

Using Dell EqualLogic Storage with Failover Clusters and Hyper-V

Microsoft Windows Server 2012 R2

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May 2014	Initial release

Audience

The information in this guide is intended for technology professionals interested in using Dell EqualLogic storage in a Microsoft Windows environment, including Failover Clusters and Hyper-V.

Introduction

Storage plays a critical role in today's business operations. With the ever-growing presence of new applications and data, storage demands continue to grow. EqualLogic provides support for both block storage, with PS Series Firmware, and Network Attached Storage (NAS) with FS Series Firmware, delivering high performance, high availability, scalability and on-demand provisioning in a unified storage environment.

Objective

This deployment and configuration guide details using Dell EqualLogic storage with Microsoft Windows Server 2012 R2 Failover Clusters and Hyper-V, including configuration options and recommendations for servers, storage and networking.



1 iSCSI optimization and recommendations

To ensure high availability of your storage configuration, review the following recommendations:

- 1. Install the latest Microsoft recommended updates from <u>Windows Update</u>.
- 2. Install the <u>Dell EqualLogic Host Integration Tools for Microsoft</u> and enable the MPIO DSM feature.
- 3. For additional information on optimizing your Storage Area Network (SAN) environment for High Availability, refer to <u>Dell EqualLogic PS Series Storage Arrays iSCSI Initiator and Operating System</u> <u>Considerations</u>



Figure 1 Dell EqualLogic PS Series storage arrays

2 Failover clustering

A Failover cluster is a group of physical or virtual servers that is often used to provide high availability and scalability for file shares and applications such as Microsoft Exchange Server, Microsoft SQL Server and Hyper-V, as well as other clustered services and roles that run on Microsoft Windows. If one of the servers, referred to as a node, fails, other nodes in the cluster can continue to provide service for the resources that failed. This is referred to as a failover.

To achieve this high availability, Failover clustering uses shared server, network and storage resources. Refer to <u>Table 1</u> for Windows Server 2012 and Windows Server 2012 R2 Failover clustering requirements.

For additional information on Failover clustering, refer to: <u>http://technet.microsoft.com/en-us/library/hh831579.aspx</u>



Server				
Component	Minimum requirement			
Cluster nodes (servers)	 A minimum of two identical servers A maximum of 32 Windows Server 2012 R2 cluster nodes have been tested with Dell EqualLogic PS Series Firmware (Microsoft Windows Server 2012 and later supports up to 64 nodes per cluster). Failover clustering feature is available on all Windows Editions, including Server Core All servers must be joined to the same Active Directory Domain and use DNS Microsoft iSCSI Initiator Recommended to use the same drive letter for boot volume on all nodes Recommended to install Dell EqualLogic Host Integration Tools for Microsoft v4.7 or later and enable the Dell EqualLogic MPIO DSM feature. 			
Network Interfaces (iSCSI)	Recommended to use at least two NICs dedicated to			
(connects servers to SAN) iSCSI per cluster node				
Network Interfaces (public and private	At least two dedicated NICs per cluster node:			
networks)	One NIC for Public Network			
(connects servers to Local Area Network)	Another NIC for Private Network			
Storage				
Component Dell EqualLogic PS Series (shared SAN)	Minimum requirement • Storage Array: Redundant control modules • Firmware: Recommended PS Series Firmware v7.0 or later			
Networking				
Component	Minimum requirement			
Network Switches (provide dedicated interconnection between the cluster nodes and the storage arrays)	 At least two network switches dedicated to iSCSI iSCSI switches must be connected together using stacking or port trunking Recommended to enable Flow Control and <u>Jumbo Frames</u> on all switches and NICS that use iSCSI traffic 			

 Table 1
 Windows Server 2012 / R2 – Failover clustering requirements with Dell EqualLogic



2.1 Windows failover cluster networks

To maintain high availability and eliminate single points of failure, ensure that all components in the network are redundant. This includes using multiple network cards with NIC teaming or Multipathing I/O (MPIO) and connecting network cards to multiple switches.

Note: Failover clustering detects networks used by the cluster by their logical subnet. It is not necessary or recommended to assign more than a single network adapter per subnet because only one card will be used in the cluster configuration and any additional network cards on the subnet will be ignored. To provide load-balancing and fault tolerance for non-ISCSI networks, consider using NIC teaming.

Network settings

Note: In a cluster, use identical network adapters with static IP addresses and ensure identical configuration settings (Speed, Duplex Mode, Flow Control) on the network adapters and switches. All cluster nodes must use DNS for name resolution. It is recommended to enable Flow Control and <u>Jumbo</u> <u>Frames</u> on all switches and NICS that use iSCSI traffic.

NIC teaming

NIC teaming (also known as Load Balancing/Failover, or LBFO) combines two or more network interfaces to provide load balancing and fault tolerance.

Note: It is recommended to use NIC teaming for all non-redundant networks. While NIC teaming is supported in the cluster configuration, it is not recommended to use NIC teaming for iSCSI networks. It is recommended to configure NIC teaming before a cluster is created, because once a network has been added to a cluster, it can no longer be modified.

For information about NIC teaming, refer to <u>NIC Teaming Overview</u> in the Windows Server Technical Library.



When deploying a Windows Failover Cluster, you must plan for several types of network traffic.

Public network

The public network is used to access the LAN network. It is recommended to dedicate at least one network interface per cluster node for the public network. Additional network interfaces can be used to provide redundancy.

Private network

The private network is used for cluster communication and heartbeat. It is recommended to dedicate at least one network interface per cluster node for the private network. Additional network interfaces can be used to provide redundancy. Private networks can have two possible configurations:

- In a two-node cluster, the private network interfaces of each cluster node can be directly connected to each other with a crossover network cable.
- In larger clusters, the private network interfaces of each cluster node should be connected to a network switch.

Note: It is typically not necessary to configure default gateway or DNS settings for private networks. It is also recommended to disable the following on all private network interfaces: DNS registration, LMHOSTS lookup, and NetBIOS over TCP/IP.

iSCSI SAN - Multipathing I/O (MPIO)

The SAN network is used to provide connectivity between servers and data. To provide high availability and redundancy in the server's iSCSI connections to data volumes, install the Dell EqualLogic Host Integration Tools for Microsoft and enable the MPIO DSM feature. It is recommended to dedicate at least two network interfaces per cluster node for iSCSI and that all MPIO configuration settings are identical across all cluster nodes. For more information, refer to: <u>Configuring and Deploying the Dell EqualLogic Multi-Path I/O</u> <u>Device Specific Module with Microsoft Windows</u>.

Refer to Figure 2 and Figure 3 for examples of Windows Failover Cluster networks in a two node and 32 node cluster.



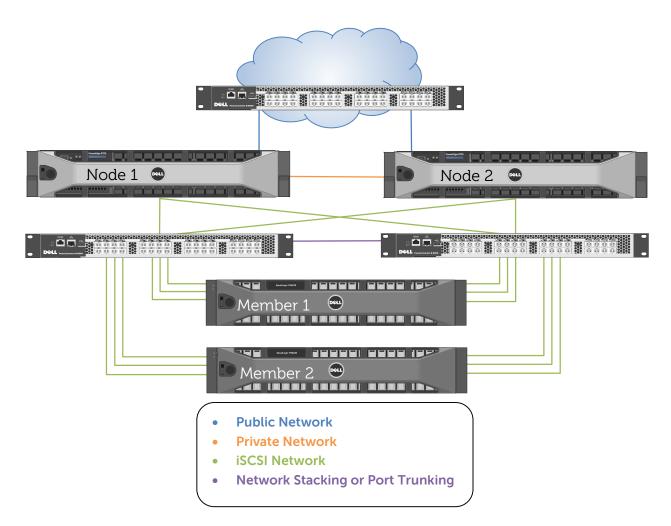


Figure 2 Failover cluster networks in a two node cluster



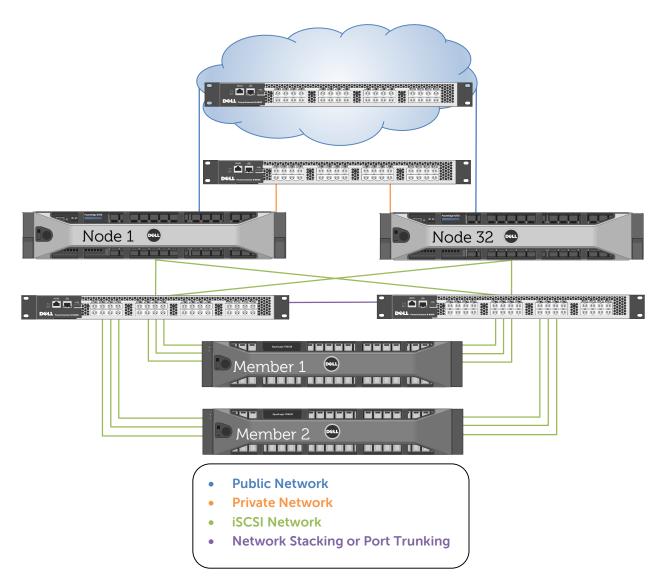


Figure 3 Failover cluster networks in a 32 node cluster



2.2 Failover clustering steps

- 1. It is recommended that all components on the servers, networking and storage hardware are configured with redundancy.
- 2. Pre-plan all required cluster configuration information such as: cluster name, cluster name IP, server public and private IP addresses, server iSCSI IP addresses and PS Series Group information.
- 3. Review iSCSI optimization and recommendations.
- 4. Configure server networking for public, private and iSCSI networks.
- 5. Join all servers to the same Active Directory Domain.
- 6. Install the Failover clustering feature on all servers.
- 7. <u>Create an EqualLogic volume</u> to be accessed by all cluster nodes. This volume is to be used a <u>Disk</u> <u>Witness</u> for the cluster.
- 8. <u>Run the Cluster Validation Wizard</u> to ensure the system is ready to form a cluster.
- 9. <u>Create a Failover Cluster</u> by configuring cluster name, cluster management IP, cluster nodes, storage, and quorum.
- 10. Configure additional storage, if required.

2.3 Install the Failover clustering feature

The Failover clustering feature must be added to each server in the planned cluster. It is recommended to first attach storage before validating and creating a cluster. Each server must be joined to the same Active Directory Domain.

- 1. Launch Server Manager.
- 2. Click on Add roles and features.

Tab		Server Manag	iger
Server M	anager • Dashboard		- 🕃 👠 Wandle Took Refi
Dashboard	WELCOME TO SERVER MANAGER		
輩 Local Server ■ All Servers ■電 File and Storage Services ♪	Configure this local CACK START 2 Add roles and feature 3 Add other servers to 4 Contract of the servers to		
	WHAT'S NEW (4) Create a server group		Hide
	ROLES AND SERVER GROUPS Roles: 1 Server groups: 1 Servers total: 1		
	File and Storage 1	1 All Servers 1	
	Manageability Events Events	Manageability Events	
	Performance Services BPA results Performance	Services Performance	
	BPA results	BPA results	

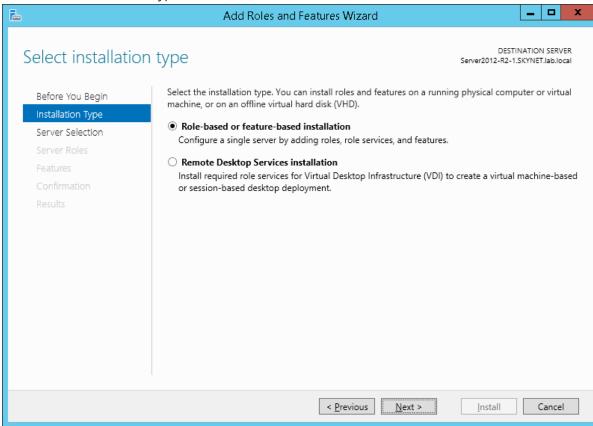


3. Verify that the prerequisites have been completed and click **Next** to continue.

B	Add Roles and Features Wizard	_		x
Before you begin Before You Begin Installation Type Server Selection Server Roles		ole serv	I SERVE .lab.loc vices,	ER cal
Features Confirmation Results	Start the Remove Roles and Features Wizard Before you continue, verify that the following tasks have been completed: • The Administrator account has a strong password • Network settings, such as static IP addresses, are configured • The most current security updates from Windows Update are installed If you must verify that any of the preceding prerequisites have been completed, close the complete the steps, and then run the wizard again. To continue, click Next.	wizaro	d,	
	Skip this page by default < Previous	С	ancel	



4. To select the installation type, select Role-based or feature-based installation and click Next.





5. To select the destination server, click **Select a server from the server pool**. Highlight the local server from the list and click **Next**.

B	Add Roles and Fe	atures Wizard		_ 🗆 X
Select destinatior	n server			INATION SERVER .SKYNET.lab.local
Before You Begin Select a server or a virtual hard disk on which to install roles and features.				
Installation Type	Select a server from the server p	ool		
Server Selection	O Select a virtual hard disk			
Server Roles	Server Pool			
Features				
Confirmation	Filter:			
Results	Name	IP Address	Operating System	m
	Server2012-R2-1.SKYNET.lab.local	10.10.6.20,	10.1 Microsoft Windo	ws Server 2012
	<	Ш		>
	1 Computer(s) found This page shows servers that are rur Add Servers command in Server Ma collection is still incomplete are not	nager. Offline servers and n		
		< <u>P</u> revious <u>N</u> ext :	> <u>I</u> nstall	Cancel



6. Selecting a server role is not required. Click Next.

B	Add Roles and Features Wizard	_ _ X
Before You Begin Installation Type Server Selection Server Roles Features Confirmation Results		DESTINATION SERVER Server2012-R2-1.SKYNET.lab.local Description Windows Server Update Services allows network administrators to specify the Microsoft updates that should be installed, create separate groups of computers for different sets of updates, and get reports on the computers and the updates that
	Remote Desktop Services]
	< <u>P</u> revious <u>N</u> ex	xt >Install Cancel



7. To select the feature, click to select Failover Clustering.

a	Add Roles and Features Wizard	_ D X				
Select features		DESTINATION SERVER Server2012-R2-1.SKYNET.lab.local				
Before You Begin Installation Type Server Selection	Select one or more features to install on the selected server. Features NET Framework 3.5 Features	Description Failover Clustering allows multiple				
Server Roles Features		servers to work together to provide high availability of server roles. Failover Clustering is often used for				
Confirmation Results	P Background intelligent transfer service (bits) BitLocker Drive Encryption BitLocker Network Unlock BranchCache Client for NFS Data Center Bridging Direct Play Enhanced Storage ✓ Failover Clustering Group Policy Management IIS Hostable Web Core Ink and Handwriting Services ✓	File Services, virtual machines, database applications, and mail applications.				
< <u>P</u> revious <u>N</u> ext > <u>Install</u> Cancel						



8. To add the additional features that are required for Failover Clustering, click Add Features.

Add Roles and Features Wizard	x
Add features that are required for Failover Clustering?	
The following tools are required to manage this feature, but do not have to be installed on the same server.	
A Remote Server Administration Tools]
▲ Feature Administration Tools	
▲ Failover Clustering Tools	
[Tools] Failover Cluster Management Tools	
[Tools] Failover Cluster Module for Windows PowerShe	
< III >	
✓ Include management tools (if applicable)	
Add Features Cancel	



9. To select the feature, click **Next** to continue.

a	Add Roles and Features Wizard	_ D X
E Select features Before You Begin Installation Type Server Selection Server Roles Features Confirmation Results	Select one or more features to install on the selected server. Features I.NET Framework 3.5 Features I.NET Framework 4.5 Features (2 of 7 installed) I.Background Intelligent Transfer Service (BITS) BitLocker Drive Encryption BitLocker Network Unlock BranchCache Client for NFS Data Center Bridging Direct Play Enhanced Storage	DESTINATION SERVER Server2012-R2-1.5KYNET.Jab.Jocal Description Failover Clustering allows multiple servers to work together to provide high availability of server roles. Failover Clustering is often used for File Services, virtual machines, database applications, and mail applications.
	Failover Clustering Group Policy Management IIS Hostable Web Core Ink and Handwriting Services III	
	< <u>P</u> revious <u>N</u> ext >	Install Cancel

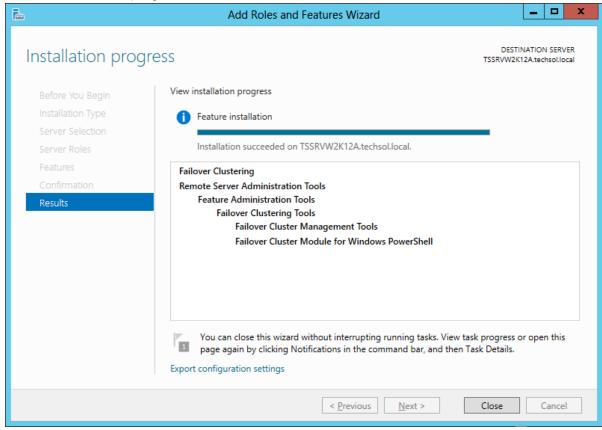


10. Confirm the installation selections, and click Install.

a	Add Roles and Features Wizard	_		x		
Confirm installation	on selections server2012-R2-1	INATION .SKYNET				
Before You Begin	To install the following roles, role services, or features on selected server, click Install.			,		
Installation Type	Restart the destination server automatically if required					
Server Selection	Optional features (such as administration tools) might be displayed on this page becaus been selected automatically. If you do not want to install these optional features, click P	~		aar		
Server Roles	their check boxes.					
Features	Failover Clustering					
Confirmation Results	Remote Server Administration Tools Feature Administration Tools Failover Clustering Tools Failover Cluster Management Tools Failover Cluster Module for Windows PowerShell					
	Export configuration settings Specify an alternate source path					
	< Previous Next > Install Cancel					



11. View the installation progress. Once the installation has succeeded, click Close.





3 Deploying storage in a cluster

It is recommended to first attach storage before validating and creating a cluster. A Failover cluster will, at minimum, require a quorum disk. Additional storage can then be added to the cluster to support file shares and applications.

3.1 Creating a cluster disk

In a Windows Server 2012 R2 Failover cluster, it is typically recommend to configure a quorum witness. A disk witness stores the cluster configuration database and should be excluded from backups and antivirus scanning. For additional information on quorum configurations, refer to <u>Configuring cluster quorum</u> <u>settings</u>.

To create a cluster disk for the quorum or application data:

- 1. Using Dell EqualLogic management tools, such as Group Manager or PowerShell Tools, create a volume in the Dell EqualLogic PS Series Group.
 - a. For a quorum disk witness, the minimum recommended size for an NTFS partition is 512 MB. It is possible, but not necessary, to use a larger size for a disk witness.
 - b. For a non-quorum cluster disk, such as a Cluster Shared Volume (CSV), size the volume as required for the workload requirements.
- 2. Modify the volume settings to **Allow simultaneous access to the volume from more than one iSCSI initiator**. This is required for cluster configurations.

	Modify v	olume settings		x	
Volume Server2	Volume Server2012-R2-ClusterQuorum				
General Space	Advanced				
Volume iSCSI setting	6				
iSCSI target: -52aed6-1	ec0a0b73-b2121	ab03b752d7f-server	2012-r2-clusterquoru	m 🗅	
Public alias. Server281	2-R2-ClusterGa	oram			
📝 Allow simultaneous g	connections from	initiators with differe	ent IQNs		
Allow only if your enviro	nment can safely	handle multiple initia	tors accessing the targ	let.	
Volume RAID prefere	nce			_	
Automatic					
RAID 50					
RAID <u>1</u> 0					
RAID <u>5</u>					
🔘 RAID <u>6</u>					
RAID 6 (<u>a</u> ccelerated)					
Thin provisioning mo	des				
Generate initiator err		avaina finik in avana	ded		
Leave online when n		-	ueu		
			OK Car	icel	



3. Configure access controls on the volume to allow access from each server in the planned cluster. This is required for cluster configurations. To help prevent data corruption, ensure that only the servers in the planned cluster can access the volume.

8		tekmktlab-10Gb PS Group Manager		_ _ ×
EqualLogic Group Manager				grandmin Logged in 1/16/14 9:01 AM Log out
Volumes Image: ProstCol_Copil_ Image: ProstCol_Copil_Copil_ Image: ProstCol_Copil_Copil_ Image: ProstCol_Copil_Copil_Copil_ Image: ProstCol_Copil_Copil_Copil_Copil_Copil_ Image: ProstCol_Copil_Cop	Volume Server/2012-22-Cluster-Ouo Activities Volume Server. Comment Server. Co	ses Snapshots Replication Collections Schedules Tol List read-write regroups ◎ Add es ◎ Add	Connections P edifesses Apple	Image: Section of the section of t
Tools 🗖	Alarms 🛞 0 🛕 3 🎴 0 🛛 Oper	ations 💥 0 📀 0		<i>∀</i> 0 5

4. For additional information on creating a volume and modifying volume access controls in a Dell EqualLogic Group, refer to <u>Appendix A</u>.

