, when registering a single node or a clustered appliance, the NexentaStor username you entered must have privileges to execute REST API requests.
12. Type the NexentaStor REST port number.
13. The default port number for NexentaStor 5.x is 8080 for HTTP and 8443 for HTTPS
14. Type the NexentaStor username and password for API authentication.
   The NexentaStor user must have privileges to execute REST API requests.
15. Click Register.
16. Log off from the vSphere Web Client.
17. Press <Ctrl> + F5 to reload the page.

Note: If you inadvertently registered a node as a single node but the node is a member of a cluster, registration will fail.
Registration will fail if you inadvertently registered an unclustered node and checked the HA Cluster option.
To take advantage of the NexentaStor VVOL features, you must complete the following configuration steps on NexentaStor and vSphere.

Creating Pools in NexentaStor

NexentaStor VVOLs use a pool of raw storage capacity or an aggregation of pools with different storage capabilities that NexentaStor can provide to virtual volumes. If you have not configured a pool yet, you must create pools using the NexentaFusion GUI or NexentaStor 5.x CLI.

See pool creation instructions in:
- NexentaStor 5.x CLI Configuration Guide
- NexentaFusion 1.x online help

Creating VVOL Datastore

After pools are created in NexentaStor, create a VVOL datastore, then associate a NexentaStor appliance and its pool as the source. You can mount VVOL datastore on a specific ESXi host or cluster.

To create a VVOL datastore using the VMware vSphere Web Client:

1. Go to the Home page.
2. Click on Hosts and Clusters.
3. Right click on Datacenter and go to Storage → New Datastore. Ensure that the location displayed in the Create Datastore window is where you intended to set up the datastore.
4. Select VVOL as the datastore type.
5. Select the name of the datastore and pool from the list provided by the NexentaStor appliances. If the expected pools are not visible in this list, see the Rescan sub-section below.
6. Select a single host or multiple hosts that you want to mount the VVOL datastore on.
7. Review the configuration options and click Finish.

Rescanning the VASA Storage Provider

When creating a new VVOL datastore, rescan if the NexentaStor appliance storage pools do not show up in step 5 above.

To rescan the Nexenta VASA Provider to discover existing NexentaStor pools:
1. Log in to the VMware vSphere Web Client.
3. From the Inventory list, select the vCenter server.
4. Click the Manage tab.
5. Click Storage Providers in the right pane.
7. Click Rescan.

Viewing the Storage Capabilities of the Datastore

After you mount the datastore to specific hosts that are managed by vCenter, all NexentaStor storage capabilities are published to the vSphere environment. Exposure of the storage capabilities lets you create the storage policies easily. Storage policies are described in the next section.

To view the storage capabilities using the VMware vSphere Web Client:
   Go to Home ➔ Storage.
   Select the VVOL datastore and click the Manage tab.
   Click Setting to view the storage capabilities.

Figure 7: Summary of the Datastore
Creating Storage Policies

Storage policy-based management plays a major role in virtual machine deployment. You can use predefined storage policies, but you can also create your own storage policies for VMs based on the NexentaStor storage capabilities. The following Nexenta storage capabilities are exposed to vSphere and can be used when customizing a storage policy according to the needs of your applications that will run on the VMs.

Table 2: Supported Nexenta Storage Capabilities

<table>
<thead>
<tr>
<th>NexentaStor Capabilities</th>
<th>Supported Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundancy Type</td>
<td>raid0, raidz1, raidz2, raidz3, mirror, raid10</td>
</tr>
<tr>
<td>Disk Drive</td>
<td>HDD or SSD</td>
</tr>
<tr>
<td>Snapshots</td>
<td>ZFS snapshots enabled by default</td>
</tr>
<tr>
<td>Data Reduction</td>
<td>Compression can be enabled or disabled. Default compression algorithm is LZ4</td>
</tr>
<tr>
<td>Record Size</td>
<td>Settable from 1Kb to 1024 Kb</td>
</tr>
<tr>
<td>Rate Limit</td>
<td>Sets the maximum bandwidth per second that can be consumed by VVOL. Maximum bandwidth measurement is Mb/s.</td>
</tr>
</tbody>
</table>

After the policies are created, they can be applied directly to the VMs during its creation.

To create or edit storage policies, using VMware vSphere Web Client:

1. Go to Home → VM Storage Policies.
2. Use the icons under the Objects tab to create, edit, or enable VM storage policies.
3. Select rules based on the data services provided by Nexenta.

