



NETAPP TECHNICAL REPORT

Microsoft Hyper-V on NetApp Deployment Guide

Abhinav Joshi, NetApp
Chaffie McKenna, NetApp
January 2009 | TR-3733

Version 1.0

ABSTRACT

This document provides step-by-step guidance on how to configure a Microsoft® Windows Server® 2008 Hyper-V™ solution on NetApp® storage.

TABLE OF CONTENTS

1	INTRODUCTION	3
2	SOLUTION ARCHITECTURE	4
3	SOLUTION CONFIGURATION	4
3.1	NETAPP STORAGE SYSTEM CONFIGURATION	4
3.2	NETWORKING CONFIGURATION.....	6
3.3	MICROSOFT HYPER-V AND SCVMM CONFIGURATION.....	9
3.4	INSTALL NETAPP SOFTWARE ON WINDOWS SERVER 2008	20
3.5	FIBRE CHANNEL ZONING CONFIGURATION (OPTIONAL)	33
3.6	NETAPP STORAGE PROVISIONING	35
3.7	MICROSOFT WINDOWS FAILOVER CLUSTERING CONFIGURATION.....	46
3.8	DISK PROVISIONING ON WINDOWS SERVER 2008 SERVER(S).....	64
4	VIRTUAL MACHINE PROVISIONING	64
4.1	PROVISIONING USING HYPER-V MANAGER	64
4.2	PROVISIONING USING SCVMM 2008.....	75
5	QUICK MIGRATION SETUP AND CONFIGURATION	87
5.1	ENABLE HIGH AVAILABILITY FOR VM.....	87
6	NETAPP DEDUPLICATION ON PRIMARY STORAGE	94
7	QUICK MIGRATION	94
8	TESTING AND VALIDATION OF THE HYPER-V AND NETAPP ENVIRONMENT	96
9	ACKNOWLEDGEMENTS	96

1 INTRODUCTION

This document provides step-by-step guidance on how to configure a Microsoft® Windows Server® 2008 Hyper-V™ solution on NetApp® storage. It documents in detail the configuration steps for an environment with two Windows Server 2008 [Hyper-V](#) systems with full installation, two Windows Server 2008 Hyper-V systems with server core installation, one Windows Server 2008 full installation system with [System Center Virtual Machine Manager 2008 \(SCVMM\)](#) installed, and one NetApp FAS3070C storage array configured with both FC and iSCSI protocols. The information in this guide assists in setting up a proof of concept (POC) environment or even a production environment. This guide is intended for storage and systems administrators who are familiar with Microsoft Hyper-V and NetApp storage.

Note: The scope of this document is limited to deployment instructions only; it should not be considered as a design guide. For detailed information about NetApp best practices for Hyper-V, see [NetApp TR-3702](#) and [TR-3701](#).

Proper licensing for the NetApp controllers, NetApp storage management software installed on the Windows Server 2008 Hyper-V servers, Microsoft Windows Server 2008, and any OS installed on the virtual machines must be obtained to use the features described in this guide. Where appropriate, trial licenses can be used for many of the components in order to test the configuration.

Figure 1 shows the configuration process that is outlined in this document.

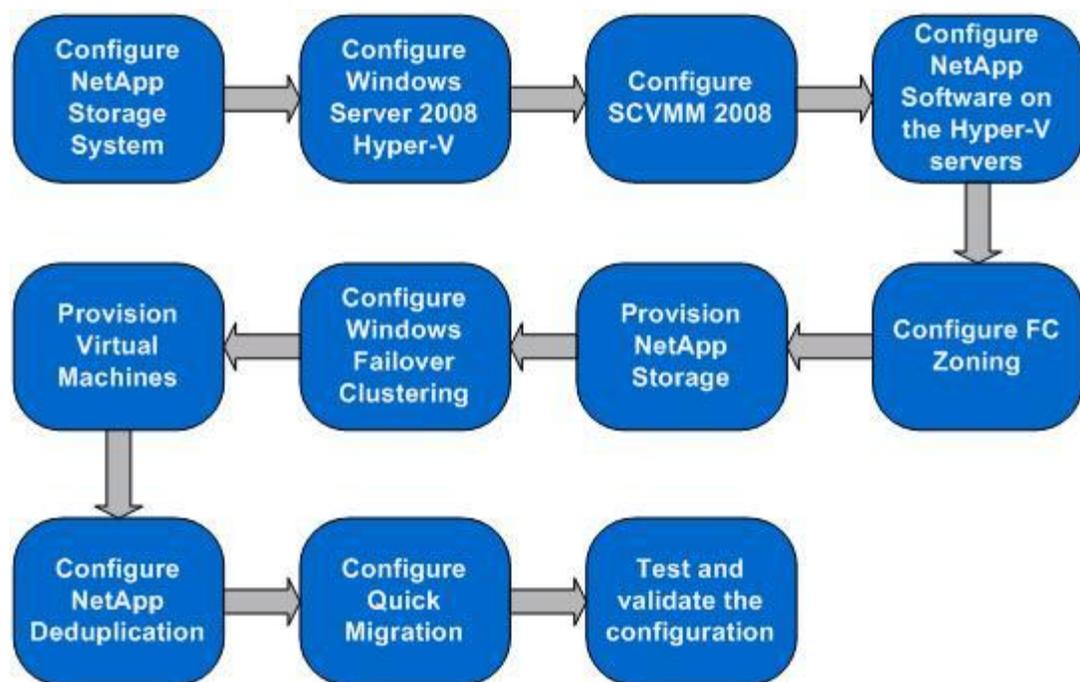


Figure 1) Steps for setting up Hyper-V on NetApp storage.

2 SOLUTION ARCHITECTURE

Figure 2 shows the high-level architecture of the environment setup to demonstrate the deployment of Microsoft Hyper-V on NetApp storage.

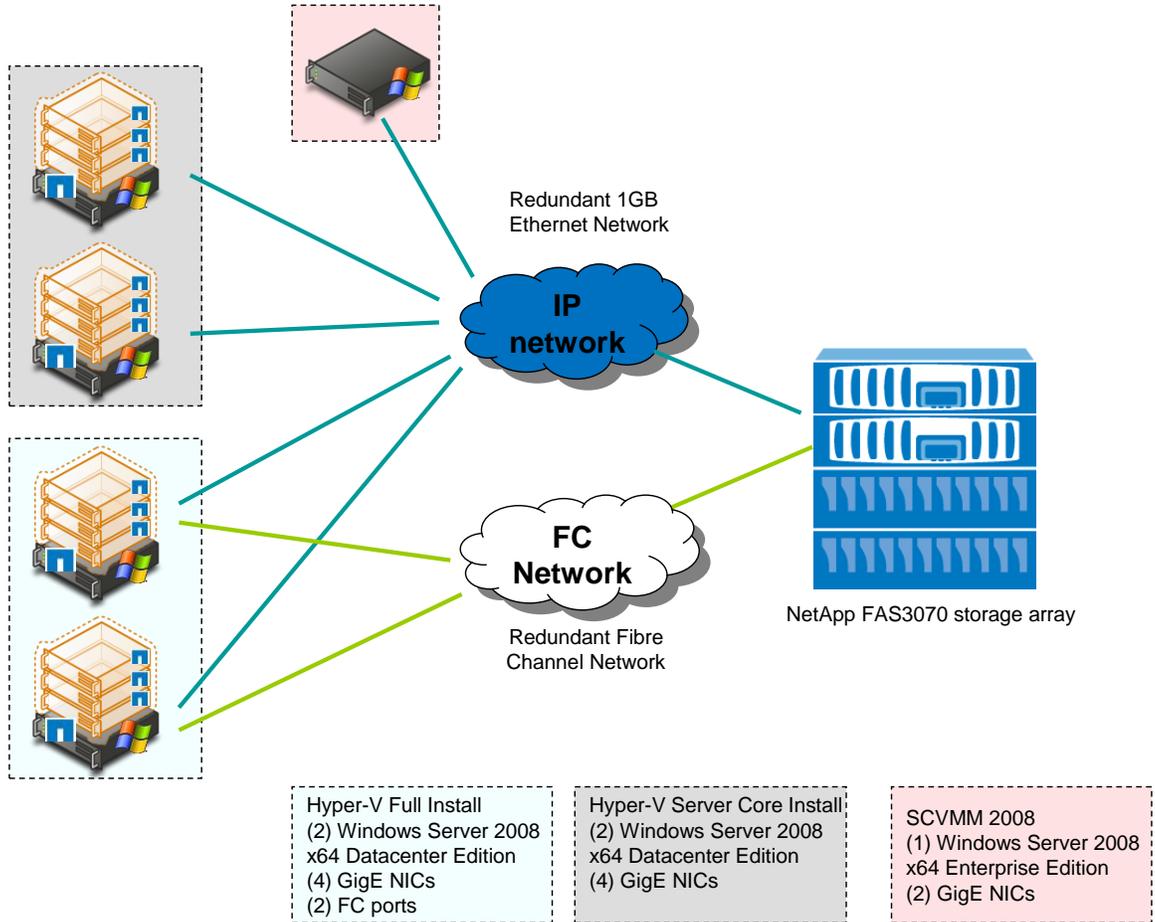


Figure 2) Physical architecture.

3 SOLUTION CONFIGURATION

3.1 NETAPP STORAGE SYSTEM CONFIGURATION

It is important to follow the recommendations and requirements described in this document for a successful deployment of the environment shown in Figure 2.

3.1.1 NetApp Storage System Hardware and Software Requirements

The components, quantity, and details shown in Table 1 describe the requirements for configuring NetApp storage systems. It is important to install the required hardware and software components to support the planned environment shown in Figure 2.

Table 1) NetApp storage system hardware and software requirements.

NetApp System Component	Quantity	Details
Number and Type of Controllers	1	FAS3070c
1GB Ethernet NICs	2-4	Min. two per controller (on board)
Fibre Channel Ports	2-4	Min. two per controller (on board)
Data ONTAP®	n/a	Version 7.3 or later
FAS Controller CF Mode	n/a	Single Image

3.1.2 NetApp Software Requirements

The NetApp software components described in Table 2 are meant to be installed on the Windows Server 2008 Hyper-V servers planned as part of the environment shown in Figure 2.

Table 2) NetApp software requirements.

NetApp Software Component	Quantity	Details
NetApp Windows® Host Utilities Kit	4	5.x (one per Microsoft Windows Server 2008 server)
NetApp Data ONTAP DSM for Windows MPIO	4	3.2r1 (one per Microsoft Windows Server 2008 server)
NetApp SnapDrive® for Windows	2	6.x (one per Microsoft Windows Server 2008 server with full installation)

3.1.3 NetApp License Requirements

The NetApp license components described in Table 3 are meant to be installed on both the NetApp storage system and the Microsoft Windows Server 2008 servers planned as part of the environment shown in Figure 2. It is important to pay attention to the details column to determine which license components should be installed on the NetApp storage system and which on the Microsoft Windows Server 2008 servers.

Table 3) NetApp license requirements.

NetApp License Component	Quantity	Details
FCP	2	One per controller
iSCSI	2	One per controller
Cluster	1	
NetApp SnapDrive for Windows	2	One per Microsoft Windows Server 2008 server with full installation
NetApp SnapRestore®	2	One per controller
NetApp Windows Host Utilities Kit	4	One per Microsoft Windows Server 2008 server
NetApp Data ONTAP DSM for Windows MPIO	4	One per Microsoft Windows Server 2008 server

3.2 NETWORKING CONFIGURATION

3.2.1 IP Network Configuration

For a redundant, highly available IP storage network, configure virtual interfaces (VIF) on both of the NetApp storage controllers, using the procedure outlined in this section. If this is an existing storage array that already has the VIFs configured, this procedure may not be necessary.

For this exercise, we used one Ethernet switch. In your environment, you may have multiple switches. Figure 3 shows the connectivity.

