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

Hyperconverged Infrastructure Business Unit

Technical Documentation

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Table of Contents

Introduction
vVols Components
vVols Requirements
Configuring vVols
Configuration Guidelines
Configuration Procedures
vSphere Storage Time Synchronization12
Storage Provider Registration14
Mapping Storage Capabilities to VM Storage Policies
Mapping Storage Capabilities to VM Storage Policies Procedure20
Virtual Machine Creation
Virtual Machine Migration with Storage vMotion
vVols Interoperability
vSphere Enterprise Features
VMware Products and Solutions
vVols CLI Commands
vVols ESXCLI Namespaces
vVols ESXCLI Namespace Commands
Reference
vVols Resources
Product Documentation Error! Bookmark not defined.
Documentation Error! Bookmark not defined.
vVols References
VMworld Presentations
About the Authors

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

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- **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



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vSphere View 0000 0000 0 \odot \odot vm vm vm 0000 0 0 0000 \odot 0000 \rangle vSphere vVols vVols Datastore Storage View vVols Partner VASA Provider J 🗊 🕞 1 || I Ш Storage Array Cluster Storage Container

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 <u>http://www.vmware.com/products/virtual-volumes</u>.

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.

Summary	Monitor	Configure	Permissions	VMs	Datastores	Networks	Updates	
 Storage Networking Virtual Machines System 		Time	Configura	tion				
		Date	e & Time					03/25/2019, 8:28:02 AM
		NTP	Client					Enabled
Host P	rofile	NTP	Service Status					Running
Time Configuration		NTP	Servers					
Certific	ate Management							

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.

Edit Time Configuration imh6.satm.eng.vmware.com					
Specify how the date	e and time on this host should b	e set.			
Manually configu	re the date and time on this hos	it			
2019-03-25	08:28:42				
(date and time are in	ISO 8601 format)				
Use Network Time	ne Protocol (Enable NTP client)				
NTP Servers		time.vmware.com			
		Separate servers with commas, e.g. 10.31.21.2, fe00::2800			
NTP Service Sta	atus:	Running			
NTP Service Sta	artup Policy:	Start and stop with host			
		CANCEL	ок		

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.

Name	NexGen
URL	https://w3-hs1-ng-01a.eng.vmware.com:8443/
User name	admin
Password	
Use storage provider certif	ficate
Certificate location	BROWSE

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.

Storage Providers	NexGen Ctrlr A		Online			https://w3-hs1-ng-01a.eng.vmware.com:8443/
vSAN	w3-hs1-ng-01 (2/2 c	online)		Active	255	
	⊿ NexGen Ctrir B		Online			https://w3-hs1-ng-01b.eng.vmware.com:8443/
	w3-hs1-ng-01 (2/2 c	online)		Standby	255	
	IOFILTER Provider jmh	i6.satm	Online			https://jmh6.satm.eng.vmware.com:9080/ve
	<					
	General Supported	Vendor ID	s Certific	ate Info		
	Provider name Provider status Active/standby status Activation URL Provider version VASA API version Default namespace Provider ID Supported profiles	NexGen C Online Automatic https://w3 2.0 2.0 com.nexg NGSVP:2N Storage P	trlr A -hs1-ng-01a.ei enstorage.ng: 4137S001177 rofile Based N	ng.vmware.co sVasaProvide Management	om:8443/ er	

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.

vm vSphere Cli	ient Menu 🗸	Q Search in all environments	
	9	Jm-vcsa.satm.eng.vmware.com	
✓ 🗗 jm-vcsa.satm.eng.	vmware.com	Summary Monitor Configure Permissions Datacenters Hosts & Clusters	VN
 OCI OCI C1 C2-6.7 jmh3.satm jmh4.satm jmh5.satm jmh5.satm Sample Sector Sample Sector<td>eng.vmware.com eng.vmware.com Actions - jmh6 satm.eng.v New Virtual Machine.</td><td>virtual Machines: 8 Hosts: 9</td><td></td>	eng.vmware.com eng.vmware.com Actions - jmh6 satm.eng.v New Virtual Machine.	virtual Machines: 8 Hosts: 9	
> 📋 СЗ	Deploy OVF Template	n Attributes	^
	New vApp	/te Value	•
	Maintenance Mode Connection Power	• •	
	Certificates	>	• •
	Storage	New Datastore	ney
	🧕 Add Networking	🗓 Rescan Storage	
		. h Information	~

Figure 13: Add New Datastore Wizard

5. Select the VVol as the virtual datastore type.

1 Туре	Туре
2 Name and container sele	Specify datastore type.
3 Ready to complete	VMFS
	Create a VMFS datastore on a disk/LUN.
	NFS
	Create an NFS datastore on an NFS share over the network.
	VVol
	Create a Virtual Volumes datastore on a storage container connected to a storage
	provider.

