VMware® vSphere Virtual Volumes (vVols): Getting Started Guide

Hyperconverged Infrastructure Business Unit

Technical Documentation

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vmware®

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Introduction

vVols implements the core tenants of the VMware Software-Defined Storage vision to enable a fundamentally, and more efficient, operational model for external storage in virtualized environments, centering on the application instead of the physical infrastructure.

vVols enables application-specific requirements to drive storage provisioning decisions while leveraging the rich set of capabilities provided by storage arrays. Some of the primary benefits delivered by vVols focus around operational efficiencies and flexible consumption models.

- vVols simplifies storage operations by automating manual tasks and reducing operational dependencies between the vSphere Admin and the Storage Admin. By using policy-driven automation as the operations model, provisioning and change management are simplified and expeditated.
- vVols simplifies the delivery of storage service levels to applications by providing administrators with granular control of storage resources and data services at the VM level that can be dynamically adjusted in real-time.
- vVols improves resource utilization by enabling more flexible consumption of storage resources, when needed and with greater granularity. The precise consumption of storage resources eliminates overprovisioning. The Virtual Datastore defines capacity boundaries, access logic, and exposes a set of storage array data services accessible to the virtual machines provisioned.
- Virtual Datastores are purely logical constructs that may be configured on the fly, when needed, without disruption. The storage container itself does not require formatting and does not have a file system.

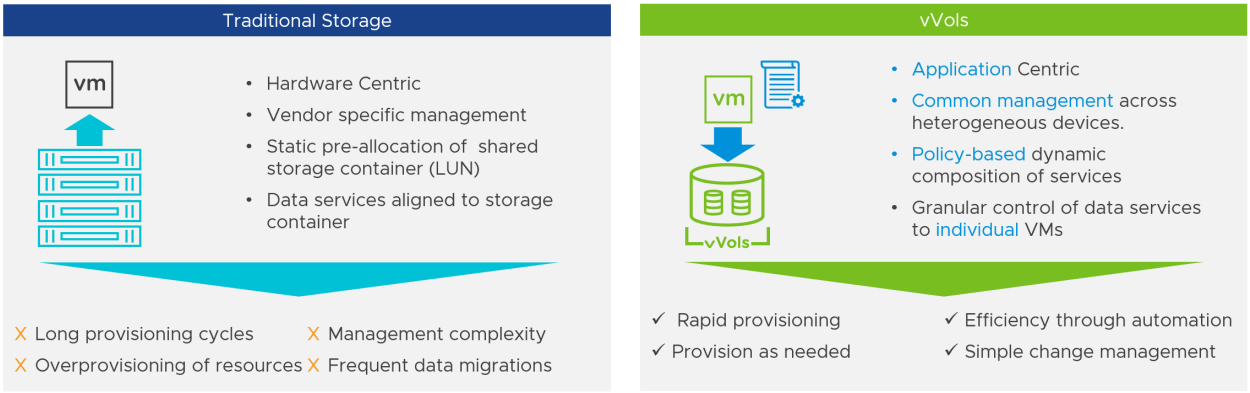

Figure 1: Operational Model Transformation

Historically, vSphere storage management has been based on constructs defined by the storage array: LUNs and filesystems. A storage administrator would configure array resources to present large, homogenous storage pools that would then be consumed by vSphere administrator.

Since a single, homogeneous storage pool would potentially contain many different applications and virtual machines; this approach resulted in needless complexity and inefficiency. vSphere administrators could not easily specify specific requirements on a per-VM basis.

Changing service levels for a given application usually meant relocating the application to a different storage pool. Storage administrators had to forecast well in advance what storage services might be needed in the future, usually resulting in the overprovisioning of resources.

With vVols, this approach is fundamentally changed. vSphere administrators use policies to express application requirements to a storage array. The storage array responds with an individual storage container that precisely maps to application requirements and boundaries.

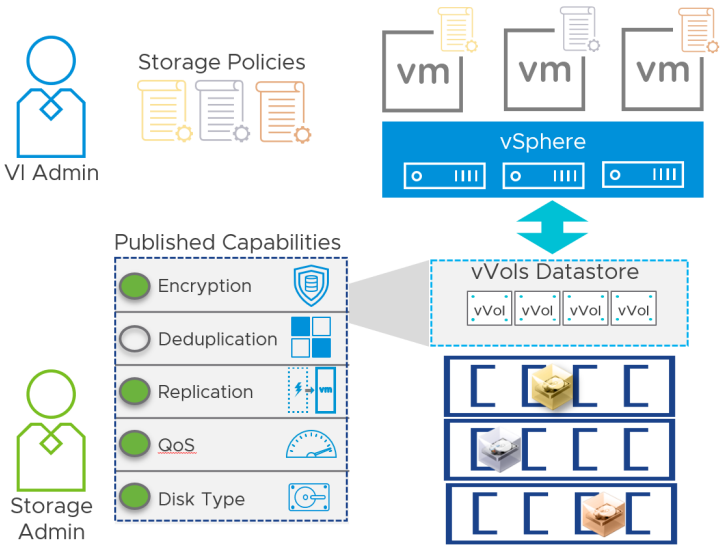

Figure 2: vVols Operational Model

Typically, the virtual datastore is the lowest granular level at which data management occurs from a storage perspective. However, a single virtual datastore contains multiple virtual machines, which might have different requirements. With the traditional approach, differentiation on a per virtual machine level is difficult. The vVols functionalities allow for the differentiation of virtual machine services on a per-application level by offering a new approach to storage management.

Rather than arranging storage around features of a storage system, vVols arranges storage around the needs of individual virtual machines, making storage, virtual machine centric. vVols map virtual disks and their respective components directly to objects, called vVols, on a storage system. This mapping allows vSphere to offload intensive storage operations such as snapshot, cloning, and replication to the storage system. It is important to familiarize yourself with the concepts that are relevant to vVols and their functionality. This document provides a summarized description and definitions of the key components of vVols.

vVols Components

The following is a summarized description and definition of the key components of vVols: vVols are a new type of virtual machine objects, which are created and stored natively on the storage array. vVols are stored in storage containers and mapped to virtual machine files/objects such as VM swap, VMDKs, and their derivatives. There are five different types of vVols objects, and each of them maps to a specific virtual machine file.

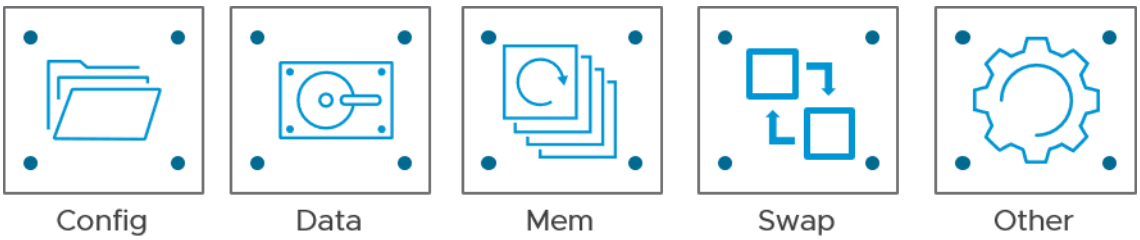

Figure 3: vVols Object Types

- **Config –** VM Home, Configuration files, logs
- **Data –** Equivalent to a VMDK
- **Memory –** Snapshots
- **SWAP –** Virtual machine memory swap
- **Other –** vSphere solution specific object

Vendor Provider (VP)

The vendor provider, also known as the VASA provider, is a storage-side software component that acts as a storage awareness service for vSphere and mediates out-of-band communication between vCenter Server, and the ESXi hosts on one side, and a storage system on the other. Storage vendors exclusively develop their own VASA.

The ESXi hosts and vCenter Server connect to the VASA and obtain information about available storage topology, capabilities, and status.

Subsequently, vCenter Server provides this information to vSphere clients, exposing the capabilities allowing the virtual administrator to craft storage policies via SPBM.

The VASA is typically setup and configured by the vSphere administrator in one of two ways:

- Automatically via the array vendors plug-in
- Manually through the vCenter Server

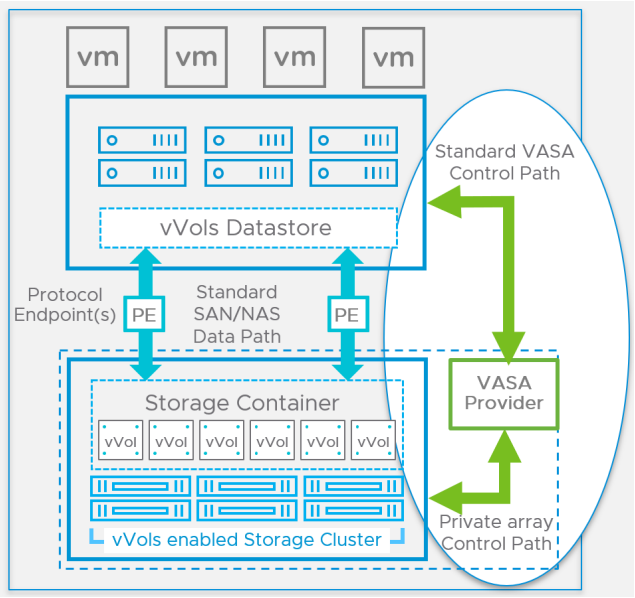

Figure 4: Vendor (VASA) Provider

Storage Container (SC)

Unlike traditional LUN and NFS based vSphere storage, the vVols functionality does not require pre-configured LUNs or volumes on a storage side.

Instead, vVols uses a storage container, which is a pool of raw storage capacity and aggregation of storage capabilities that a storage system can provide to vVols.

Depending on the storage array implementation, a single array can support multiple storage containers. Storage Containers are typically setup and configured by storage administrators.