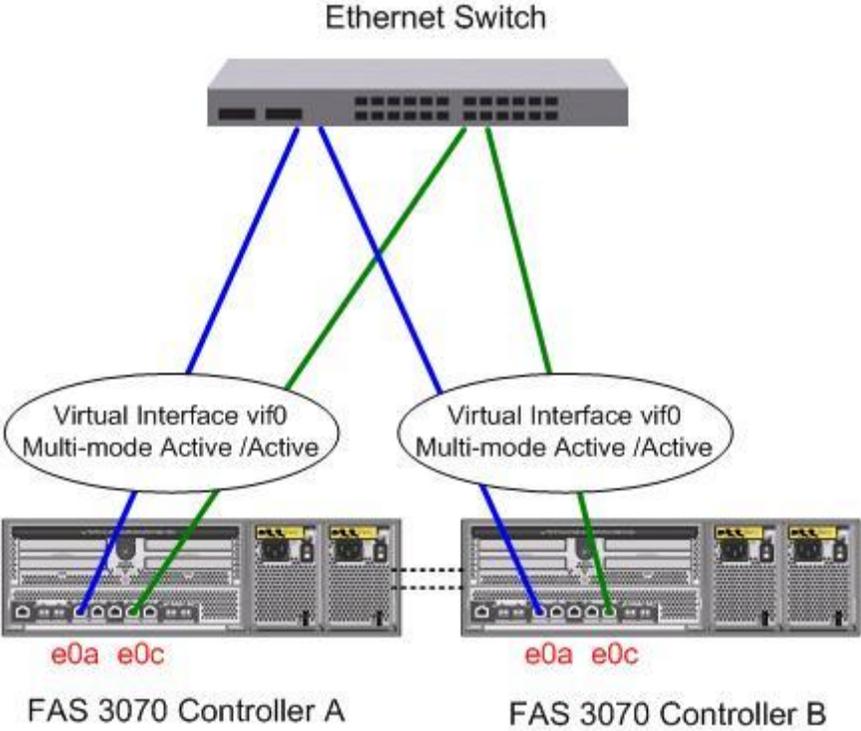
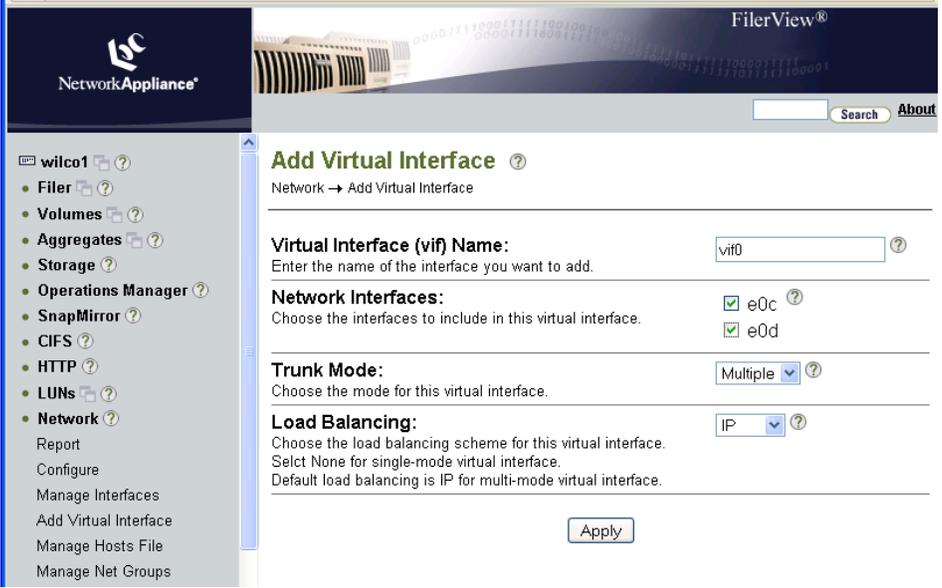
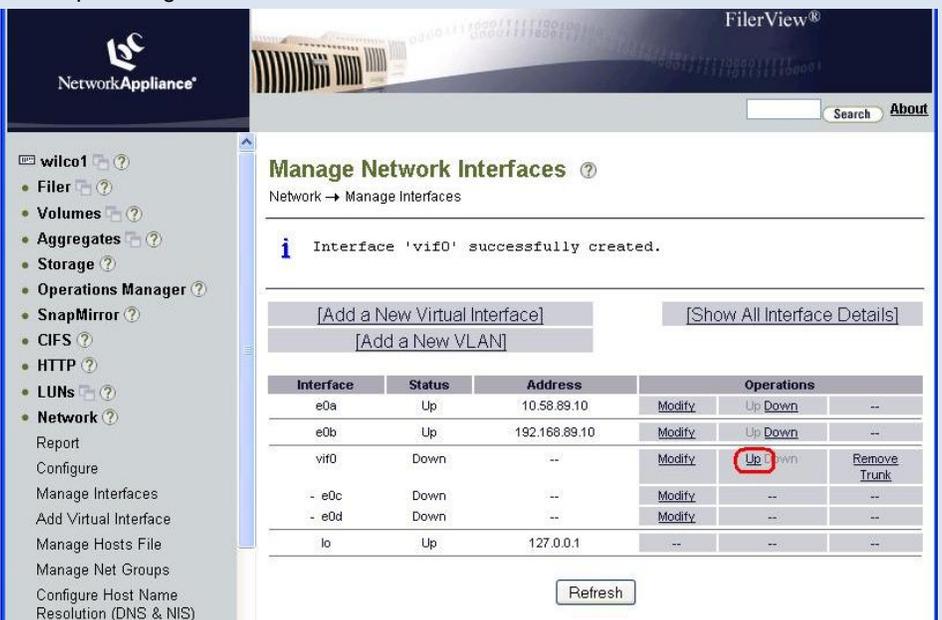


Figure 3) NetApp storage controller VIF configuration.

To create a virtual interface on NetApp storage controllers, follow these steps.

Step	Action																																										
1.	Log in to the FilerView® GUI and select Network > Add Virtual Interface.																																										
2.	Enter the VIF name and select the network interfaces that will be part of the VIF. Select Multiple from the Trunk Mode drop-down list and select IP from the Load Balancing drop-down list. Click Apply.																																										
																																											
3.	Click Up to bring the virtual interface online.																																										
	 <table border="1"> <thead> <tr> <th>Interface</th> <th>Status</th> <th>Address</th> <th colspan="3">Operations</th> </tr> </thead> <tbody> <tr> <td>e0a</td> <td>Up</td> <td>10.58.89.10</td> <td>Modify</td> <td>Up Down</td> <td>--</td> </tr> <tr> <td>e0b</td> <td>Up</td> <td>192.168.89.10</td> <td>Modify</td> <td>Up Down</td> <td>--</td> </tr> <tr> <td>vif0</td> <td>Down</td> <td>--</td> <td>Modify</td> <td>Up Down</td> <td>Remove Trunk</td> </tr> <tr> <td>- e0c</td> <td>Down</td> <td>--</td> <td>Modify</td> <td>--</td> <td>--</td> </tr> <tr> <td>- e0d</td> <td>Down</td> <td>--</td> <td>Modify</td> <td>--</td> <td>--</td> </tr> <tr> <td>lo</td> <td>Up</td> <td>127.0.0.1</td> <td>--</td> <td>--</td> <td>--</td> </tr> </tbody> </table>	Interface	Status	Address	Operations			e0a	Up	10.58.89.10	Modify	Up Down	--	e0b	Up	192.168.89.10	Modify	Up Down	--	vif0	Down	--	Modify	Up Down	Remove Trunk	- e0c	Down	--	Modify	--	--	- e0d	Down	--	Modify	--	--	lo	Up	127.0.0.1	--	--	--
Interface	Status	Address	Operations																																								
e0a	Up	10.58.89.10	Modify	Up Down	--																																						
e0b	Up	192.168.89.10	Modify	Up Down	--																																						
vif0	Down	--	Modify	Up Down	Remove Trunk																																						
- e0c	Down	--	Modify	--	--																																						
- e0d	Down	--	Modify	--	--																																						
lo	Up	127.0.0.1	--	--	--																																						

To edit the RC file, follow these steps.

Step	Action
1.	Edit the RC file in the <code>/etc</code> directory of each NetApp storage controller's root volume. Note: If using Windows to edit RC file, use WordPad instead of Notepad when asked what program to open the RC file with.
2.	Edit the RC file on both of the storage controllers by adding the following lines just before the <code>savecore</code> entry. For this exercise, we will use the 192.168.89.0/24 network for iSCSI connectivity: <pre>vif create multi vif0 -b ip e0c e0d ifconfig vif0 192.168.89.10 netmask 255.255.255.0 partner vif0 up</pre>
3.	To reread the configuration from the RC file, log in to each storage controller console and enter the following command: <pre>source /etc/rc</pre>

3.2.2 Fibre Channel Network Configuration

This procedure is required only if you plan to test Hyper-V over Fibre Channel. Otherwise, skip to section 3.3.

For a redundant, highly available FC storage network, perform FC connectivity on both of the NetApp storage controllers as shown in Figure 4. If this is an existing storage array that already has the Fibre Channel network configured, this procedure may not be required. Also, Single Image is the recommended CF mode.

For this exercise, we will use two FC switches; each NetApp controller has one FC connection to each switch. Figure 4 shows the connectivity.

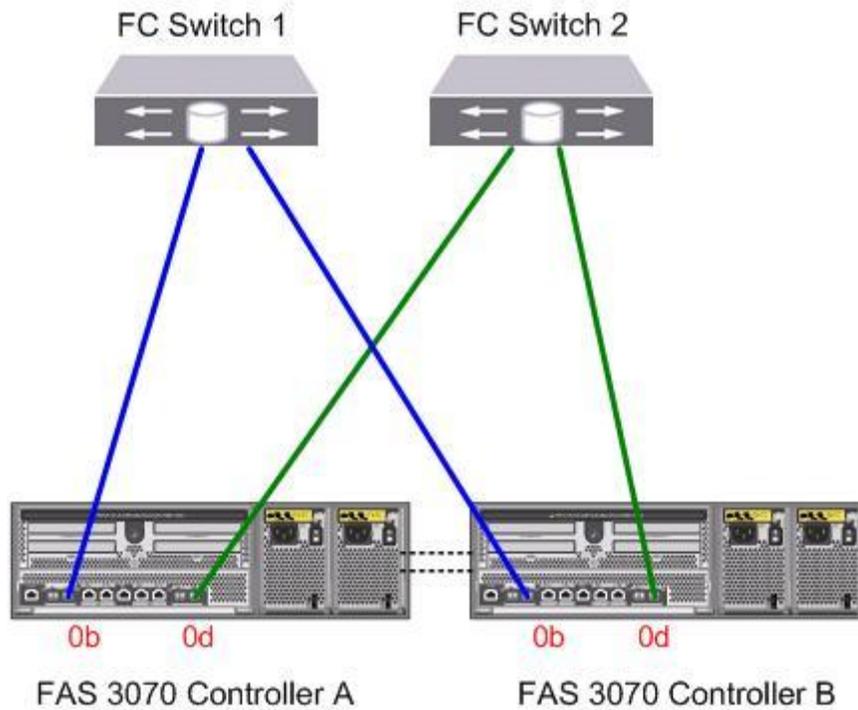


Figure 4) NetApp storage controller target ports configuration.

3.3 MICROSOFT HYPER-V AND SCVMM CONFIGURATION

3.3.1 Windows Server 2008 Full Installation

3.3.1.1 System Requirements

For detailed information on system requirements, refer to the Microsoft [documentation](#).

Software Requirements

Software Components	Quantity and/or Type
Windows Server 2008 x64 Enterprise or Windows Server 2008 x64 Datacenter Edition (Windows Server 2008 Standard Edition does not support Windows Failover Clustering)	2
License keys for OS to be installed on Hyper-V child VMs	2
The system should be able to use a name-resolution service, such as Domain Name System (DNS), DNS dynamic update protocol, Windows Internet Name Service (WINS), or Hosts file.	N/A
Active Directory Domain	N/A

Hardware Requirements

Hardware Components	Quantity and/or Type
64-bit servers with support for hardware-assisted virtualization technology, such as Intel® Virtualization Technology (Intel VT) or AMD Virtualization (AMD-V), identical hardware, and the same processor architecture	2
Minimum CPU speed	1.0GHz
Processor	Intel VT or AMD-V
Minimum RAM	512MB (additional memory needed for each child OS)

Network Requirements

Network Components	Quantity and/or Type
Network adapters per server	4

3.3.1.2 Install Microsoft Windows Server 2008

For detailed information on the installation and configuration of Windows Server 2008, refer to the Microsoft [documentation](#).

- Follow the instructions carefully and be sure to apply the Hyper-V update packages for Windows Server 2008 (KB950050) on the parent partition of the full installation.
- Install all Microsoft packages required for Hyper-V according to the instructions in the Microsoft documentation.

3.3.1.3 Network Configuration

CONFIGURE MANAGEMENT INTERFACE

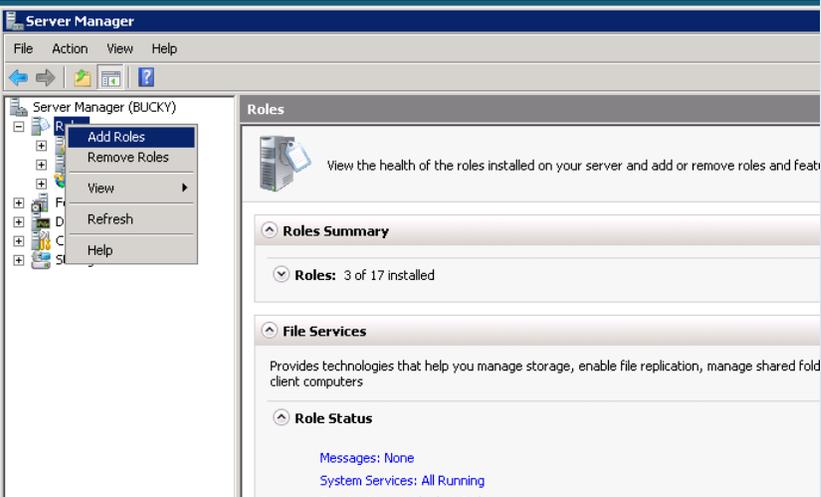
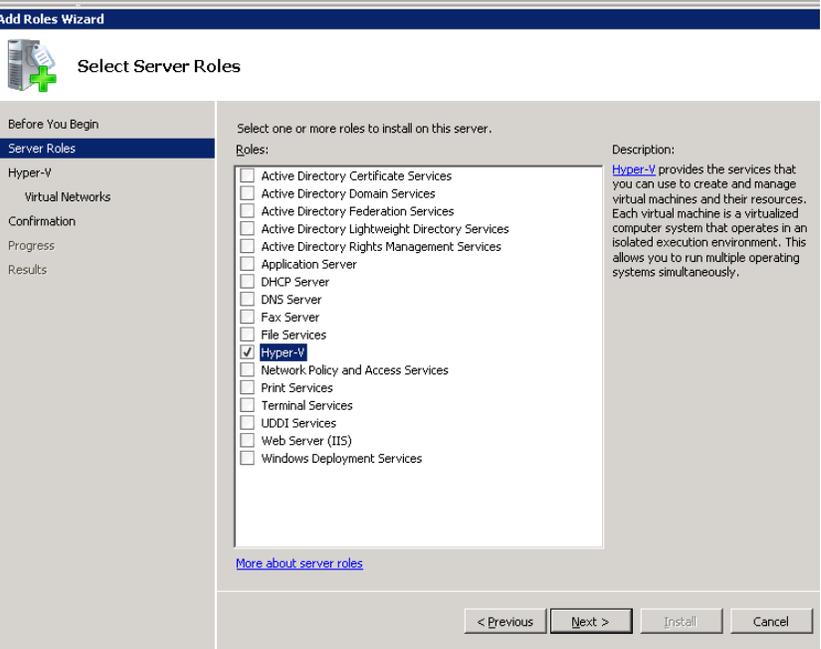
Configure one network adapter on the Windows Server 2008 server or servers to be used for the management network; give it an easily readable name (for example, LLAN01); and assign a static public IP address.