Figure 14: Datastore Type

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



2 Name and container sele 3 Ready to complete	Name and container selection Specify datastore name and b	acking storage containe	r.					
	Datastore name: NG-VVol							
	Backing Storage Container							
	Name T	Identifier T	Maxim 🔻	Existing Datastore T				
	PoolOwnerA_ZM137S001177- ZMF26U38367	vvol:d21f2212003 0767c77662adf00d	62 TB	NG-VVol				
	PoolOwnerB_ZM137S001177- ZMF26U38367	vvol:d23f5b72003 4003c77662adf00d	62 TB					
	Nimble-VVol-B	vvol:0000000100 8c1a4576fbacfe66	62 TB					
	VVols-SPBM	vvol:0000000900 8767d10e8c9a4047	62 TB					
				4 items				
	For SCSI-backed VVol da Configure SCSI PE LUNs created without configur VVol datastore as inacce	atastores, PE LUNs need before creating a datas ring PE LUNs, the ESXi h essible.	d to be config tore. If the da tost marks co	gured manually. X atastore is rrresponding				
	Backing Storage Container De	tails						
	Storage array(s) w3-hs1 Storage provider(s) NexGe	-ng-01 n Ctrir A						



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

-

 1 Type 	Ready to complete	
 2 Name and container sele. 	Review your settings selectio	ns before finishing the wizard.
3 Ready to complete		
	General	
	Name:	NG-VVol
	Type:	V VOI
	Backing storage container	details
	Name:	PoolOwnerA_ZM137S001177-ZMF26U38367
	UUID:	vvol:d21f22120033b311-0767c77662adf00d
	Storage array(s):	w3-hs1-ng-01
	Storage provider(s):	NexGen Ctrir A

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.

vm vSphere Clie	nt Menu 🗸	Q Search in all environments
D D B	<u>@</u>	SING-VVOI ACTIO
✓ 🗗 jm-vcsa.satm.eng.v	mware.com	Summary Monitor Cor
 DC1 Local NFS VMFS 		 More Alarm Definitions Scheduled Tasks General
V Vols		Connectivity with Hosts
N-VVol-Cali		Capability sets
NG-VVol		Default profiles
Unity-VVol	Actions - NG-VVol	col Endpoints
0	🛅 New Virtual Machine.	
	🧟 Browse Files	
	PRegister VM	
	C Refresh Capacity Info	ormation
	Move To	
	Rename	
	🔯 Mount Datastore to A	dditiona
	🛃 Unmount Datastore	Mount Datastore to Additional Hosts
	Tags & Custom Attrib	utes 🕨
	Add Permission	
	Alarms	•

Figure 16: Mount Datastore to Additional Hosts

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

Ν	Mount Datastore to Additional Hosts NG-VV01					×
		Host T		Cluster	Ŧ	
	•	jmh6.satm.eng.vmware.com		C2-6.7		<u>~</u>
	-					



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.

vm vSphere Client Menu ∨	Q Search in all environments			
Policies and Profiles	VM Storage Deligios			
😤 VM Customization Specifications	VIM Storage Policies			
📑 VM Storage Policies	😤 Create VM Storage Policy			
🕞 Host Profiles	Create a new VM storage policy			
📸 Storage Policy Components	Name			
	Host-local PMem Default Storage Policy			
	IIII NI VO/ole Cali			

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.

Create VM Storage Policy	com.nexgenstorage.ngsVasaProvider rules			
1 Name and description	Placement Tags			
2 Policy structure	Quality Of Service:1.0	Business Critical Policy 2	~	
3 com.nexgenstorage.ngsVasaProvi		Mission Critical Policy 1		
4 Storage compatibility		Business Critical Policy 3		
5 Review and finish		Non Critical Policy 4 Non Critical Policy 5		



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

Create VM Storage Policy	Storage compatibility	×
1 Name and description 2 Policy structure	Compatible storage 65.5 TB (58.07 TB free)	Compatible 🔻
3 com.nexgenstorage.ngsVasaProvi	Name Y Datacenter Y Type Y Free Space Y Capacity Y	Warnings y
4 Storage compatibility	SG-VVol DC1 VVol 58.07 TB 65.5 TB	
5 Review and finish		



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

Create VM Storage Policy	Review and finish		×
1 Name and description 2 Policy structure	General Name Description	NG-VVols	
3 com.nexgenstorage.ngsVasaProvi	vCenter Server	jm-vcsa.satm.eng.vmware.com	
4 Storage compatibility	Placement Quality Of Service:1.0	Business Critical Policy 2	
5 Review and finish			





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.