3.1.1 Making a volume available to Windows

- 1. From each server in the planned cluster, connect to the volume(s) using an iSCSI initiator.
 - a. When connecting to the target volume with the Microsoft iSCSI initiator, to ensure that the system will automatically attempt to restore the connection to the volume upon reboot, click **Add this connection to the list of Favorite Targets**.
 - b. To enable multi-path, click Enable multi-path.
 - c. Click OK.

Connect To Target	x
Target name: om.equallogic:0-565006-5e91a1201-0030000000552260-volume1	
Add this connection to the list of Favorite Targets. This will make the system automatically attempt to restore the connection every time this computer restarts.	
Enable multi-path	
Advanced OK Cancel	



- 2. From any server in the planned cluster, initialize, online, and format the disks. This is not required to be performed on each server.
 - a. For the partition style, Master Boot Record (MBR) or GUID Partition Table (GPT) are supported.
 - b. It is recommended to use Basic disks with an NTFS partition.
 - c. For a quorum disk witness:
 - i. NTFS and ReFS are supported
 - ii. Should be a dedicated volume
 - iii. Does not need a drive letter assignment
 - iv. Cannot be a CSV
 - d. For CSV, partitions can use NTFS or ReFS (in Server 2012 R2 and later).

Note: Certain features, such as Offloaded Data Transfers (ODX) are not supported on ReFS.

Note: For identification purposes, it is recommended to specify Windows volume labels that match the volume name in the Dell EqualLogic Group.

3. The volume is now available to Windows and is ready to store data and be added to the cluster. For additional information on making a Dell EqualLogic volume available to Windows, refer to <u>Appendix A</u>.



4 Validating a cluster configuration

The Validate a Configuration Wizard provides a set of tests for servers, network and storage to assess and report on how well the cluster hardware and software can support Failover clustering.

Note: It is strongly recommended to validate a cluster configuration with all tests before the cluster is created. It is also possible to perform validation after the cluster is created. However, attached storage and other resources may become unavailable to the cluster during tests.

1. From any server in the planned cluster, launch Failover Cluster Manager.

唱	Failo	ver Cluster Manager			_ 🗆 X
<u>File Action View H</u> elp					
📲 Failover Cluster Manager	Failover Cluster Manager		^	Actions	
	Create failover clusters, validate hardware for pr configuration changes to your failover clusters.	otential failover clusters, and perform		Failover Cluster Manager	•
	configuration changes to your failover clusters.			Validate Configuration	
	- Overview			🖏 Create Cluster	
	Overview	· · · · · · · · · · · · · · · · · · ·		Connect to Cluster	
	A failover cluster is a set of independent computers the availability of server roles. The clustered servers (calle	d nodes) are connected by physical		View	•
	cables and by software. If one of the nodes fails, anoth This process is known as failover.	er node begins to provide services.		Q Refresh	
				Properties	
	∧ Clusters			Help	
	Name	Role Status			
	No items found.				
			≡		
	 Management 				
	To begin to use failover clustering, first validate your h	ardware configuration, and then			
	create a cluster. After these steps are complete, you o cluster can include copying roles to it from a cluster ru Windows Server 2012, or Windows Server 2008 R2.	an manage the cluster. Managing a			
		,			
	Validate Configuration				
	Create Cluster				
	Connect to Cluster				
	More Information				
	Failover cluster topics on the Web				
	Failover cluster communities on the Web		~		
	Microsoft support page on the Web		~		



2. From the Action Menu, select Validate Configuration.

輼		
File	Action View Help	
(=	Validate Configuration	
I I I I I I I I I I I I I I I I I I I	Create Cluster Connect to Cluster Refresh Properties Help	Failover Cluster Manager Create failover clusters, Overview
		A failover cluster is a set of ind begins to provide services. Thi

3. Note that storage resources connected to the server may become unavailable to the cluster during the validation. To continue, click **Next**.

- M	Validate a Configuration Wizard	x
Before Yo	ou Begin	
Before You Begin Select Servers or a Cluster Testing Options Confirmation Validating Summary	This wizard runs validation tests to determine whether this configuration of servers and attached storage is set up correctly to support failover. A cluster solution is supported by Microsoft only if the complete configuration (servers, network, and storage) passes all tests in this wizard. In addition, all hardware components in the cluster solution must be "Certified for Windows Server 2012 R2." If you want to validate a set of unclustered servers, you need to know the names of the servers. Important: the storage connected to the selected servers will be unavailable during validation tests. If you want to validate an existing failover cluster, you need to know the name of the cluster or one of its nodes. You must be a local administrator on each of the servers that you want to validate. To continue, click Next. More about cluster validation tests	
	<u>N</u> ext > Cancel]

4. Add the names of all servers in the planned cluster, and click **Next**.

刺	Valio	late a Configuration Wizard	x
Select Se	ervers or a Cluster		
Before You Begin Select Servers or a Cluster		rs, add the names of all the servers. , add the name of the cluster or one of its nodes.	
Testing Options Confirmation Validating Summary	Enter name: Selected servers:	Server2012-R2-1.SKYNET.lab.local Add Server2012-R2-2.SKYNET.lab.local Eemove < Previous Next > Cancel Cancel	



5. Select the testing options and click **Next**. It is recommended to select **Run all tests.** Microsoft will typically require a complete cluster validation report for support issues related to Failover clustering.

- W	Validate a Configuration Wizard	x
Testing C	Options	
Before You Begin Select Servers or a Cluster	Choose between running all tests or running selected tests. The tests examine the Cluster Configuration, Hyper-V Configuration, Inventory, Network, Storage, and	
Testing Options Confirmation Validating	System Configuration. Microsoft supports a cluster solution only if the complete configuration (servers, network, and storage) can pass all tests in this wizard. In addition, all hardware components in the cluster solution must be "Certified for Windows Server 2012 R2."	
Summary	Run all tests (recommended)	
	 Run only tests I select 	
	More about cluster validation tests	
	< <u>P</u> revious <u>N</u> ext > Cancel]



6. If existing storage has been previously assigned to the cluster, optionally select the additional storage to validate, and click **Next**. Note that storage resources connected to the server may become unavailable during the validation.

N	Validate a Configuration Wizard	x
Review S	Storage Status	
Before You Begin Select Servers or a Cluster Testing Options Review Storage Status Confirmation Validating Summary	You can select additional storage to validate from the list below. Name Assigned To Server2012-R2-Cluster-Quorum Disk Witness in Quorum Server2012-R2-Cluster-vol1 Cluster Shared Volumes Server2012-R2-Cluster-vol2 Available Storage	
	< <u>P</u> revious <u>N</u> ext > C.	ancel

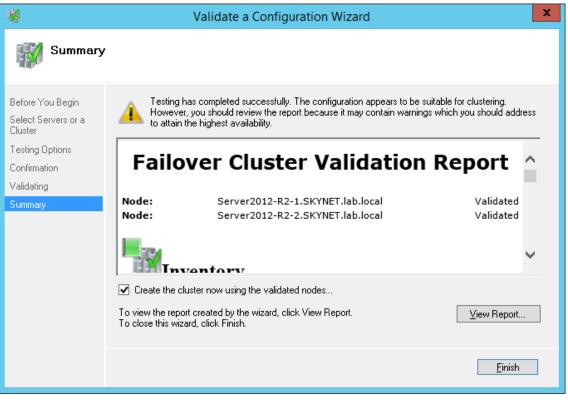


7. Review the settings, and click **Next** to continue.

N	Validate a Configuration	Wizard	x
Confirma	tion		
Before You Begin Select Servers or a Cluster	You are ready to start validation. Please confirm that the following settings are correct:		
Testing Options	Servers to Test		
Confirmation	Server2012-R2-1.SKYNET.lab.local		
Validating	Server2012-R2-2.SKYNET.lab.local		
Summary	Tests Selected by the User	Category	
	List Fibre Channel Host Bus Adapters	Inventory	
	List iSCSI Host Bus Adapters	Inventory	
	List SAS Host Bus Adapters	Inventory	
	List BIOS Information	Inventory	~
	List Environment Variables	Inventory	
	To continue, click Next.		
		< <u>P</u> revious <u>N</u> ext≻ Can	cel



- 8. Review the summary.
 - a. To view the report created by the wizard, click View Report.
 - b. If testing has completed successfully, optionally click to select **Create the cluster now using the validated nodes**. To close the wizard, click **Finish**.





9. Validation results can be additionally viewed in **%SystemRoot%\Cluster\Reports\Validation Report** *date and time*.html.

👪 l ⊋ 👪 = l	Reports	_ D X
File Home Share	View	~ 🔞
🗇 🗇 🔻 🚺 Ciw	′indows\Cluster\Reports ✓ ♥	Search Reports 🔎
🔆 Favorites	Name	·
🔤 Desktop	😰 Validation Report 2014.01.21 At 13.44	.04
🗼 Downloads	🙀 Validation Report 2014.01.17 At 15.48	.11
📃 Recent places	🙀 Validation Report 2014.01.16 At 10.50	.49 =
	📄 Validation Data For Node Set 709F1E	824E34CB140E50A044FFCAE4210C2B0
🌉 This PC	📄 ValidateStorage	
	📄 Spotfix_ResCluster Disk 3_Disk5Part1	
📬 Network	🙀 QuorumConfiguration	
	📆 HAVirtualMachine	~
	< III	>
10 items 1 item selected	618 KB	III 🖬



10. After the wizard has completed, the report displays the results in each category. All required tests must pass. In some instances, an acceptable warning will display. Thoroughly review the status of each item and ensure that any identified issues have been resolved. It may be necessary to rerun the Validate a Configuration Wizard multiple times until all items have been addressed.



Name	Result	Description
<u>List Disks</u>		Success
List Disks To Be Validated		Success
Validate CSV Network Bindings		Success
Validate CSV Settings		Success
Validate Disk Access Latency		Success
Validate Disk Arbitration		Success
Validate Disk Failover		Success
<u>Validate File System</u>		Success
Validate Microsoft MPIO-based disks		Success
Validate Multiple Arbitration		Success
Validate SCSI device Vital Product Data (VPD)		Success
Validate SCSI-3 Persistent Reservation		Success
Validate Simultaneous Failover		Success
Validate Storage Spaces Persistent Reservation		Success

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11. When troubleshooting issues or making changes to an existing cluster configuration, such as adding a new node, attaching new storage, and updating device drivers or networking and storage firmware - it may not be necessary to rerun all validation tests. Instead, optionally run specific tests related only the specific problem or configuration change that was made.

樹	Validate a Configuration Wizard	x
Test Sele	ection	
Before You Begin Select Servers or a Cluster Testing Options Test Selection Review Storage Status Confirmation Validating Summary	Select the tests that you want to run. A few tests are dependent on other tests. If you choose a dependent test, the test that it depends on will also run. Description Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image: Cluster Configuration Image:	
	< <u>P</u> revious <u>N</u> ext > Cancel	

Note: It is recommended to keep a small and unused volume available for storage validation. This allows the Validate a Configuration Wizard to run all of the required storage tests against that specific volume, without negatively impacting storage connectivity to other volumes that are in use by the cluster.

5 Creating a Failover cluster

- 1. It is recommended to logon to the server as a Domain Administrator with access to all of the servers in the planned cluster.
- 2. From any server in the planned cluster, launch Failover Cluster Manager.
- 3. From the Action menu, select Create Cluster.

闂	Failover Cluster Manager	x
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp		
🗢 🄿 🔽 🚺 🏹		
📲 Failover Cluster Manager	Enilover Cluster Manager	
	Validate Configuration Idate hardware for potential failover clusters, and perform Failover Cluster Manager	
	Create Cluster pur failover clusters. W Validate Configuration	
	Connect to Cluster	
R	View View Connect to Cluster	
	Refresh endent computers that work together to increase the view view	•
	Properties the nodes fails, another node begins to provide services.	
	Help Properties	
	∧ Clusters	
	Name Role Status	
	No items found.	
	E	
	Management	
	To begin to use failover clustering, first validate your hardware configuration, and then create a cluster. After these steps are complete, you can manage the cluster. Managing a cluster can include copying roles to it from a cluster running Windows Server 2012 R2, Windows Server 2012, or Windows Server 2008 R2.	
	Validate Configuration	
	Treate Cluster	
	Connect to Cluster	
	More Information	
	Failover cluster topics on the Web	
	Ealover cluster communities on the Web	
	Microsoft support name on the Wah	
This action launches a wizard tha	at will guide you through the process of creating a new cluster.	





4. Click **Next** to continue.

4 9	Create Cluster Wizard	x
Before Yo	ou Begin	
Before You Begin Select Servers Validation Warning Access Point for Administering the Cluster Confirmation Creating New Cluster Summary	This wizard creates a cluster, which is a set of servers that work together to increase the availability of clustered roles. If one of the servers fails, another server begins hosting the clustered roles (a process known as failover). Before you run this wizard, we strongly recommend that you run the Validate a Configuration Wizard to ensure that your hardware and hardware settings are compatible with failover clustering. Microsoft supports a cluster solution only if the complete configuration (servers, network, and storage) can pass all tests in the Validate a Configuration Wizard. In addition, all hardware components in the cluster solution must be "Certified for Windows Server 2012 R2." You must be a local administrator on each of the servers that you want to include in the cluster. To continue, click Next. More about Microsoft support of cluster solutions that have passed validation tests Do not show this page again	



5. Configure the Access Point for Administering the Cluster.

- a. Type the name to be used when managing the cluster.
- b. For each network to be used, click to select the network and provide a unique IP address.
- c. Click **Next** to continue.

Image: Second system Create Cluster Wizard						
Access Point for Administering the Cluster						
Before You Begin Access Point for Administering the Cluster	Type the name you want to use when administering the cluster. Cluster N <u>a</u> me: Server2012-R2-Cluster					
Confirmation Creating New Cluster	The NetBIOS name is limited to 15 characters. One or more IPv4 addresses could not be configur automatically. For each network to be used, make sure the network is selected, and then type a address.					
Summary	Networks Address Image: Constraint of the second sec					
	< <u>P</u> revious <u>N</u> ext > Cance	i				



6. Review the settings and click **Next** to continue.

Note: By default, the **Add all eligible storage to the cluster** option is selected. This will automatically add all volumes that are currently accessible by all cluster nodes as available storage to the cluster. If this option is selected, the smallest size volume may automatically be designated as a disk witness in the quorum. Once the cluster is created, it is recommended to verify that all disks were assigned properly. Optionally, click to deselect the **Add all eligible storage to the cluster** option if you want to configure storage later.

i		Create Cluster Wizard	x
Confirma	tion		
Before You Begin Access Point for Administering the	You are ready to creat The wizard will create	e a cluster. your cluster with the following settings:	
Cluster Confirmation	Cluster: Node: Node:	Server2012-R2-Cluster Server2012-R2-1.SKYNET.lab.local Server2012-R2-2.SKYNET.lab.local	^
Creating New Cluster Summary	Node: IP Address:	10.124.4.30	
			~
	Add all eligible stora		
	To continue, click Next		
		< <u>P</u> revious <u>N</u> ext > C	ancel



- 7. Review the summary.
 - a. To view the report created by the wizard, click **View Report**.
 - b. To close the wizard, click **Finish**.

a		Create Cluster Wizard	×
Summary			
Before You Begin Access Point for Administering the Cluster	You have suc	cessfully completed the Create Cluster Wizard.	
Confirmation		Create Cluster	^
Creating New Cluster			
Summary	Cluster: Node: Node: Quorum: IP Address: Warnings	Server2012-R2-Cluster Server2012-R2-1.SKYNET.lab.local Server2012-R2-2.SKYNET.lab.local Node and Disk Majority (Cluster Disk 1) 10.124.4.30	~
		ated by the wizard, click View Report. lick Finish.	⊻iew Report
			<u> </u>





6 Managing a cluster

Once a cluster has been created, you can connect to the cluster to configure and manage storage, quorum settings, networking and clustered roles.

6.1 Connecting to a cluster

- 1. Logon to the server as a Domain Administrator with access to all of the servers in the planned cluster.
- 2. From any server in the cluster, launch Failover Cluster Manager.
- 3. If required, connect to the cluster.
 - a. From the Action menu, select Connect to cluster.

罌		
File	Action View Help	
-	Validate Configuration	
瞾 F	Create Cluster	Follower Churchen Manageme
·益「	Connect to Cluster	Failover Cluster Manager
	Refresh	Create failover clusters,
	Properties	
	Help	 Overview

b. Enter the name of a cluster, a cluster node, or a clustered role, or select a previously connected cluster from the list and click **OK**.

嘲	Select Cluster
	Enter the name of a cluster, a cluster node, or a clustered role, or select a previously connected cluster from the list.
Cluster name:	<cluster on="" server="" this=""></cluster>
	<cluster on="" server="" this=""></cluster>
	server2012-r2-cluster.skynet.lab.local



6.2 Viewing disks in a cluster

- 1. From the left pane of **Failover Cluster Manager**:
 - a. Click to expand the cluster.
 - b. Click to expand **Storage**.
 - c. Click to select **Disks**. Disks that have already been added to the cluster are displayed in the right pane.

檻		Failover Cluster Ma	anager
File Action View Help Image: Constraint of the second seco			
 Hailover Cluster Manager ▲ Pailover 2012-R2-Cluster.SKYNET.lab.local ■ Roles 	Disks (7) Search	PQu	eries 🔻 🕁 👻
 Wodes Storage Disks Pools Networks Cluster Events 	Name Cluster Disk 3 Cluster Disk 4 Cluster Disk 5 Cluster Disk 6	Status Offline Offline Offline Offline Offline	Assigned To Available Storage Available Storage Available Storage Available Storage



6.3 Adding disks to a cluster

Before adding a disk to a cluster, you must first <u>create the cluster disk and make the volume available to</u> <u>Windows</u>.

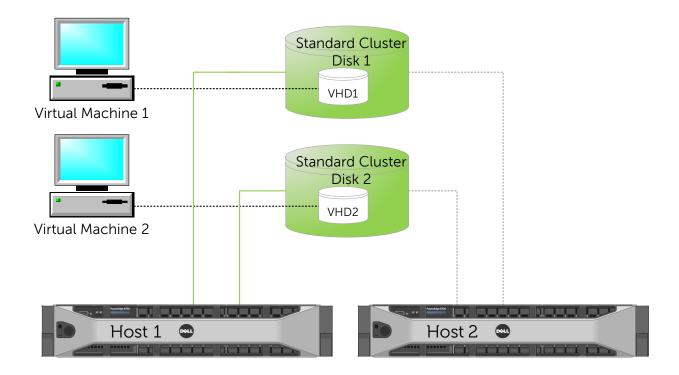
When adding disks to a cluster, there are two types of disks: Standard clustered disks and CSV:

• Standard clustered disk: A volume is able to be accessed by only one cluster node at a time. Only during a failover event can the volume be accessed by another single node. This event will failover the entire volume and impact every other resource on the shared disk. For example, with this limitation, each individual Hyper-V Virtual Machine requires its own dedicated standard clustered disk volume in order to be migrated or fail over independently of other virtual machines. With standard clustered disks, the number of managed volumes must increase with the addition of each virtual machine. This adds complexity to storage management of clustered virtual machines.

Refer to Figure 4 for an example of a Hyper-V environment using standard clustered disks.

• **CSV**: In contrast, CSVs are able to be accessed by all cluster nodes simultaneously. So, all virtual machines that are running across multiple cluster nodes can all access their Virtual Hard Disk (VHD) files at the same time, even though the VHD files potentially reside on a single CSV volume. In a CSV configuration, clustered virtual machines can fail over to another node seamlessly and independently of one another, without impacting other resources on the volume. You can easily continue to add additional virtual machines to a CSV without increasing complexity in storage management.

Refer to Figure 5 for an example of a Hyper-V environment using CSVs.