Containers are used to define:

- Storage capacity allocations and restrictions
- Storage policy settings based on data service capabilities on a per virtual machine basis

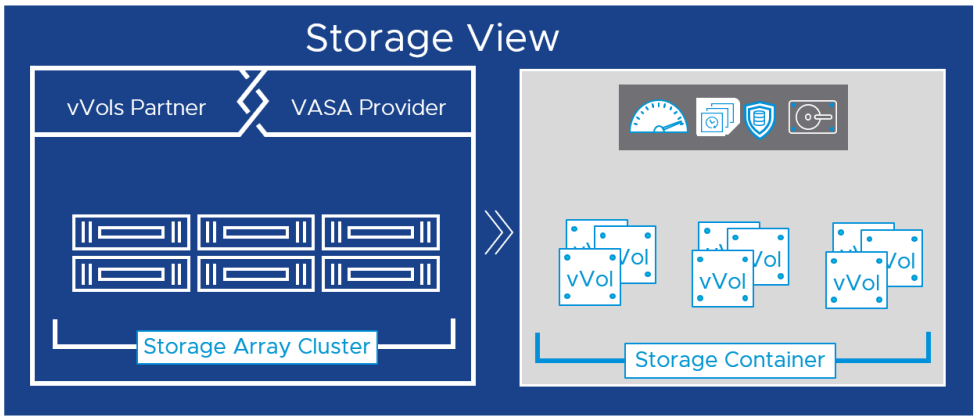

Figure 5: Storage Containers

Virtual Datastore

A Virtual Datastore represents a storage container in a vCenter Server instance and the vSphere Web Client. A vSphere Virtual Datastore represents a one-to-one mapping to the storage system's storage container.

The storage container (or Virtual Datastore) represents a logical pool where individual vVols are created.

Virtual Datastores are typically setup and configured by vSphere administrators.

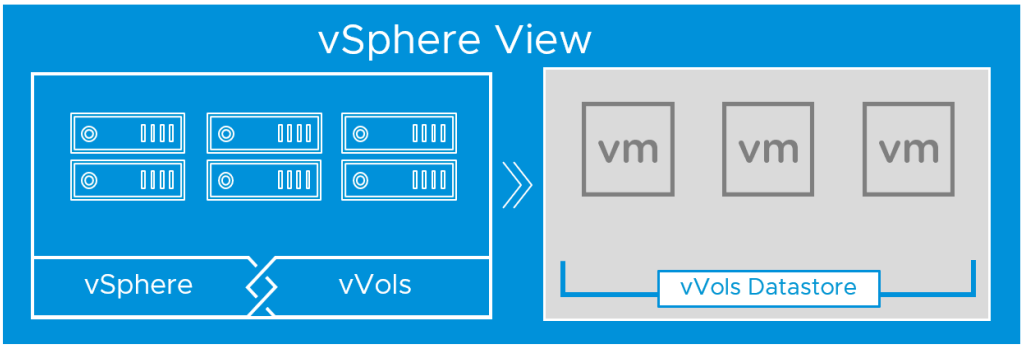

Figure 6: vVols Datastore

A one to one mapping of vVols datastore to a storage container on the array. If another vVols datastore is needed, a new storage container must be created.

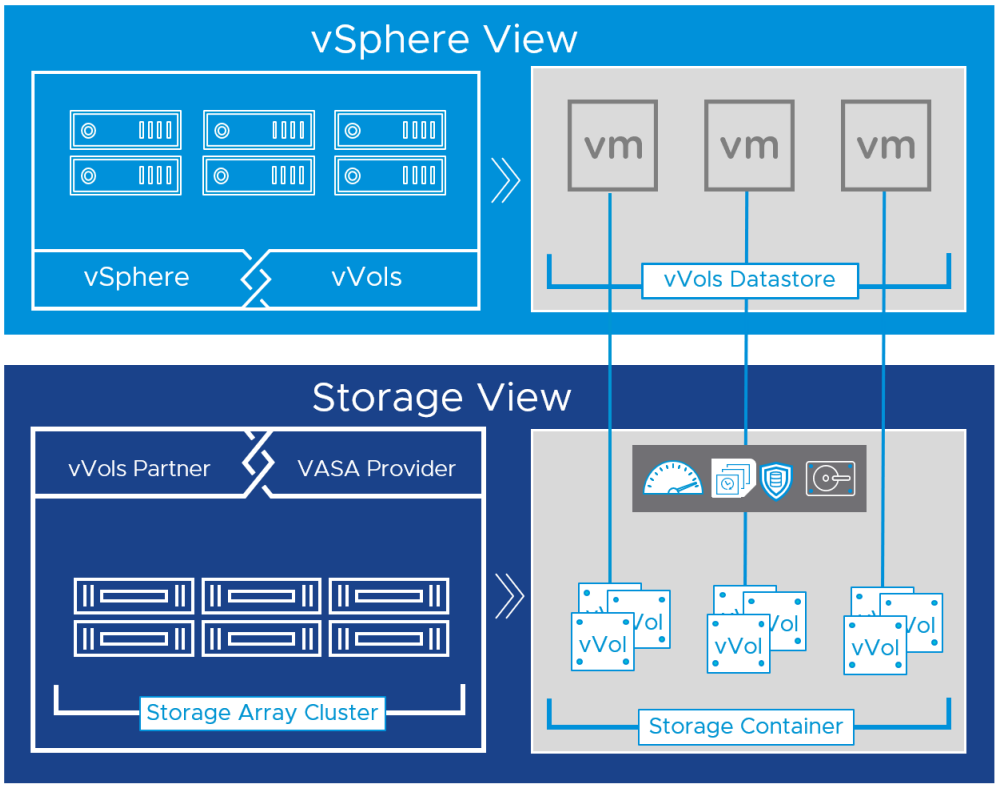

Figure 7: vVols Datastore to Storage Container

Note: For in-depth information about vVols and its components please referrer to the official vVols product page http://www.vmware.com/products/virtual-volumes.

Protocol Endpoints (PE)

Although storage systems manage all aspects of vVols, ESXi hosts have no direct access to vVols on the storage side. Instead, ESXi hosts use a logical I/O proxy, called the Protocol Endpoint, to communicate with vVols and virtual disk files that vVols encapsulate.

ESXi uses PEs to establish a data path, on-demand, from virtual machines to their respective vVols.

PEs are compatible with all SAN/NAS industry-standard protocols:

- iSCSI
- NFS v3
- Fiber Channel (FC)
- Fiber Channel over Ethernet (FCoE)

PEs are setup and configured by Storage administrators.

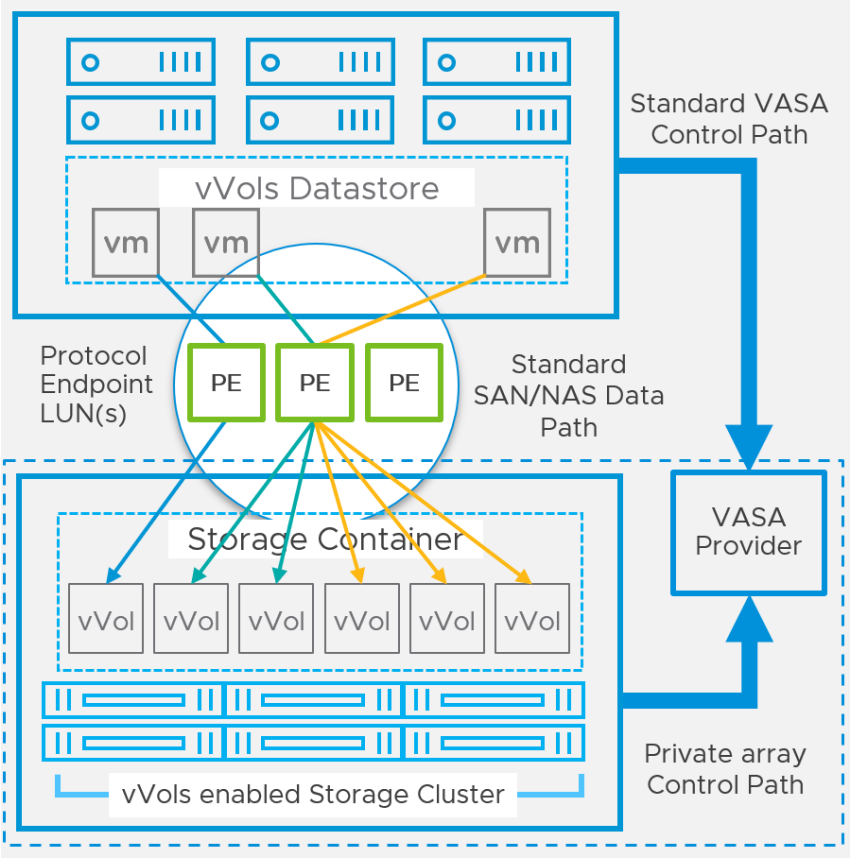

Figure 8: Protocol Endpoint

vVols Requirements

Software

The use of vVols requires the following software components:

- vCenter Server 6.0 Appliance (VCSA) or vCenter Server 6.0 for Windows
- ESXi 6.0
- vSphere Web Client

Hardware

The use of vVols requires the following hardware components:

- Any Server that is certified for vSphere 6.0 that is listed on the VMware compatibility guide.
- A third-party storage array system that supports vVols and able to integrate with vSphere through the VMware APIs for Storage Awareness (VASA).
- Depending on the vendor-specific implementation, storage array system may require a firmware upgrade to support vVols. Check with your storage vendor for detailed information and configuration procedures.

License

The use of vVols requires the following license:

- Standard
- Enterprise Plus

Configuring vVols

The configuration of vVols requires that both the storage system and the vSphere environment are prepared correctly. From a storage perspective, the vVols required components such as the protocol endpoints, and storage containers must be configured.

The procedure for configuring the vVols components on the storage system varies based on the vendor implementation and can be potentially different based on the array brand and model.

For detailed information on the procedures to configure the vVols required components, refer to the storage system's documentation or contact your storage vendor.