CONFIGURE IP STORAGE INTERFACES

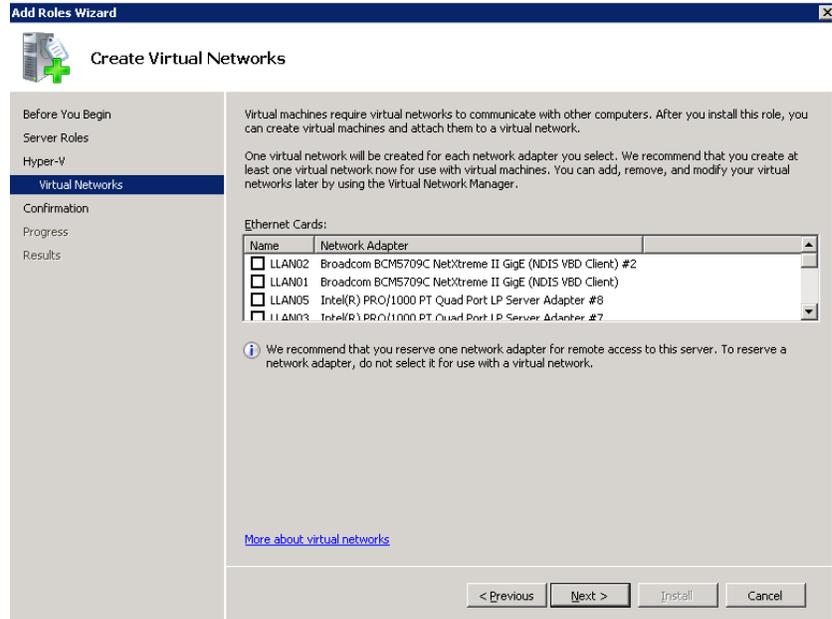
This procedure is required only if configuring NetApp shared storage over iSCSI. Configure two network adapters on the server or servers to be used for configuring and managing iSCSI storage traffic over MS iSCSI Software Initiator and NetApp SnapDrive software. The two network connections are recommended for high availability. Assign them easily readable names (for example, SLAN01 and SLAN02) and static public or private IP addresses. Make sure that the NetApp storage network port or virtual interface (for iSCSI storage) can be reached from the servers.

3.3.1.4 Install Hyper-V Role

To install the Hyper-V Role, follow these steps. For more information on installing Hyper-V role, refer to the Microsoft [documentation](#).

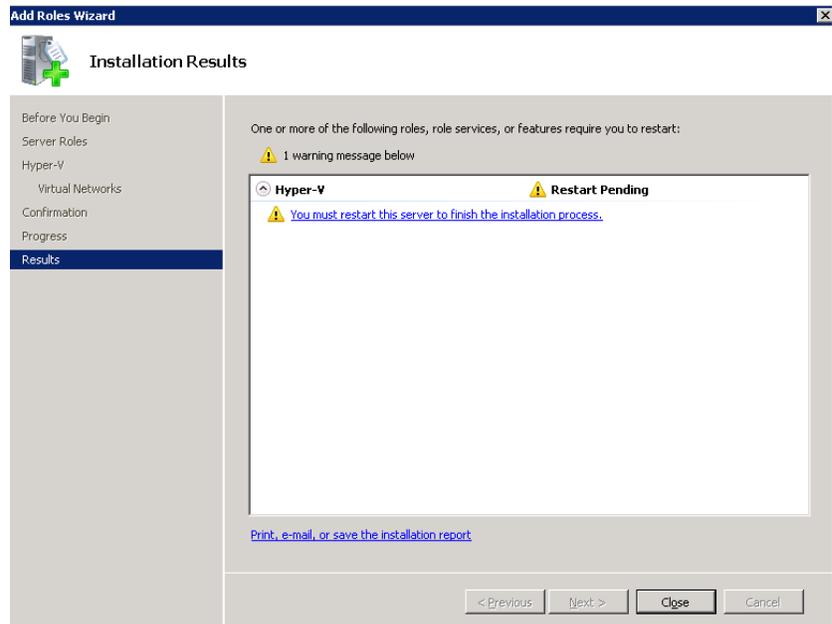
Step	Action
1.	Open Server Manager: Start > Programs > Administrative Tools > Server Manager.
2.	Right-click Roles in the left pane.
3.	<p>Select Add Roles from the context menu.</p>  <p>The screenshot shows the Server Manager console for a server named 'BUCKY'. The left pane shows the 'Roles' folder selected, and a context menu is open with 'Add Roles' highlighted. The right pane shows the 'Roles' overview, including a 'Roles Summary' section indicating 3 of 17 roles are installed, and 'File Services' and 'Role Status' sections.</p>
4.	<p>Select Hyper-V from the list of server roles and click Next.</p>  <p>The screenshot shows the 'Add Roles Wizard' window. The 'Server Roles' tab is selected in the left pane. In the main area, a list of roles is displayed with checkboxes. 'Hyper-V' is checked. A description for Hyper-V is provided on the right: '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.' Navigation buttons at the bottom include '< Previous', 'Next >', 'Install', and 'Cancel'.</p>
5.	Review the information associated with the Introduction to Hyper-V and click Next.

6. You can select Ethernet cards for virtual networks at this time, or you can choose to configure the virtual networks after the configuration of Hyper-V. For this exercise, we will perform this step later. Click Next to continue.



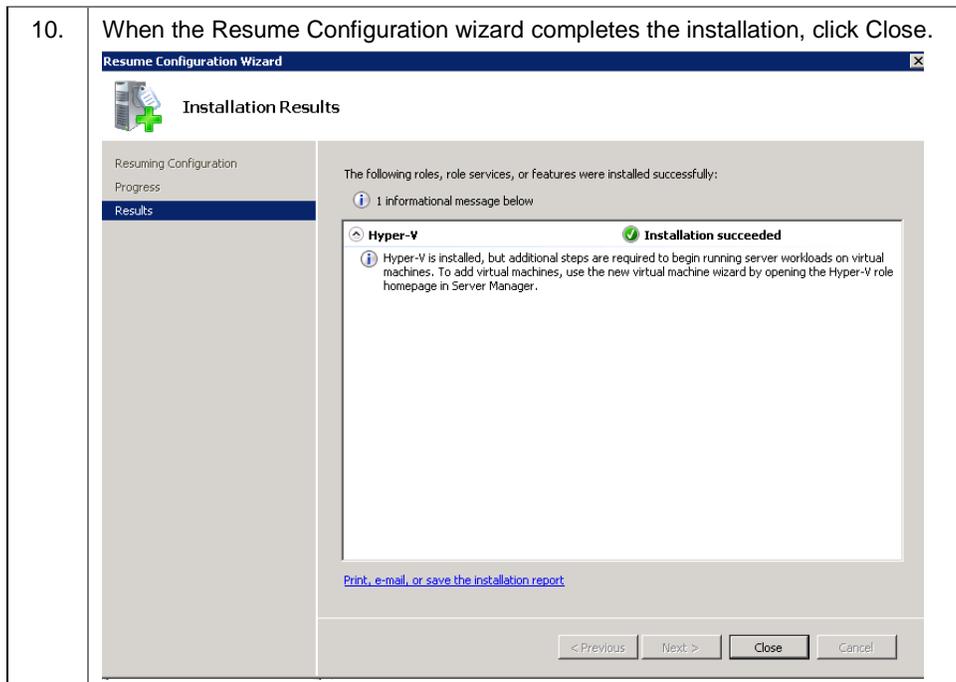
7. Review the confirmation information and click Install.

8. The computer must be restarted to complete the installation. Click Close to finish the wizard and then click Yes to restart the computer.



9. Upon restart, log in with the same account used to install the Hyper-V role.

10. When the Resume Configuration wizard completes the installation, click Close.

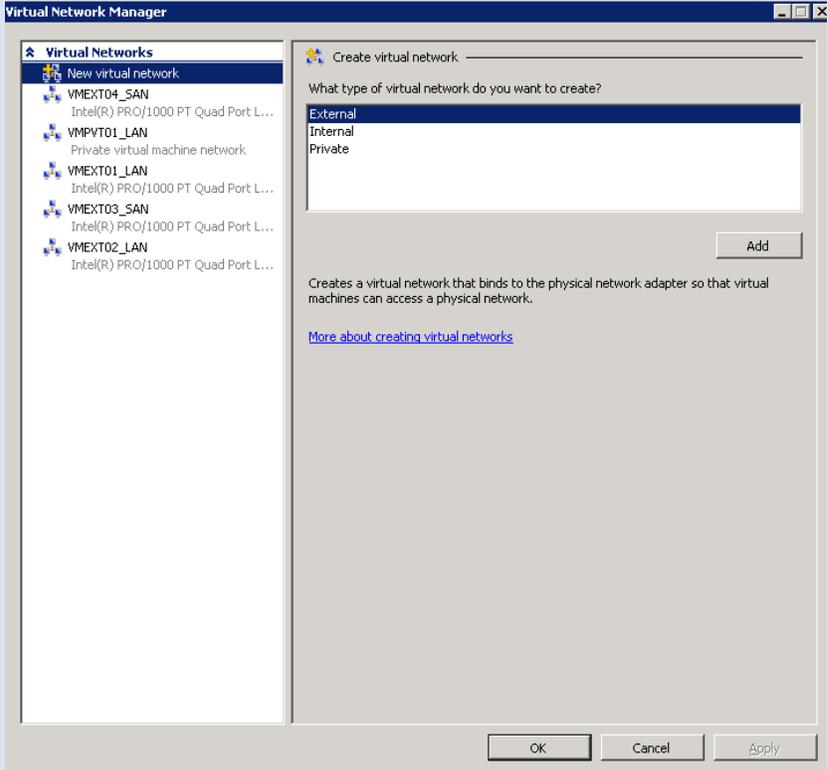


3.3.1.5 Virtual Network Configuration

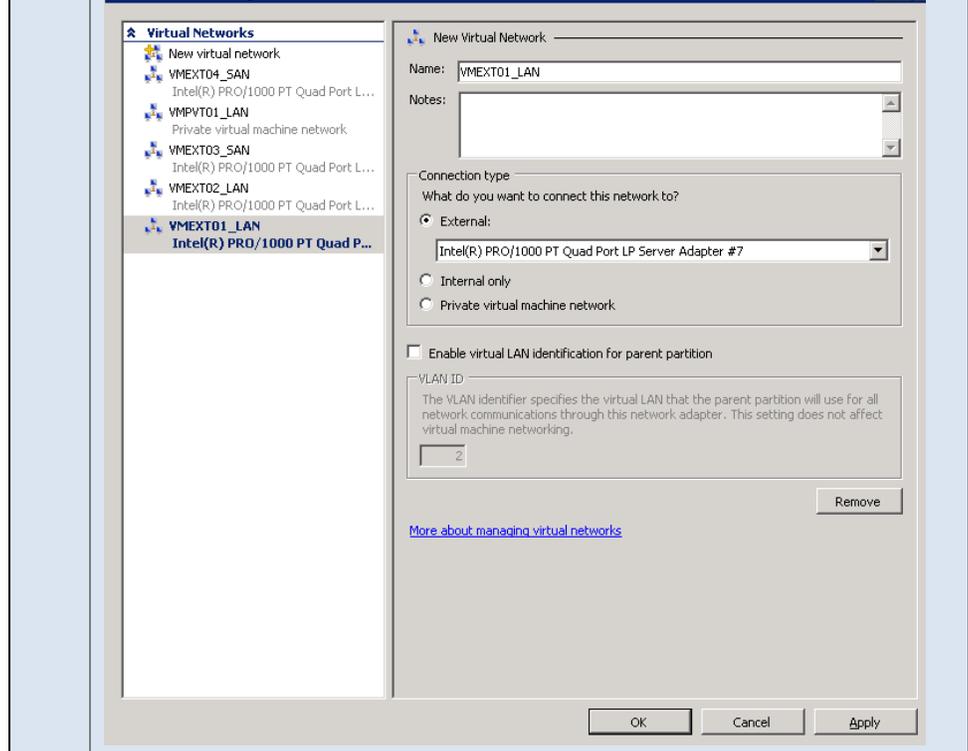
Create Hyper-V Virtual Networks by using the procedure outlined in the following Microsoft documentation:

- <http://technet.microsoft.com/en-us/library/cc816585.aspx>
- http://technet.microsoft.com/en-us/library/cc732470.aspx#BKMK_ConfigVN

For this exercise, we created public networks for VM LAN traffic and SAN traffic (for configuring the iSCSI software initiator on the child VM).

Step	Action
1.	Open Hyper-V Manager: Start > Programs > Administrative Tools > Hyper-V Manager.
2.	From the Actions menu on the right, select Virtual Network Manager.
3.	<p>Below "Create virtual network", select the type of network to create. The types of network are External, Internal, and Private.</p> <p>For this exercise we will create one external network for virtual machine LAN traffic. The same procedure applies to creating an external network for SAN traffic. In all, we will create two external networks for LAN and two external networks for SAN.</p> 
4.	In the Virtual Network Manager window, click Add to open the New Virtual Network page.