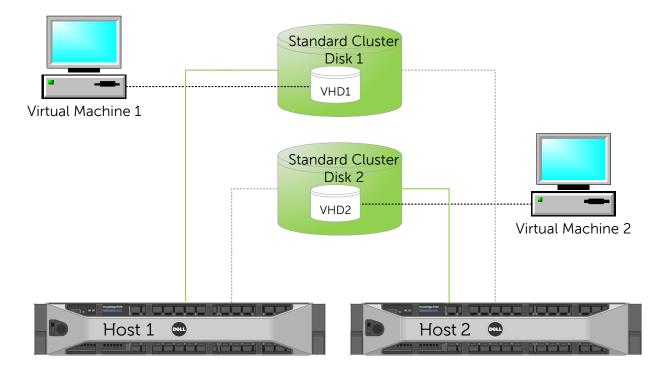


Figure 4 Hyper-V environment using standard clustered disks

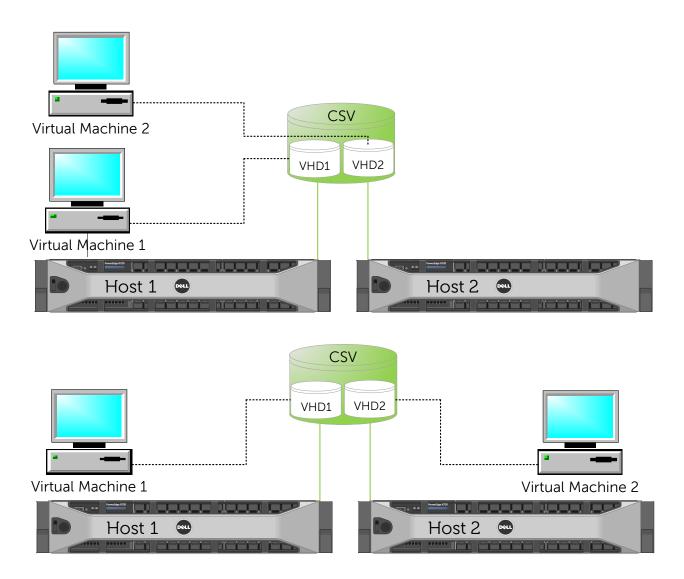
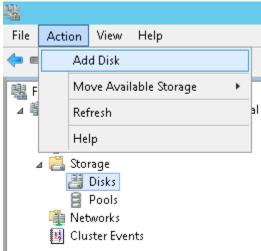


Figure 5 Hyper-V environment using Cluster Shared Volumes



To add a disk to a cluster:

- 1. From the left pane of **Failover Cluster Manager**:
 - a. Click to expand the cluster.
 - b. Click to expand **Storage**.
 - c. Click to select **Disks**.
- 2. From the Action menu, select Add disk.





3. Select the new disk or disks to add to the cluster. If during cluster creation, the option was selected to **Add all eligible storage to the cluster**, all volumes that were accessible by all cluster nodes at that time were already added as available storage to the cluster.

Add Disks to a Cluster					x	
Select the disk or disks	Select the disk or disks that you want to add.					
Available disks:						
Resource Name	Disk Info	Capacity	Signature/Id			
🗹 进 Cluster Disk 7	Disk 6 on node SERVER2012-R2-1	100 GB	189829175			
				OK	Cancel	

4. To add a disk to a CSV, refer to the section, <u>Adding a disk to a CSV</u>. For additional information on viewing disks in a cluster, refer to the section, <u>Viewing disks in a cluster</u>.



6.4 Renaming cluster disks

Note: For identification purposes, it is recommended to rename cluster disks to match the corresponding Windows volume names.

- 1. From the left pane of Failover Cluster Manager:
 - a. Click to expand the cluster.
 - b. Click to expand Storage.
 - c. Click to select **Disks**. Disks that have already been added to the cluster are displayed in the right pane.
 - d. Click to select a disk from the right pane. Notice that the corresponding volume is displayed in the bottom pane.

电 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이 이		
File Action View Help		
📲 Failover Cluster Manager	Disks (3)	
⊿ i Server2012-R2-Cluster.SKYNET.lab.local	Search	
📷 Roles 弾 Nodes	Name	Status
⊿ 📇 Storage	📇 Cluster Disk 1	🕥 Online
Disks Pools	📇 Cluster Disk 2	Online
📲 Pools 📲 Networks	📇 Cluster Disk 3	💿 Online
Cluster Events		
	Cluster Disk 1	
	Volumes (1)	
	Server2012-R2-ClusterQuorum (H:)	
	NTFS 961 MB free of 1.01 GB	



2. From the Action menu, select Properties.

輼					
File	Acti	on View Help			
= 🔷		Bring Online			
围F		Take Offline		Disks (3)	
⊿ 8		Information Details	ocal	Search	
		Show Critical Events		Name	Status
		More Actions		Cluster Disk 1	Online
		Properties		📇 Cluster Disk 2	Online
		Help		📇 Cluster Disk 3	💿 Online
	5	Cluster Events			
				V Cluster Disk 1	
				Volumes (1)	
				Server2012-R2-ClusterQuorum (H:)	
				NTFS 961 MB free of 1.01 GB	

3. For identification purposes, it is recommended to rename cluster disks to match the corresponding Windows volume names. Provide a name for the cluster disk, and click **OK**.

職 File Action View Help			Failover Cluster Mar
 Failover Cluster Manager Server2012-R2-Cluster.SKYNET.lab.local Roles Nodes Storage Disks Pools Networks Cluster Events 	Disks (3) Search Name Cluster Disk 1 Cluster Disk 2 Cluster Disk 3 ✓ Cluster Disk 1 Volumes (1) Server2012-R2-ClusterQuorum (H.) NTFS 961 MB free of 1.01 GB	Cluster Disk 1 Pr General Dependencies Policies Advantice Image: Server2012/B2/2017 Type: Physical Disk Type: Physical Disk Status: Online Disk number: 3 Image: Server2012/B2/B2/B2/B2/B2/B2/B2/B2/B2/B2/B2/B2/B2	ced Policies Shadow Copies



4. For identification purposes, it is recommended to rename all cluster disks to match the corresponding Windows volume names.

龝			
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp			
🗢 🔿 🖻 🖬 🛛			
📲 Failover Cluster Manager	Disks (3)		
▲ W Server2012-R2-Cluster.SKYNET.lab.local	Search		
📷 Roles			
📫 Nodes	Name	Status	
🔺 📇 Storage	📇 Server2012-R2-ClusterQuorum	🕜 Online	
📇 Disks	📇 Server2012-R2-Clustervol1	🕥 Online	
🗧 Pools	E Server2012-R2-Clustervol2	🕥 Online	
Cluster Events			

6.5 Configuring cluster quorum settings

A quorum configuration manages the number of failures that a cluster can handle. As it is critical that all cluster nodes are in sync with each other, if the number of failures exceeds what is specified by the quorum configuration, the cluster will stop running to avoid corruption.

When creating a cluster in Microsoft Windows Server 2012 R2, the best quorum configuration is automatically determined based on the number of nodes and availability of shared storage. The configuration can also be manually modified, if required. It is not typically recommended to modify the quorum configuration, unless a node has been added or removed from the cluster using a non-dynamic quorum configuration.

The available quorum configurations are:

- Node Majority: Recommended for clusters with an odd number of nodes. No quorum witness is configured.
- Node and Disk Majority: Recommended for clusters with an even number of nodes. Uses shared storage as a disk witness.
- Node and File Share Majority: For clusters with special configurations, such as multi-site clusters using storage replication or clusters with no shared storage. Uses a file share as a witness.
- No Majority: Disk Only: Not recommended, because a failure of the disk may become a single point of failure. Uses shared storage as a disk witness.

For additional information on quorum configurations, go to: <u>http://technet.microsoft.com/en-us/library/cc731739.aspx</u>

- 1. To select a quorum configuration option, from the left pane of **Failover Cluster Manager**:
 - a. Click to select the cluster.
 - b. From the Action menu, select More Actions > Configure Cluster Quorum Settings.

瓔								
File	Action	View	Help					
← ■	Va Vi	onfigure alidate Cl ew Valid dd Node	luster ation Repo	rt	al		Cluster Server2012-R2-Clus Summary of Clu	ster
	Re	ose Con eset Rece ore Actio	ent Events	•	-	Configure C	Name: Server2012-R2-Clust Name: Server2012-R2-Cluster Current Host Server: Server luster Quorum Settings	SKY
		efresh roperties				Copy Cluster		u
	-	elp				Destroy Clus		
			Move Core C Cluster-Awa	Cluster Resources re Updating	•			



- 2. Click to select one of the quorum configuration options. The default dynamic witness option significantly reduces the risk that the cluster will fail due to witness failure. In Windows Server 2012, it is required to configure a witness and manually adjust the quorum configuration if nodes are added or removed from the cluster. In Windows Server 2012 R2, it is no longer required to manually adjust the quorum configuration if node membership changes. By default, the cluster will determine the quorum management options, including the quorum witness. To bypass the default configuration and manually configure a disk witness, select from either the Select the quorum witness or Advanced quorum configuration options.
 - a. **Use default quorum configuration**: The cluster will determine the quorum management options, including the quorum witness.
 - b. **Select the quorum witness**: You can add or change the quorum witness. The cluster will determine the other quorum management options.
 - c. **Advance quorum configuration**: You determine the quorum management options such as the node voting configuration, including the quorum witness.

鼊	Configure Cluster Quorum Wizard						
Select Quorum Configuration Option							
Before You Begin	Select a quorum configuration for your cluster.						
Select Quorum Configuration Option	Use default quorum configuration						
Confirmation	The cluster determines quorum management options, including the quorum witness.						
Configure Cluster Quorum Settings	○ <u>S</u> elect the quorum witness						
Summary	You can add or change the quorum witness. The cluster determines the other quorum management options.						
	O Advanced quorum configuration						
	You determine the quorum management options, including the quorum witness.						
	Failover Cluster Quorum and Witness Configuration Options						
	< <u>Previous</u> <u>Next</u> > Cancel						



- 3. When selecting a quorum witness or advanced quorum configuration, to configure a disk witness, select **Configure a disk witness**.
 - a. Optionally, for clusters with special configurations, such as multi-site clusters using storage replication or clusters with no shared storage, you can **Configure a file share witness** by designating a file share that is not hosted by the cluster.

巃	Configure Cluster Quorum Wizard	x					
Select Q	Select Quorum Witness						
Before You Begin Select Quorum Configuration Option Select Quorum Witness Configure Storage Witness Configure Cluster Quorum Settings Summary	Select a quorum witness option to add or change the quorum witness for your cluster configuration. As a best practice, configure a quorum witness to help achieve the highest availability of the cluster. • Configure a gisk witness Adds a quorum vote of the disk witness Adds a quorum vote of the file share witness Adds a quorum vote of the file share witness Adds a quorum vote of the file share witness Do not gonfigure a quorum witness Failover Cluster Quorum and Witness Configuration Options						



b. Select the storage volume that you want to assign as the disk witness and click **Next**.

體	Configure Cluster Quorum Wizard						
Configure Storage Witness							
Before You Begin Select Quorum Configuration Option	Select the storage volume that you want to as	sign as the disk witne:	\$8.				
Select Quorum	Name	Status	Node	Location			
Witness	🔽 🖃 📇 Server2012-R2-ClusterQuorum	🕜 Online	Server2012-R2-2	Cluster Gr			
Configure Storage	Volume: (H)	File System: NTFS	961 MB free of 1.01 GB				
Witness	🔲 🖃 📇 Server2012-R2-Clustervol2	💿 Online	Server2012-R2-1	Available			
Confirmation	Volume: (I)	File System: NTFS	99.9 GB free of 100 GB				
Configure Cluster Quorum Settings							
Summary	<			>			
	Some storage resources are not listed be they are not online.	ecause they do not su < <u>P</u> reviou		rage or Cancel			

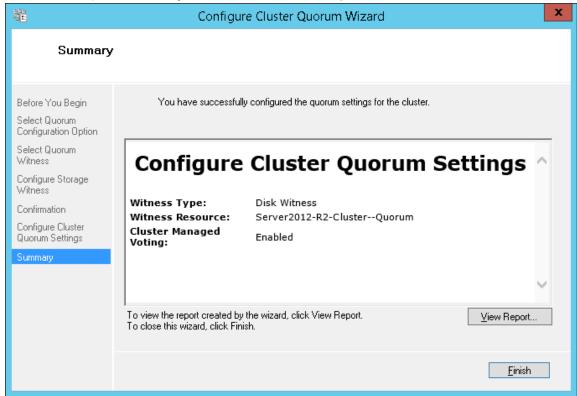


c. Review the settings and click **Next**.

體	Configure Cluster Quorum Wizard					
Confirmat	lion					
Before You Begin Select Quorum Configuration Option	You are ready to configure the	e quorum settings of the cluster.				
Select Quorum Witness	Witness Type: Witness Resource:	Disk Witness Server2012-R2-ClusterQuorum	^			
Configure Storage Witness	Cluster Managed Voting:	Enabled				
Confirmation	All nodes are configured	to have quorum votes				
Configure Cluster Quorum Settings	Your cluster quorum cor above.	figuration will be changed to the configuration shown				
Summary			\sim			
	, To continue, click Next.					
		< <u>P</u> revious <u>N</u> ext > Cance	9			



d. To view the report created by the wizard, click View Report. To close the wizard, click Finish.



4. After configuring the cluster quorum, it is recommended to run a **Validate Quorum Configuration** test to verify the quorum settings.

6.6 Validating quorum configuration

To validate the quorum configuration:

1. In Failover Cluster Manager, from the Action menu, select Validate Configuration.

Action	View	Help						
Val	idate Co	onfigurati	on					
Co Ref Pro	nnect to fresh operties		•				▲ ▲ A fi	Create failover clusters, Create failover clusters, Overview ailover cluster is a set of ind gins to provide services. Thi Clusters
	Val Cre Co Ref Pro	Validate Co Create Clu	Validate Configurati Create Cluster Connect to Cluster Refresh Properties	Validate Configuration Create Cluster Connect to Cluster Refresh Properties Help				



2. Select Run only tests I select, and click Next.

- W	Validate a Configuration Wizard						
Testing C	Options						
Before You Begin	Choose between running all tests or running selected tests.						
Testing Options Test Selection	The tests examine the Cluster Configuration, Hyper-V Configuration, Inventory, Network, Storage, and System Configuration.						
Review Storage Status	pass all tests in this wizard. In addition, all hardware components in the cluster solution must be "Certified						
Confirmation	for Windows Server 2012 R2."						
Validating							
Summary O Run <u>all tests (recommended)</u>							
	Run only tests I select						
	More about cluster validation tests						
	< <u>P</u> revious <u>N</u> ext > Cancel						



3. Click to de-select all test categories.

- N	Validate a Configuration Wizard	x
Test Sele	ection	
Before You Begin Testing Options Test Selection Confirmation Validating Summary	Select the tests that you want to run. A few tests are dependent on other tests. If you choose a dependent test, the test that it depends on will also run. Description Image: Cluster Configuration Inventory Inventory Network Image: Storage System Configuration	
	< <u>P</u> revious <u>N</u> ext > Cancel	



- 4. Click to expand **Cluster Configuration**.
 - a. Click to select Validate Quorum Configuration.
 - b. Click Next.

N	Validate a Configuration Wizard
Test Sele	ection
Before You Begin Testing Options Test Selection Confirmation Validating Summary	Select the tests that you want to run. A few tests are dependent on other tests. If you choose a dependent test, the test that it depends on will also run.
	< <u>P</u> revious <u>N</u> ext > Cancel

Yes!

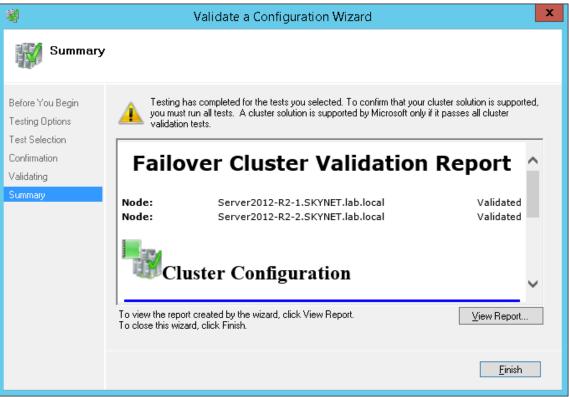


5. Review the settings, and click **Next**.

W	Validate a Configuration	Wizard	x
Confirma	lion		
Before You Begin Testing Options Test Selection	You are ready to start validation. Please confirm that the following settings are correct:		_
	Servers to Test		
Confirmation	Server2012-R2-1.SKYNET.lab.local		\sim
Validating	Server2012-R2-2.SKYNET.lab.local		
Summary			
·	Tests Selected by the User	Category	
	Validate Quorum Configuration	Cluster Configuration	~
	To continue, click Next.		
		< <u>Previous</u> <u>N</u> ext > Cance	!



- 6. Review the summary.
 - a. To view the report created by the wizard, click **View Report**. Thoroughly review the status of each item and ensure that any identified issues have been resolved.
 - b. To close the wizard, click Finish.





6.7 Configuring cluster networking

Cluster networks are automatically created for detected networks connected to all cluster nodes. Cluster networks can be configured for different purposes with the following options:

Table 2 Cluster network option	able 2	Cluster	network	options	5
--------------------------------	--------	---------	---------	---------	---

Setting	Description	Usage
Allow cluster communications (Cluster Only)	Only cluster nodes will use this network for internal cluster communications and CSV traffic.	 Often used for: Private networks Cluster traffic Heartbeat Hyper-V Live Migration
Allow cluster and client communications (Cluster and Client)	Cluster nodes and clients will use the network. Cluster IP Address resources (Highly Available virtual machines, SQL databases, File Servers, and other resources) can be created on this network for clients to connect to.	Often used for: Public networks Management networks Hyper-V Replica traffic Cluster traffic
Do not allow cluster network communications (None)	Cluster communications will not be sent over this network	Often used for: • iSCSI SAN

Note: It is recommended to allow cluster communications on multiple networks.



Refer to the following examples of common configurations for Private, Public and Storage cluster networks:

Network Name	Cluster Use						
Private	Cluster Only						
						Failove	r Cluster Manag
ile <u>A</u> ction <u>V</u> iew <u>H</u> elp							
• 🔿 🙍 🖬 👔							
📱 Failover Cluster Manager	Networks (3)					-	
I Server2012-R2-Cluster.SKYNET.I Roles	ab.local Search						
🐴 Nodes	Name 🔺	Status	Cluster Use	Information			
🔺 📇 Storage	🔢 Private	🕑 Up	Cluster Only				
E Disks Pools	Public	🕥 Up	Cluster and Client				
Networks	👫 Storage	🕥 Up	None				
📕 Cluster Events							
	👻 🌆 Priva	te					
	Name				Status	Owner Node	Information
)12-R2-1 - LAN5-OnBoard - Privat			🕥 Up	Server2012-R2-1	
		adcom BCM5709C NetXtreme II 0 ses:10.10.10.1	GigE (NDIS VBD Client) #3	37			
)12-R2-2 - LAN5-OnBoard - Privat		_	🕥 Up	Server2012-R2-2	
		adcom BCM5709C NetXtreme II (ses:10.10.10.3	GigE (NDIS VBD Client) #3	37			
		808.10.10.10.0					

Network Name	Cluster Use
Public	Cluster and Client

						Failove	er Cluster Manag
Eile Action View Help							
Eailover Cluster Manager	Networks (3) Search						
🧱 Roles 📫 Nodes	Name 🔺	Status	Cluster Use	Information			
🔺 📇 Storage	🔢 Private	🕥 Up	Cluster Only				
Disks	Public	🕥 Up	Cluster and Client				
Pools	Storage	🕥 Up	None				
题 Cluster Events	Y Public						
	Name				Status	Owner Node	Information
	 Server2012-R2-2 - Adapter: Intel(R) Gigabit IP V4 Addresses: 10.124 	ET Quad Port Sen	ver Adapter #4		🕐 Up	Server2012-R2-2	
	 E Server2012-R2-1 - I Adapter: Intel(R) Gigabit IP V4 Addresses: 10.124 	ET Quad Port Sen	ver Adapter #3		😰 Up	Server2012-R2-1	



Network Name	Cluster Use
Storage	None

趨						Failove	r Cluster Manager
<u> </u>							2
🗢 🔿 📶 🚺 🖬						_	
📲 Failover Cluster Manager	Networks (3)						
▲ 🎼 Server2012-R2-Cluster.SKYNET.lab.local	Search						
📷 Roles 弾 Nodes	Name 🔺	Status	Cluster Use	Information			
🔺 📇 Storage	Private	🕥 Up	Cluster Only				
Disks	🕕 Public	💽 Up	Cluster and Client				
Pools	🔢 Storage	💽 Up	None				
I Cluster Events							
	👻 🎼 Storage						
	Name				Status	Owner Node	Information
	Server2012-R2-1	-vEthernet (VM-SAN1) al Ethernet Adapter #4			🕐 Up	Server2012-R2-1	
	IP V4 Addresses: 10.1						
	🖃 🛒 Server2012-R2-2	- vEthernet (VM-SAN1)			💽 Up	Server2012-R2-2	
		al Ethernet Adapter #4					
I	IP V4 Addresses: 10.1	0.6.22					

Note: The iSCSI SAN network should be disabled for cluster communications so that the SAN can remain dedicated to storage related traffic.

To modify the settings for a cluster network:

- 1. From the left pane of **Failover Cluster Manager**:
 - a. Click to expand the cluster.
 - b. Click on Networks.
- 2. Networks that have already been added to the cluster are displayed in the right pane.
- 3. Click on a network to display the associated network adapters.
- 4. Right-click on the desired network and select Properties.