Configuration Guidelines

The following requirements must be satisfied before enabling vVols:

Storage

- The storage system must be vVols compatible and able to integrate with vSphere 6.0 through the VMware APIs for Storage Awareness (VASA) 2.0.
- A storage vendor provider must be available. If the vendor provider is not available as part of the storage system a vendor provider appliance must be deployed.
- The Protocol Endpoints, and Storage Containers must be configured on the storage system.

vSphere

- Follow the appropriate guidelines to setup the appropriate storage solution that will be used, Fiber Channel, FCoE, iSCSI, or NFS. This may require the installation and configuration of physical or software storage adapters on ESXi hosts.
- Synchronize the time of all storage components with vCenter Server and all ESXi hosts. It is recommended to utilize Network Time Protocol (NTP) for the synchronization.

Configuration Procedures

To configure vVols in vSphere 6.0, the procedures defined below must be performed. The procedures are focused on vSphere specific tasks and workflow of the components:

- vSphere Storage Time synchronization
- Storage Provider registration
- Creating a Virtual Datastore for vVols

vSphere Storage Time Synchronization

Before enabling vVols, it is recommended for all the hosts and vCenter Server instances to have their time synchronized. VMware recommends the use of a Network Time Server for all the systems to maintain accurate timekeeping.

vCenter Server Time Synchronization

Perform the necessary procedure to configure the vCenter Server instances to utilized a time synchronization service suitable to the version of vCenter Server being used (Windows or Linux).

ESXi host Time Synchronization

Perform the following steps on ESXi host that will utilize vVols. This procedure may be automated with PowerCLI and other command-line utilities.

ESXi Host Time Synchronization Configuration Procedure

1. Select the host in the vSphere inventory.
2. Click the Manage tab and click Settings.
3. In the System section, select Time Configuration.
4. Click Edit and set up the NTP server.

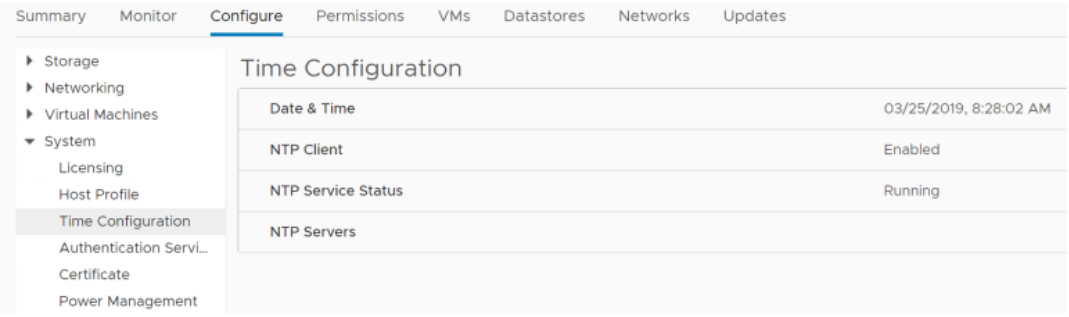

Figure 9: ESXi Host Time Configuration Settings

a. Select Use Network Time Protocol (Enable NTP client).
b. Set the NTP Service Startup Policy.
c. Enter the IP addresses of the NTP servers to synchronize with.
d. Click Start or Restart in the NTP Service Status section.

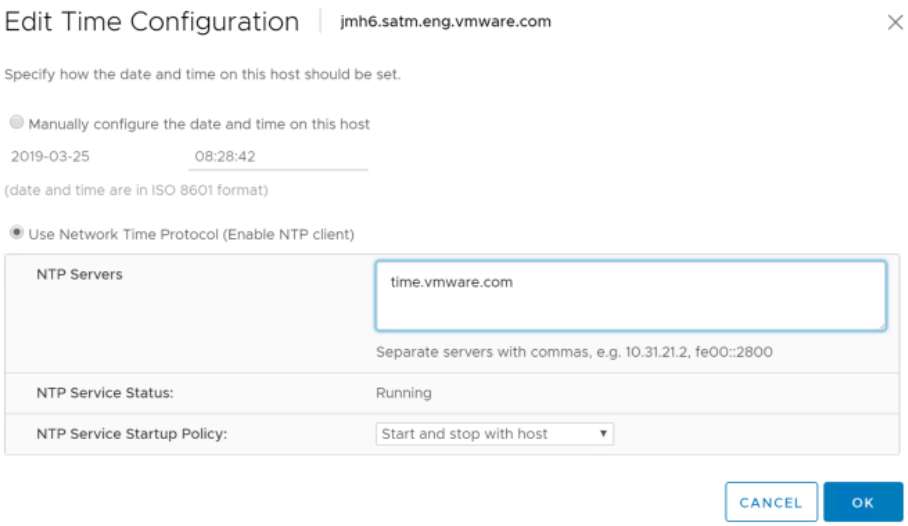

Figure 10: NTP Service Configuration

5. Click OK. The host synchronizes with the NTP server.
6. Click the Manage tab and click Settings.
7. In the System section, select Time Configuration.
8. Click Edit and set up the NTP server.
    a. Select Use Network Time Protocol (Enable NTP client).
    b. Set the NTP Service Startup Policy.
    c. Enter the IP addresses of the NTP servers to synchronize with.
    d. Click Start or Restart in the NTP Service Status section.
9. Click OK. The host synchronizes with the NTP server.

Storage Provider Registration

To create a Virtual Datastore for vVols, a storage container must exist on the storage array and in vSphere 6.x a communication link must be established between the vCenter Server instance and the storage system. The VASA provider exports the storage system's capabilities and presents them to the vCenter Server instances as well as the ESXi hosts via the VASA APIs.

Storage Provider Registration Procedure

In the event the storage provider is not implemented as a hardware component of the storage system, verify that a VASA provider appliance has been deployed and obtain its credentials from the storage administrator.

1. Browse to vCenter Server in the vSphere Web Client navigator.
2. Click the Manage tab and click Storage Providers.
3. Click the Register a new storage provider icon.
4. Type the connection information for the storage provider, including the name, URL, and credentials.

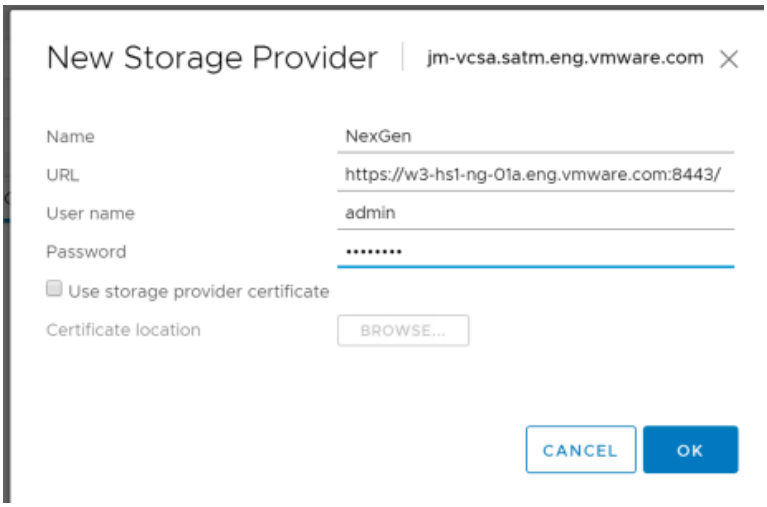

Figure 11: Storage Provider Manual Registration

5. (Optional) To direct vCenter Server to the storage provider certificate, select the Use storage provider certificate option, and specify the certificate's location. If you do not select this option, a thumbprint of the certificate is displayed. You can check the thumbprint and approve it.
6. Click OK to complete the registration.

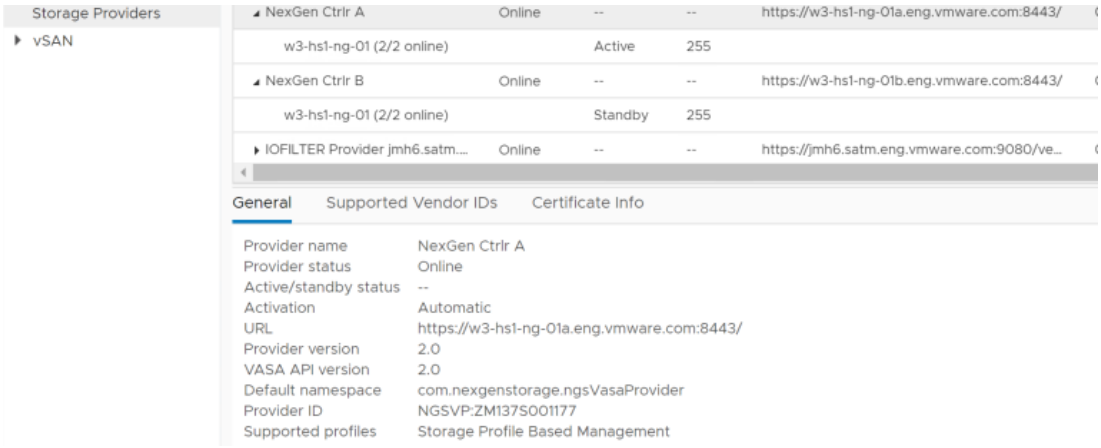

Figure 12: Storage Provider Successfully Registered

At this point, the vCenter Server instance has been registered with the VASA provider and established a secure SSL connection with it.

Note: Storage Providers can also be automatically configured through the storage system's vSphere Web Client plug-in or from the storage system's UI when registering a vCenter.

Virtual Datastore Creation Procedure

To create a vVols datastore use the New Datastore wizard from the vSphere Web Client.

1. Select the host in the vSphere inventory.
2. Right-click and browse to the storage menu.
3. Click the New Datastore option.
4. Type a datastore name.
    a. Ensure the name utilized is not a duplicate of another datastore name in the vCenter Server instance inventory.
    b. If the same datastore is to be mounted on multiple hosts, the name of the datastore must be the same across all of the hosts.