5. Enter a name for the new network and specify the external physical adapter to bind to this virtual network. Review the other properties and modify them if necessary. Click OK to create the virtual network and close Virtual Network Manager; or click Apply to create the virtual network and continue using Virtual Network Manager. (This virtual network will later bind to the new virtual machine that will be created by using the Hyper-V Manager.)



3.3.2 Windows Server 2008 Server Core Installation

This procedure is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.3.3.

The server core installation option of the Windows Server 2008 operating system installs a minimal server installation of Windows Server 2008 to run supported server roles, including the Hyper-V role.

3.3.2.1 System Requirements

For detailed information on system requirements, refer to the Microsoft [documentation](#).

Software Requirements

Software Components	Quantity and/or Type
64-bit Windows Server 2008 Enterprise or Windows Server 2008 Datacenter Edition	2
License keys for OS to be installed on Hyper-V child VMs	2
The system should be able to use a name-resolution service, such as Domain Name System (DNS), DNS dynamic update protocol, Windows Internet Name Service (WINS), or Hosts file	N/A

Active Directory Domain	N/A
-------------------------	-----

Hardware Requirements

Hardware Components	Quantity and/or Type
64-bit servers with support for hardware-assisted virtualization technology, such as Intel Virtualization Technology (Intel VT) or AMD Virtualization (AMD-V), identical hardware, and the same processor architecture	2
Minimum CPU speed	1.0GHz
Processor	Intel VT or AMD-V
Minimum RAM	512MB (additional memory needed for each child OS)

Network Requirements

Network Components	Quantity and/or Type
Network adapters per server	2 (minimum)

3.3.2.2 Install Microsoft Windows Server 2008

For detailed information on the installation and configuration of Windows Server 2008 server core installation, refer to the Microsoft [documentation](#).

Be sure to follow the instructions in setting up the following:

- Setting the administrative password
- Setting a static IP address
- Joining a domain
- Renaming the server (optional)
- Activating the server
- Configuring the firewall for remote administration and enabling Remote Desktop Protocol (RDP) access
- Applying the Hyper-V update packages for Windows Server 2008 (KB950050) on the parent partition of the Server Core installation
- Installing any other Microsoft packages required for Windows Server 2008 with server core installation, according to the Microsoft documentation

Step	Action
1.	<p>Enable remote management of the servers by using the Computer Management Microsoft Management Console (MMC) snap-in.</p> <pre>netsh advfirewall firewall set rule group="Remote Administration" new enable=yes</pre> <p>This opens up the rules to allow Remote Management and unlock the following MMC snap-ins:</p> <ul style="list-style-type: none"> • Task Scheduler (taskschd.msc) • Event Viewer (eventvwr.msc) • Shared Folders (fsmgmt.msc) • Performance Monitor (perfmon.msc) • Device Manager (devmgmt.msc)

CONFIGURE THE VIRTUAL DISK SERVICE (VDS)

By default, the Virtual Disk Service is set to start manually on server core installations of Windows Server 2008. The service should be set to start automatically and after that it should be started manually. This enables you to use the MMC Disk Management snap-in to remotely access a server core installation.

Step	Action
1.	<p>Enter the following command on both of the servers:</p> <pre>sc config vds start=auto</pre>
2.	<p>Start the VDS Service:</p> <pre>net start vds</pre>

ENABLE EXCEPTIONS IN THE FIREWALLS

Remote disk management exception also needs to be enabled on the server core installation server and the server that is used to manage the server core installation server.

Step	Action
1.	<p>Enter the following command on both of the servers:</p> <pre>netsh advfirewall firewall set rule group="Remote Volume Management" new enable=yes</pre> <p>Now the server core can be managed by using the Disk Management portion of the Computer Management MMC snap-in.</p>

3.3.2.3 Install the Hyper-V Role

Follow the instructions in the Microsoft [documentation](#) to enable the Hyper-V Role.

Step	Action
1.	Enter the following command on both of the servers: <pre>start /w ocsetup Microsoft-Hyper-V</pre> 

3.3.2.4 Network Configuration

CONFIGURE MANAGEMENT INTERFACE

If it was not done earlier when installing the Windows Server 2008 server core option, configure one network adapter on the Windows Server 2008 server or servers to be used for the management network and assign a static public IP address.

Step	Action
1.	Enter the following command on both of the servers: <pre>netsh interface ipv4 set address name="<ID>" source=static address=<StaticIP> mask=<SubnetMask> gateway=<DefaultGateway></pre>

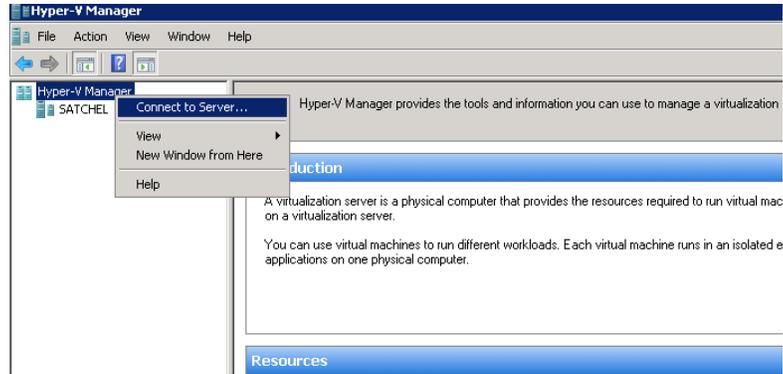
CONFIGURE IP STORAGE INTERFACES

This procedure is required only if configuring NetApp shared storage over iSCSI. Configure two network adapters on the Windows Server 2008 server or servers to be used for configuring and managing iSCSI storage traffic over MS iSCSI Software Initiator and NetApp SnapDrive® software. Assign static IP addresses to the two network adapters. The two network connections are recommended for high availability. Make sure that the NetApp IP storage network port or virtual interface can be pinged from the servers.

Step	Action
1.	Enter the following command on both of the servers: <pre>netsh interface ipv4 set address name="<ID>" source=static address=<StaticIP> mask=<SubnetMask> gateway=<DefaultGateway></pre>

3.3.2.5 Virtual Network Configuration

The Windows Server 2008 server core installation does not have the Hyper-V Manager GUI, but you can remotely manage the server by using the Hyper-V Manager on the Windows Server 2008 full installation server.



Create virtual networks for VM LAN and SAN traffic (if configuring LUNs by using the iSCSI software initiator inside the child VM) by using the procedure described in section 3.3.1.5.

3.3.3 SCVMM 2008 Installation

For the detailed procedure for installing and configuring SCVMM, refer to the Microsoft [documentation](#). For this exercise, we will install SCVMM on a Windows Server 2008 full installation system.

3.3.3.1 SCVMM Server Components

The first procedure in installing SCVMM is to install the server components. Follow these steps.

Step	Action
1.	Select Server from the installation splash screen.
2.	Accept the license terms.
3.	Select an option for updating SCVMM: Microsoft Update or manual methods.
4.	Select whether to participate in the Microsoft Customer Improvement Program.
5.	Enter your name and the name of your organization.
6.	If you have completed the prerequisites check, click Next to continue the installation.
7.	Select an installation path for the SCVMM server components.
8.	Select the appropriate SQL Server® settings. If you choose to configure SCVMM with a previously installed SQL Server instance, follow the Microsoft recommendations: http://technet.microsoft.com/en-us/library/bb740749(TechNet.10).aspx .
9.	<ul style="list-style-type: none"> a. Select a share name for the SCVMM library; if possible, choose a share name that is short and easy to recall. b. Select a share location. Select the LUN that you configured for the SCVMM library, then select Create New Folder on the LUN and select the newly created folder. If possible, select a short folder name for the SCVMM library, usually matching the share name. c. Enter a share description.
10.	Unless you have good reason to change the default port settings for the SCVMM installation, do not change them. If you do make changes, be sure to record the newly configured port numbers and their respective settings.
11.	Review the summary of settings, then select Install to begin installation of SCVMM and its required components.

12.	Depending on the components required by SCVMM, which may or may not already be installed on the server, you may be asked to answer requests to run or install components using pop-ups outside the installation. These are generated by the SCVMM installation. Click Run to continue installing SCVMM.
13.	When the installation is complete, review the summary information and click Close to finish installing the SCVMM.

3.3.3.2 SCVMM Administrator Console

The second procedure is to install the SCVMM Administrator Console components, either on the server on which you just installed the server components or on another supported server or workstation.

To install the Administrator Console, follow these steps.

Step	Action
1.	Select Administrator Console from the installation splash screen.
2.	Accept the license terms.
3.	Select an option for updating SCVMM: Microsoft Update or manual methods.
4.	Acknowledge information associated with the Microsoft Customer Improvement Program.
5.	If you have completed the prerequisites check, click Next to continue the installation.
6.	Select an installation path for the SCVMM server components.
7.	Enter the port number configured during the previous installation of the SCVMM server components.
8.	Review the summary of settings before continuing, then click Install to begin installing SCVMM and its required components.
9.	Depending on the components required by SCVMM, which may or may not already be installed on the server, you may be asked to answer requests to run or install components using pop-ups outside the installation. These are generated by the SCVMM installation. Click Run to continue installing SCVMM.
10.	After the installation is complete, review the summary information and click Close to finish installing the SCVMM.

3.4 INSTALL NETAPP SOFTWARE ON WINDOWS SERVER 2008

3.4.1 Windows Server 2008 Full Install

3.4.1.1 NetApp Windows Host Utilities Kit

To install Windows Host Utilities 5.x on the servers, follow these steps.

Step	Action																																																																
1.	Log in to NOW™ (NetApp on the Web), (http://now.netapp.com). Under Software Download, click Download Software.																																																																
2.	On the download software page, select Windows in either the FCP Host Utilities entry or the iSCSI Host Utilities entry and then click Go. Windows Host Utilities 5.x combines two previous products, iSCSI WHU 4.1 and FCP WHU 4.0. <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Product Name</th> <th>Status</th> <th>Platform</th> <th>Action</th> </tr> </thead> <tbody> <tr><td>ContentDirector</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>ContentReporter</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>DAFS Database Accelerator</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Data ONTAP GX</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Data ONTAP SMI-S Agent</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>DataFort</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Data Decryption Software</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Disaster Recovery Adapter for VMware SRM</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Lifetime Key Management Software</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Lifetime Key Management Appliance</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>FAS Easy-Start Wizard</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>FCP Host Utilities (Attach Kits)</td><td>Active/Renewed</td><td>Windows</td><td>Go</td></tr> <tr><td>Fibre Channel Switch</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>Ingrian OS</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> <tr><td>iSCSI Host Utilities (Support Kits)</td><td>Active/Renewed</td><td><Select Platform></td><td>Go</td></tr> </tbody> </table> </div>	Product Name	Status	Platform	Action	ContentDirector	Active/Renewed	<Select Platform>	Go	ContentReporter	Active/Renewed	<Select Platform>	Go	DAFS Database Accelerator	Active/Renewed	<Select Platform>	Go	Data ONTAP GX	Active/Renewed	<Select Platform>	Go	Data ONTAP SMI-S Agent	Active/Renewed	<Select Platform>	Go	DataFort	Active/Renewed	<Select Platform>	Go	Data Decryption Software	Active/Renewed	<Select Platform>	Go	Disaster Recovery Adapter for VMware SRM	Active/Renewed	<Select Platform>	Go	Lifetime Key Management Software	Active/Renewed	<Select Platform>	Go	Lifetime Key Management Appliance	Active/Renewed	<Select Platform>	Go	FAS Easy-Start Wizard	Active/Renewed	<Select Platform>	Go	FCP Host Utilities (Attach Kits)	Active/Renewed	Windows	Go	Fibre Channel Switch	Active/Renewed	<Select Platform>	Go	Ingrian OS	Active/Renewed	<Select Platform>	Go	iSCSI Host Utilities (Support Kits)	Active/Renewed	<Select Platform>	Go
Product Name	Status	Platform	Action																																																														
ContentDirector	Active/Renewed	<Select Platform>	Go																																																														
ContentReporter	Active/Renewed	<Select Platform>	Go																																																														
DAFS Database Accelerator	Active/Renewed	<Select Platform>	Go																																																														
Data ONTAP GX	Active/Renewed	<Select Platform>	Go																																																														
Data ONTAP SMI-S Agent	Active/Renewed	<Select Platform>	Go																																																														
DataFort	Active/Renewed	<Select Platform>	Go																																																														
Data Decryption Software	Active/Renewed	<Select Platform>	Go																																																														
Disaster Recovery Adapter for VMware SRM	Active/Renewed	<Select Platform>	Go																																																														
Lifetime Key Management Software	Active/Renewed	<Select Platform>	Go																																																														
Lifetime Key Management Appliance	Active/Renewed	<Select Platform>	Go																																																														
FAS Easy-Start Wizard	Active/Renewed	<Select Platform>	Go																																																														
FCP Host Utilities (Attach Kits)	Active/Renewed	Windows	Go																																																														
Fibre Channel Switch	Active/Renewed	<Select Platform>	Go																																																														
Ingrian OS	Active/Renewed	<Select Platform>	Go																																																														
iSCSI Host Utilities (Support Kits)	Active/Renewed	<Select Platform>	Go																																																														
3.	Select Windows Host Utilities 5.0. <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>FCP Host Utilities (Attach Kits) for Windows®</p> <p>This page contains a list of FCP Host Utilities for Windows that have been tested with the NetApp Filer running the FCP protocol.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Initiator</th> <th>Date Posted</th> </tr> </thead> <tbody> <tr> <td>Windows® Host Utilities 5.0 (see support matrix for specific configurations)</td> <td>01-JUL-2008</td> </tr> <tr> <td>Fibre Channel Host Utilities 4.0.1 for Windows® 2003 and 2008 (see support matrix for specific configurations)</td> <td>18-JUN-2008</td> </tr> <tr> <td>Fibre Channel Host Utilities 4.0 for Windows® 2003 and 2008 (see support matrix for specific configurations)</td> <td>24-JAN-2008</td> </tr> <tr> <td>FCP Windows® Host Utilities 3.0 for Native OS (use with SnapDrive 4.2 and later, and Data ONTAP DSM)</td> <td>31-OCT-2006</td> </tr> <tr> <td>FCP Windows® Attach Kit 3.0 (use with SnapDrive 4.1 and earlier, and NTAP DSM)</td> <td>13-APR-2006</td> </tr> </tbody> </table> </div>	Initiator	Date Posted	Windows® Host Utilities 5.0 (see support matrix for specific configurations)	01-JUL-2008	Fibre Channel Host Utilities 4.0.1 for Windows® 2003 and 2008 (see support matrix for specific configurations)	18-JUN-2008	Fibre Channel Host Utilities 4.0 for Windows® 2003 and 2008 (see support matrix for specific configurations)	24-JAN-2008	FCP Windows® Host Utilities 3.0 for Native OS (use with SnapDrive 4.2 and later, and Data ONTAP DSM)	31-OCT-2006	FCP Windows® Attach Kit 3.0 (use with SnapDrive 4.1 and earlier, and NTAP DSM)	13-APR-2006																																																				
Initiator	Date Posted																																																																
Windows® Host Utilities 5.0 (see support matrix for specific configurations)	01-JUL-2008																																																																
Fibre Channel Host Utilities 4.0.1 for Windows® 2003 and 2008 (see support matrix for specific configurations)	18-JUN-2008																																																																
Fibre Channel Host Utilities 4.0 for Windows® 2003 and 2008 (see support matrix for specific configurations)	24-JAN-2008																																																																
FCP Windows® Host Utilities 3.0 for Native OS (use with SnapDrive 4.2 and later, and Data ONTAP DSM)	31-OCT-2006																																																																
FCP Windows® Attach Kit 3.0 (use with SnapDrive 4.1 and earlier, and NTAP DSM)	13-APR-2006																																																																