					Failover Cluster Manager
File Action View Help					
🍓 Failover Cluster Manager	Networks (2)				
∡ 10 Server2012-R2-Cluster.SKYNET.lab.local	Search				
🃫 Nodes	Name 🔺	Status	Cluster Use	Information	
⊿ 📇 Storage	🔢 Cluster Network 1	1nforma	tion Details]	
📇 Disks 🗧 Pools	Cluster Network 2		ritical Events		
Networks 10 Cluster Events		Propert	ies		
	V Cluster Network	: 1			
	Subnets: 10.10.0.0/1	16			



- 5. Select a configuration option, and click **OK**.
 - a. To allow cluster communication only:
 - i. Select Allow cluster network communication on this network.
 - ii. De-select Allow clients to connect through this network.
 - b. To allow cluster network and client communication:
 - i. Select Allow cluster network communication on this network.
 - ii. Select Allow clients to connect through this network.
 - c. To prevent a network from being used for cluster traffic (recommended for iSCSI Networks):
 - i. Select **Do not allow cluster network communications on this network**.

	Cluster Network 1 Properties
General	
	luster Network 1
<u>N</u> ame:	
Cluster Net	twork 1
C	Allow cluster network communication on this network
	Allow clients to connect through this network
•	Do not allow cluster network communication on this network
Status:	Up
Subnets:	10.10.0.0/16
	OK Cancel Apply

For additional information on configuring Windows Failover Cluster Networks, refer to: <u>http://blogs.technet.com/b/askcore/archive/2014/02/20/configuring-windows-failover-cluster-networks.aspx</u>.



6.8 High availability and clustered roles

Failover clustering provides high availability and scalability for file shares and applications such as Microsoft Exchange Server, Microsoft SQL Server and Hyper-V, as well as other clustered services and roles that run on Microsoft Windows. If one of the servers, referred to as a node, fails, other nodes in the cluster can continue to provide service for the resources that failed.

To create a clustered role:

- 1. From the left pane of **Failover Cluster Manager**:
 - a. Click to expand the cluster.
 - b. Right-click on Roles and select Configure Role.

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File Action	View Help
🗢 🄿 🗖 🗖	1
📲 Failover Clust	er Manager Ro
⊿ 📲 Server201	2-R2-Cluster.SKYNET.lab.local
🔚 Roles	
👰 Node	Configure Role
⊳ 📇 Stora ा∰ Netw	Virtual Machines 🕨 🕨
🧾 Clust	Create Empty Role
	View 🕨
	Refresh
	Help



2. From the **High Availability Wizard**, select the role to configure for high availability.

80	High Availability Wizard	x
to Select Ro	ole	
Before You Begin Select Role	Select the role that you want to configure for high availability: DFS Namespace Server DHCP Server Distributed Transaction Coordinator (DTC) File Server Generic Application Generic Service Hyper-V Replica Broker SSCSI Target Server	
	< <u>Previous</u> <u>Next</u> > Ca	incel

3. For additional information on creating a Highly Available virtual machine, refer to <u>Highly Available</u> <u>virtual machines</u>.



7 Cluster Shared Volumes

Cluster Shared Volumes (CSV) are a clustered NTFS (or ReFS in Windows Server 2012 R2) file system which enables multiple Failover cluster nodes to simultaneously maintain read-write access to a common volume. This distributed CSV architecture increases disk performance because disk I/O is load balanced across the cluster nodes. With CSVs, resources can fail over independently and seamlessly from one node to another, while allowing the volume to remain online and uninterrupted.

In contrast, since <u>standard clustered disks</u> (Non-CSV) can only be accessed by a single node at a time, resources on the volume cannot be failed over independently from each other. During failover events of standard cluster disks, all resources that use the volume all failover together. Therefore, if using standard clustered disks (non-CSV) it is recommended to maintain one virtual machine per disk.

CSVs are commonly used for:

- Clustering virtual hard disks (VHD) for Hyper-V virtual machines
- Scale-out file shares to store application data, such as SQL Server data and Hyper-V virtual machine files, for the Scale-Out File Server clustered role

Item	Description					
File System Format	Basic disk formatted with NTFS, or ReFS (Server 2012 R2 only)					
System Disk Drive Letter	The system disk drive letter must be the same on all nodes					
Disk Arrangement	Recommended to isolate system files/page files, and data files on separate CSVs					
Restrictions	 Cannot be used as a quorum disk Cannot be used as a Pass-Through disk for a virtual machine 					

Table 3	CSV requirements
---------	------------------



7.1 Adding a disk to a CSV

To add a disk to a CSV, you must first add a disk to the Available Storage group of the cluster (if it has not been previously added). Refer to the following sections for additional information:

- Creating a Cluster Disk
- Making a volume available to Windows
- Adding disks to a cluster
- <u>Renaming cluster disks</u>
 - 1. To add a disk in Available Storage to a CSV, from the left pane of Failover Cluster Manager:
 - a. Click to expand the cluster.
 - b. Click to expand Storage.
 - c. Click to select **Disks**.
 - 2. In the **Disks** pane, right-click on the desired disk from Available Storage and select **Add to Cluster Shared Volumes**.

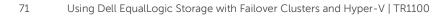
Name and State A								x		
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp										
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📲 Failover Cluster Manager	Disks (7)				Ac	tions				
▲ Herein Server2012-R2-Cluster.SKYNET.lab.local Roles	Search	Search 🔎 Queries 🔻 🕁 👻				Disks				
Nodes	Name		Status	Assigned To	4	Add Disk				
⊿ 📇 Storage	🕂 Cluster Disk 3		Offline	Available Storage	a	Move Available Storage		•		
📇 Disks	🕂 Cluster Disk 4		Online	Available Storage	=	View		•		
Pools	📇 Cluster Disk 5		Offline	Available Storage	a			-		
Ill Cluster Events	📇 Cluster Disk 6		Online	Available Storage	?			_		
	🔠 Server2012-R2-Cluster-Quoru	n	🕜 Online	Disk Witness in Quo	-			_		
	Every 2012-R2-Clustervol 1		Online	Available Storage	Se	rver2012-R2-Clustervol1		•		
	Server2012-R2-Clustervol2	5	Bring Online			Bring Online				
			Take Offline			Take Offline				
		<u>a</u>	Add to Cluster	luster Shared Volumes A		Add to Cluster Shared Volumes				
		8	Information Details		Information Details Show Critical Events					
		8	Show Critical Events							
			More Actions		•	More Actions		•		
			Remove			Remove				
			Properties			Properties				
	< III			🛛 🕜 Help						
	Server2012-R2-Cluster-vol 1									
	Volumes (1)									
	Server2012-R2-Cluster	rvol1	(G·)							
	NTFS 99.9 GB free of									
	< III									
Disks: Server2012-R2-Clustervol1				/				_		



- 3. Note that the disk has been added to Cluster Shared Volumes. Click to select the disk.
 - a. The CSV is now available as a Windows mount point, with a Cluster Shared Volume File System (CSVFS), to all cluster nodes. Make note of the mount point,

%SystemDisk%\ClusterStorage<<volume>>. This is the path that the cluster will use to access resources on the CSV. The CSVFS designation allows the cluster to differentiate the CSV from other NTFS or ReFS volumes. While CSVFS supports the same general functionality as NTFS or ReFS, certain storage features such as compression are not supported in Windows Server 2012 R2.

繊	Failover Cluster Manager								
<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp									
 Failover Cluster Manager Server 2012-R2-Cluster.SKYNET.lab.local Roles Nodes Storage Pools Networks Cluster Events 	Value Search Name Cluster Disk 3 Outer Disk 4 Outer Disk 5 Outer Disk 6 Server2012-R2-Cluster-vol1 Server2012-R2-Cluster-vol2	I1 (C:\ClusterStorag	Queries Queri	Actions Disks Image: Second Strate Storage View Image: Second Storage View Image: Second Storage View Image: Second Storage Image: Second Sto					
Disks: Server2012-R2-Clustervol1	< III		>						



7.2 Renaming CSVs

Note: For identification purposes, it is recommended to rename CSV mount points to match the corresponding cluster disk and NTFS volume names. It is recommended to first rename CSV mount points before configuring cluster resources, because renaming a CSV mount point for a CSV that has active cluster resources will cause the cluster resources to fail.

- 1. From the left pane of Failover Cluster Manager:
 - a. Click to expand the cluster.
 - b. Click to expand **Storage**.
 - c. Click to select **Disks**.
 - d. In the **Disks** pane, click to select the CSV.
 - e. In the **Volumes** section, make note of the mount point,

	Faile	over Cluster M	anager	
le <u>A</u> ction <u>V</u> iew <u>H</u> elp				
Failover Cluster Manager	Disks (7)			Actions
Server2012-R2-Cluster.SKYNET.lab.local	Search		🔎 Queries 🔻 🕁 💌 👽	Disks
🥞 Roles 👊 Nodes	Name	Status	Assigned To (🛃 Add Disk
⊿ 📇 Storage	Cluster Disk 3	Offline	Available Storage	📑 Move Available Storage
📇 Disks	Cluster Disk 4	Online	Available Storage	View
Pools	Cluster Disk 5	Offline	Available Storage	
Networks Cluster Events	Cluster Disk 6	Online	Available Storage	
tiuster Events	Server2012-R2-Cluster-Quorum	Online	Disk Witness in Quorum	I Help
	Server2012-R2-Clustervol1	Online	Cluster Shared Volume	Server2012-R2-Clustervol1
	Every Server 2012-R2-Clustervol 2	Online	Available Storage	🚱 Bring Online
				Take Offline
				Information Details
				Show Critical Events
				Move
				More Actions
				Remove from Cluster Shared Volumes
				Properties
	< 111		>	👔 Help
	Server2012-R2-Cluster-vol1			
	Volumes (1)			
	Server2012-R2-Clustervol1 (C:\ClusterStorage\Volume1) CSVFS 99.9 GB free of 100 GB			
	< III			
			>	
isks: Server2012-R2-Clustervol1				



- 2. From Windows Explorer, navigate to the mount point folder.
 - a. Right-click on the folder, and select Rename.

🕞 🚺 🗢 🛛					C	lusterStorage			 2		
ile Home Sha	re View										
) 🐵 👻 🕇 📕 🕨	This PC 🕨 Local Di	sk (C:) ► ClusterStorage ►					~ C			
Favorites	Name		•	Date m	odified	Туре	Size				
Desktop	🛃 Volume1		1	1/16/20	14 11:49 AM	File folder	104,859,64				
〕 Downloads			Open								
📃 Recent places			Open in new window								
			Share with	+							
📮 This PC			Restore previous versions								
			Pin to Start								
퇶 Network			Send to	×							
			Cut								
			Сору								
			Create shortcut								
		0	Delete								
		0	Rename								
			Properties								
tem 1 item selected											

b. Provide a name for the mount point. For identification purposes, it is recommended to rename CSV mount points to match the corresponding cluster disk and NTFS volume names.

📓 l 🕞 🚺 = l		ClusterStorage			- 0	x
File Home St	nare	View				× 🕐
🗲 🕘 🔻 1 퉱 I	• This	s PC 🔸 Local Disk (C:) 🔸 ClusterStorage	~ C	Search ClusterStorage	2	,c
🔆 Favorites	^	Name	Date modified	Туре	Size	
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1 item 1 item selecte	⊻ ≥d					



- 3. From the left pane of Failover Cluster Manager:
 - a. Click to expand the cluster.
 - b. Click to expand **Storage**.
 - c. Click to select **Disks**.
 - d. In the **Disks** pane, click to select the CSV.
 - e. In the **Volumes** section, make note of the newly renamed mount point. This is the path that the cluster will use to access resources on the CSV.

<u>F</u> ile <u>A</u> ction <u>V</u> iew <u>H</u> elp				
🗢 🔿 😰 🖬				
📲 Failover Cluster Manager	Disks (3)			
⊿ is Server2012-R2-Cluster.SKYNET.lab.local Roles	Search			
🗿 Nodes	Name	Status	Assigned To	0
⊿ 📇 Storage	Escret 2012-R2-Clustervol2	Online	Available Storage	5
📇 Disks	📇 Server2012-R2-ClusterQuorum	🕥 Online	Disk Witness in Quorum	5
🗧 Pools 🖼 Networks	E Server2012-R2-Clustervol1	🕜 Online	Cluster Shared Volume	Ş
📓 Cluster Events				
	Server2012-R2-Cluster	er-vol 1		
	Volumes (1)			\neg
	Server2012-R2-Cluster		torage\Server2012-R2-Cluster	∙vol1)



8 Hyper-V

Hyper-V enables you to create and manage a virtualized server environment. This virtualization capability maximizes the usage of physical hardware resources, such as CPU, network, storage and memory, by enabling those resources to be shared by multiple virtual machines. Hyper-V enables you to create virtual machines and manage their virtual resources. Each virtual machine runs an isolated instance of its own Operating System, referred to as a Guest Operating System.

Hyper-V can be installed on a single server or on multiple servers in a cluster to provide highly available resources, such as virtual machines, that can failover from one node to another in the event of failures. This level of availability is made possible by the usage of shared storage resources, such as SANs.

For more information on Hyper-V, refer to: <u>http://technet.microsoft.com/library/hh831531</u>

8.1 Hyper-V in a Failover cluster

Hyper-V Failover clustering steps:

- 1. Review Failover clustering steps
- 2. Ensure that Hardware-Assisted Virtualization and Data Execution Prevention are both enabled on the processor
- 3. Install the Hyper-V role on all cluster nodes
- 4. Configure virtual networks
- 5. Create a virtual machine
- 6. Configure a virtual machine for high availability
- 7. Install the Guest Operating System on the virtual machine
- 8. Modify virtual machine settings

8.2 Installing the Hyper-V role

Before enabling the Hyper-V role in Windows, ensure that Hardware-Assisted Virtualization and Data Execution Prevention are both enabled on the processor. The setting for Intel is **XD execute disable** and the setting for AMD is **NX no execute**.

Installing the Hyper-V role includes the required components and optional management tools. The required components include The Hyper-V hypervisor, Virtual Machine Management Service, a WMI provider, and other components such as the VMbus, Virtualization Service Provider (VSP) and Virtual Infrastructure Driver (VID).

The management tools for Hyper-V are: Hyper-V Manager GUI, a Microsoft Management Console snapin, Virtual Machine Connection Manager, and Hyper-V PowerShell cmdlets for optionally managing Hyper-V from a PowerShell interface.

The Hyper-V role must be added to each server in a Hyper-V Failover cluster.

- 1. Launch Server Manager.
- 2. Click on Add roles and features.

Server N	lanager • Dashboard		- 🕄 🏴 Manage Tools Yeaw Help
III Dashboard	WELCOME TO SERVER MANAGER		
Enshboard Coal Server All Server All Servers File and Storage Services ▷	COURCETART COURC	1 I I All Servers 1 O Manageability Events Services Performance BPA results	Hidr

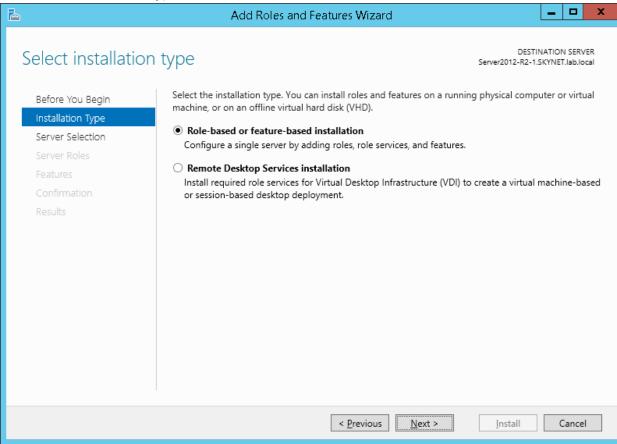


3. Verify that the prerequisites have been completed, and click **Next** to continue.

B	Add Roles and Features Wizard	-		x
Before you begin	DESTII Server2012-R2-1.	NATION SKYNET		
Before You Begin Installation Type Server Selection Server Roles Features Confirmation Results	 This wizard helps you install roles, role services, or features. You determine which roles, role features to install based on the computing needs of your organization, such as sharing do hosting a website. To remove roles, role services, or features: Start the Remove Roles and Features Wizard Before you continue, verify that the following tasks have been completed: The Administrator account has a strong password Network settings, such as static IP addresses, are configured The most current security updates from Windows Update are installed If you must verify that any of the preceding prerequisites have been completed, close the complete the steps, and then run the wizard again. To continue, click Next. Skip this page by default	ocume	nts, o	
	< Previous Next > Install	C	ancel	



4. To select the installation type, select **Role-based or feature-based installation** and click **Next**.





5. To select the destination server, click **Select a server from the server pool**. Highlight the local server from the list, and click **Next**.

a	Add Roles and	Features Wizard			-		x
Select destination	n server			DESTIN Server2012-R2-1.9			
Before You Begin Installation Type	Select a server or a virtual hard d		oles and featur	es.			
Server Selection	 Select a virtual hard disk 						!
Server Roles Features Confirmation	Server Pool						
Results	Name	IP	Address	Operating System	1		
	Server2012-R2-1.SKYNET.lab.loc Computer(s) found This page shows servers that are Add Servers command in Server 	III running Windows Serv Manager. Offline server		at have been adde	d by u	using	>
	collection is still incomplete are r	< <u>P</u> revious	<u>N</u> ext >	Install	0	Cancel	1



6. Click to select the **Hyper-V** role.

B	Add Roles and Features Wizard	_ _ ×
Select server roles Before You Begin Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration Default Stores Confirmation Results	Select one or more roles to install on the selected server. Roles Active Directory Certificate Services Active Directory Domain Services Active Directory Federation Services Active Directory Lightweight Directory Services Active Directory Rights Management Services Active Directory Rights Management Services Active Directory Rights Management Services Application Server DHCP Server DNS Server Fax Server File and Storage Services (2 of 12 installed)	DESTINATION SERVER Server2012-R2-1.5KYNET.Jab.Jocal Description Hyper-V provides the services that you can use to create and manage virtual machines and their resources. Each virtual machine is a virtualized computer system that operates in an isolated execution environment. This allows you to run multiple operating systems simultaneously.
	Hyper-V Network Policy and Access Services Print and Document Services Remote Access Remote Desktop Services	
	< <u>P</u> revious <u>N</u> e	ext > Install Cancel



7. Click Add Features to select the tools required to manage Hyper-V.

à	Add Roles and Features Wizard	x
_		
Ac	Id features that are required for Hyper-V?	
	following tools are required to manage this feature, but do not to be installed on the same server.	
⊿	Remote Server Administration Tools	
	▲ Role Administration Tools	
	▲ Hyper-V Management Tools	
	[Tools] Hyper-V Module for Windows PowerShell	
	[Tools] Hyper-V GUI Management Tools	
·	Include management tools (if applicable)	
	Add Features Cancel	



8. Click Next.

A	Add Roles and Features Wizard	_ D X
Select server roles Before You Begin Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration Default Stores Confirmation	Add Roles and Features Wizard Select one or more roles to install on the selected server. Roles Active Directory Certificate Services Active Directory Domain Services Active Directory Federation Services Active Directory Rights Management Services Active Directory Rights Management Services DHCP Server DNS Server Fax Server	DESTINATION SERVER Server2012-R2-1.SKYNET.lab.local Description Hyper-V provides the services that you can use to create and manage virtual machines and their resources. Each virtual machine is a virtualized computer system that operates in an isolated execution environment. This allows you to run multiple operating systems simultaneously.
Results	File and Storage Services (2 of 12 installed) Hyper-V Network Policy and Access Services Print and Document Services Remote Access Remote Desktop Services V	
	< <u>P</u> revious <u>N</u> ext	> Install Cancel

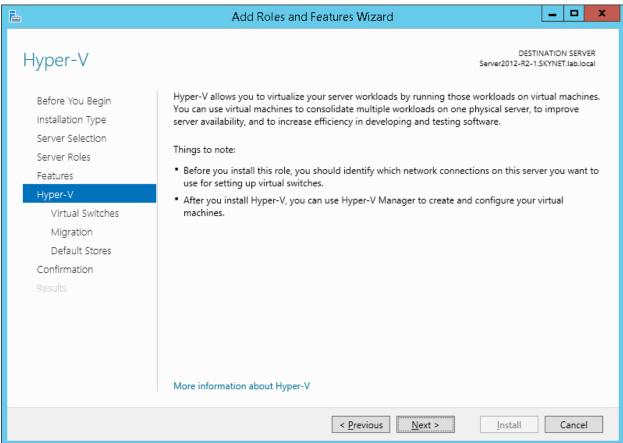


9. Selecting a feature is not required. Click **Next**.

a	Add Roles and Features Wizard	_ 🗆 X
Select features Before You Begin	Select one or more features to install on the selected server.	DESTINATION SERVER Server2012-R2-1.SKYNET.lab.local
Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration Default Stores Confirmation Results	Image: NET Framework 3.5 Features Image: NET Framework 4.5 Features (2 of 7 installed) Image: NET Framework 4.5 Features (2 of 7 installed) Background Intelligent Transfer Service (BITS) BitLocker Drive Encryption BitLocker Network Unlock BranchCache Client for NFS Data Center Bridging Direct Play Enhanced Storage Failover Clustering (Installed) Group Policy Management IIS Hostable Web Core Ink and Handwriting Services 	Description .NET Framework 3.5 combines the power of the .NET Framework 2.0 APIs with new technologies for building applications that offer appealing user interfaces, protect your customers' personal identity information, enable seamless and secure communication, and provide the ability to model a range of business processes.
	< III >	Install Cancel



10. Before installing the role, identify the network connections on the server to be used for virtual switches. Click **Next**.