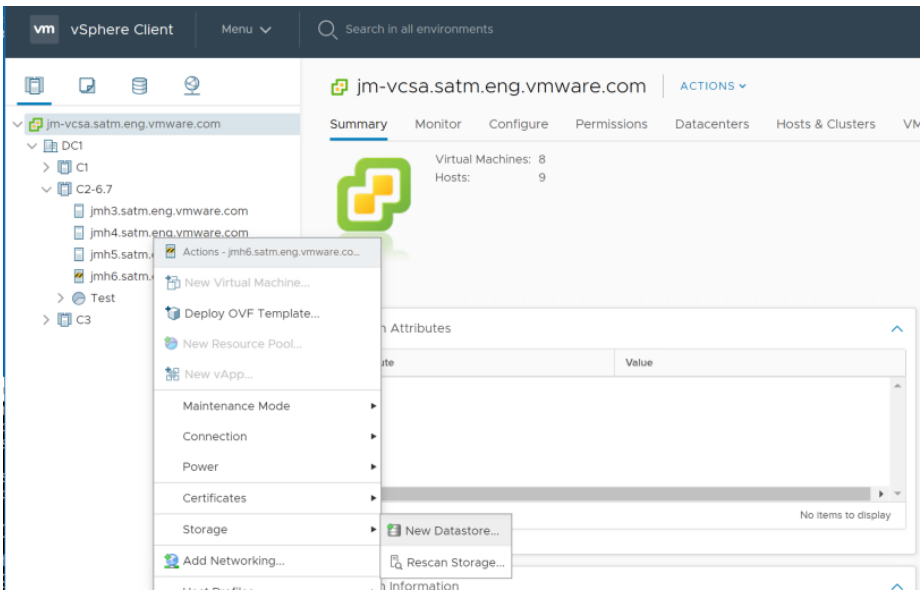

Figure 13: Add New Datastore Wizard

5. Select the VVol as the virtual datastore type.

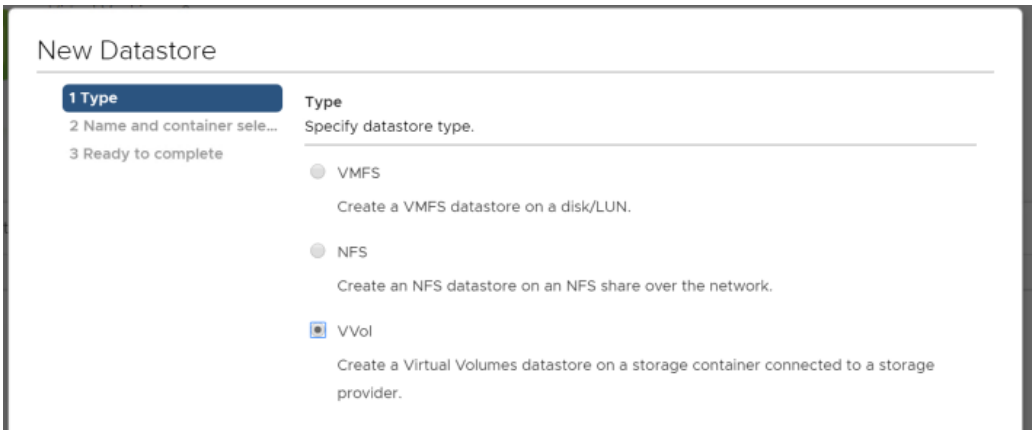

Figure 14: Datastore Type

6. From the list of storage containers, select a backing storage container.

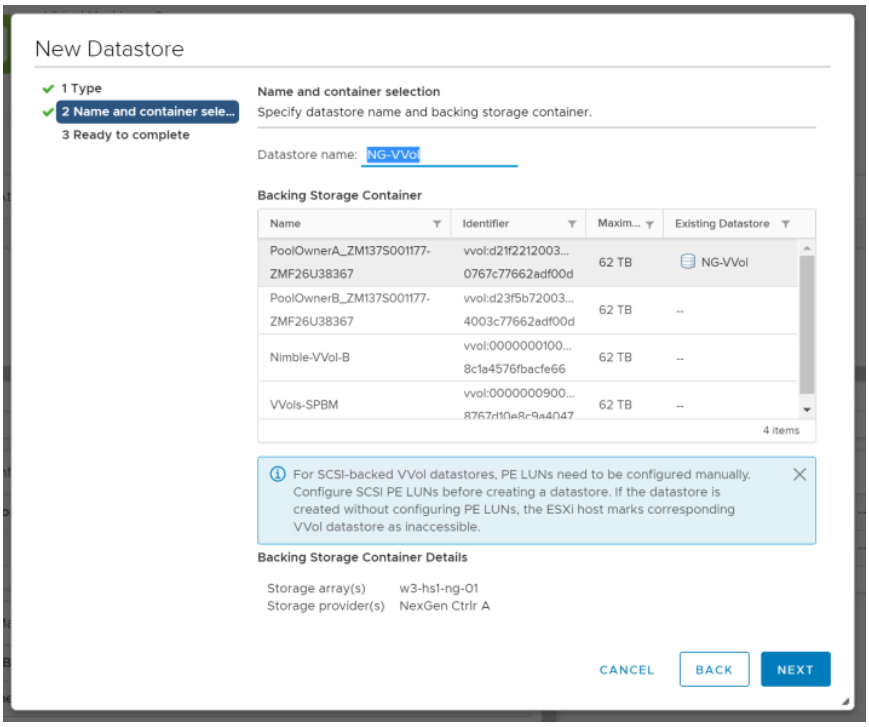

Figure 15: Storage Container Selection

7. Click next to review the configuration options and click Finish.

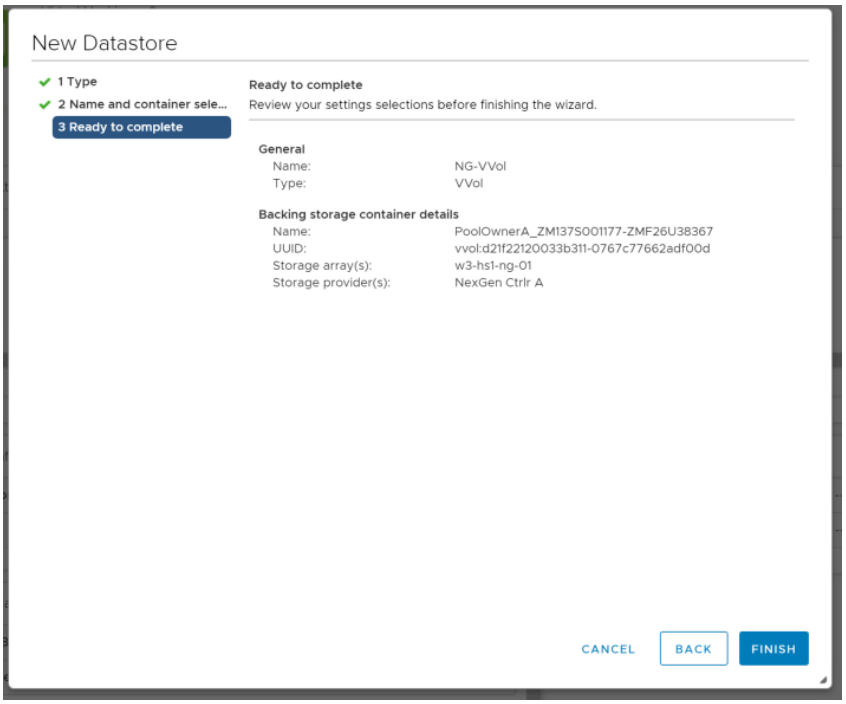

Figure 16: Virtual Datastore Mapping to Storage Container

After the vVols datastore is created, other datastore operations such as renaming, browsing, mounting, and unmounting the datastore may be performed.

Mounting the Virtual Datastore onto Multiple Hosts

Once a vVols Datastore is created and mounted on a single host, the datastore configuration procedure will not work. This is because a vVols datastore is already mapped to a storage container. To mount the vVols datastore use the "Mount Datastore to Additional Hosts" Procedure.

This procedure is performed from the Storage view of the vSphere Client.

1. From the vSphere Client, navigate to the Storage view tab.
2. Right-click on the desired virtual datastore and select Mount Datastore to Additional Hosts.