4. On the Windows Host Utilities 5.0 Download Page, click `netapp_windows_host_utilities_5.0_x64.msi` to download the file.

Windows® Host Utilities 5.0 Download Page

This page provides access to the software installation package for Windows® Host Utilities 5.0.

Note: For Windows guest operating systems running on Hyper-V or Virtual Server 2005 R2 virtual machines, use the appropriate Host Utilities version type of the virtual machine, not the processor type of the parent system.

Downloading Windows Host Utilities Software

To download the software, complete the following steps:

- Click one of the following installation packages. The package works for all Windows versions supported on that processor type.
 - For Windows x86 (32 bit) systems, click `netapp_windows_host_utilities_5.0_x86.msi` (approximately 11.2 MB).
 - For Windows x64 (AMD and Intel) systems, click `netapp_windows_host_utilities_5.0_x64.msi` (approximately 11.2 MB).
 - For Windows IA64 (Itanium) systems, click `netapp_windows_host_utilities_5.0_IA64.msi` (approximately 11.2 MB).
- Specify the directory location to which you want to download the installation package.
- After downloading is complete, install the Host Utilities by following the steps in the [Setup Guide](#).

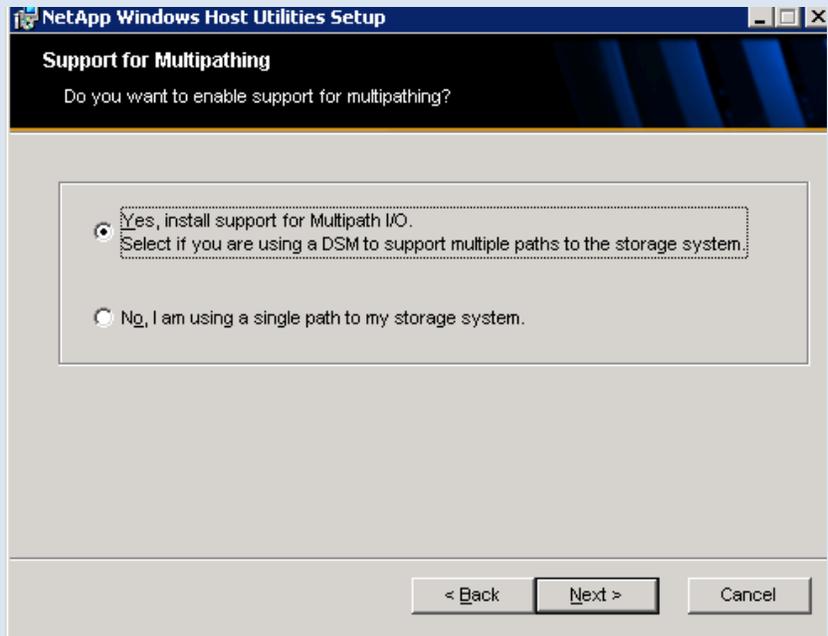
5. Double-click the downloaded file and click Run. Make sure that you are logged in as local administrator or domain administrator to the Windows Server 2008 server.
- Note:** If there is a Microsoft hot fix prerequisite, a warning appears and the installation is canceled. Download the required hot fix and retry the host utilities installation.
6. On the welcome page, click Next.
7. Accept the licensing agreement and click Next.

8. Select the protocol support required and click Next.
- The base registry entries and HBA parameters are set depending on your choice.
 - Host utilities are installed.
 - Select the Both option to install all of the utilities.

For this exercise, we will select Both.



9. If you will have multiple paths configured to the storage array, select "Yes, install support for Multipath I/O" and click Next.
- For Windows Server 2008, this automatically installs and enables the Microsoft MPIO components feature and installs support for the Microsoft Device Specific Module (MSDSM).

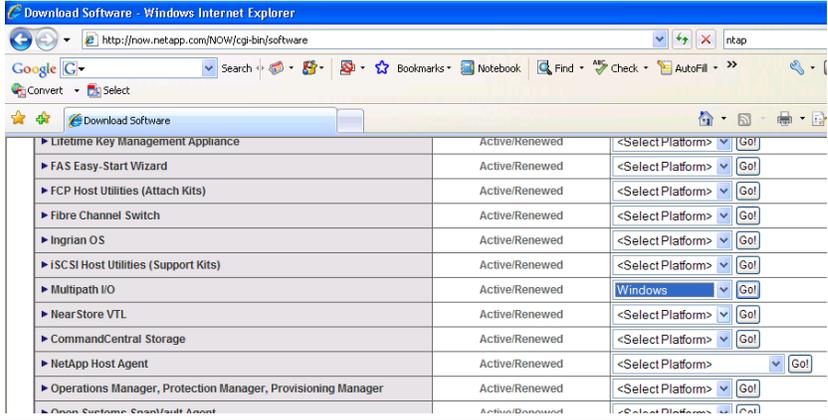


10. Specify the installation location and click Next.

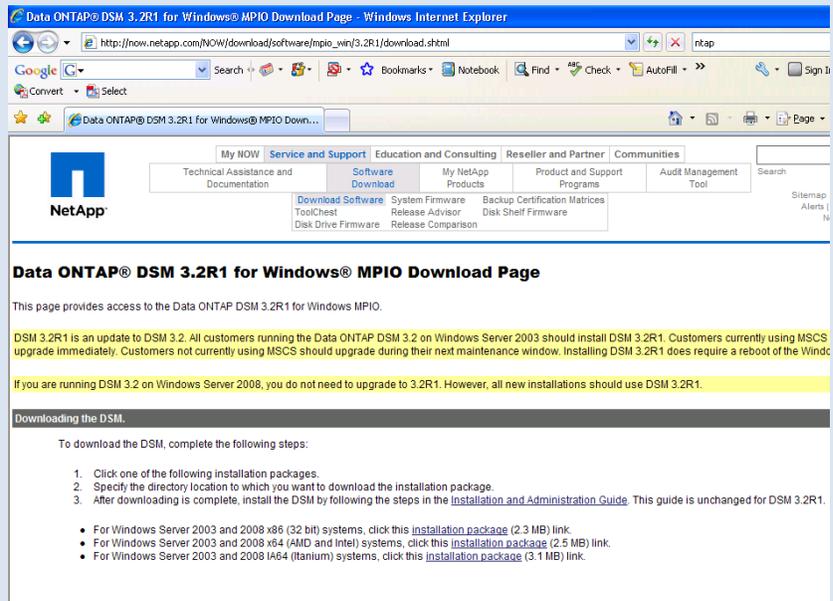
11.	Click Next to begin the installation.
12.	Monitor the installation and click Finish when it is complete.
13.	The computer must be restarted to complete the installation. Click Yes to restart the computer.
14.	When the computer restarts, verify the installation: Start > Programs > NetApp > Windows Host Utilities. Also navigate to the installation directory to verify the installed files.

3.4.1.2 NetApp Data ONTAP DSM for Windows MPIO

To install Data ONTAP DSM for Windows MPIO on the servers, follow these steps.

Step	Action
1.	Log in to NOW (http://now.netapp.com). Under Software Download, click Download Software.
2.	Next to Multipath I/O, select Windows and click Go. 
3.	On the Multipath I/O for Windows page, click View and Download.
4.	On the Data ONTAP DSM for Windows MPIO page, click Data ONTAP DSM 3.2R1 for Windows MPIO.
5.	Read the Data ONTAP DSM 3.2R1 for Windows MPIO Description Page and click Continue.
6.	Read the Base Customer Software License Agreement and click Accept.

7. On the Data ONTAP DSM 3.2R1 for Windows MPIO Download Page, click Install Package for Windows Server 2008 x64 (AMD and Intel) systems to download the file to the server.

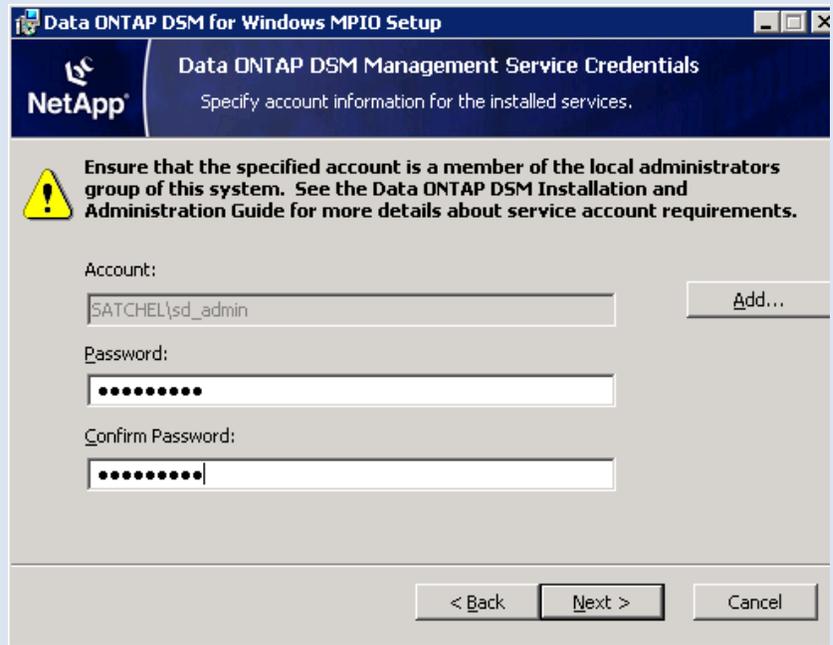


8. On the server, double-click the installation file and click Next on the welcome screen.

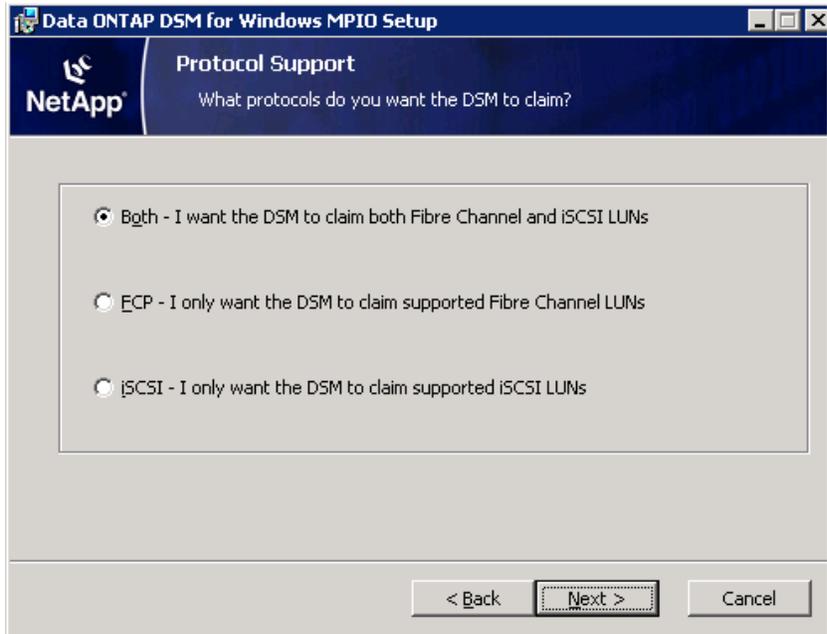
9. Accept the license agreement and click Next.