11. Virtual machines require virtual switches to access network resources. A virtual switch is created for each network adapter that is selected. Click to select the network adapters to use for virtual switches. You can also bypass this step now – and later add, remove and modify virtual switches by using Virtual Switch Manager. For additional information on creating virtual switches, refer to: <u>Configuring Virtual Networks</u>.

B	Α	Add Roles and Features Wizard	_ □ >	x
Create Virtual Sw			DESTINATION SERVER 2012-R2-1.SKYNET.lab.local	
Before You Begin Installation Type Server Selection Server Roles Features	machines and attach them to a One virtual switch will be creat	ted for each network adapter you select. We recommend that you create at leas th connectivity to a physical network. You can add, remove, and modify your vir	t one virtual switch now	,
Hyper-V	Name	Description	^	1
Virtual Switches	LAN4-OnBoard	Broadcom BCM5709C NetXtreme II GigE (NDIS VBD Client)	≡	
Migration	LAN3-OnBoard	Broadcom BCM5709C NetXtreme II GigE (NDIS VBD Client)		
Default Stores	LAN1-PCI	Intel(R) Gigabit ET Quad Port Server Adapter	~]
Confirmation Results	We recommend that you a select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select it for use with a virted of the select of th	reserve one network adapter for remote access to this server. To reserve a netwo	ork adapter, do not	
		< <u>P</u> revious <u>N</u> ext >	nstall Cancel]



12. Because the server is part of a cluster, do not click to select **Allow this server to send and receive live migrations of Virtual Machines**. This step can be manually configured later using Failover Cluster Manager. Click **Next**.

B	Add Roles and Features Wizard	_ 🗆 X
Uirtual Machine N Before You Begin Installation Type		
Server Selection Server Roles Features Hyper-V Virtual Switches <u>Migration</u> Default Stores Confirmation Results	 Allow this server to send and receive live migrations of virtual machines Authentication protocol Select the protocol you want to use to authenticate live migrations. Use Credential Security Support Provider (CredSSP) This protocol is less secure than Kerberos, but does not require you to set up constrained delegation. To perform migration, you must be logged on to the source server. Use Kerberos This protocol is more secure but requires you to set up constrained delegation in your environment to perform live migration when managing this server remotely. If this server will be part of a cluster, do not enable migration now. Instead, you will configure the server for live n including specifying networks, when you create the cluster. 	tasks such as
	< Previous Next > Install	Cancel



- 13. Specify the default locations to store virtual hard disk and virtual machine configuration files.
 - a. To accept the defaults, click Next.
 - b. To specify an alternate location, such as an existing clustered volume, click **Browse**. If using a clustered volume, specify the volume as the location for the virtual machine VHD files, as well as the virtual machine configuration files.

à	Add Roles and Features Wizard	-	D X
Default Stores	DESTII Server2012-R2-1.	NATION SKYNET.I	
Before You Begin Installation Type Server Selection Server Roles	Hyper-V uses default locations to store virtual hard disk files and virtual machine configuration files, unless you specify locations when you create the files. You can change these default locations now, or you can change them later by mod settings. Default location for virtual hard disk files:	ifying H	Hyper-V
Features	C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks	Br	owse
Hyper-V	Default location for virtual machine configuration files:		
Virtual Switches	C:\ProgramData\Microsoft\Windows\Hyper-V	Br	owse
Migration			
Default Stores			
Confirmation Results			
Results			
	< <u>P</u> revious <u>Next</u> Install	Ca	ancel



14. Optionally, click to select **Restart the destination server automatically if required**. Confirm the installation selections, and click **Install**.

B	Add Roles and Features Wizard	x
Confirm installati		
Before You Begin	To install the following roles, role services, or features on selected server, click Install.	
Installation Type	Restart the destination server automatically if required	
Server Selection	Optional features (such as administration tools) might be displayed on this page because they have been selected automatically. If you do not want to install these optional features, click Previous to clear their check boxes.	
Server Roles	you do not want to install these optional features, click Previous to clear their check boxes.	
Features	Hyper-V	
Hyper-V	Remote Server Administration Tools	
Virtual Switches	Role Administration Tools Hyper-V Management Tools	
Migration	Hyper-V GUI Management Tools	
Default Stores	Hyper-V Module for Windows PowerShell	
Confirmation		
Results		
	Export configuration settings Specify an alternate source path	
	< <u>P</u> revious <u>N</u> ext > <u>I</u> nstall Cancel	

15. Review the summary, and click **Close**. A restart may be required.



8.3 Hyper-V cluster networking

In a Hyper-V cluster, plan for several varying types of network traffic. The different types of network traffic are summarized in the following table:

Network traffic type	Description
Management	Used to manage the Hyper-V Host Operating System and virtual machines
Cluster	Used for inter-node cluster communication, such as the cluster heartbeat
Live Migration	Used for virtual machine Live Migration between Hyper-V hosts
Storage	Used for iSCSI or SMB traffic
Virtual machine access	Used for virtual machine connectivity

Table 4Hyper-V cluster network traffic types

To simplify management and improve network security, isolate different types of network traffic. Refer to <u>Configuring Cluster Networking</u> for additional information on isolating network traffic, including the Storage network.

For additional network recommendations in a Hyper-V cluster in Windows Server 2012/R2, including optionally using Quality of Service (QoS) to converge multiple types of network traffic on network adapters, refer to: <u>http://technet.microsoft.com/en-us/library/dn550728.aspx</u>

8.3.1 Live Migration network

With Hyper-V Live Migration, virtual machines can move between Hyper-V hosts without experiencing downtime. Virtual machines can use Live Migration between nodes in the same cluster, between nodes in different clusters, or between a cluster and a stand-alone Hyper-V host. Thus, all Hyper-V hosts using Live Migration must be connected to a network that is configured to allow live migrations.

Live Migration traffic can saturate the network, so it is recommended to use a dedicated network for Live Migration.

Note: To use Live Migration in a Hyper-V cluster, it is recommended to use CSVs.

For additional information on Live Migration, refer to: <u>http://technet.microsoft.com/en-us/library/hh831435.aspx</u>



8.3.2 Configuring virtual networks

Hyper-V Manager can be used to configure virtual networks so that virtual machines can access network resources.

Similar to how a physical network switch provides network connectivity for physical devices, a Hyper-V virtual switch provides connectivity between virtual machines and the physical network.

There are three types of virtual switches:

Virtual switch type	Description		
External	 Provides connectivity to the physical network for virtual machines Binds to a physical network adapter on the Hyper-V host 		
Internal	 Provides connectivity between virtual machines, and between the virtual machines and the Hyper-V host Does not bind to a physical network adapter on the Hyper-V host. No access to physical network 		
Private	 Provides connectivity between virtual machines only Does not bind to a physical network adapter on the Hyper-V host. No access to physical network 		

Table 5Virtual switch types

In a Hyper-V cluster, create identical virtual switches on each cluster node to ensure that the virtual switch configuration is identical on each node. Refer to Figure 7 for an example of a virtual machine configured with multiple virtual switches for the LAN and SAN.

Note: To use Dell EqualLogic MPIO in a Windows Guest Operating System, configure the virtual machine with access to at least two virtual switches that are bound to physical iSCSI SAN adapters on the Hyper-V host and install the DSM feature of Dell EqualLogic Host Integration Tools for Microsoft on all Hyper-V hosts and Windows Guest Operating Systems.

To provide load-balancing and fault tolerance for non-ISCSI networks, consider using NIC teaming.



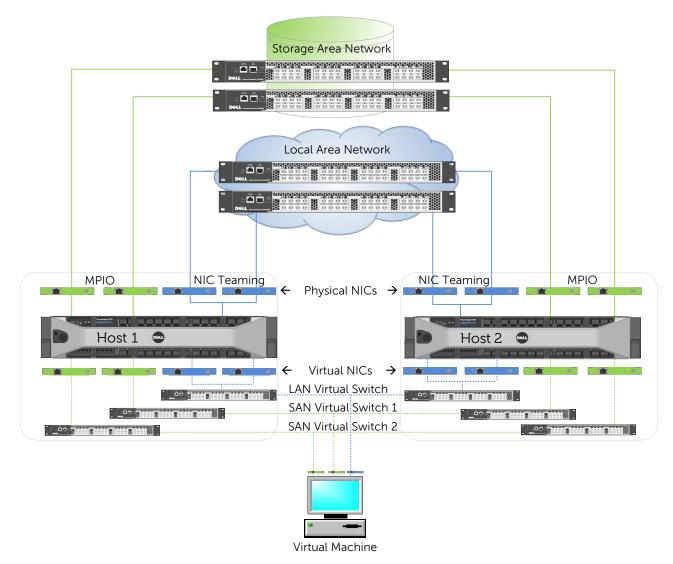


Figure 7 Hyper-V virtual machine configured with multiple virtual switches for LAN and SAN

To create an external Hyper-V virtual switch that will bind to a physical network adapter on the Hyper-V host:

- 1. Launch Hyper-V Manager.
- 2. If required, connect to the Hyper-V server.
- 3. Right-click on the Hyper-V server and select Virtual Switch Manager.

File Action View H	Help
🗢 🔿 🖄 🔝 👔	
Hyper-V Manager	
	New 🕨
	Import Virtual Machine
	Hyper-V Settings
	Virtual Switch Manager
	Virtual SAN Manager
	Edit Disk
	Inspect Disk
	Stop Service
	Remove Server
	Refresh
	View •
	Help
,	



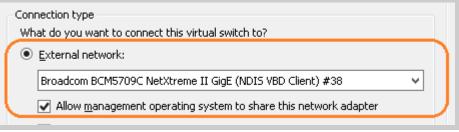
- 4. Click to highlight New virtual network switch.
 - a. Click to highlight **External**.
 - b. Click Create Virtual Switch.

👯 Virtual	Switch Manager for SERVER2012-R2-1
Xirtual Switches New virtual network switch Global Network Settings MAC Address Range 00-15-5D-06-15-00 to 00-15-5D-0	Create virtual switch
	Create Virtual Switch that binds to the physical network adapter so that virtual machines can access a physical network.



5. Specify the name and click to select the physical network adapter that the External virtual switch will bind to.

Note: If the Hyper-V host only has one physical network adapter, to avoid losing network connectivity during creation of the virtual switch, click to select **Allow management Operating System to share this network adapter**.





6. Create additional virtual switches, as required, to provide the virtual machine with connectivity to the networks used by the Hyper-V host. External virtual switches bind to physical network adapters on the Hyper-V host. To provide virtual machines with connectivity to the LAN and SAN for example, ensure that the correct adapters are selected for each virtual switch. If virtual machines will be using direct-attached storage by using the iSCSI initiator in the Guest Operating System, they will need access to virtual switches that are bound to the Hyper-V host's SAN adapters.

Note: To use Dell EqualLogic MPIO in a Windows Guest Operating System, create virtual switches for at least two SAN adapters on the Hyper-V host and install the DSM feature of Dell EqualLogic Host Integration Tools for Microsoft on all Hyper-V hosts and Windows Guest Operating Systems.

🕄 Virtual	Switch Manager for SERVER2012-R2-1
Virtual Switches New virtual network switch	📩 Virtual Switch Properties ————————————————————————————————————
WH-LAN1 Broadcom BCM5709C NetXtreme II	Name:
Broadcom BCM5709C NetXtreme II	Notes:
VM-SAN1 Intel(R) 10 Gigabit AF DA Dual Por WM-SAN2	<u>^</u>
Intel(R) 10 Gigabit AF DA Dual Por Global Network Settings	Connection type
MAC Address Range 00-15-5D-06-15-00 to 00-15-5D-0	What do you want to connect this virtual switch to?
	Intel(R) 10 Gigabit AF DA Dual Port Server Adapter #2 Broadcom BCM5709C NetXtreme II GigE (NDIS VBD Client) #36 Broadcom BCM5709C NetXtreme II GigE (NDIS VBD Client) #38 Intel(R) 10 Gigabit AF DA Dual Port Server Adapter Intel(R) 10 Gigabit AF DA Dual Port Server Adapter #2 Intel(R) Gigabit ET Quad Port Server Adapter #3 Intel(R) Gigabit ET Quad Port Server Adapter #4 Private network
	VLAN ID In Enable virtual LAN identification for management operating system The VLAN identifier specifies the virtual LAN that the management operating system will use for all network communications through this network adapter. This setting does not affect virtual machine networking. 2
	Remove SR-IOV can only be configured when the virtual switch is created. An external virtual switch with SR-IOV enabled cannot be converted to an internal or private switch.
	QK Cancel Apply

To provide load-balancing and fault tolerance for non-ISCSI networks, consider using NIC teaming.





7. In a Hyper-V cluster, create identical virtual switches on each cluster node and ensure that the virtual switch properties, including name and connection types, are identical.

🗱 Virtua	Il Switch Manager for SERVER2012-R2-1
Virtual Switches New virtual network switch	👯 Create virtual switch
🗉 💑 VM-LAN1	What type of virtual switch do you want to create?
Broadcom BCM5709C NetXtreme II	External Internal
Broadcom BCM5709C NetXtreme II	Private
VM-SAN1 Intel(R) 10 Gigabit AF DA Dual Por	
🗉 💑 VM-SAN2	Create Virtual Switch
Intel(R) 10 Gigabit AF DA Dual Por Global Network Settings	
MAC Address Range	Creates a virtual switch that binds to the physical network adapter so that virtual machines can access a physical network.
00-15-5D-06-15-00 to 00-15-5D-0	
,	
	<u>QK</u> <u>Cancel</u> <u>Apply</u>
	J Switch Manager for SERVER2012_R2_2
	Il Switch Manager for SERVER2012-R2-2
Virtual Switches	Il Switch Manager for SERVER2012-R2-2
Virtual Switches New virtual network switch	
Image: Second State Image: Second State	Create virtual switch What type of virtual switch do you want to create? External
Virtual Switches New virtual network switch Jack VM-LAN2	Create virtual switch
Virtual Switches New virtual network switch wr4ual network switch wr4ual network switch wr4uax Broadcom BCM5709C NetXtreme II wr4veSAN2 Intel(R) 10 Glabit AF DA Dual Por @ w 4veSAN1	Create virtual switch do you want to create? Deternal
★ Virtual Switches ★ New virtual network switch ★ WH-LAN2 Broadcom BCM5709C NetXtreme II Broadcom BCM5709C NetXtreme II ★ WH-SAN2 InteR(R) 10 Gigabit AF DA Dual Por Broadcom Logabit AF DA Dual Por ★ WH-SAN1 InteR(R) 10 Gigabit AF DA Dual Por Broadcom Logabit AF DA Dual Por	
★ Virtual Switches ≪ New virtual network.switch WebLAN2 Broadcom BCM5709C NetXtreme II	Create virtual switch do you want to create? Deternal
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Virtual Switches New virtual network switch WeLAN2 Broadcom BCM5709C NetXtreme II WeSAN2 Intel(R) 10 Gigabit AF DA Dual Por WeSAN1 Intel(R) 10 Gigabit AF DA Dual Por WeLAN1 Broadcom BCM5709C NetXtreme II & Global Network Settings	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	
Yirtual Switches New virtual network switch WeV-LAN2 Broadcom BCM5709C NetXtreme II WV-SAN2 Intel(R) 10 Gigabit AF DA Dual Por WV-SAN1 Intel(R) 10 Gigabit AF DA Dual Por Get WV-LAN1 Broadcom BCM5709C NetXtreme II Global NetWork Settings WAC Address Range	

- 8. Upon creation of the Hyper-V virtual switches on the Hyper-V hosts, Virtual Ethernet Adapters are created for each virtual switch. To view the Virtual Ethernet Adapters used by the virtual switches:
 - a. Launch: Control Panel\Network and Internet\Network Connections.
 - b. Each Virtual Ethernet Adapter will include the virtual switch name.

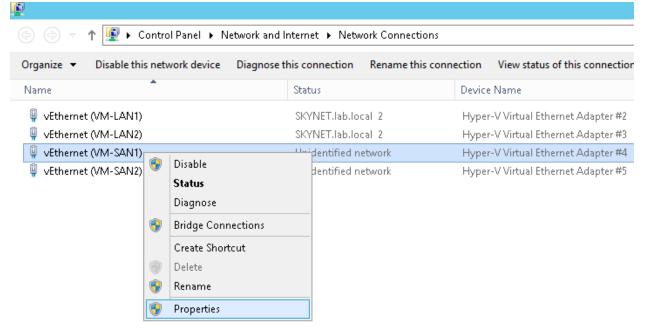
ø	Network Connections	_ _ X		
🍥 💿 🕆 🖳 🕻 Control Panel 🔸 Network and Internet 🔸 Network Connections 🔹 🗸 Search Network Connections 🔎				
Organize 🔻		III 👻 🗔 🥝		
Name	Status	Device Name		
📱 vEthernet (VM-LAN1)	SKYNET.lab.local 2	Hyper-V Virtual Ethernet Adapter #2		
📱 vEthernet (VM-LAN2)	SKYNET.lab.local 2	Hyper-V Virtual Ethernet Adapter #3		
🚇 vEthernet (VM-SAN1)	Unidentified network	Hyper-V Virtual Ethernet Adapter #4		
💚 vEthernet (VM-SAN2)	Unidentified network	Hyper-V Virtual Ethernet Adapter #5		

8.3.3 Enable Jumbo Frames

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If using Jumbo Frames, enable it on all switches and NICS that use iSCSI traffic, including virtual switches and Virtual Ethernet Adapters. It is important to verify these settings on all nodes in a cluster, as well as in the Guest Operating System.

1. To enable Jumbo Frames on a physical or Virtual Ethernet Adapter, Right-click on the adapter used for iSCSI traffic and select **Properties**.



2. Click on **Configure**.

VEthernet (VM-SAN1) Properties
Networking Sharing
Connect using:
Hyper-V Virtual Ethernet Adapter #4
<u>C</u> onfigure
This connection uses the following items:
Client for Microsoft Networks Microsoft Failover Cluster Virtual Adapter Performance Microsoft Failover Cluster Virtual Adapter Performance File and Printer Sharing for Microsoft Networks QoS Packet Scheduler A Hyper-V Extensible Virtual Switch Microsoft Network Adapter Multiplexor Protocol A Link-Layer Topology Discovery Mapper I/O Driver Image: A standard descent and the standard d
Install Uninstall Properties
Description Allows your computer to access resources on a Microsoft network.
OK Cancel



3. In the Advanced tab, verify that Jumbo Frames are enabled. This should be confirmed on all physical and virtual network adapters that are used for iSCSI traffic.

Hyper-V Virtual Ethernet	Adapter #4 Properties 🛛 🗙
General Advanced Driver Details	Events
The following properties are available for the property you want to change on the on the right.	
Property:	<u>V</u> alue:
IPSec Offload IPv4 Checksum Offload Jumbo Packet Large Send Offload Version 2 (IPv4) Large Send Offload Version 2 (IPv6) Network Address TCP Checksum Offload (IPv4) TCP Checksum Offload (IPv6) UDP Checksum Offload (IPv6)	9014 Bytes 4088 Bytes 9014 Bytes Disabled
	OK Cancel



8.4 Creating a virtual machine

- 1. Launch Hyper-V Manager.
- 2. From the Action menu, select New -> Virtual Machine.

File Ac	tion View Help			
◈▫	New	•	Virtual Machine	
H H	Import Virtual Machine		Hard Disk	F
	Hyper-V Settings		Floppy Disk	1
	Virtual Switch Manager	T		
	Virtual SAN Manager			
	Edit Disk			
	Inspect Disk			
	Stop Service			
	Remove Server			
	Refresh			
	Help			

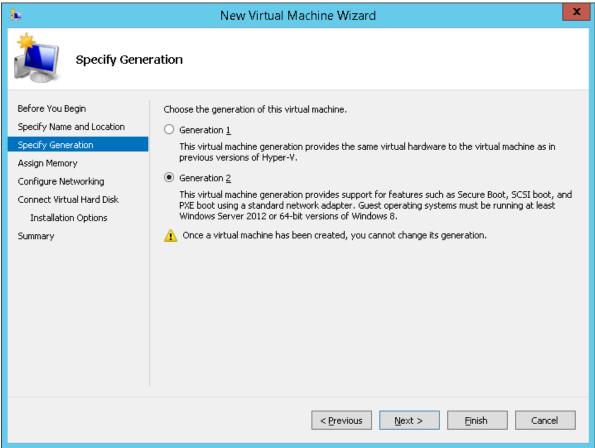


- 3. Specify the name and location for the virtual machine.
 - a. Use a descriptive name that helps you easily identify the virtual machine, such as the name of the Guest Operating System or application.
 - b. To store the virtual machine in a different location, such as shared SAN storage (recommended for High Availability), click to select Store the Virtual Machine in a different location and click Browse to specify the location. If using a clustered volume, specify the shared volume as the location for the virtual machine.