VM storage policy enforcement will match datastores that satisfy all the rules in at least one of the rule-sets. After creating the storage policies, you can now associate the policy with a VM when deploying or managing it. To create VMs, ensure that you have a VVOL datastore created and mounted on the required hosts. You can create new VMs and deploy them onto a VVOL datastore for virtual volumes.
5 Supported VM Operations

With a Virtual Volume (VVOL), you create individual virtual machines and use it as a unit of storage management. VVOLs maps virtual disks and their derivatives, clones, snapshots, and replicas, directly to objects called virtual volumes on a storage system. This mapping allows vSphere to offload intensive storage operations such as snapshots, cloning, and replication to the storage system.

The following table lists the VM-level operations provided by the NexentaStor VVOL solution.

Table 3: Supported Operations on VM Provided by VVOL

<table>
<thead>
<tr>
<th>Operations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM Creation</td>
<td>Once you have set up the vSphere infrastructure and NexentaStor appliance and defined respective policies, you can deploy VMs onto the VVOL datastore type for virtual volumes. Nexenta recommends you to create a new VM on a datastore that is compatible with the storage policy. You can assign the storage policy when you create a new VM or when performing other operations on the VM, such as cloning and replication. You can also edit an already existing VM and change the policy based on the storage requirements. To create a new VM using VMware vSphere Web Client: 1. Go to Home → Hosts and Clusters. 2. Select the cluster where you intend to create the VM. 3. Click Create a new virtual machine from the Basic Tasks. 4. Follow the wizard to create a new VM.</td>
</tr>
</tbody>
</table>
| VM Clones           | Below is a list of cloning options you can perform on per-VM basis. You can clone only when the VM is powered ON.  
• Clone the VM into the same VVOL datastore and offload the clone operation to the array.  
• Clone the VM across different NexentaStor datastores. Cloning VMs across multi-vendor datastores is done by vCenter(not by NexentaStor VVOL) but could be relatively slow.  
• Clone from a VVOL datastore to a VMFS datastore on the same array. |
| VM Migration/Move to | Below are several migration options supported by VVOL on NexentaStor:  
• Migration of a VVOL-based VM between VVOL datastores on the same array  
• Migration of a VVOL-based VM between VVOL datastores on different arrays  
• Migration of a VVOL-based VM between a VVOL datastore and a traditional VMFS/NFS datastore on the same or different array (VVOL → VMFS/NFS).  
• Migration of a VVOL-based VM between hosts. VMs behave differently when they have snapshots and when they do not have snapshots. The various states a VM can be in when migrating them are: powered on Storage vMotion without snapshots powered on Storage vMotion with snapshots powered off (cold) migration without snapshots powered off (cold) migration with snapshots |
<table>
<thead>
<tr>
<th>Operations</th>
<th>Description</th>
</tr>
</thead>
</table>
| VM Snapshot    | Create a snapshot of a VVOL-based VM similar to the traditional method of creating a VM snapshot on a regular datastore, except that the VM snapshot of a VVOL-based VM is created directly on the NexentaStor appliance. Below are the available snapshot operations you can do:  
  • Revert the snapshot to the state captured at the moment of snapshot creation.  
  • Clone from a snapshot.  
  • Delete snapshot. |
To uninstall NexentaStor VVOLs, follow the process steps below.

```
1. Remove VM snapshots.
2. Remove VMs.
3. Remove folders created on Nexenta VVOL datastores.
4. Unmount Nexenta VVOL datastores.
```

### Cleaning Up the Environment

The first step is to remove traces of VVOL in your environment using the vSphere Client.

1. **Remove VM snapshots.**
2. **Remove VMs.**
3. **Remove folders created on Nexenta VVOL datastores.**
4. **Unmount Nexenta VVOL datastores.**

### Unregistering NexentaStor Appliance from VASA

To unregister NexentaStor from VASA using vSphere Web Client Plugin:

1. On the Home page, click **Nexenta Storage Systems** icon.
2. In the left-side menu, go to NexentaStor → Nexenta Storage Systems.
3. Click the **Unregister** icon.
4. Select the **Unregister for VASA** checkbox.
5. Click **OK**.

**Note:** You can unregister the NexentaStor appliance only for VASA and still continue to manage the appliance using the vCenter plugin.

### Unregistering the Nexenta VASA Provider

1. From the vSphere Web Client, go to Home → Hosts and Clusters.
2. Click the Manage tab.
3. Select Storage Provider.
4. Select Nexenta VASA Provider.
5. Click the **Unregister** icon.

   To unregister the Nexenta VASA Provider, you must have unregistered NexentaStor appliances from VASA using vCenter Plugin as described in the previous section.

6. Power off and delete VASA server(s).

   To check that the Nexenta VASA Provider is unregistered, refresh the list of providers to verify that the provider is actually removed from the provider list.