10. On the License Key page, enter the license key and click Next.

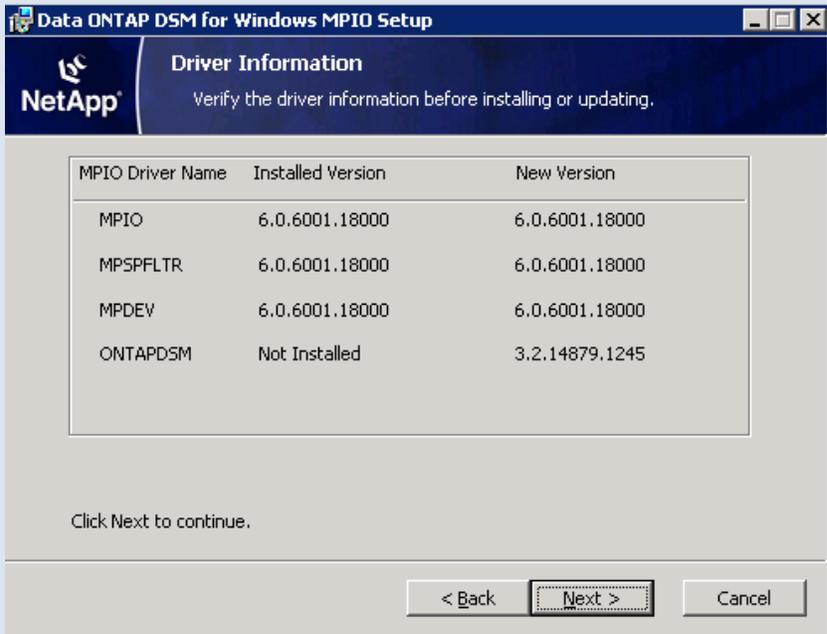
11. On the Data ONTAP DSM Management Service Credentials page, enter the account information for a user account that is a member of the local administrator group of the Windows Server 2008 server and click Next. For this exercise, we will use a local user account, sd_admin, which is a member of the local administrator group for the server.



12. Select the protocol support required and click Next. For this project, we will select Both.



13. Verify the driver information and click Next.



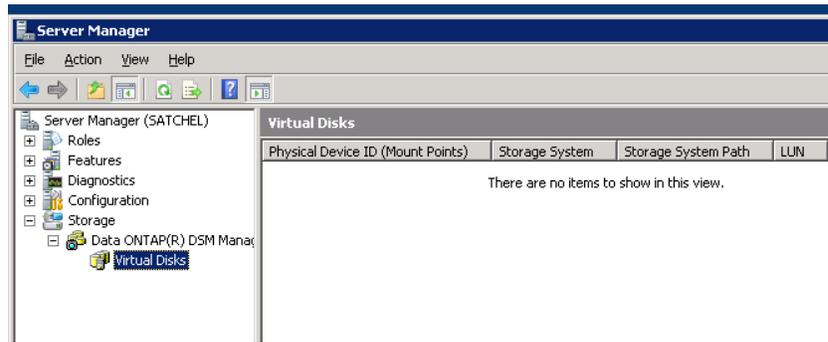
14. Verify the installation folder and click Next.

15. Click Install to begin installation.

16. On completion, click Finish.

17. Click Yes to restart the computer.

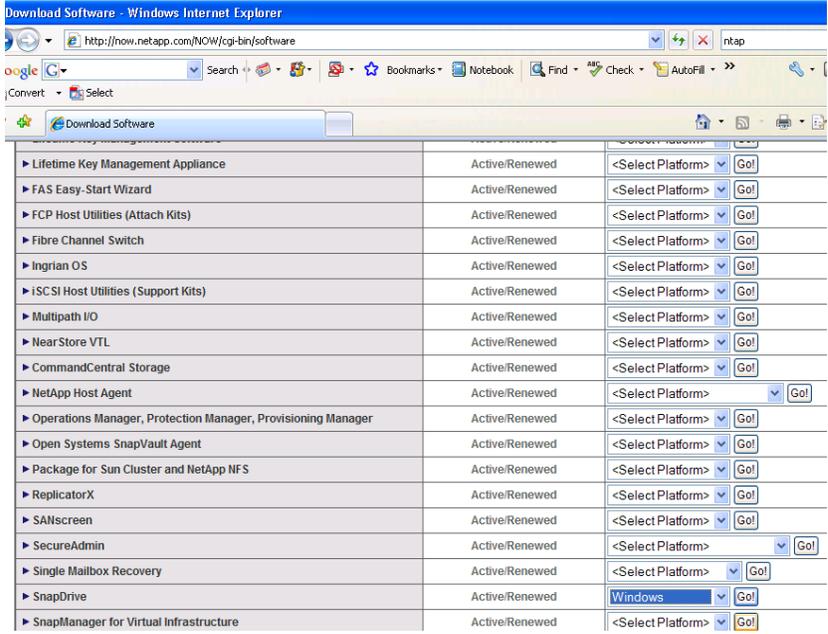
18. After restarting, verify the installation: Server Manager > Storage > Data ONTAP DSM Manager.



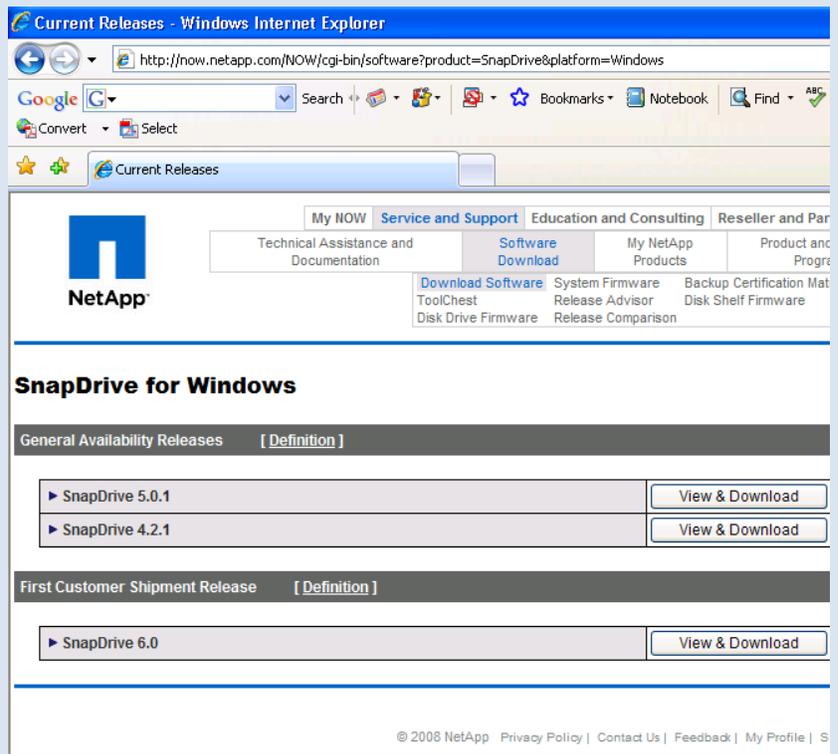
3.4.1.3 NetApp SnapDrive for Windows

DOWNLOAD

To download NetApp SnapDrive 6.0 for Windows, follow these steps.

Step	Action
1.	Log in to NOW (http://now.netapp.com). Under Software Download, click Download Software.
2.	On the Download Software page, next to SnapDrive, select Windows and click Go. 

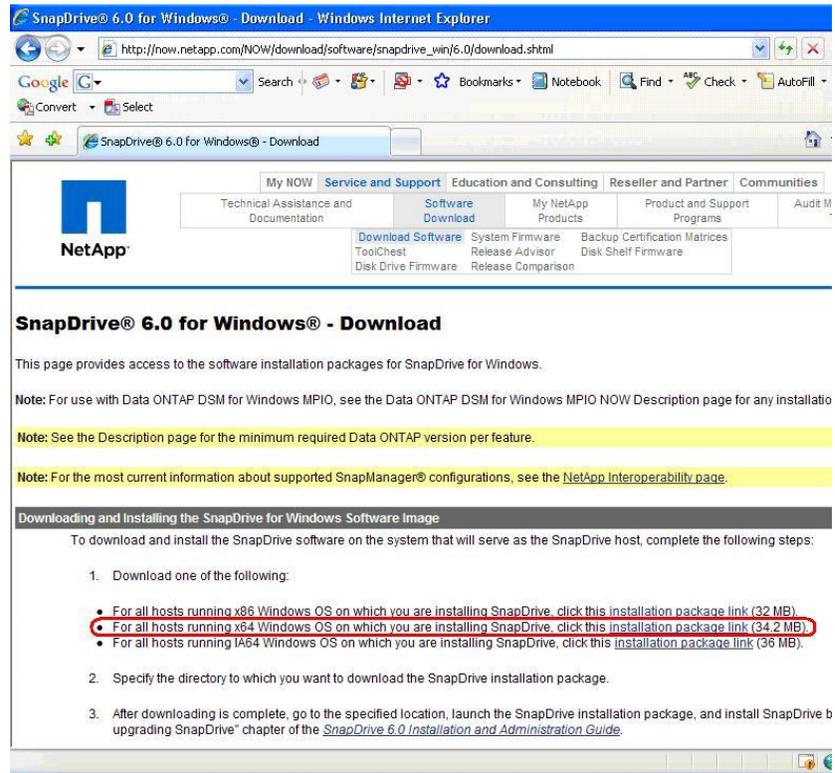
3. Click View and Download for SnapDrive 6.0.



4. Read the SnapDrive 6.0 for Windows description page and click Continue.

5. Read the Customer Software License agreement and click Accept.

6. On the SnapDrive 6.0 for Windows – Download page, click the installation package link for x64 Windows OS.

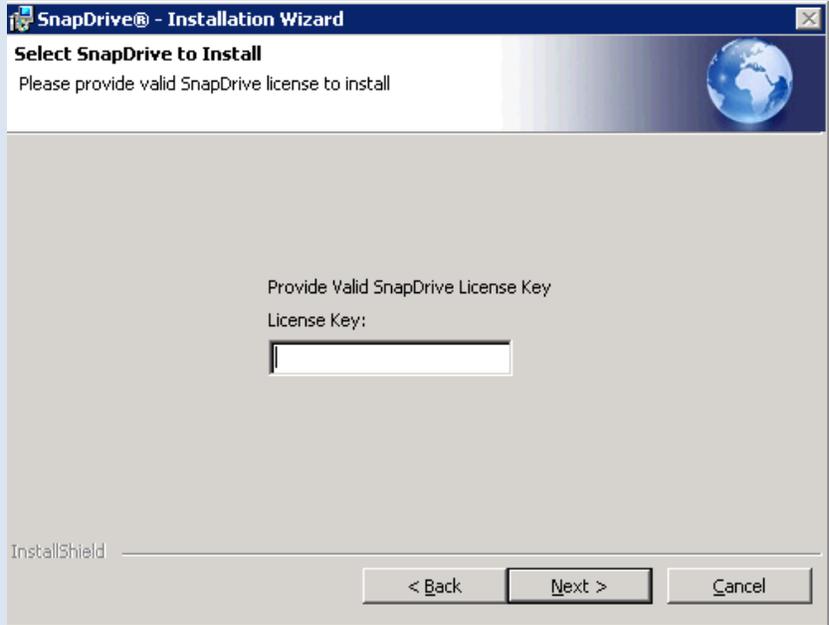


7. Download and install the required Microsoft Windows hotfixes from the Microsoft support Web site (<http://support.microsoft.com/>).

INSTALLATION

Before installing SnapDrive 6.0 for Windows, you must establish a SnapDrive service account and make sure that the authentication requirements are met. To perform functions related to SnapDrive for Windows on either the host or a storage system, SnapDrive needs to be able to use a service account that has specific types of access established. The transport protocols that can be used are RPC, HTTP, and HTTPS. For configuration information about these protocols, see the SnapDrive 6.x Installation and Administration Guide.

For this guide, we will assume that the storage system and servers are not part of the same domain and that HTTP is used as the transport protocol.

Step	Action
1.	<p>Configure User Account on the storage system. For this exercise, we will create a user with the same user name (sd_admin) as used in section 3.4.1.2, "NetApp Data ONTAP DSM for MPIO."</p> <ol style="list-style-type: none"> Log in to the NetApp storage controller CLI. Create a new role for SnapDrive and add the required API capabilities: <pre>useradmin role add sd_admin_r -a login-*,api-*</pre> Create a new group and assign the role created in the previous step: <pre>useradmin group add sd_admin_g -r sd_admin_r</pre> Create a new user and add it to the group created in the previous step: <pre>useradmin user add sd_admin -g sd_admin_g</pre>
2.	<p>Create a new local user on the server with the same user name and password as created on the storage system in step 1. For this exercise, we will use the same local user account (sd_admin) that was used in section 3.4.1.2. "NetApp Data ONTAP DSM for MPIO."</p>
3.	<p>Log in to the server as local or domain administrator and double-click the SnapDrive installer.</p>
4.	<p>Click Next at the welcome screen, accept the license agreement, and click Next.</p>
5.	<p>Enter the license key and click Next.</p> 
6.	<p>Verify the installation location and click Next.</p>

7. Enter SnapDrive Service Credentials information. This can be any domain user who is member of the local Administrators group on the Windows Server 2008. For this exercise, we have created a domain user sd_admin.

Note: The domain user is required if the Windows Server 2008 servers will be configured as nodes in Windows Failover Cluster.