1 Select a creation type	Select a creation type		
2 Select a name and folder	How would you like to create a virtual m	achin	e?
3 Select a compute resource	,	_	\
4 Select storage	Create a new virtual machine	^	This option guides you through creating a
5 Select compatibility	Deploy from template		new virtual machine. You will be able to
6 Select a quest OS	Clone an existing virtual machine		customize processors, memory, network
7 Customize bardware	Clone virtual machine to template		connections, and storage. You will need to
Plandy to complete	Clone template to template		install a guest operating system after
s Ready to complete	Convert template to virtual machine		creation



- 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

New	Virtua	l Machine
-----	--------	-----------

2 Select a name and folder	Select the destination compute resource for this operation	
3 Select a compute resource		
4 Select storage	✓ In DC1	
5 Select compatibility	> 📋 C1	
5 Select a guest OS	✓ □ C2-6.7	
7 Customize hardware	jmh3.satm.eng.vmware.com	
8 Ready to complete	jmh4.satm.eng.vmware.com	
	jmh5.satm.eng.vmware.com	
	jmh6.satm.eng.vmware.com (Maintenance Mode)	
	> 🕞 Test	
	> 🖺 C3	

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.



1 Select a creation type 2 Select a name and folder	Select storage Select the storage for the co	onfiguration and disk fil	es	
3 Select a compute resource 4 Select storage 5 Select compatibility 6 Select a guest OS	Encrypt this virtual mach VM Storage Policy:	NG-VVol Busine	ess Critical 🛛 🗸	
7 Customize hardware	Disable Storage DRS for t	his virtual machine		
8 Ready to complete	Name	Capacity	Provisioned	Free
	S NG-VVol	65.5 TB	10.51 TB	58.07 TB
	 Storage Compatibility: In 	compatible		
	C2-SDRS	1.74 TB	88.45 GB	1.65 TB
	JMh3-DS1	32.5 GB	1.41 GB	31.09 GB
	JMh4-DS1	32.5 GB	1.41 GB	31.09 GB
	JMh5-DS1	32.5 GB	1.41 GB	31.09 GB
	JMh6_DS1	32.5 GB	1.41 GB	31.09 GB
	N-VVol	450 GB	446.52 GB	399.35 GB
	 Compatibility 			•
	✓ Compatibility checks su	ucceeded.		
	L			

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.

- 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.

 1 Select a creation type 2 Select a name and folder 	Ready to complete Click Finish to start creation.	
 3 Select a compute resource 4 Select storage 		
 5 Select compatibility 	Provisioning type	Create a new virtual machine
6 Select a guest OS	Virtual machine name	VVol-VM
8 Ready to complete	Folder	DC1
	Cluster	C2-6.7
	Datastore	NG-VVol
	VM storage policy	NG-VVol Business Critical
	Guest OS name	Microsoft Windows Server 2012 (64-bit)
	Virtualization Based Security	Disabled
	CPUs	2
	Memory	4 GB
	NICs	1
	NIC 1 network	VM Network
	NIC 1 type	F1000F
		Compatibility: ESXi 6.7 and later (VM version 14)

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.

- 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



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

1 Select a migration type 2 Select storage	Select storage Select the destination storage f	or the virtual machir	ne migration.			
3 Ready to complete						Configure per disk 🔵
	Select virtual disk format:		Th	in Provision	~	
	VM Storage Policy:		N	VVols Cali 🗸 🗸		
	Disable Storage DRS for this	virtual machine				
	Name	Capacity	Provisioned	Free	Туре	Cluster
	 Storage Compatibility: Comp 	patible				
	N-VVol-Cali	5.5 TB	4.2 TB	3.32 TB	VVol	
	 Storage Compatibility: Incom 	npatible				
	C2-SDRS	1.74 TB	88.45 GB	1.65 TB		
	JMh3-DS1	32.5 GB	1.41 GB	31.09 GB	VMFS 6	
	N-VVol	450 GB	446.52 GB	399.35 GB	VVol	
	NG-VVol	65.5 TB	10.6 TB	58.02 TB	VVol	
	Unity-NFS	150 GB	1.51 GB	148.49 GB	NFS v3	
	Compatibility					,
	 Compatibility checks succe 	eeded.				
	L					

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.

VVol-VM - Migrate		
 1 Select a migration type 2 Select storage 	Ready to complete Verify that the information is co	prrect and click Finish to start the migration.
3 Ready to complete		
	Migration Type	Change storage. Leave VM on the original compute resource
	Virtual Machine	VVoI-VM
	Storage	N-VVol-Cali
	VM storage policy	N VVols Cali
	Disk Format	Thin Provision

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 configvVol 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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