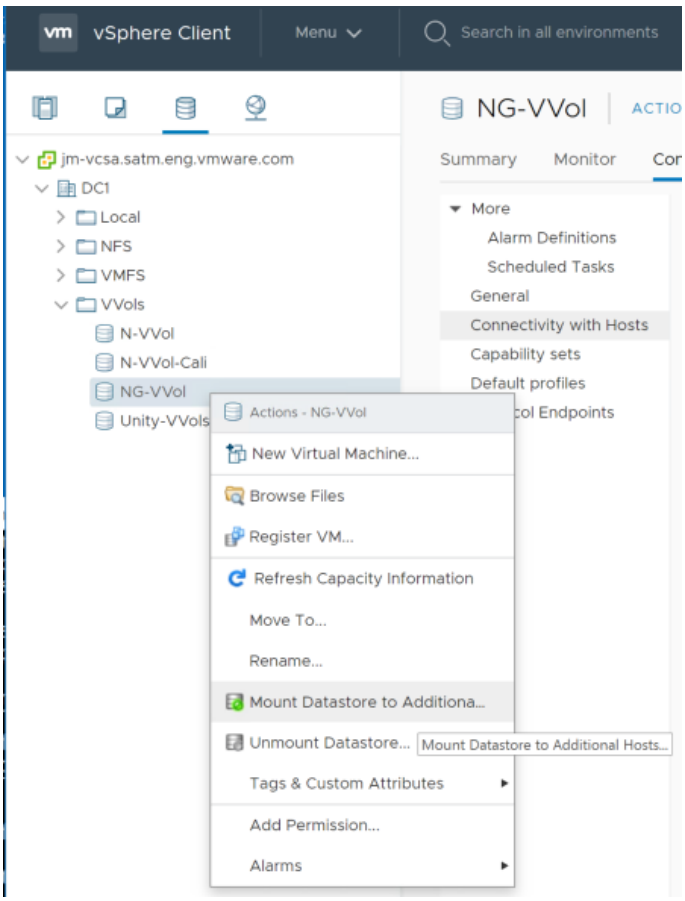

Figure 16: Mount Datastore to Additional Hosts

3. Select the available hosts to mount the Virtual Datastore and click OK.

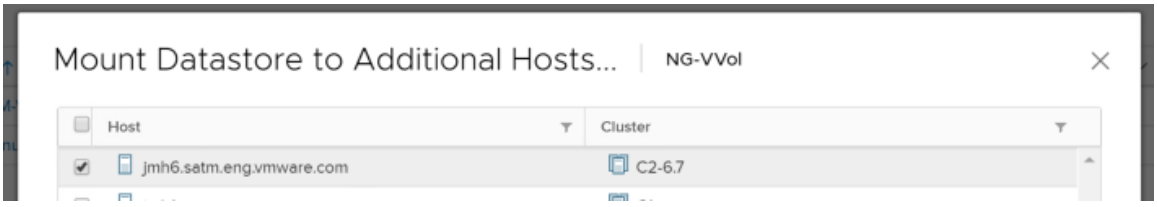

Figure 17: Multiple Hosts Selection

The vVols datastore should be automatically mounted to all the selected hosts. Looking at the Connectivity with Hosts can validate the action was successful. The "Connectivity with Host" view is located in the virtual datastore settings under the manage tab of the storage view in the vSphere Client.

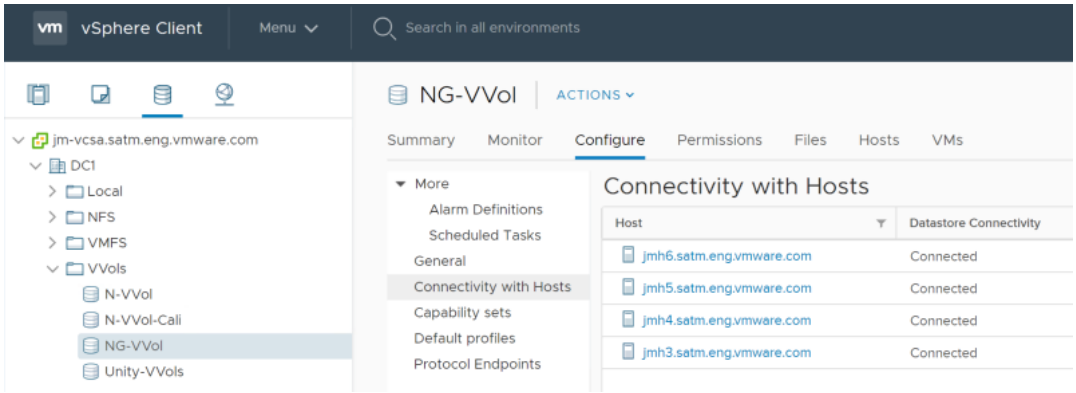

Figure 18: Virtual Datastore Multiple Host Mount Validation

Mapping Storage Capabilities to VM Storage Policies

The Storage capabilities are configured and managed on the storage systems by the storage admins. Storage capabilities are presented to vSphere via the VASA APIs in the form of data services and unique storage system features.

A vSphere admin maps the storage capabilities presented to vSphere and organize them into a set of rules that are designed to capture the quality of service requirements for virtual machines and their application. These rules are saved to vSphere in the form of a VM Storage Policy.

vVols functionalities utilize VM Storage Policy for management related operations such as placement decision, admission control, quality of service compliance monitoring, and dynamic storage resource allocation.

Mapping Storage Capabilities to VM Storage Policies Procedure

Once all the vVols related components have been configured in the infrastructure, a vSphere admin needs to define storage requirements and storage service for a virtual machine and its virtual disks.

In order to satisfy the virtual machine's service requirements, a VM Storage Policies need to be created in vSphere.

Before proceeding with the definition and creation of a VM Storage Policies, verify the vendor provider (VASA) is available and online.

1. From the vSphere Web Client Home screen, click on VM Storage Policies.
2. Click the "Create VM Storage Policy" icon.

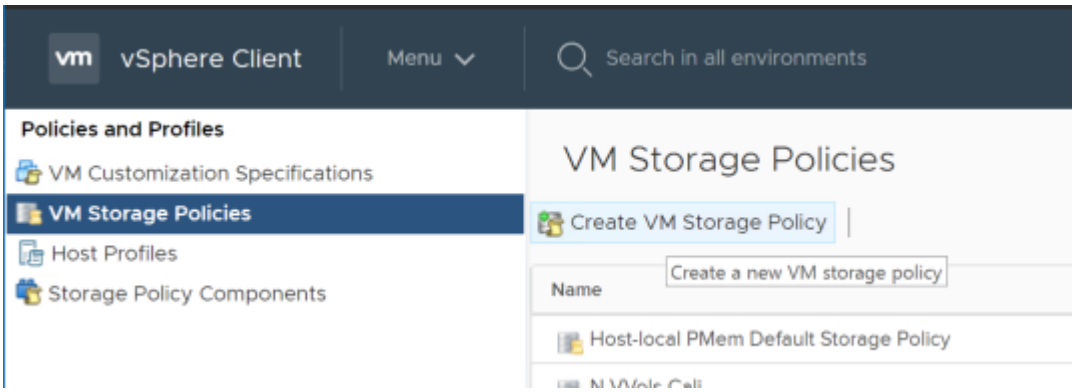

Figure 19: Create VM Storage Policy

3. Select the vCenter Server instance.
4. Type a name and description for the storage policy.
5. On the Rule-Set 1 window, select the vendor provider for the storage system that is registered with vSphere from the Rule-based and data services drop-box.
    a. The page expands to show the capabilities reported by the storage system

b. Add the necessary capabilities and specify its value

c. Make sure the value provided is within the range of values advertised by the capability profile of the storage system.

d. (optional) add tag-based capabilities.

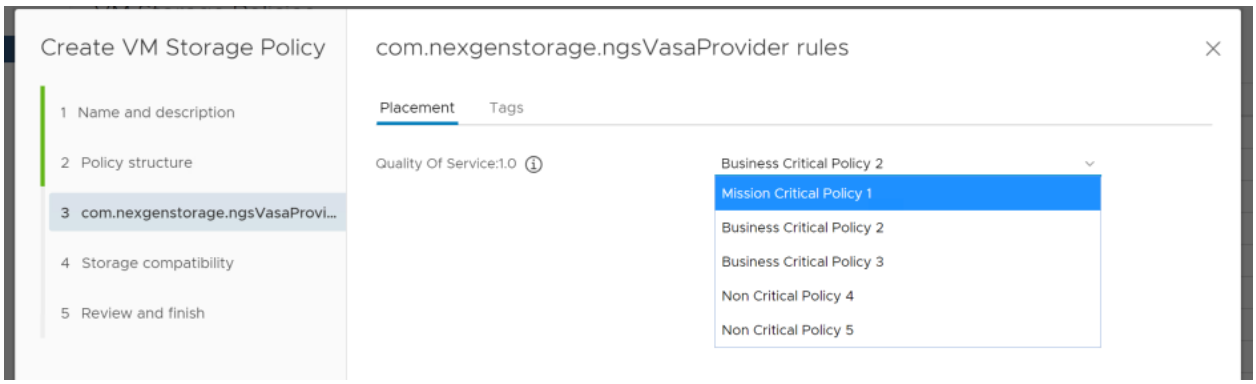

Figure 20: Policy Rule-Set Definition

6. Review the list of datastores that match the VM Storage Policy and click Next.

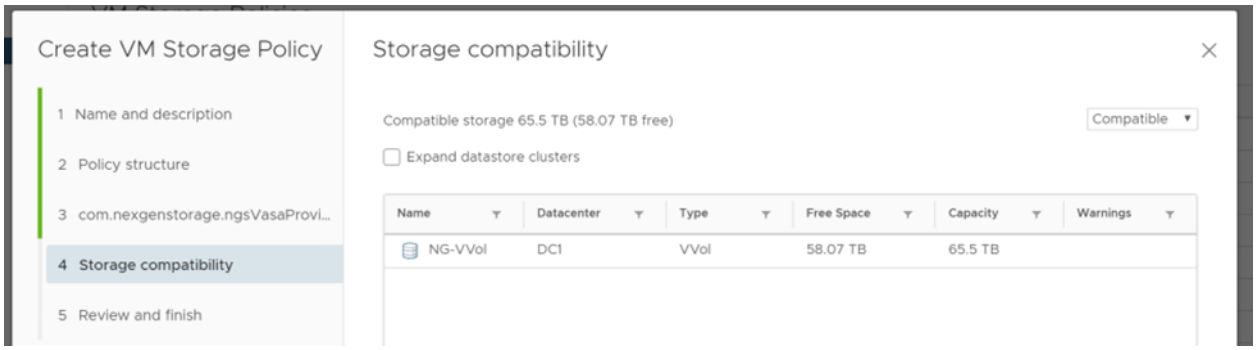

Figure 21: List of virtual Datastores Compliant with VM Storage Policy

7. Verify the VM Storage Policy configuration settings and click Finish.

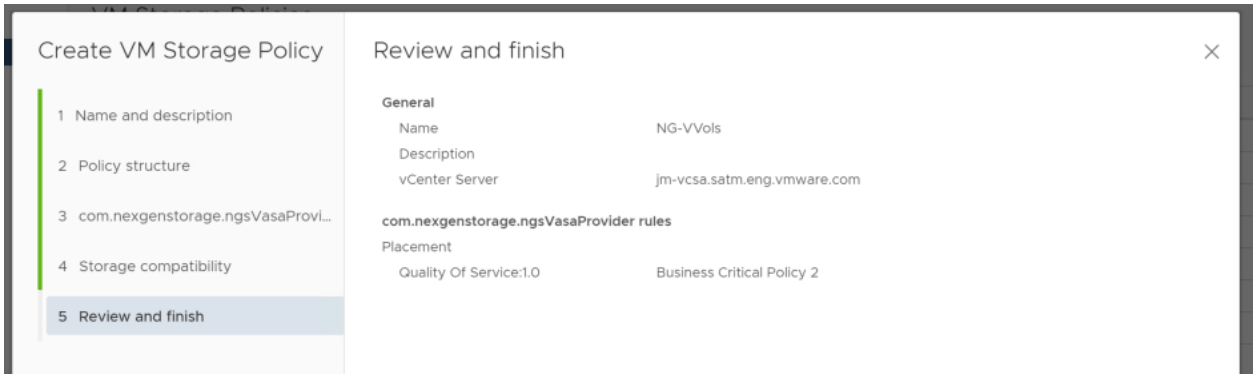

Figure 22: Policy Setting Confirmation

Make sure that the storage system's storage container meet the requirements set in the VM Storage Policy and appear on the list of compatible datastores. The VM Storage Policy should have been added to the list and can be applied to virtual machines and their virtual disks.