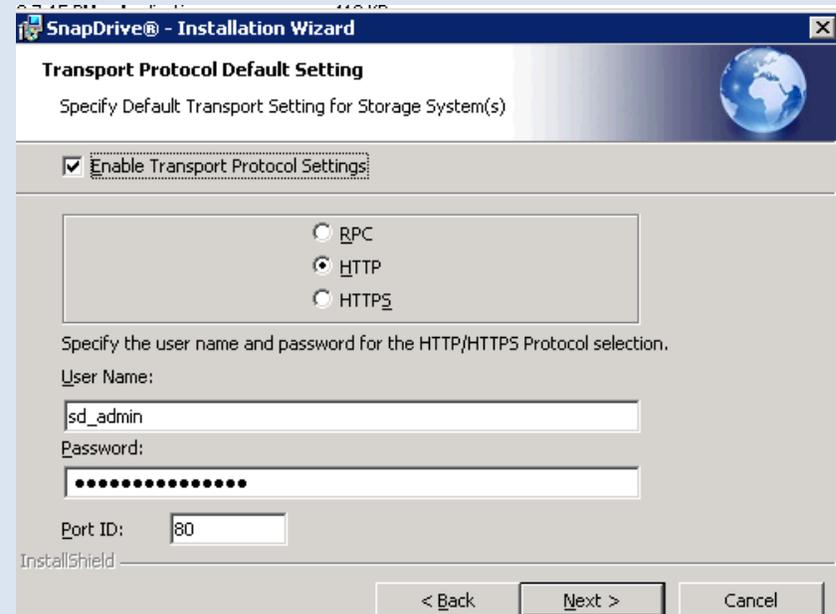


The screenshot shows the 'SnapDrive® - Installation Wizard' dialog box, titled 'SnapDrive Service Credentials'. The subtitle is 'Specify account information for the installed services.' A warning icon is present with the text: 'Ensure that the specified account is a member of the Storage System's local administrators group as well as the local administrators group of this system. See the SnapDrive Installation and Administration Guide for more details about service account requirements.' Below this, a note states: 'Note: NetApp VSS hardware provider registration also requires user account information.' The 'Account:' field contains 'REDMOND\sd_admin' and has an 'Add...' button. The 'Password:' and 'Confirm Password:' fields are masked with dots. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.

8. Verify the default SnapDrive Web services configuration and click Next.

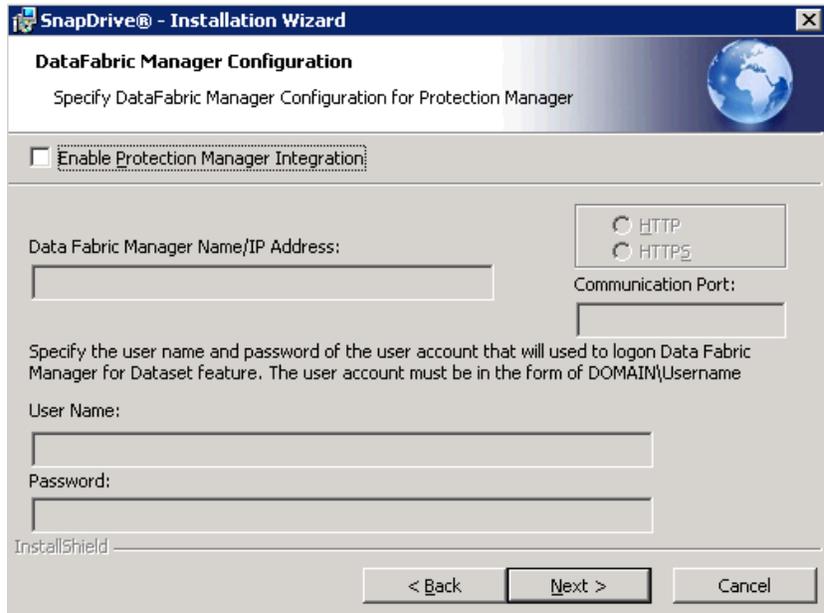
9. Select HTTP as the transport protocol. There are other options available as well. For more information, see the SnapDrive 6.x Installation and Administration Guide at <http://now.netapp.com>.

Specify the username and password for the HTTP protocols that will be used to communicate with the storage system and click Next. This username is the same local user created earlier in the procedure.

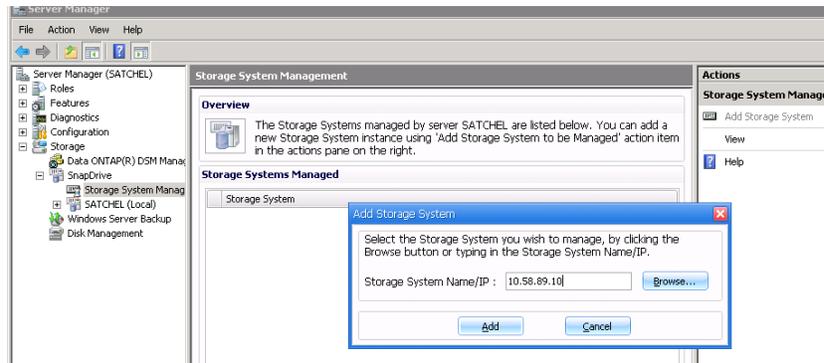


The screenshot shows the 'SnapDrive® - Installation Wizard' dialog box, titled 'Transport Protocol Default Setting'. The subtitle is 'Specify Default Transport Setting for Storage System(s)'. A checkbox labeled 'Enable Transport Protocol Settings:' is checked. Below this, three radio buttons are shown: 'RPC', 'HTTP' (which is selected), and 'HTTPS'. Below the radio buttons, the text reads: 'Specify the user name and password for the HTTP/HTTPS Protocol selection.' The 'User Name:' field contains 'sd_admin'. The 'Password:' field is masked with dots. The 'Port ID:' field contains '80'. At the bottom, there are '< Back', 'Next >', and 'Cancel' buttons.

10. (Optional) Configure Protection Manager Integration and click Next. For this exercise, we will leave the box unchecked.



11. Click Install to continue.
12. Click Finish to complete the installation.
13. Verify the installation: Server Manager > Storage > SnapDrive > Storage System Management.
14. Add the hostname or IP address of the NetApp storage array that will be used for storage.
Storage System Management > Add storage system.



3.4.2 Windows Server 2008 Server Core Installation

This procedure is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.5.

3.4.2.1 NetApp Windows Host Utilities Kit

The procedure is the same as outlined in section 3.4.1.1. The only difference is that the host utilities `msi` download file must be executed from the command line by using the following command. The rest of the installation procedure is the same.

Step	Action
1.	Enter the following command on both of the servers: <code>msiexec /package <NetApp Windows Host Utilities>.msi</code>

3.4.2.2 Install Data ONTAP DSM for Windows MPIO

The procedure for installing Data ONTAP DSM for MPIO is the same as described in section 3.4.1.2. The only difference is that the `.msi` download file must be executed from the command line by using the following command. The rest of the installation procedure is the same.

Step	Action
1.	Enter the following command on both of the servers: <code>msiexec /package <NetApp Data ONTAP DSM for MPIO>.msi</code>

3.5 FIBRE CHANNEL ZONING CONFIGURATION (OPTIONAL)

Configure Fibre Channel zoning if you plan to use Fibre Channel for connectivity between the Hyper-V servers. The procedure is the same for both full and server core installation options. For this exercise, we configure FC zoning for Windows Server 2008 full installation only.

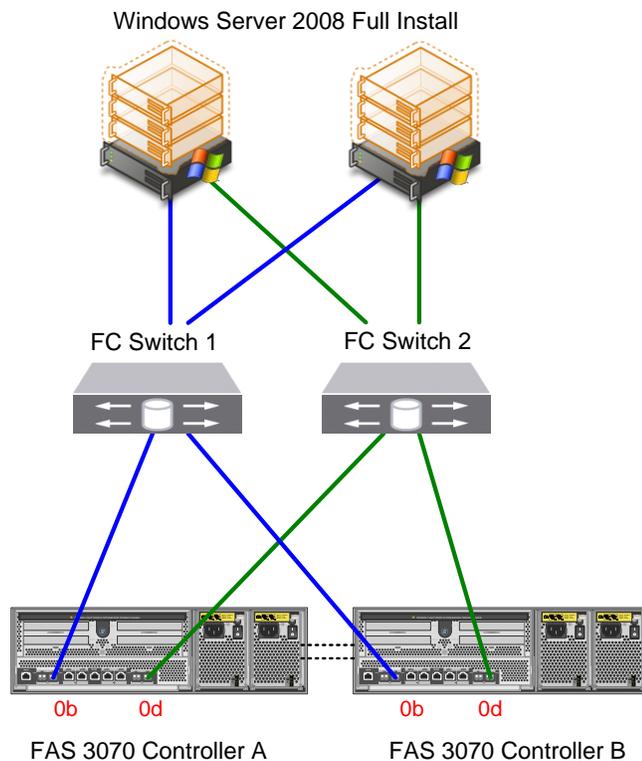
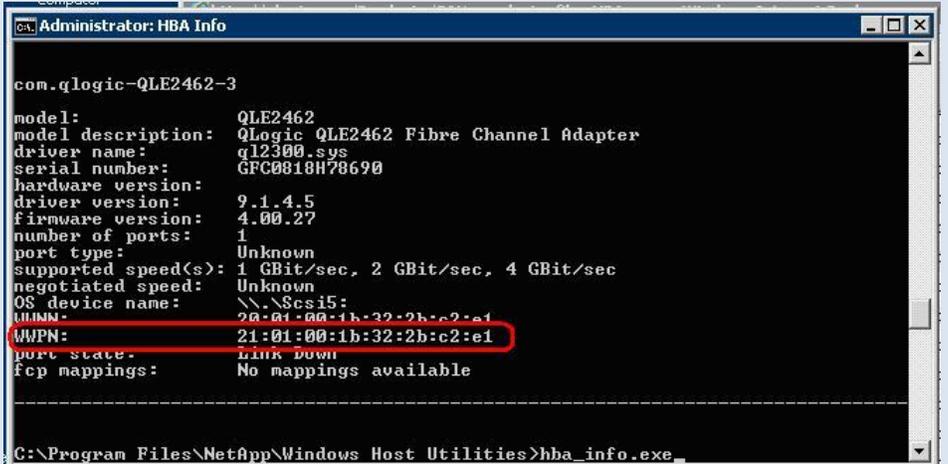


Figure 5) FC configuration.

Obtain the WWPN for the FC HBA ports on the Windows Server 2008 server by using the NetApp Windows Host Utilities installed earlier in the process. This procedure is same for both Windows Server 2008 full and server core installation options.

To obtain the WWPN, follow these steps.

Step	Action
1.	<p>On the Windows Server 2008 server, open a command line window and run the hba_info.exe file to obtain the WWPN for the HBA ports that are connected to the FC SAN switches.</p>
 <pre> Administrator: HBA Info com.qlogic-QLE2462-3 model: QLE2462 model description: QLogic QLE2462 Fibre Channel Adapter driver name: ql2300.sys serial number: GFC0818H78690 hardware version: driver version: 9.1.4.5 firmware version: 4.00.27 number of ports: 1 port type: Unknown supported speed(s): 1 GBit/sec, 2 GBit/sec, 4 GBit/sec negotiated speed: Unknown OS device name: \\.\Scsi5: WWPN: 21:01:00:1b:32:2b:c2:e1 port state: Link Down Fcp mappings: No mappings available ----- C:\Program Files\NetApp\Windows Host Utilities>hba_info.exe </pre>	

- Log in to the FilerView® GUI and select LUNs > FCP > Report to obtain the port name for the FC ports connected to the SAN switches.

The screenshot shows the FilerView GUI with the 'FC Adapters' section expanded. The following table represents the data shown in the GUI:

Slot	Description	Adapter Type	Status	FC Nodename	FC Portname	Standby
0d	Fibre Channel Target Adapter 0d (Dual-channel)	Local	ONLINE	50:0a:09:80:87:89:78:62 (500a098087897862)	50:0a:09:81:87:89:78:62 (500a098187897862)	No
0b	Fibre Channel Target Adapter 0b (Dual-channel)	Local	ONLINE	50:0a:09:80:87:89:78:62 (500a098087897862)	50:0a:09:82:87:89:78:62 (500a098287897862)	No

This step can also be performed from the CLI using the following steps:

Telnet or SSH to the NetApp storage controller and obtain the WWPN for the FC ports that are connected to the SAN switches by running the following command:

```
fcportname show
```

```

10.58.89.10 - PuTTY
login as: root
root@10.58.89.10's password:
wilco1> fcportname show
Portname                Adapter
-----                -
50:0a:09:81:87:89:78:62 0d
50:0a:09:82:87:89:78:62 0b
wilco1* >

```

- Using appropriate SAN management software, configure SAN zoning between the Windows Server 2008 server or servers and the NetApp storage array.

3.6 NETAPP STORAGE PROVISIONING

3.6.1 Configure an Aggregate

The first step to configuring storage on NetApp storage is to add a new aggregate. To configure an aggregate by using NetApp FilerView, follow these steps.

Steps	Action
1.	<p>Open NetApp FilerView, click Aggregates, and click Add.</p> 
2.	<p>For Aggregate Name, enter a name that includes “Hyper-V” and that reflects the Hyper-V environment that will use it.</p> <p>Select the Double Parity check box to take advantage of RAID-DP® (the NetApp recommended RAID level for an aggregate). Click Next.</p> 

3. For RAID Group Size, select the number of disks to assign. NetApp recommends that you accept the default value of 16.

Aggregate Wizard - RAID Parameters

RAID Group Size: 16 ?

Enter the number of disks per RAID group on this aggregate. Disks will be organized into RAID groups of this size.

< Back Cancel Next >

Done

4. For Disk Selection, select the method for selecting disks to be used for the aggregate. Automatic is selected by default and is the NetApp recommended best practice.

Aggregate Wizard - Disk Selection Method

Disk Selection: Automatic ? Manual

Select whether you want manual or automatic disk selection. If you select **automatic**, disks will be chosen for you.

< Back Cancel Next >

Done

5. For Disk Size, select the disk size to be used in the aggregate. Any Size is selected by default. NetApp recommends selecting disks of the same size when creating an aggregate.

Aggregate Wizard - Disk Size

Disk Size: Any Size ?

Select the size of disk to use. Select 'Any Size' to have the disk sizes chosen automatically.

< Back Cancel Next >

Done

6. For Number of Disks, select the number of disks to be added to the aggregate. NetApp best practice is to create as large an aggregate as possible. Assign at least three disks to provision an aggregate. Click Next and then click Commit to finish creating the new aggregate. As recommended earlier, make non root aggregates as large as possible to benefit from the I/O capacity of all the spindles in the aggregate.