8	New Virtual Machine Wizard	x
Specify Name	e and Location	
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	Choose a name and location for this virtual machine. The name is displayed in Hyper-V Manager. We recommend that you use a name that helps you earlidentify this virtual machine, such as the name of the guest operating system or workload. Name: Windows Server 2012 - VM1 You can create a folder or use an existing folder to store the virtual machine. If you don't select a folder, the virtual machine is stored in the default folder configured for this server. ✓ Store the virtual machine in a different location Location: C:\ProgramData\Microsoft\Windows\Hyper-V\ Market If you plan to take checkpoints of this virtual machine, select a location that has enough free space. Checkpoints include virtual machine data and may require a large amount of space.	
	< Previous Next > Einish Cance	I



4. Specify the generation of the virtual machine. The generation of a virtual machine determines the hardware configuration that is available to the virtual machine. Once the virtual machine has been created, you cannot change its generation. There are two supported virtual machine generations: Generation 1 and Generation 2 (Server 2012 R2 and later).





Each Generation 1 virtual machine supports a maximum of four virtual IDE devices. Generation 1 virtual machines can boot to the virtual IDE controller using: VHD, VHDX, ISO files, Pass-through disk, physical CD/DVD drive, or SMB 3.0 file share. Generation 1 virtual machines also require virtual IDE to use CD/DVD drives or ISO images. The maximum size for a Generation 1 virtual machine boot volume is 2 TB.

Each Generation 1 virtual machine also supports up to four virtual SCSI controllers, with 64 devices per controller for a maximum of 256 devices. It is not possible to boot a Generation 1 virtual machine to the virtual SCSI controller. Generation 1 virtual machines also include support for virtual floppy controllers.

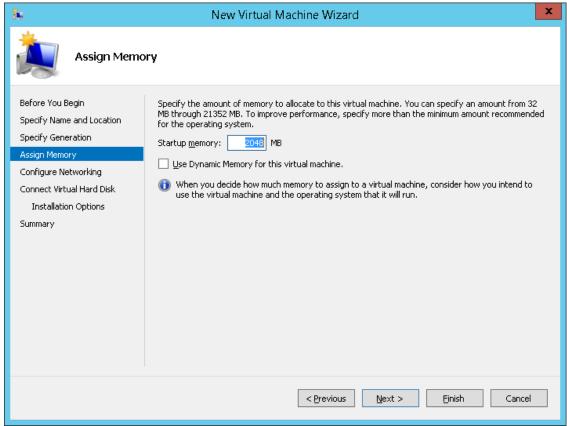
Generation 2 virtual machines no longer provide support for virtual IDE or floppy controllers. Each Generation 2 virtual machine supports up to four virtual SCSI controllers, with 64 devices per controller for a maximum of 256 devices. Generation 2 virtual machines can boot to the virtual SCSI controller using: VHDX, ISO files, Pass-through disk, physical CD/DVD drive, or SMB 3.0 file share. The maximum size for a Generation 2 virtual machine boot volume is 64 TB.

Generation 2 virtual machines support only VHDX files and do not support VHD.

For more information on virtual machine generations, refer to: <u>http://technet.microsoft.com/en-us/library/dn282285.aspx</u>



- 5. Specify the amount of memory to allocate to the virtual machine.
 - Optionally, click to select Use Dynamic Memory for this Virtual Machine. For additional information on Dynamic Memory, refer to: <u>http://technet.microsoft.com/en-us/library/hh831766.aspx</u>
 - b. Click Next.





6. To configure the virtual machine to connect to an existing virtual switch, click to select the virtual switch from the drop-down list. This can also be configured later by modifying the virtual machine's properties.

3e	New Virtual Machine Wizard
Configure Ne	tworking
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	Each new virtual machine includes a network adapter. You can configure the network adapter to use a virtual switch, or it can remain disconnected.
	< Previous Next > Einish Cancel



- 7. A virtual machine requires storage to install or run the Operating System and access data volumes. You can specify the storage during virtual machine creation or configure it later by modifying the virtual machine's properties.
 - a. To create a Virtual Hard Disk, click to select **Create a virtual hard disk.** Refer to <u>Creating a</u> <u>Virtual Hard Disk</u> for additional information.
 - b. To attach to an existing VHD, click to select **Use an existing virtual hard Disk**, and click **Browse** to specify the location of the existing VHD to attach to.
 - c. To connect the VHD later, click Attach a virtual hard disk later.
 - d. Click Next.

8	New Virtual Machine Wizard
Connect Vir	tual Hard Disk
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk Summary	A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties. C greate a virtual hard disk Use this option to create a VHDX dynamically expanding virtual hard disk. Name: Windows Server 2012 - VM1.vhdx Location: C:\ClusterStorage\Volume1\Virtual Hard Disks\Windows Server 201 Browse Size: 20 GB (Maximum: 64 TB) Location: ard Disks\Windows Server 2012 - VM1\SERVER2012-R2-VM1.VHDX Browse Attach a virtual hard disk later Use this option to skip this step now and attach an existing virtual hard disk later.
	< Previous Next > Finish Cancel

8. Review the summary. To create the virtual machine and close the wizard, click Finish.

8.5 Creating a Virtual Hard Disk

- 1. To create a new VHD, click to select **Create a new Virtual Hard Disk** and specify the name, location and size.
 - a. To store the VHD in a specific location, such as shared SAN storage (recommended for High Availability), click **Browse** to specify the location. If using a clustered volume, specify the shared volume as the location for the VHD.
 - b. Size the VHD according to the requirements for the Guest Operating System that will be installed.
 - c. Click Next.

30	New Virtual Machine Wizard	x
Connect Virt	ual Hard Disk	
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties. <u>G</u>reate a virtual hard disk Use this option to create a VHDX dynamically expanding virtual hard disk. Mame: Server 2012 - VM1.vhdx Location: C:\ClusterStorage\Volume1\Virtual Hard Disks\Windows Server 201 Browse Size: 20 GB (Maximum: 64 TB) Use this option to attach an existing VHDX virtual hard disk. Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Browse Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Use this option to attach an existing VHDX virtual hard disk. Location: C:\Users\Public\Documents\Hyper-V\Virtual Hard Disks\ Browse Attach a virtual hard disk later Use this option to skip this step now and attach an existing virtual hard disk later.	
	< <u>P</u> revious <u>N</u> ext > <u>F</u> inish Cance	1



- 2. You can install an Operating System during virtual machine creation, or you can install it later.
 - a. To install an Operating System later, click to select Install an Operating System later.
 - b. To install an Operating System from the network, click to select **Install an Operating System from a network-based installation server**. After the Virtual machine is created, you can start the virtual machine to boot to the network.
 - c. The Installation Options will vary depending on whether the virtual machine is Generation 1 or Generation 2. Refer to <u>Specify the generation of the virtual machine</u> for additional information.
 - i. Generation 1 virtual machine:
 - To install an Operating System from a bootable CD/DVD attached to the Hyper-V host or to specify a bootable ISO file, click to select **Install an Operating System from a bootable CD/DVD-ROM** and select an option. After the virtual machine is created, you can start it to boot to the CD/DVD or ISO.
 - To install an Operating System from a virtual floppy disk, click to select Install an
 Operating System from a bootable floppy disk and click Browse to specify a location.
 After the virtual machine is created, you can start it to boot to the virtual floppy disk.

30	New Virtual Machine Wizard
installation	Options
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	You can install an operating system now if you have access to the setup media, or you can install it later. Install an operating system later Install an operating system from a bootable CD/DVD-ROM Media Physical CD/DVD drive: Image file (.iso): er_2012_r2_with_update_x64_dvd_4065220.iso Browse Install an operating system from a bootable flgppy disk Media Virtual floppy disk (.vfd): Install an operating system from a network-based installation server
	< Previous Next > Finish Cancel



- ii. Generation 2 virtual machine:
 - To install an Operating System from a bootable ISO file, click to select Install an
 Operating System from a bootable image file and click Browse to specify the location of the ISO file. After the virtual machine is created, you can start the virtual machine to boot to the ISO.

30	New Virtual Machine Wizard	x
	Options	
Before You Begin Specify Name and Location Specify Generation Assign Memory Configure Networking Connect Virtual Hard Disk <u>Installation Options</u> Summary	You can install an operating system now if you have access to the setup media, or you can install it later. Install an operating system later Install an operating system from a bootable image file Media Image file (.iso): er_2012_r2_with_update_x64_dvd_4065220.iso Browse Install an operating system from a ngtwork-based installation server	
	< <u>Previous</u> <u>Next</u> > <u>Finish</u> Cance	I

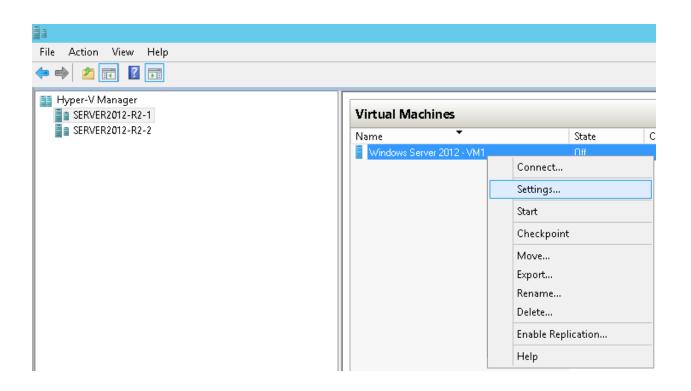
- d. Click Next.
- 3. Review the summary. To create the virtual machine and close the wizard, click **Finish**.

8.6 Modifying virtual machine settings

To view or modify virtual machine settings:

- 1. Launch Hyper-V Manager.
- 2. Right-click on the virtual machine and select Settings.

Note: Some settings can not be modified if the virtual machine is in the Running state. To modify a setting that is unavailable, first shut down the virtual machine. Also, some settings for clustered virtual machines must be modified through Failover Cluster Manager.



Note: If using a clustered virtual machine, specify the shared volume as the location for VHDs, Checkpoint File location, and Smart Paging File location.

- 3. Virtual machine configuration settings include:
 - a. Management Settings
 - Virtual machine name and description
 - Integration Services
 - Checkpoint File Location
 - Smart Paging File Location
 - Automatic Start/Stop Actions
 - b. Hardware Settings
 - Boot order
 - Memory
 - Processor
 - SCSI Controllers
 - Network Adapters

📧 Settings for Wi	ndows Server 2012 - VM1 on SERVER2012-R2-1 📃 💻 🗙
Windows Server 2012 - VM1 🔹 🗸	4 Þ 😡
 Hardware Add Hardware Firmware Boot from Hard Drive Memory 512 MB Processor 1 Virtual processor SCSI Controller Hard Drive SERVER2012-R2-VM1.VHDX Network Adapter VM-LAN1 Management Name Windows Server 2012 - VM1 Integration Services Some services offered Checkpoint File Location C:\ClusterStorage\Volume1\Virtual Smart Paging File Location C:\ClusterStorage\Volume1\Virtual Automatic Start Action Restart if previously running Automatic Stop Action Save 	Mdd Hardware You can use this setting to add devices to your virtual machine. Select the devices you want to add and click the Add button. SCSI Controller Network Adapter Fibre Channel Adapter Fibre Channel Adapter You can increase the storage available to a virtual machine by adding a SCSI controller and attaching virtual hard disks to it. A SCSI controller requires integration services in the guest operating system.
	<u>O</u> K <u>Cancel</u> <u>Apply</u>



8.7 Virtual machine storage options

There are multiple disk storage options for a virtual machine:

- <u>VHDs</u>
- Pass-through disks
- Direct-attached disks
- Server Message Block (SMB) file shares

8.7.1 VHDs

VHDs are files that reside on a physical disk which represent virtual hard disk drives. VHDs can store partitions, file systems, and data – just like physical disks can. VHDs are commonly used as storage for virtual machines. From a virtual machine, a VHD appears as a physical disk. It is recommended to store VHDs in a secure location.

Refer to Figure 8 for an example of a virtual machine configured with VHDs for boot and data volumes. The virtual machine does not require access to the SAN to use a VHD.

VHDs in Hyper-V can be of the VHD or VHDX format (VHDX is available in Windows Server 2012 and later).

- VHD supports a maximum storage capacity of 2 TB.
- VHDX supports a maximum storage capacity of 64 TB.

There are three types of VHDs:

Туре	Description
Fixed size	 Provides the best performance Recommended for applications with high disk activity The VHD file uses the entire size of the VHD The VHD file size is determined when the file is created and remains the same as data is written.
Dynamically expanding	 Provides more efficient usage of physical storage space Recommended for applications with lower disk activity The VHD file size automatically increases as data is written
Differencing	 Maintains a parent-child relationship with an existing parent disk Parent disk remains in-tact Differencing disks only contain the changes between itself (child) and the parent disk The differencing VHD file size automatically increases as data is written. Changes can be merged to the parent disk

Table 6	Virtual	Hard	Disk	types
Table 0	viituat	Taru	DISK	types



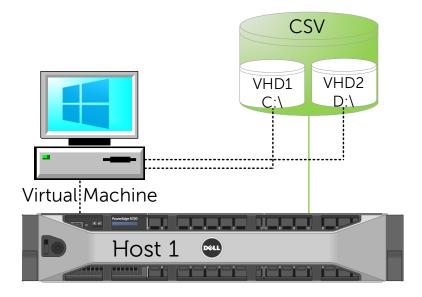


Figure 8 Hyper-V virtual machine configured with VHDs for boot and data volumes

Note: In Windows Server 2012 R2 and later, VHDs (VHDX only) can be shared by multiple virtual machines. A Shared VHDX can be used for clustering within the Guest Operating System. For additional information on VHD sharing, refer to: <u>http://technet.microsoft.com/en-us/library/dn281956.aspx</u>



8.7.2 Pass-through disks

A Pass-through disk is a physical hard disk (either locally or SAN-attached) on the Hyper-V host that is taken off-line and attached to from a virtual machine. Because the disk is offline on the Hyper-V host, a pass-through disk can only be accessed by the virtual machine. A CSV cannot be used as a Pass-through disk for a virtual machine.

Unlike VHDs, Pass-through disks cannot be dynamically expanding, and cannot use differencing disks or Hyper-V VHD snapshots. The virtual machine does not require access to the SAN to use a Pass-through disk.

Note: While VHDs have size limitations, (2 TB for VHD and 64 TB for VHDX), Pass-through disks and Direct-attached disks support sizes up to the maximum allowed by the Guest Operating System.

Refer to Figure 9 for an example of a virtual machine configured with a Pass-through disk. The disk is offline to the Hyper-V host and accessed directly from the virtual machine.

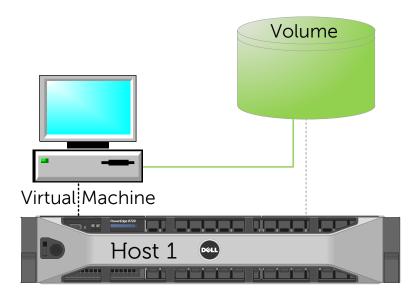


Figure 9 Hyper-V virtual machine configured with a Pass-through disk



8.7.3 Direct-attached disks

Direct-attached disks are iSCSI volumes that are connected to using an iSCSI initiator in the Guest Operating System. Direct-attached disks are not visible to the Hyper-V host and only accessible by the Guest Operating System running on the virtual machine.

Note: Windows Server 2012 and later also includes support for Direct-attached disks that use Virtual Fibre Channel, but this is unsupported for Dell EqualLogic iSCSI storage arrays.

Unlike VHDs, Direct-attached disks cannot be dynamically expanding, and cannot use differencing disks or Hyper-V VHD snapshots. VSS Hardware snapshots are supported for Direct-attached volumes in the Guest Operating System. The Dell EqualLogic Host Integration Tools for Microsoft includes a VSS Hardware Provider, as well as a VSS Requestor, Auto-Snapshot Manager/Microsoft Edition. For additional information, refer to: <u>Managing and Protecting a Windows Server Hyper-V Environment using Dell</u> <u>EqualLogic PS Series Storage Arrays and Tools</u>

Refer to Figure 10 for an example of a virtual machine configured with Direct-attached disks. The virtual machine accesses the volume directly and the volume is not visible to the Hyper-V host. The virtual machine requires access to the SAN Network to use a Direct-attached disk.



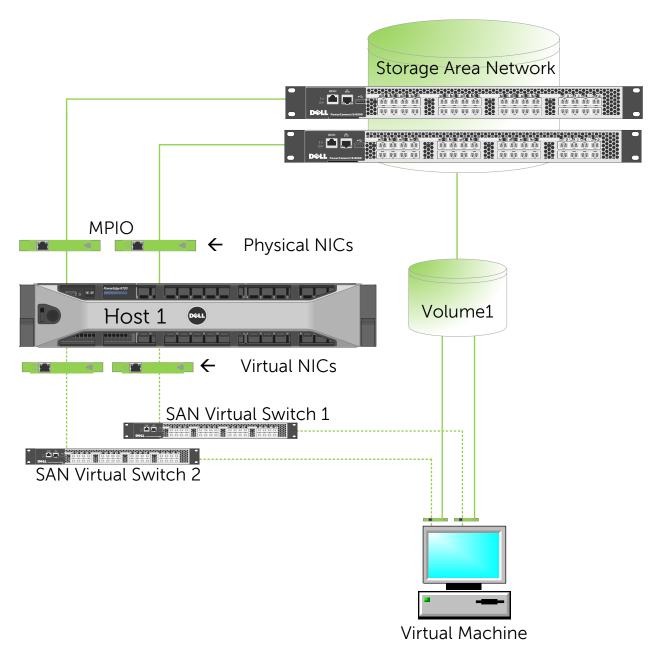


Figure 10 Hyper-V virtual machine configured with Direct-attached disks



8.7.4 Server Message Block (SMB) file shares

SMB is a network file sharing protocol that enables files or other resources to be created, accessed and modified on a remote server. Windows Server 2012 introduced version 3.0 of the SMB protocol. For additional information on SMB, refer to: http://technet.microsoft.com/en-us/library/hh831795.aspx

Files shares in Windows Server 2012 and Windows Server 2012 R2 can be used as storage for Hyper-V, to store virtual machine files such as VHDs, configuration files, and snapshots.

For additional information on deploying Hyper-V over SMB, refer to: <u>http://technet.microsoft.com/en-us/library/jj134187.aspx</u>



8.8 Attaching VHDs and Pass-through disks to virtual machines

- 1. Launch Hyper-V Manager.
- 2. Right-click on the virtual machine and select Settings.

File Action View Help				
🗢 🔿 📶 🛛 🖬				
Hyper-V Manager	Virtual Machines			
ERVER2012-R2-2	Name		State	C
	Windows Server 2012 - VM	41	Off	
		Cor	nnect	
		Set	tings	
		Sta	rt	
		Ch	eckpoint	
		Mo	ve	
		Exp	ort	
		Rer	name	
		Del	ete	
		Ena	able Replication	
		Hel	þ	



- 3. Click to highlight an IDE (Server 2012 or earlier only), or SCSI Controller.
 - a. Click to select **Hard Drive** and click **Add**.

2	Settings for Wi	ndows Server 2012 - VM2 on SERVER2012-R2-1 📃 💻 🗙
Wi	ndows Server 2012 - VM2 🛛 🗸	▲ ▶ Q.
	Hardware Add Hardware Add Hardware BIOS Boot from IDE Memory S12 MB Processor 1 Virtual processor IDE Controller 0 IDE Controller 1 SCSI Controller VM-LAN1 COM 1 None COM 2 None Diskette Drive None Management None Management None Management None Management Checkpoint File Location C:\ProgramData\Microsoft\Windo Smart Paging File Location C:\ProgramData\Microsoft\Windo Management Automatic Start Action Restart if previously running Automatic Stop Action Save	SCSI Controller You can add hard drives to your SCSI controller or remove the SCSI controller from the virtual machine. Click Add to add a new hard drive to this SCSI controller. Hard Drive Add You can configure a hard drive to use a virtual hard disk or a physical hard disk after you attach the drive to the controller. To remove the SCSI controller from this virtual machine, click Remove. All virtual hard disks attached to this controller will be removed but not deleted. Remove
,		<u>O</u> K <u>Cancel</u> Apply



- 4. You can attach to a VHD or Physical hard disk on the Hyper-V host (Pass-through disk).
 - a. To attach to a physical disk on the Hyper-V host (Pass-through disk):
 - i. Click to select **Physical hard disk** and select a disk from the drop-down menu. If the physical hard disk is not listed, first make sure the disk is offline in Disk Manager.
 - ii. Click **Apply**. After the virtual machine is started, the Guest Operating System can store data on the disk.