Virtual Machine Creation

Once the vSphere infrastructure and the storage systems are ready, and their respective policies and capabilities have been configured and defined, a vSphere admin can start deploying virtual machines to vVols datastore.

To create a new virtual machine and deploy it to a vVols datastore, follow the procedure listed below.

1. Select any virtual machine parent object in the vSphere inventory.
    a. Datacenter
    b. Cluster
    c. Host
    d. Resource pool
    e. Folder

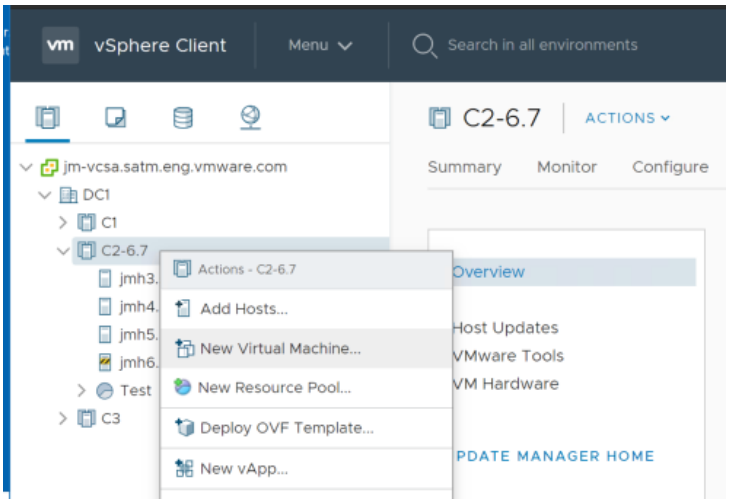

Figure 23: Create New Virtual Machine

2. Right click any of the objects listed above and choose new Virtual Machine.
3. Once the New Virtual Machine wizard opens select the Create a new Virtual Machine option and click Next.

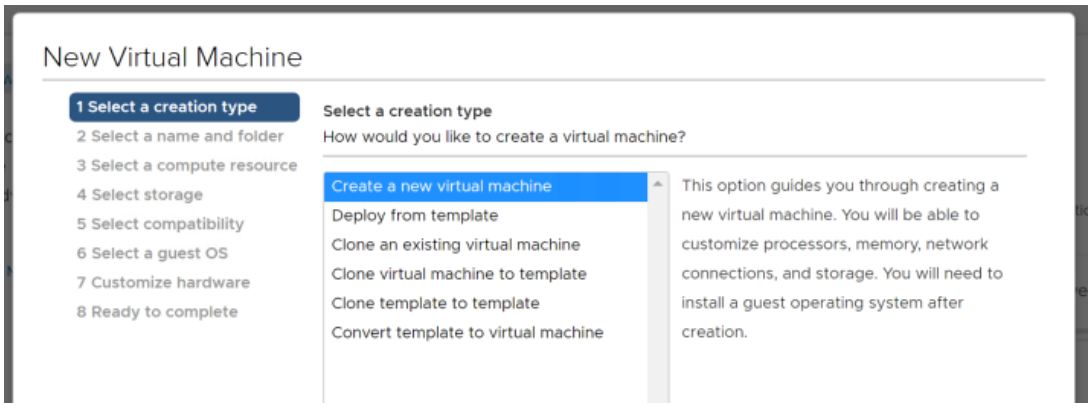

Figure 24: Virtual Machine Creation Type

4. Enter a name for the virtual machine and select a location for the Virtual Machine and click Next.
    a. Datacenter
    b. VM folder
5. Select the compute resource for the New Virtual Machine deployment operation and click Next.
    a. Cluster
    b. Host
    c. vApp
    d. Resource Pool

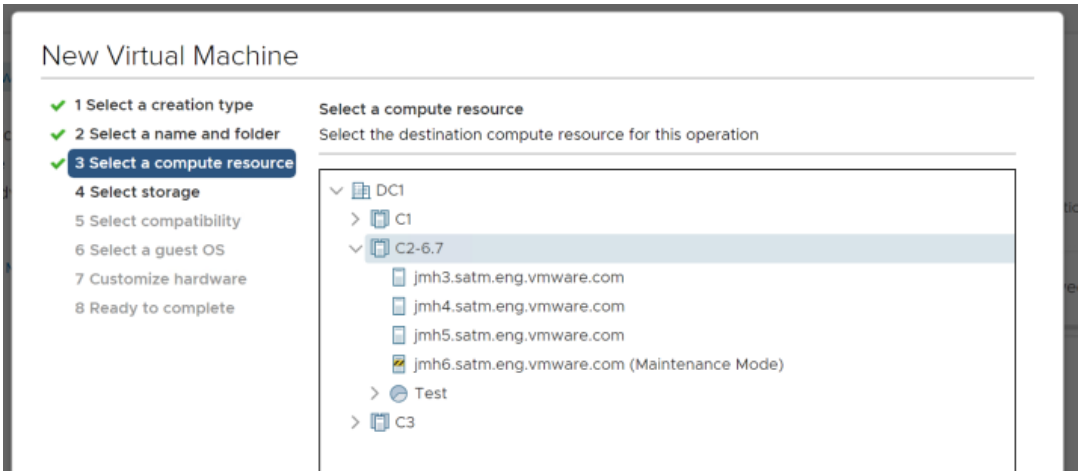

Figure 25: Select Compute Resource

6. Choose a VM Storage Policy to configure the VM storage requirements for a vVols datastore. Then select the compatible datastore that meets the storage requirements of the chosen policy and click Next.

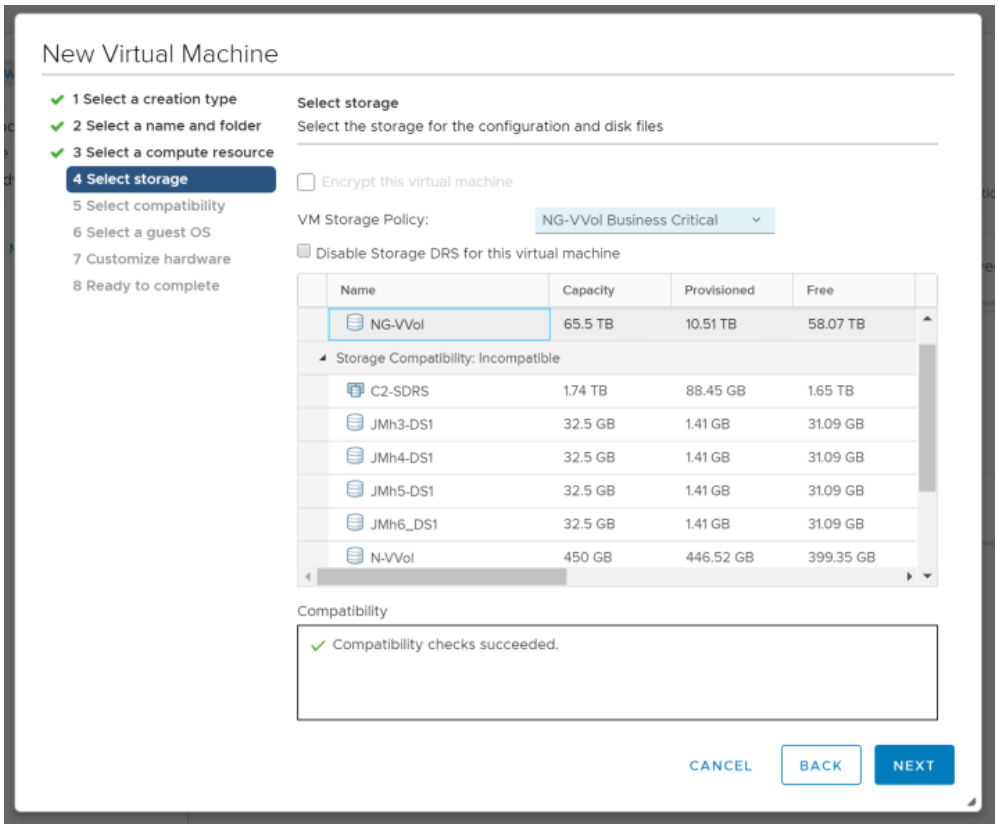

Figure 26: Select Storage with VM Storage Policy

Note: The "VM Storage Policy" option is available on all virtual machine provisioning related operations such as deploy from template, clone an existing virtual machine, clone a virtual machine to template, clone template to template.

7. Select the host compatibility level for the Virtual Machine and click next
8. Choose the Guest OS Family and Guest OS version that will be installed on the Virtual Machine and click Next.
9. Customized the virtual machine hardware as needed, then click Next.
10. Review the virtual machine configuration including the VM Storage Policy selected for accuracy the click Finish.

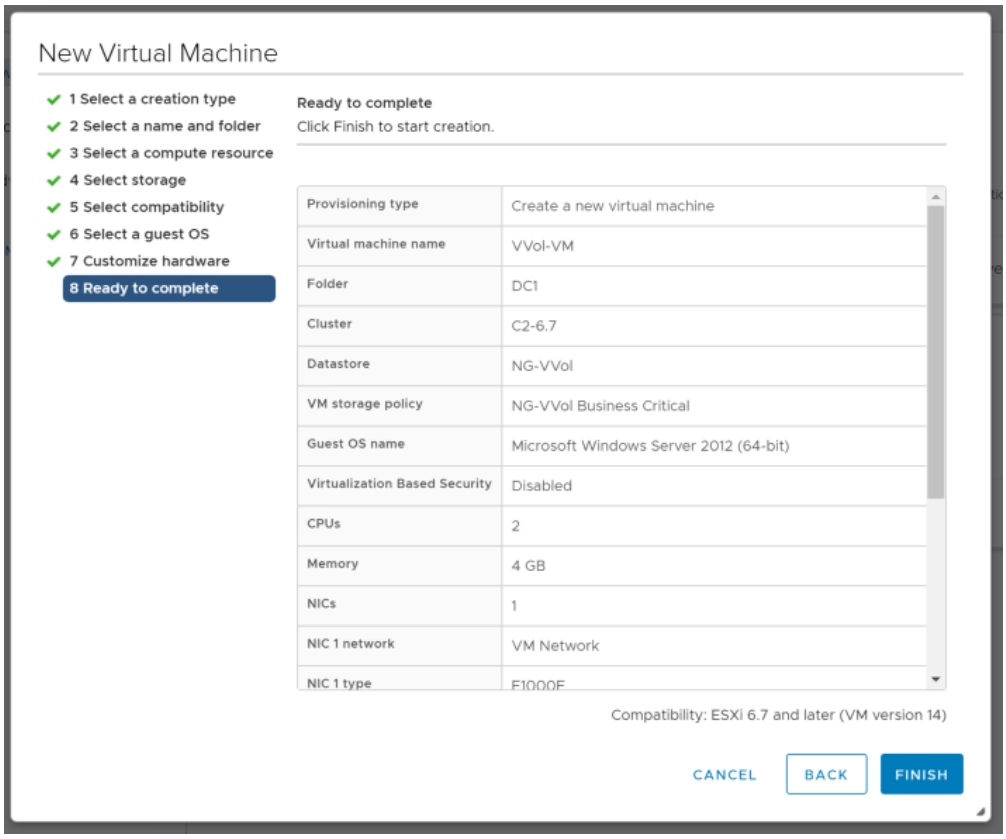

Figure 27: Virtual Machine Configuration Overview

Virtual Machine Migration with Storage vMotion

With Storage vMotion, virtual machines and their disks can be migrated from a VMFS, NFS or vSAN datastore to a vVols datastore. The migration operation may be performed between virtual datastores located on the same storage system or datastores on different storage systems.

The migration operations may be performed while the virtual machines are powered on or off.

As part of the migration operation, you select the virtual disk format, VM Storage Policy and choose to place the virtual machine and all its disks in a single location or select separate locations for the virtual machine configuration file and each virtual disk. The virtual machine does not change execution host during a Storage vMotion.

To migrate a new virtual machine onto a vVols datastore follow the procedure listed below.

1. Select any virtual machine in the vSphere inventory and select Migrate.

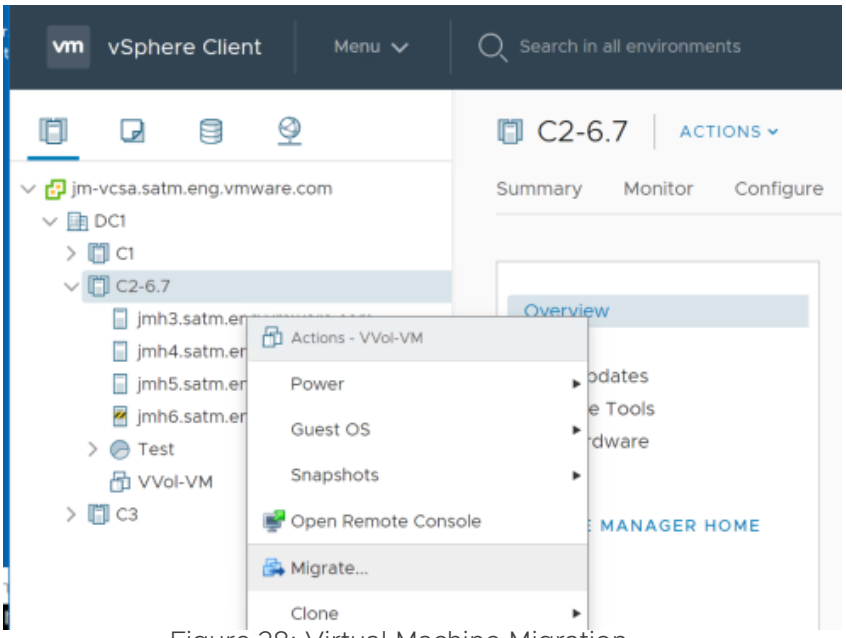

Figure 28: Virtual Machine Migration

2. Select one of the migration types options, in this case, “Change storage only” and click Next.
    a. Change compute resource only
    b. Change storage only
    c. Change both compute and storage

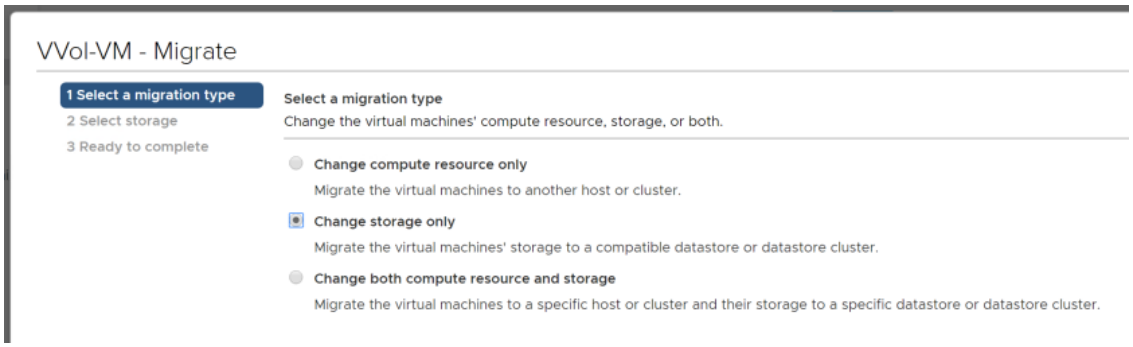

Figure 29: SvMotion Migration Options

3. Select the destination storage, virtual disk format, VM Storage Policy, and suitable virtual datastore and click Next.

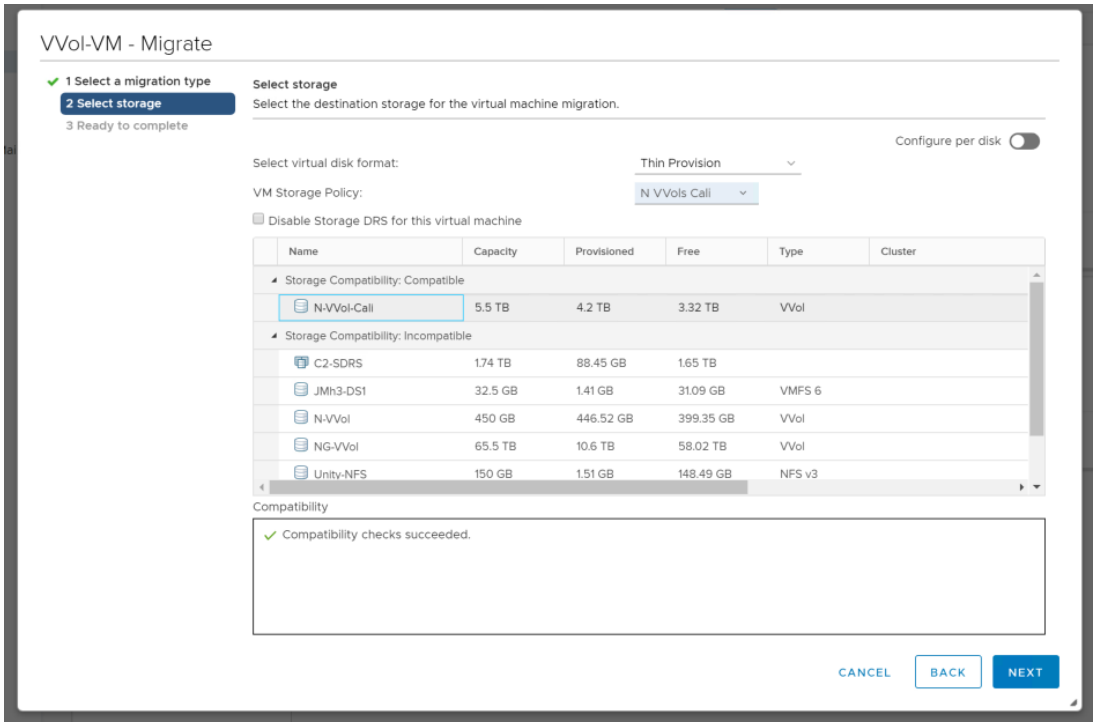

Figure 30: SvMotion Storage Target

4. Review the migration details, including the virtual datastore target, VM Storage Policy, and disk format settings selected for accuracy the click Finish.