🔢 Settings fo	r Windows Server 2012 - VM2 on SERVER2012-R2-1 📃 💻 🗙
Windows Server 2012 - VM2	✓ 4 ▶ Q.
Hardware Hardware BIOS Boot from IDE Wemory 512 MB DE Controller 0 Hard Drive SERVER2012-R2-VM1.VHDX Hard Drive SERVER2012-R2-VM1.VHDX DE Controller 1 DVD Drive None SCSI Controller None SCSI Controller None SCSI Controller OND Inve None COM 1 None COM 2 None Diskette Drive None COM 2 None IDSecte Drive None COM 2 None None None None None No	 Hard Drive You can change how this virtual hard disk is attached to the virtual machine. If an operating system is installed on this disk, changing the attachment might prevent the virtual machine from starting. Controller: Location: SCSI Controller 0 (in use) Media You can compact, convert, expand, merge, reconnect or shrink a virtual hard disk by editing the associated file. Specify the full path to the file. Yirtual hard disk: Wirtual hard disk: Disk 4 100.00 GB Bus 0 Lun 0 Target 4 Disk 4 100.00 GB Bus 0 Lun 0 Target 4 Disk 4 100.00 GB Bus 0 Lun 0 Target 4 Disk 4 100.00 GB Bus 0 Lun 0 Target 13 To remove the virtual hard disk, click Remove. This disconnects the disk but does not delete the associated file.
,	<u>O</u> K <u>Cancel</u> <u>Apply</u>



b. To attach to an existing VHD, click to select **Virtual hard disk** and click **Browse** and specify the path.

Settings for '	Windows Server 2012 - VM2 on SERVER2012-R2-1
Windows Server 2012 - VM2 🔹 🗸] ◀ ▶ Q
★ Hardware ▲ ♥ Add Hardware ● BIOS Boot from IDE ● ● Memory 512 MB ● ● Processor 1 Virtual processor ● ■ IDE Controller 0 ● ■ ■ Hard Drive SERVER2012-R2-VM1.VHDX ● ■ ■ Hard Drive	 Hard Drive You can change how this virtual hard disk is attached to the virtual machine. If an operating system is installed on this disk, changing the attachment might prevent the virtual machine from starting. Controller: Location: SCSI Controller 0 (in use) Media You can compact, convert, expand, merge, reconnect or shrink a virtual hard disk by editing the associated file. Specify the full path to the file. Virtual hard disk:
SERVER2012-R2-VM1.VHDX IDE Controller 1 ODVD Drive None SCSI Controller Hand Drive <file></file>	O Physical hard disk: Disk 1 1.01 GB Bus 0 Lun 0 Target 7
Network Adapter VM-LAN1 COM 1 None COM 2 None Diskette Drive None Amanagement	If the physical hard disk you want to use is not listed, make sure that the disk is offline. Use Disk Management on the physical computer to manage physical hard disks. To remove the virtual hard disk, click Remove. This disconnects the disk but does not delete the associated file. Remove
 Name Windows Server 2012 - VM2 Integration Services Some services offered Checkpoint File Location C:\ProgramData\Microsoft\Win 	<u>Q</u> K <u>Cancel Apply</u>



c. To create a new VHD, click **New** to launch the New Virtual Hard Disk Wizard.

🗈 Settings fo	or Windows Server 2012 - VM2 on SERVER2012-R2-1 📃 💻 🗖	x		
Windows Server 2012 - VM2	✓ 4 ► Q.			
 ★ Hardware ▲ Add Hardware ▲ BIOS Boot from IDE ➡ Memory 512 MB ➡ Processor 1 Virtual processor ■ IDE Controller 0 ▲ Hard Drive SERVER2012-R2-VM1,VHDX ➡ IDE Controller 1 ▲ DVD Drive None ➡ SCSI Controller ♥ ➡ Hard Drive 	 Hard Drive You can change how this virtual hard disk is attached to the virtual machine. If an operating system is installed on this disk, changing the attachment might prevent the virtual machine from starting. Controller: Location: SCSI Controller Q (in use) Media You can compact, convert, expand, merge, reconnect or shrink a virtual hard disk by editing the associated file. Specify the full path to the file. Virtual hard disk:			
cfile> Metwork Adapter VM-LAN1 COM 1 None COM 2 None Diskette Drive None Management Name Windows Server 2012 - VM2 Integration Services Some services offered Checkpoint File Location C:\ProgramData\Microsoft\Win	If the physical hard disk you want to use is not listed, make sure that the disk is offline. Use Disk Management on the physical computer to manage physical hard disks. To remove the virtual hard disk, click Remove. This disconnects the disk but does not delete the associated file. Remove			
<u>O</u> K <u>Cancel</u> <u>Apply</u>				



i. Choose the disk format and click **Next**.

2	New Virtual Hard Disk Wizard	x
Choose Disk	Format	
Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary	What format do you want to use for the virtual hard disk? <u>V</u> HD Supports virtual hard disks up to 2,040 GB in size. v <u>H</u> DX This format supports virtual disks up to 64 TB and is resilient to consistency issues that might oc from power failures. This format is not supported in operating systems earlier than Windows Server 2012.	cur
	< <u>Previous</u> <u>N</u> ext > <u>Finish</u> Cance	



ii. Choose the VHD type, and click **Next**.

۵.	New Virtual Hard Disk Wizard
Choose Disk	Туре
Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary	 What type of virtual hard disk do you want to create? Figed size This type of disk provides better performance and is recommended for servers running applications with high levels of disk activity. The virtual hard disk file that is created initially uses the size of the virtual hard disk and does not change when data is deleted or added. Dynamically expanding This type of disk provides better use of physical storage space and is recommended for servers running applications that are not disk intensive. The virtual hard disk file that is created is small initially and changes as data is added. Differencing This type of disk is associated in a parent-child relationship with another disk that you want to leave intact. You can make changes to the data or operating system without affecting the parent disk, so that you can revert the changes easily. All children must have the same virtual hard disk format as the parent (VHD or VHDX).
	< Previous Next > Einish Cancel



- iii. Specify the name and location of the VHD, and click Next.
- iv. To store the VHD in a specific location, such as shared SAN storage (recommended for High Availability), click **Browse** to specify the location.
- v. Click Next.

2	New Virtual Hard Disk Wizard	x
Specify Nam	e and Location	
Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary	Specify the name and location of the virtual hard disk file. Name: New Virtual Hard Disk.vhdx Location: ::\ClusterStorage\Volume1\Virtual Hard Disks\Windows Server 2012 - VM2\]	Browse
	< <u>P</u> revious <u>N</u> ext > <u>E</u> inish	Cancel



vi. You can create a new blank VHD, copy the contents of an existing physical disk on the Hyper-V host, or copy the contents of an existing virtual hard disk. Select an option and click **Next**.

5	New Virtual Hard Disk Wizard	x
Configure I	Disk	
Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location	You can create a blank virtual hard disk or copy the contents Create a new blank virtual hard disk Size: 20 GB (Maximum: 64 TB) Copy the contents of the specified physical disk:	of an existing physical disk.
Configure Disk. Summary	Physical Hard Disk \\.\PHYSICALDRIVE0 \\.\PHYSICALDRIVE1 \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE3 \\.\PHYSICALDRIVE3 \\.\PHYSICALDRIVE4 \\.\PHYSICALDRIVE5 \\.\PHYSICALDRIVE6 O Copy the contents of the specified virtual hard disk Path: 1\Virtual Hard Disks\Windows Server 2012 - VM1\S	Size ▲ 279 GB ■ 1 GB ■ 74 GB ■ 50 GB ● 99 GB ♥ 500 GB ♥ 99 GB ♥ ERVER2012-R2-VM1,VHDX Browse
	< Previous Nex	kt > Finish Cancel

vii. To create the VHD and close the wizard, click **Finish**.



5. To save the settings, click **Apply**. After the Virtual machine is started, the Guest Operating System can store data on the disk.

Settings fo	r Windows Server 2012 - VM2 on SERVER2012-R2-1 📃 💻 🗙
Windows Server 2012 - VM2	✓ 4 ► Q.
 ★ Hardware Memory S12 MB ➡ Processor 1 Virtual processor ➡ IDE Controller 0 ➡ Hard Drive SERVER2012-R2-VM1.VHDX ➡ IDE Controller 1 ➡ DVD Drive None ➡ SCSI Controller ➡ Hard Drive None ➡ SCSI Controller ➡ Hard Drive None ➡ COM 1 None ➡ COM 2 None ➡ Diskette Drive None ▲ Management 	 Hard Drive You can change how this virtual hard disk is attached to the virtual machine. If an operating system is installed on this disk, changing the attachment might prevent the virtual machine from starting. Controller: Location: SCSI Controller Q (in use) Media Media You can compact, convert, expand, merge, reconnect or shrink a virtual hard disk by editing the associated file. Specify the full path to the file. Yirtual hard disk: SclusterStorage\Volume1\Virtual Hard Disks\Windows Server 2012 - VM2\Nev New Edit Inspect Browse Physical hard disk: Disk 1 1.01 GB Bus 0 Lun 0 Target 7 If the physical hard disk, vou want to use is not listed, make sure that the disk is offline. Use Disk Management on the physical computer to manage physical hard disk, click Remove. This disconnects the disk but does not delete the associated file.
Name Windows Server 2012 - VM2 Integration Services Some services offered Checkpoint File Location C:\ProgramData\Microsoft\Win	✓ OK Cancel Apply
	<u>QK</u> <u>Cancel</u> <u>Apply</u>

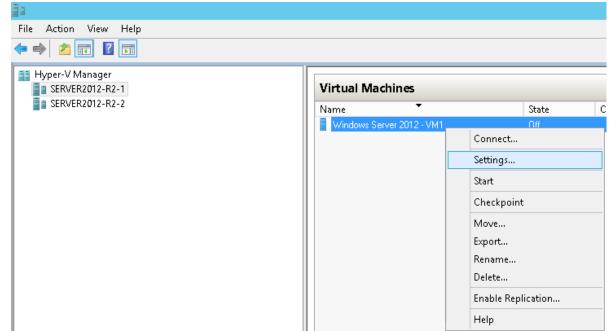


8.9 Using Direct-attached disks with virtual machines

In order for a Guest Operating System to access the iSCSI SAN, the virtual machine must be configured with virtual network adapters for virtual switches that are bound to the physical SAN adapters on the Hyper-V host.

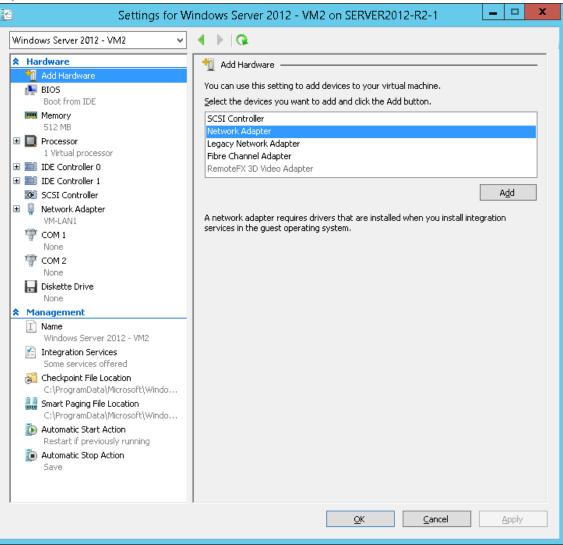
To configure a virtual machine with virtual network adapters:

- 1. Launch Hyper-V Manager.
- 2. Right-click on the virtual machine, and select Settings.





- 3. Click Add Hardware.
 - a. Click to select **Network Adapter** or **Legacy Network Adapter** (Generation 1 virtual machine only), and click **Add**.





b. Click to select a virtual switch that is bound to a physical adapter on the Hyper-V host and click **Apply**. In order for a virtual machine Guest Operating System to access the iSCSI SAN, the virtual machine must be configured with virtual network adapters for virtual switches that are bound to the physical SAN adapters on the Hyper-V host.

🔢 Settings for W	indows Server 2012 - VM2 on SERVER2012-R2-1 📃 💻 🗙
Windows Server 2012 - VM2 🗸 🗸	4 ▶ Q.
 ★ Hardware M Add Hardware BIOS Boot from IDE Memory S12 MB S12 MB Processor Virtual processor IDE Controller 0 IDE Controller 1 	
SCSI Controller Network Adapter VM-LAN1	2 Bandwidth Management
 Network Adapter Not connected COM 1 None COM 2 None Diskette Drive None Management Name Windows Server 2012 - VM2 Integration Services Some services offered Checkpoint File Location C:\ProgramData\Microsoft\Windo Smart Paging File Location C:\ProgramData\Microsoft\Windo Smart Paging File Location C:\ProgramData\Microsoft\Windo Automatic Start Action 	Enable bandwidth management Specify how this network adapter utilizes network bandwidth. Both Minimum Bandwidth and Maximum Bandwidth are measured in Megabits per second. Minimum bandwidth: Maximum bandwidth: Mbps To leave the minimum or maximum unrestricted, specify 0 as the value. To remove the network adapter from this virtual machine, click Remove. Remove Use a legacy network adapter instead of this network adapter to perform a network-based installation of the guest operating system or when integration services are not installed in the guest operating system.
Restart if previously running Automatic Stop Action Save	<u>Q</u> K <u>C</u> ancel <u>Apply</u>

Note: To use Dell EqualLogic MPIO in a Windows Guest Operating System, configure the virtual machine with access to at least two virtual switches that are bound to physical SAN adapters on the Hyper-V host, and install the DSM feature of Dell EqualLogic Host Integration Tools for Microsoft on all Hyper-V hosts and Windows Guest Operating Systems.

To provide load-balancing and fault tolerance for non-ISCSI networks, consider using NIC teaming.

4. From the Guest Operating System, you can configure the network interfaces and connect directly to iSCSI EqualLogic volumes. If using Jumbo Frames, ensure that it is enabled on all switches and NICS that use iSCSI traffic, including virtual switches and virtual Ethernet adapters. It is important to verify these settings on all nodes in a cluster, as well as in the Guest Operating System. For additional information on Jumbo Frames, refer to the section Enable Jumbo Frames.

Direct-attached volumes are not managed in Hyper-V Manager. From the Guest Operating System, Direct-attached iSCSI volumes are managed the same as if they were in a physical environment. For additional information on creating an EqualLogic volume and making it available to Windows, refer to <u>Appendix A</u>.



8.10 Highly available virtual machines

In a cluster, virtual machines can be configured for High Availability so that they can failover or migrate to other nodes. Virtual machine High Availability is made possible by using shared storage. For shared storage, virtual machines can use CSVs, standard clustered disks, or SMB 3.0 File Shares (in Server 2012 and later).

To ensure that a virtual machine can be clustered and highly available, all of its storage must first be present in the cluster. For additional information on adding disks to a cluster, including standard clustered disks and CSVs, refer to the section: <u>Adding disks to a cluster</u>.

Note: Starting with Microsoft Windows Server 2012, Microsoft no longer supports the use of multiple virtual machines in a single clustered role. An example of this configuration would be a <u>standard</u> <u>clustered disk</u> (non-CSV) containing multiple virtual machines. Therefore, to ensure High Availability and gain improved virtual machine mobility between nodes, either use CSV's or maintain one virtual machine per standard cluster disk (non-CSV).



8.10.1 Creating virtual machine clustered roles

- 1. From the left pane of **Failover Cluster Manager**:
 - a. Click to expand the cluster.
 - b. Right-click on **Roles**, and select **Configure Role**.

輼	
File Action	View Help
🗢 🔿 🖄	
💐 Failover Clu	uster Manager
⊿ 🎼 Server2	012-R2-Cluster.SKYNET.lab.local
🔚 Role	24
📫 No	Configure Role
⊳ 📇 Stc 🎼 Ne	Virtual Machines 🕨
📕 Clu	Create Empty Role
	Refresh
	Help

2. Click to select the Virtual Machine role, and click Next.

8 7	High Availability Wizard
to Select Ro	le
Before You Begin Select Role Select Virtual Machine Confirmation Configure High Availability Summary	Select the role that you want to configure for high availability:
	< <u>P</u> revious <u>N</u> ext > Cancel

3. Click to select the existing virtual machines to configure for High Availability, and click **Next**.

8 9	High Availability Wizard	x
tir Select Vir	tual Machine	
Before You Begin Select Role	Select the virtual machine(s) that you want to configure for high availability.	_
Select Virtual Machine Confirmation Configure High Availability Summary	Server2012-R2-VM1 Running Server2012-R2-2 Server2012-R2-VM2 Server2012-R2-2 Server2012-R2-VM3 Server2012-R2-2	
	< <u>P</u> revious <u>N</u> ext > Cancel	



4. To continue, click **Next**.

Ø	Hi	gh Availability Wizard	x
tonfirma 🗞	tion		
Before You Begin Select Role	You are ready to configure h	nigh availability for a Virtual Machine.	
Select Virtual Machine Configure High Availability Summary	Virtual Machine: Virtual Machine: Virtual Machine: Virtual Machine: Virtual Machine: Virtual Machine:	Server2012-R2-VM1 - CSV Server2012-R2-VM2 - CSV Server2012-R2-VM3 - CSV Server2012-R2-VM4 - CSV Server2012-R2-VM5 - CSV Server2012-R2-VM6 - CSV	
		< Previous Next >	Cancel



5. Review the **Summary**. To view the report created by the wizard, click **View Report** and click **Finish**.

\$ 7	High Availability Wizard	x
to Summary		
Before You Begin Select Role	High availability was successfully configured for the role.	
Select Virtual Machine		
Confirmation		
Configure High Availability	Virtual Machine	
Summary	Virtual Machine	
	All of the virtual machine configurations chosen were successfully made hig available.	illi
	Name Result Description	
	Server2012-R2-VM1 - CSV Success	*
	To view the report created by the wizard, click View Report. To close this wizard, click Finish.	ew Report
		<u>F</u> inish



8.10.2 Managing virtual machine clustered roles

- 1. From the left pane of Failover Cluster Manager:
 - a. Click to expand the cluster.
 - b. Click to select **Roles**. Clustered virtual machine roles will be displayed in the right-pane.

魂				Fail	over Cluste	r Manager
<u>File</u> <u>A</u> ction <u>V</u> iew <u>H</u> elp						
🗢 🔿 📶 🚺 🖬				_		
📲 Failover Cluster Manager	Roles (7)					
Server2012-R2-Cluster.SKYNET.lab.local	Search					
Roles			-			
Nodes	Name	Status	Туре	Owner Node	Priority	Information
⊿ 📇 Storage	Server2012-R2-VM1 - CSV	🕥 Running	Virtual Machine	Server2012-R2-2	Medium	
Disks	Server2012-R2-VM2 - CSV	💿 Running	Virtual Machine	Server2012-R2-2	Medium	
Pools	Server2012-R2-VM3 - CSV	💿 Running	Virtual Machine	Server2012-R2-2	Medium	
Cluster Events	Server2012-R2-VM4 - CSV	💿 Running	Virtual Machine	Server2012-R2-1	Medium	
	Server2012-R2-VM5 - CSV	仓 Running	Virtual Machine	Server2012-R2-1	Medium	
	Server2012-R2-VM6 - CSV	仓 Running	Virtual Machine	Server2012-R2-1	Medium	



- 2. Right-click on the clustered role to perform additional actions, including:
 - Connect to the virtual machine console
 - Start or Stop the virtual machine
 - Shutdown or Turn Off the virtual machine
 - Manage virtual machine Settings
 - Launch Hyper-V Manager
 - Enable Hyper-V Replication
 - Perform a Live Migration, Quick Migration or Storage Migration
 - Live migration Move the virtual machine to another node without pausing
 - **Quick migration** Pause the virtual machine, Move to another node, and start the virtual machine on the other node
 - Storage migration Move only the virtual machine storage to another storage location
 - Change the Startup Priority
 - View Details
 - Show Critical Events
 - Add resources
 - Remove the clustered Role
 - Configure the Preferred Owners (cluster nodes) for the Role
 - Manage Failover and Failback settings

Roles (7)		
Search		
Name		Status
Server2012-R2-VM1 - CSV	-	<u> </u>
Server2012-R2-VM2 - CSV		Connect
Server2012-R2-VM3 - CSV	0	Start
Server2012-R2-VM4 - CSV	0	Save
Server2012-R2-VM5 - CSV	0	Shut Down
Server2012-R2-VM6 - CSV		Turn Off
Server2012-R2-VM9 and VM	1	Settings
	3	Manage
	1	Replication •
		Move 🕨
	20	Cancel Live Migration
	٩	Change Startup Priority
	5	Information Details
	<u>1</u>	Show Critical Events
	4	Add Storage
	đ	Add Resource
		More Actions
	×	Remove
		Properties



8.11 Protection and recovery of virtual machines

Dell EqualLogic Host Integration Tools for Microsoft enables application-consistent data protection and quick recovery of Hyper-V virtual machines. For additional information, refer to: <u>Managing and Protecting</u> <u>a Windows Server Hyper-V Environment using Dell EqualLogic PS Series Storage Arrays and Tools</u>

8.12 Guest clustering

Similar to a Failover cluster comprised of physical servers, virtual machines can be also be used to create a guest cluster for high availability of the workloads and roles running within the Guest Operating System.

There are multiple storage options for a guest cluster:

- iSCSI: From the Guest Operating System, Direct-attached iSCSI volumes are managed the same as if they were in a physical environment. Direct-attached disks are iSCSI volumes that are connected using an iSCSI initiator in the Guest Operating System. Direct-attached disks are not visible to the Hyper-V host and only accessible by the Guest Operating System running on the virtual machine. For additional information on creating an EqualLogic volume and making it available to Windows, refer to <u>Appendix</u> <u>A</u>.
- Shared VHD: In Windows Server 2012 R2 and later, VHDs can be shared by multiple virtual machines. A Shared VHD can be used for clustering within the Guest Operating System. With Shared VHDs, guest clusters do not necessarily require direct access to the SAN, thus using Shared VHDs for guest clusters has an advantage over using direct-attached iSCSI volumes. The Shared VHD will not consume iSCSI sessions from the Guest Operating System. For additional information on deploying a guest cluster using a shared VHD, refer to: http://technet.microsoft.com/library/dn265980.aspx.
- Virtual Fibre Channel: Windows Server 2012 and later also include support for Direct-attached disks that use Virtual Fibre Channel, but this is unsupported for Dell EqualLogic iSCSI storage arrays.

For additional information on using Guest Clustering for High Availability, refer to: <u>http://technet.microsoft.com/en-us/library/dn440540.aspx</u>

8.13 Hyper-V Offloaded Data Transfer

Today's prevalence of server virtualization has resulted in increased demands for high-speed data transfers for storage and data migration. In the past, data transfers were traditionally performed through LAN networks. This legacy data transfer method burdened server capabilities and resulted in high utilization of server resources such as network, CPU and memory.

To maximize the full potential of intelligent storage arrays and high-speed SANs, Dell and other storage vendors collaborated with Microsoft to develop a new T10 Standard for SAN data transfers called Offloaded Data Transfers (ODX).

ODX provides the ability to automatically and quickly transfer large amounts of data, including virtual machines and file shares, directly between EqualLogic volumes without impacting valuable server performance. This reduces server resource usage such as CPU, memory and network by offloading the file transfers to a high-speed SAN.

ODX is a native feature of Windows Server 2012 and later and is on by default. Dell EqualLogic PS Series Firmware v6.0 and later includes support for ODX. ODX is supported on NTFS File systems.

Common Hyper-V storage operations involving large amounts of data, such as merging, moving, and compacting a VHD, use ODX and pass these operations to the Hyper-V host so that the workloads can take advantage of ODX as if they were running in a physical environment.

Note: VHDs attached to a virtual IDE controller do not support ODX.

For additional information on ODX with Dell EqualLogic and Hyper-V, refer to the following resources:

http://en.community.dell.com/techcenter/extras/m/white_papers/20437937.aspx

http://technet.microsoft.com/en-us/library/hh831375.aspx

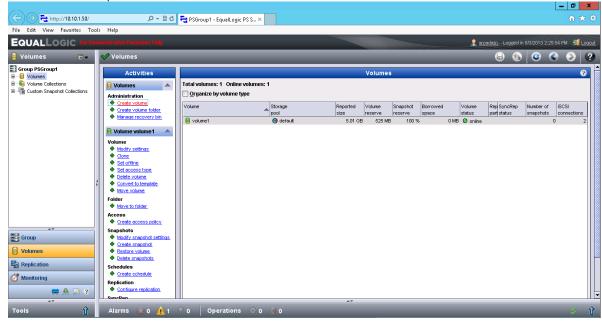


A Using Dell EqualLogic storage with Microsoft Windows

A.1 Creating a volume in an EqualLogic PS Series Group

Create volumes to access storage space in a pool, and modify volume size and attributes on-demand.

- 1. In the lower-left pane of the Group Manager GUI, click Volumes.
- 2. In the Activities pane, click Create Volume.



- 3. Specify General properties and Storage pool assignment.
 - a. Provide a Name and Description (optional) for the volume.
 - b. Select the storage pool to be used for the volume.
 - c. Click Next.

	Cr	eate volu	ime		×
Step 1 - Volume Settings					0
	General properties 'Name; pescription: volume to be used by Microsoft Windows Server 2012 Folder Create volume in toder Storage pool assignment				
	Storage pool Capacity Free Drives Pool encryption				Pool encryption
	O default	10.13 00		3 SAS HDD	X None
				Back	Cancel



- 4. Specify Volume space and Snapshot space.
 - a. In the **Volume size** field, enter the desired volume size.
 - b. To optionally enable thin provisioning, click to select **Thin provisioned volume**. Use the sliders in the **Reported volume size** section to adjust settings. You can enable or disable thin provisioning on a volume at any time.
 - c. In the **Snapshot space** section, enter the desired percentage of the volume to be used for snapshots.
 - d. Click Next.

	Create vol	ume		×		
Step 2 - Space				?		
	Ihin provisioned volume (use slid	(max. 80.56 GB) lers below to adjust settin	gs)			
	Snapshot space Snapshot reserve (% of volume res	erve): 100				
	🔋 Reported volume size 5.01 G	🔋 Reported volume size 5.01 GB				
	Free 525	Unreserved 4.				
	10%	6	1%	10		
	Stimated changes in storage	e pool default		12		
	Storage pool default	Current	New	Change		
	Volume reserve	0 MB	525 MB	525 MB		
	Snapshot reserve	0 MB	525 MB	525 MB		
	Replication reserve	0 MB	0 MB	0 MB		
	Delegated space	0 MB	0 MB	0 MB		
	Free pool space	16.13 GB	15.1 GB	-1.03 GB		
	Available for borrowing	16.13 GB	15.62 GB	-525 MB		
		Sack	ext 📎 🗸 Ein	ish 🔀 Cancel		

Note: PS Series Groups use access control records to prevent unauthorized computer access to iSCSI targets (volumes or snapshots). To log in to a volume or snapshot, the server's iSCSI initiator must comply with conditions specified in the access control record. For additional information on access control records, refer to the *Dell EqualLogic Group Manager Administrator's Manual* at http://eqlsupport.dell.com.



- 5. To enable multiple initiators to access the volume, as in a cluster configuration, optionally click to select **Allow simultaneous connections from initiators with different IQNs.**
- 6. Specify one or more of the following options and click **Next**.

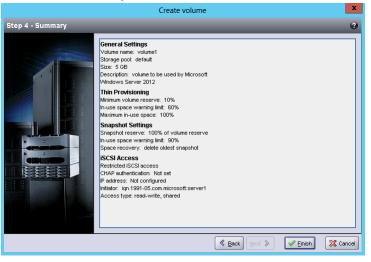
Option	Description
Authenticate using CHAP user name	Restricts access to computers that supply the specified CHAP user name and its associated password (or "secret"). The credentials must match a local CHAP account or a CHAP account on an external RADIUS server.
Limit access by IP address	Restricts access to iSCSI initiators that match the specified IP address.
Limit access to iSCSI Initiator name	Restricts access to iSCSI initiators that match the specified name.

Table 7 iSCSI access options

	Create volume	x
Step 3 - iSCSI Access		•
	ISCSI access Ng access Egestricted access Authenticate using CHAP user name: Upint access by IP address (asterisks allowed): Limit access to iSCSI initiator name: Limit access to iSCSI initiator name: Authenticate using CHAP user name: Paddress (asterisks allowed): Limit access to iSCSI initiator name: Malow simultaneous connections from initiators with different IQNs Allow only if your environment can safely handle multiple initiators accessing the target.	
	Seack Next > Section S	Cancel



7. Review the summary, and click Finish.





A.2 Connecting to an EqualLogic volume from Windows

The Microsoft iSCSI Initiator enables you to connect a Windows computer to EqualLogic iSCSI storage through the server's network adapters. Connecting to volumes with the Microsoft iSCSI Initiator will cause iSCSI SAN disks to appear as if they are locally attached to the server.

- 1. Launch iSCSI Initiator from Windows.
- 2. In the Discovery tab, click **Discover Portal.**

		Initiator Prop	
RADIUS	Conl	iguration	😝 Dell EqualLogic MPIO
Targets	Discovery	Favorite Targe	ets Volumes and Device
Farget portals The system will I Address	look for <u>T</u> argets Port	on following portals: Adapter	Refresh IP address
		over Portal. t the address above	Discover Portal and Remove
SNS servers The system is re Name	gistered on the	following įSNS server	s: Refresh
		Server. t the server above a	Add Server
To remove an iS then click Remov	NS server, selec	t the server above a	_

- 3. If required, specify the EqualLogic PS Series Group that you want to add.
 - a. In the IP address or DNS name field, enter the IP address or DNS name of the EqualLogic PS Series Group.
 - b. In the Port field, enter the network port number (Default is 3260).
 - c. To enable CHAP authentication, click **Advanced** and configure the required settings.
 - d. Click OK.

Discover Target Portal							
Enter the IP address or DNS name and por want to add.	Enter the IP address or DNS name and port number of the portal you						
To change the default settings of the disco the Advanced button.	wery of the target portal, c	lick					
IP address or DNS name:	Port: (Default is 3260.)						
10.10.1.50	3260						
Advanced	<u>O</u> K <u>C</u> ancel						

- 4. Discover all volumes that the server has access to.
 - a. Click the **Targets** tab, and then click **Refresh.** A list of discovered volumes is displayed.
 - b. Click to select the desired volume and click **Connect.**

	iS	CSI Initiator Pro	operties		×
RADIUS		onfiguration	3	Dell EqualLogic MPI	0
Targets	Discovery	Favorite Ta		Volumes and Dev	
- Ouick Connect -			-	1	
		get using a basic cor en click Quick Conne		ype the IP address or	
<u>T</u> arget:				Quick Connect	c
Discovered targ	jets				
				<u>R</u> efresh	
Name					Sta
ian.2001-05.c	om.equallogic:0	-565006-5e91a1201	-00300000	00552260-volume1	Ine
ian.2001-05.c	om.equallogic:0	-565006-ba31a1201	-0020000	004521b7-vss-contro	L Ina
<		ш			>
click Connect.		tions, select a targel		Connect	
To completely o then click Disco		get, select the targe	t and	Disconnect	
	erties, including et and click Prop	configuration of se erties.	sions,	Properties	
	on of devices as then click Devic	sociated with a targ es.	st, select	De <u>v</u> ices	
More about basi	c iSCSI connect	ions and targets			
			ж	Cancel	Apply

- 5. Connect to the Target.
 - a. To make the system automatically attempt to restore the connection to the volume upon reboot, click **Add this connection to the list of Favorite Targets**.
 - b. To enable multi-path, click Enable multi-path.
 - c. Click **OK**.

147

Connect To Ta	arget X
Target name:	
om.equallogic:0-565006-5e91a1201-00300000 Add this connection to the list of Favorite Tar This will make the system automatically atten connection every time this computer restarts	rgets. mpt to restore the
✓ Enable multi-path	
Advanced	OK Cancel



A.3 Making an EqualLogic volume available to Windows

After connecting to the iSCSI target, you can make the volume available to Windows so that it can be used to store data.

- 1. Launch the **Disk Management** Console in Windows Server 2012.
 - a. From the Action menu, select **Rescan disks**.

File 🗛	ction Vi	ew Help							
(n e	Refresh	1							
Volur	Rescan	Disks	Туре	File System	Status	Capacity	Free Spa	% Free	1
■ <mark>(C</mark> ■ Sy:	Create Attach		Basic Basic	NTFS NTFS	Healthy (B Healthy (S	39.66 GB 350 MB	28.53 GB 109 MB	72 % 31 %	
	All Tas	ks 🕨							
	Help								
Disk									
Disk Basic 40.00 GB Online	0	System Reserv 350 MB NTFS Healthy (System	red n, Active, Prima		ЭВ NTFS у (Boot, Page Fi	ile, Crash Dump	o, Primary Partiti	ion)	

- 2. Bring the new disk online.
 - a. Right-click on the disk and select **Online**.

Objekt Online Unknown Online S.01 G8 Online Offline (Properties Help Help	3			Disk Man	agement				x
Volume Layout Type File System Status Capacity Free Special System Image: CC-IDE Control Contine Simple Basic NTFS Healthy (B 39.66 GB 28.53 GB 72 % Image: System Reserved Simple Basic NTFS Healthy (S 350 MB 109 MB 31 % Image: System Reserved Simple Basic Image: System Reserved 39.66 GB NTFS 139.66 GB NTFS Online Healthy (System, Active, Primary Pa Image: System Reserved 39.66 GB NTFS Healthy (Boot, Page File, Crash Dump, Primary Partition) Image: System State System Stat									
C(C) Simple Basic NTFS Healthy (B 39.66 GB 28.53 GB 72 % System Reserved Simple Basic NTFS Healthy (S 350 MB 109 MB 31 % Disk 0 Basic A0.00 GB Online Sto GB Online Properties Help Yelp Yelp Yelp Yelp Yelp Yelp Yelp Y	-	51 🖸 🗳 😼							
System Reserved Simple Basic NTFS Healthy (S 350 MB 109 MB 31 % Disk 0 Basic 40,00 GB Online S50 GB Healthy (System, Active, Primary Pa Healthy (Boot, Page File, Crash Dump, Primary Partition) Disk 1 Unknown S.01 GB Properties Help · · · · · · · · · · · · · · · · · · ·									
Image: System Reserved 320 for B NTFS Online System Reserved 350 MB NTFS 39.66 GB NTFS Healthy (System, Active, Primary Pa Healthy (Boot, Page File, Crash Dump, Primary Partition) Image: Strain S									
Basic 40.00 GB Dolline System Reserved Basic GB Healthy (System, Active, Primary Pa Healthy (Boot, Page File, Crash Dump, Primary Partition) Healthy (Boot, Page File, Crash Dump, Primary Partition) Composition Healthy (Boot, Page File, Crash Dump, Primary Partition) Healthy (Boot, Page File, Crash Dump, Primary Partition) Healthy (Boot, Page File, Crash Dump, Primary Partition) Composition Healthy (Boot, Page File, Crash Dump, Primary Partition) Healthy (Boot, Page File, Crash Dump, Primary Page File, Crash Dump, Prima	System Reserved	Simple	Basic	NIFS	Healthy (S	350 MB	109 MB	31%	
40.00 GB Online 350 MB NTFS Healthy (System, Active, Primary Pa Bisk 1 Unknown 5.01 GB Properties Help V CD-ROM 0									
Unknown 5.01 GB Online Help Properties Help V									^
CD-ROM 0	Basic 40.00 GB	350 MB NTFS		39.66 0		le, Crash Dump), Primary Parti	tion)	
	Basic 40.00 GB Online	350 MB NTFS Healthy (System, A Online Properties		39.66 0		le, Crash Dump	o, Primary Partit	tion)	
	Basic 40.00 GB Online Colisk 1 Unknown S.01 GB Offline CD-ROM 0	350 MB NTFS Healthy (System, A Online Properties Help		39.66 0		le, Crash Dump), Primary Partif	tion)	



- 3. You must initialize a disk before Disk Manager can access it.
 - a. Right-click on the disk and select Initialize Disk.

2			Disk Man	agement				x
File Action View	/ Help							
🔶 🔿 🛛 🖬 🚺	1 🖸 📽 🗟	3						
Volume	Layout	Type	File System	Status	Capacity	Free Spa	% Free	
🖜 (C:)	Simple	Basic	NTFS	Healthy (B	39.66 GB	28.53 GB	72 %	
■ System Reserved	Simple	Basic	NTFS	Healthy (S	350 MB	109 MB	31 %	
40.00 GB 3	iystem Reserv 50 MB NTFS	ed	(C:) 39.66 (3B NTFS				_
Basic 40.00 GB Online			39.66		le, Crash Dumj	p, Primary Partit	ion)	
Basic S 40.00 GB Online H Disk 1 Unknown 5.01 GB	50 MB NTFS		39.66		le, Crash Dumj	p, Primary Partit	ion)	
Basic 5 40.00 GB 7 Online 4 Online 4 Online 4 Unknown	50 MB NTFS Healthy (System		39.66		le, Crash Dumj	p, Primary Partit	ion)	
Basic S 40.00 GB Online H Disk 1 Unknown 5.01 GB	50 MB NTFS Healthy (System Initialize Disk		39.66		le, Crash Dumj	p, Primary Partit	ion)	

4. Select the disk and partition style and click **OK**.

Initialize Disk
You must initialize a disk before Logical Disk Manager can access it. Select disks: I Disk 1
Use the following partition style for the selected disks: ● MBR [Master Boot Record] ● GPT (GUID Partition Table) Note: The GPT partition style is not recognized by all previous versions of Windows.
OK Cancel



- 5. Create a Simple Volume on the disk.
 - b. Right-click on the disk and select New Simple Volume.

(⇒ ⇒ 🖬 🚺	i 🖬 🖸 🛍	0					
Volume	Layout	Type File System	Status	Capacity	Free Spa	% Free	
ာ (C:) ⊃ System Reserve	Simple ed Simple	Basic NTFS Basic NTFS	Healthy (B Healthy (S	39.66 GB 350 MB	28.53 GB 109 MB	72 % 31 %	
							_
Disk 1 Basic 5.01 GB	5.01 GB	New Simple Volume New Spanned Volume					/
Basic 5.01 GB Online	5.01 GB Unallocated	New Spanned Volume New Striped Volume New Mirrored Volume					
Basic 5.01 GB		New Spanned Volume New Striped Volume					

6. Click Next.

New Simple Volume Wizard	x
Welcome to the New Simple Volume Wizard	
This wizard helps you create a simple volume on a disk.	
A simple volume can only be on a single disk.	
To continue, click Next.	
< <u>₿</u> ack <u>N</u> ext > Canc	el :

7. Specify the volume size, and click **Next**.

New Sim	ple Volume Wizard
Specify Volume Size Choose a volume size that is between the maximum and minimum sizes.	
Marine filmers in MD	5127
Maximum disk space in MB:	5127
Minimum disk space in MB:	8
Simple volume size in MB:	
	< Back Next > Cancel

8. Optionally, assign a drive letter or path and click Next.

New Simple Volume Wizard	
Assign Drive Letter or Path For easier access, you can assign a drive letter or drive path to your partition.	
<back next=""> Cancel</back>	

- 9. Format the partition by specifying **File system**, **Allocation unit size** and **Volume label** and click **Next**.
 - a. For identification purposes, it recommended to specify a volume label that matches the volume name in the Dell EqualLogic Group.

New Simple Volume Wizard	
Format Partition To store data on this partition, you must format it first.	
Choose whether you want to format this volume, and if so, what settings you want to use.	
O Do not format this volume	
Image: Format this volume with the following settings:	
<u>F</u> ile system:	NTFS V
Allocation unit size:	Default v
⊻olume label:	volume1
✓ Perform a quick format	
Enable file and folder compression	
	< <u>B</u> ack <u>N</u> ext> Cancel

- 10. The volume is now available to Windows and is ready to store data.
 - a. Review the settings, and click Finish.

New Simple Volume Wizard		
	Completing the New Simple Volume Wizard	
	You have successfully completed the New Simple Volume Ward. You selected the following settings: Volume type: Simple Volume Disk selected: Disk 1 Volume size: SIZ2 MB Drive letter or path: E: File system: NTFS Allocation unit size: Default Volume labe! volume1 Unick format: Yee To close this wizard, click Finish.	
< <u>B</u> ack Finish Cancel		

B Additional resources

Web resources

- Dell EqualLogic Support Site Download Dell EqualLogic software and documentation
- Dell EqualLogic Technical Content A collection of all EqualLogic technical content
- <u>Dell Storage Online Publications</u> Storage solution best practices for enterprise application and data center environments.

Technical documents

- Using Dell EqualLogic Storage with Microsoft Windows Server 2012
- <u>Hyper-V Technology Overview</u>
- <u>Managing and Protecting a Windows Server Hyper-V Environment using Dell EqualLogic PS Series</u> <u>Storage Arrays and Tools</u>
- <u>Setup and Configuration of a Windows Server Core Hyper-V Host Using PowerShell and Dell</u>
 <u>EqualLogic Storage and Tools</u>
- Deploying a dedicated Hyper-V management guest using PowerShell and Dell EqualLogic storage and tools
- <u>Automation and Integration with MS System Center Virtual Machine Manager 2012 SP1 and Dell</u> <u>EqualLogic Storage</u>
- Deploying and Configuring the Dell EqualLogic Multipath Device Specific Module with Microsoft Windows