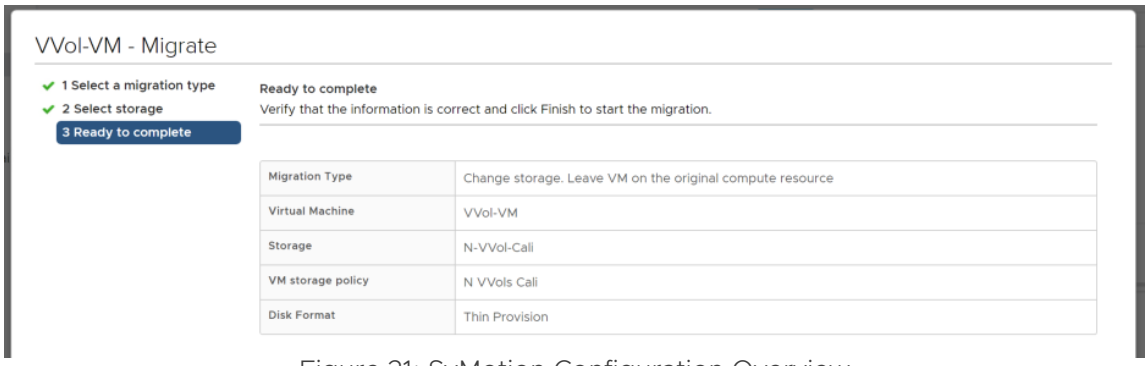

Figure 31: SvMotion Configuration Overview

vVols Interoperability

vSphere Enterprise Features

The following table highlights the vSphere enterprise features that are available in the vSphere 6.x are supported with vVols.

vSphere 6.x Supported Features
Storage Policy-Based Management (SPBM)
Thin Provisioning
Linked Clones
Native Snapshots
NFSv3.x
View Storage Accelerator (CBRC)
vMotion
Storage vMotion
vSphere SDK (VC API)
vSphere Web Client
Host Profiles / Stateless
vSphere HA
XvMotion
vSphere Auto Deploy

Table 1: vSphere 6.x Enterprise Features Supported by vVols

VMware Products and Solutions

The following table highlights the products and solutions that are available, which provide support and interoperability for are vVols.

VMware Supported Products and Solutions
VMware vSphere 6.x
VMware vRealize Automation 6.2
VMware Horizon 6.1
VMware vSphere Replication 6.x
VMware Virtual SAN 6.x

Table 2: VMware Products and Solutions Supported by vVols

Note: vVols storage containers can be presented to hosts that are members of a vSAN cluster. Virtual machines can have VMDKs simultaneously stored on both vVols Storage Containers and a vSAN Datastore.

vVols CLI Commands

The esxcli command line framework has been updated to include a vVols module. All of the new vVols esxcli commands are grouped under the storage, vVols namespace.

vVols ESXCLI Namespaces

The vVols namespace contains multiple sets of commands. Each namespace is focused on a different operating function of the vVols related components. There are five available namespaces, and their respective description are listed below:

- **storagecontainer** – Operations to create, manage, remove vVols Storage Containers
- **daemon** – Operations pertaining to vVols daemon
- **protocolendpoint** – Operations on vVols Protocol Endpoints.
- **vasacontext** – Operations on the vVols and VASA context.
- **vasaprovider** – Manage vVols VASA Provider Operations

esxcli storage vvol command line syntax samples:

```
esxcli storage vvol –h

Usage: esxcli storage vvol {cmd} [cmd options]

Available Namespaces:

      storagecontainer Operations to create, manage, remove and restore VVol
      StorageContainers.

      daemon Operations pertaining to VVol daemon.

      protocolendpoint Operations on VVol Protocol EndPoints.

      vasacontext Operations on the VVol VASA context.

      vasaprovider Manage VVol VASA Provider Operations.
```

vVols ESXCLI Namespace Commands

The vVols storagecontainer namespace commands provide the ability to list the storage containers are mapped to an ESXi host. As well as the ability to scan for abandoned vVols within storage containers.

esxcli storage vvol storagecontainer command line syntax samples:

```
esxcli storage vvol storagecontainer –h

Usage: esxcli storage vvol storagecontainer {cmd} [cmd options]

Available Namespaces:

      abandonedvvol Operations on Abandoned Virtual Volumes.

Available Commands:

      list List the VVol StorageContainers currently known to the ESX host.
```

abandonedvvol – is a state in which vVols are placed whenever a failure to delete event happens. i.e. failure to delete swap vvol during a VM power-off operation thought a particular path. This behavior typically happens when there are communication issues with the Vendor/VASA Provider.

In this scenario instead of failing the VM power-off operation, the system makes note of that vVol on a per-VM-namespace basis onto an abandon vVols tracking file so that it could be deleted later when the Vendor/VASA Provider is back online. A periodic thread tries to delete such abandoned vVols.

scan option – this option allows the initiation of a background scan of a respective vVols datastore, searching for abandoned vVols. The operation goes over all the Config-vVol, looking for the abandoned vVols tracking files and tries to delete them.

The successful initiation of the scan doesn't indicate that the operation succeeded or failed. This is a long running operation that might take long time to complete, as we don't scan all the config-vVol at once to avoid putting load on the Vendor/VASA Provider for a non-important operation like garbage collecting old vVols.

esxcli storage vvol storagecontainer abandonedvvol syntax samples:

```
esxcli storage vvol storagecontainer abandonedvvol scan -p eqlDatastore
true
```

List – provides the ability to display or list the number of virtual datastores and details for vVols and that are known to a particular vSphere host.

esxcli storage vvol storagecontainer list syntax sample:

```
esxcli storage vvol storagecontainer list
```

```
eqlDatastore
      StorageContainer Name: eqlDatastore
      UUID: vvol:6090a0681067ae78-2e48c5020000a0f6
      Array: com.dell.storageprofile.equallogic.std:eqlgrp1
      Size(MB): 1048590
      Free(MB): 972540
      Accessible: true
      Default Policy:


engDatastore
      StorageContainer Name: engDatastore
      UUID: vvol:6090a06810770d5b-cd4ad5d7a1042074
      Array: com.dell.storageprofile.equallogic.std:eqlgrp1
      Size(MB): 4194315
      Free(MB): 4173930
      Accessible: true
      Default Policy:


dbDatastore
      StorageContainer Name: dbDatastore
      UUID: vvol:6090a0681077bdce-8b4b1515a2049013
      Array: com.dell.storageprofile.equallogic.std:eqlgrp1
      Size(MB): 1024005
      Free(MB): 1009635
      Accessible: true
      Default Policy:
```

The `daemon` in the namespace – Is utilized to perform unbind vVol operations from all Vendor/VASA Provider that are known to a particular vSphere host.

unbindall – this option is utilized to unbind all vVols from all the Vendor/VASA Provider known to a particular ESXi Host. This operation is performed for testing purposes or to force the cleanup of all vVols data path.

esxcli storage vvol storagecontainer daemon unbindall syntax sample:

```
Usage: esxcli storage vvol daemon unbindall [cmd options]

Description:

 unbindall  Unbind all virtual Volumes from all VPs known to the ESX host.

Cmd options:

esxcli storage vvol daemon unbindall
```

The `protocolendpoint` namespace commands provide the ability to list the all the information with regards to the Protocol Endpoints configuration to a vSphere host.

List – provides the ability to display or list the number of protocol endpoints and their configuration details to a particular ESX host.

```
esxcli storage vvol protocolendpoint

Usage: esxcli storage vvol protocolendpoint {cmd} [cmd options]

Available Commands:

list        List the VVol Protocol EndPoints currently known to the ESX host.

esxcli storage vvol protocolendpoint list

naa.6090a0681077ad11863e05020000a061
      Host Id: naa.6090a0681077ad11863e05020000a061
      Array Id: com.dell.storageprofile.equallogic.std:eqlgrp1
      Type: SCSI
      Accessible: true
      Configured: true
      Lun Id: naa.6090a0681077ad11863e05020000a061
      Remote Host:
      Remote Share:
      Storage Containers: 6090a068-1067-ae78-2e48-c5020000a0f6
```

The `vasacontext` namespace command provide the ability to get the vCenter Server UUID for which the Vendor/VASA Provider is currently registered.

get - this option is utilized to get the VVol VASA context or vCenter Server UUID's.

```
esxcli storage vvol vasacontext –h

Usage: esxcli storage vvol vasacontext {cmd} [cmd options]

Available Commands:

get                Get the VVol VASA Context (VC UUID).

esxcli storage vvol vasacontext get
5742ead8-0695-48bd-9ae4-7416164423ef
```

The `vasaprovider` namespace command provides the ability to list the Vendor/VASA Providers that are is currently registered onto a particular ESXi host.

list - this option is utilized to list all the Vendor/VASA Providers and their information details that are registered to a particular ESX host.

```
esxcli storage vvol vasaprovider –h

Usage: esxcli storage vvol vasaprovider {cmd} [cmd options]

Available Commands:

list               List the VASA Providers registered on the host.

esxcli storage vvol vasaprovider list

Dell Equallogic VASA Provider
      VP Name: Dell Equallogic VASA Provider
      URL: https://10.144.106.39:8443/vasa-version.xml
      Status: online
      Arrays:
            Array Id: com.dell.storageprofile.equallogic.std:eqlgrp1
            Is Active: true
            Priority: 0
```

Reference

vVols Resources

Product Page
https://www.vmware.com/products/vsphere/features/virtual-volumes.html

Solution Overview
https://storagehub.vmware.com/t/vsphere-storage/vsphere-virtual-volumes-technical-overview

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Documentation
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About the Authors

Rawlinson Rivera was a Principal Architect in the Storage and Availability Business Unit at VMware, Inc.

Follow Rawlinson on Twitter: @PunchingClouds

Jason Massae is a Technical Marketing Architect in the Hyperconverged Infrastructure Business Unit at VMware focusing on vVols and core/external storage

Follow Jason on Twitter: @jbmassae

VMware, Inc. 3401 Hillview Avenue Palo Alto CA 94304 USA Tel 877-486-9273 Fax 650-427-5001 www.vmware.com.