Aggregate Wizard - Number of Disks

Number of Disks: 14 ?

Select the number of disks of size 'Any Size' to add to the aggregate. There are a total of 16 spares available.

< Back Cancel Next >

Done

3.6.2 Configure Flexible Volumes

Flexible volumes (FlexVol®) contain LUNs that are accessed by Windows Server 2008 servers over FC or iSCSI. These LUNs can be used as logical disk drives (called *physical disks* in Hyper-V terminology) that serve as the storage location for the virtual hard disk (VHD) files representing the VMs running on Windows Server 2008 server, or as a physical disk directly accessed by the VM (also referred to as a *pass-through disk*).

For this exercise, we create flexible volumes for hosting quorum disks and for VMs provisioned via Hyper-V Manager on both the Windows Server 2008 full and server core installation options, and also SCVMM.

Note: It is not a technical requirement to create separate flexible volumes for hosting VMs provisioned using different methods.

3.6.2.1 Create a NetApp Flexible Volume for the LUN Configured As the Windows Failover Cluster Quorum Disk on Full Installation

To configure a flexible volume by using NetApp FilerView, follow these steps.

Step	Action
1.	Open NetApp FilerView, click Volumes, and click Add.
2.	For Volume Type Selection, select Flexible. 

3. Enter the volume name.

NetApp recommends accepting the default values for Language and UTF-8, unless you have good reason to change these values.

Volume Wizard - Volume Parameters

Volume Name: ?
Enter a name for the new volume.

Language: ?
Select the language to use on this volume.

UTF-8: UTF-8 ?
Select to make language of this volume UTF-8 encoded.

Internet 100%

4. For Containing Aggregate, select the aggregate on which the flexible volume should be created, such as the aggregate that you created in section 3.6.1, "Configure an Aggregate."
- For Space Guarantee, select the appropriate option. To achieve volume-level thin provisioning, select None". For this exercise, we will select Volume.
- For details on different volume configuration settings to achieve space savings, refer to [NetApp TR 3505](#).

Volume Wizard - Flexible Volume Parameters

Containing Aggregate
 Select the aggregate to contain this volume. Only non-snaplock aggregates are displayed.
 HyperV_Production (932 GB, raid_dp) ?

Space Guarantee
 Sets the space guarantee. Volume guarantees space for the entire volume in the containing aggregate; File guarantees space for a file at file allocation time.
 volume ?

< Back Cancel Next >

one Internet 100%

5. For Volume Size Type, select Total Size. Enter the volume size (for example, 10GB). For Snapshot Reserve, enter 0.

Volume Wizard - Flexible Volume Size

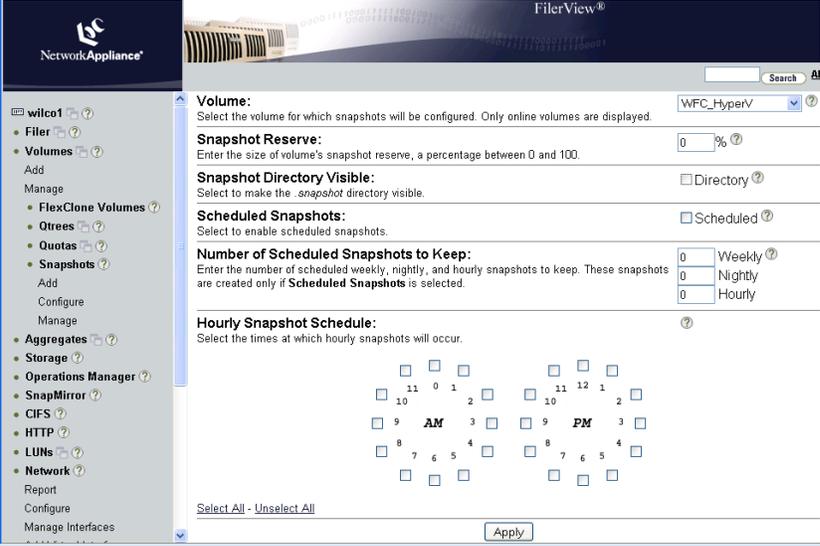
Volume Size Type:
 Select **Total Size** to enter the total volume size (including snap reserve) and **Usable Size** to enter the usable volume size (excluding snap reserve).
 Total Size ?
 Usable Size

Volume Size:
 Enter the desired volume size. The containing aggregate, HyperV_Production has a maximum of 932 GB space available.
 10 GB ?
 932 GB (Max)

Snapshot Reserve :
 Enter the snapshot reserve for volume WFC_HyperV. The range is between 0% and 100%. The default is 20%.
 0 % ?

< Back Cancel Next >

Internet 100%

6.	Click Next to verify the settings and click Commit.
7.	<p>Disable the automatic Snapshot™ schedule for the volume: Volume > Snapshots > Configure. Select the volume name from the drop-down list, uncheck Scheduled, enter '0 for weekly, nightly, and hourly snapshots, and click Apply.</p>  <p>This step can also be performed by using the CLI. To set the volume options for Snapshot copies to the recommended setting by using the CLI:</p> <ol style="list-style-type: none"> Log in to the NetApp console. Set the volume Snapshot schedule: <pre>snap sched <vol-name> 0 0 0</pre>
8.	<p>Set the volume fractional reserve value to 0. For detailed information about this setting, see NetApp TR 3505.</p> <pre>vol options <vol-name> fractional_reserve 0</pre>

3.6.2.2 Create a NetApp Flexible Volume for the LUN Configured as the Windows Failover Cluster Quorum Disk on Server Core Installation

This procedure is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.6.2.3. Repeat the procedure described in section 3.6.2.1 to create a 10GB flexible volume to host the LUN to be used as the quorum disk on server core installation.

3.6.2.3 Create a NetApp Flexible Volume for the LUNs Configured to Host VMs Created by Using Hyper-V Manager on Windows Server 2008 Full Installation

Repeat the procedure described in section 3.6.2.1 to create a 100GB flexible volume to host the LUN to be used for VMs created by using Hyper-V Manager on full installation.

3.6.2.4 Create a NetApp Flexible Volume for the LUNs Configured to Host VMs Created by Using Hyper-V Manager on Windows Server 2008 Server Core Installation

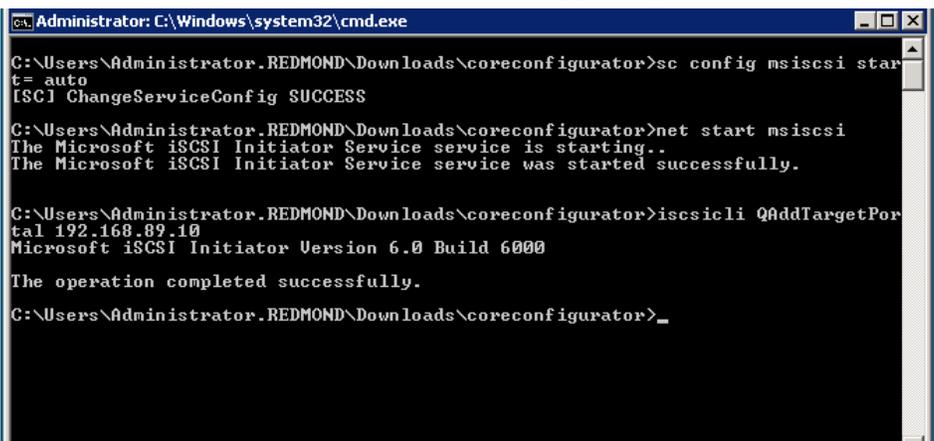
This procedure is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.6.2.5. Repeat the procedure described in section 3.6.2.1 to create a 100GB flexible volume to host the LUN to be used for VMs created by using Hyper-V Manager on server core Installation.

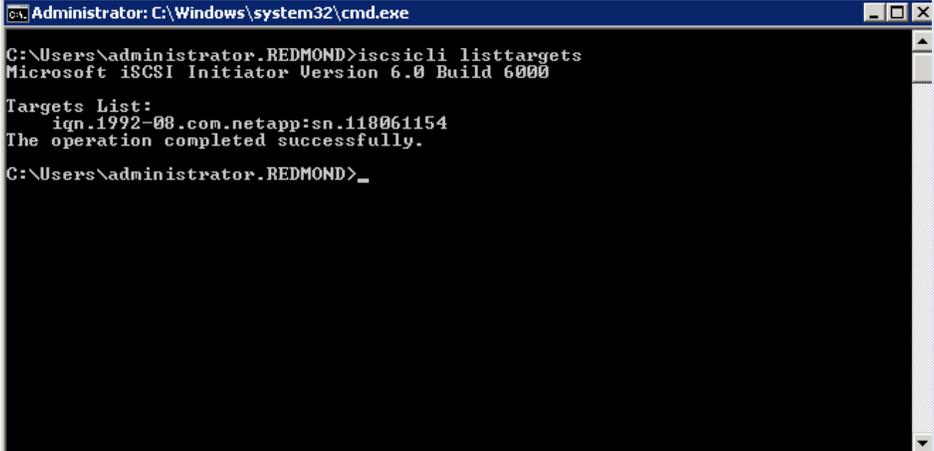
3.6.2.5 Create a NetApp Flexible Volume for the LUNs Configured to Host VMs Created by Using SCVMM 2008

Repeat the procedure described in section 3.6.2.1 to create a 100GB flexible volume to host the LUN to be used for VMs created by using SCVMM 2008.

3.6.3 Configure iSCSI on Windows Server 2008 Server

This procedure is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.7.

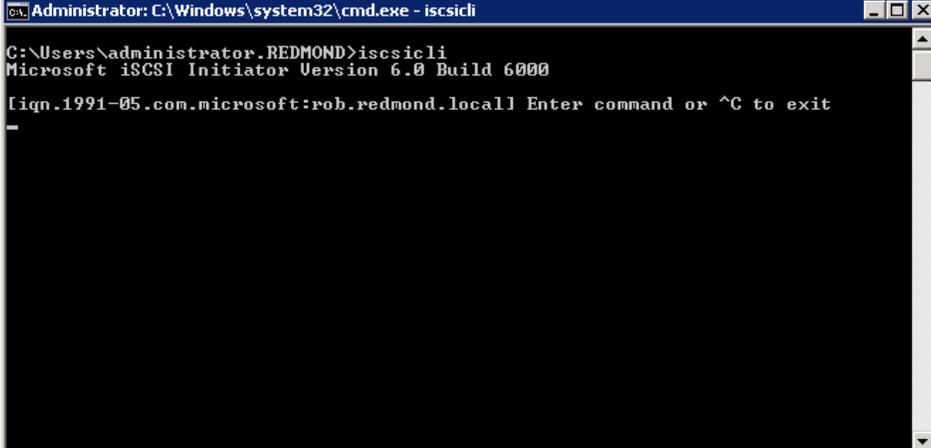
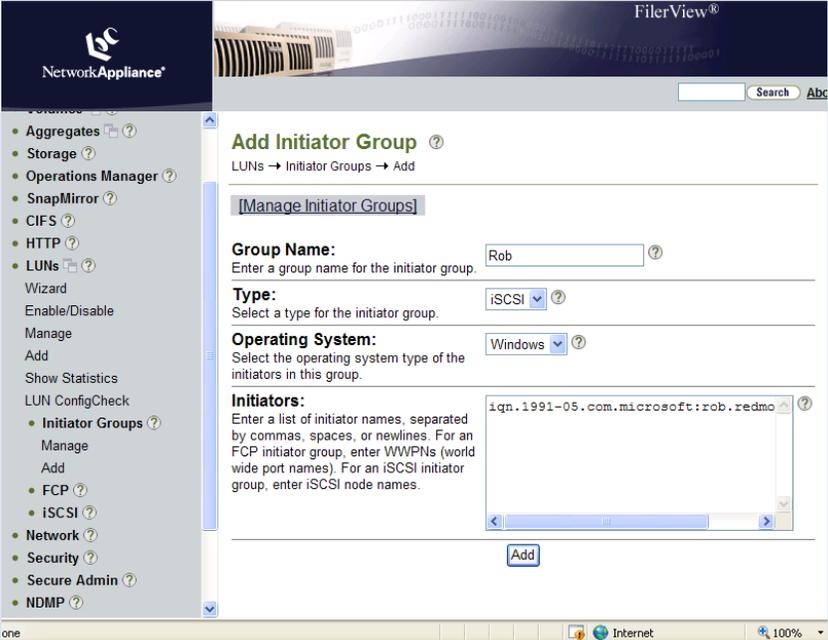
Step	Action
1.	<p>The Windows Server 2008 server core installation needs to have the iSCSI services running to access the iSCSI target. Use the following command at the prompt to initiate the services during the boot and start the service:</p> <pre>sc config msiscsi start= auto net start msiscsi</pre> 
2.	<p>After the services are started, add the target's (NetApp storage array) IP address. Use the following command to add the target portal:</p> <pre>iscsicli QAddTargetPortal <Portal IP Address></pre> <p>where <Portal IP Address> is the IP of the NetApp storage controller.</p> 

3.	<p>After adding the Portal IP, use the following command to list the target IQNs:</p> <pre>iscsicli ListTargets</pre> 
4.	<p>The IQN obtained from the previous command can be used to establish an iSCSI session.</p> <p>Use the following command to perform a login and establish a connection:</p> <pre>iscsicli QloginTarget <target_iqn></pre> <p>where <target_iqn> is the IQN obtained in step 3</p> <p>The login operation returns a message indicating a successful session.</p>

3.6.4 Configure Windows Server 2008 Initiator Groups on NetApp Storage

This procedure is required only for Windows Server 2008 servers with server core installation. Otherwise, skip to section 3.7.

For Windows Server 2008 servers with the full installation option, NetApp SnapDrive software is used to perform this procedure.

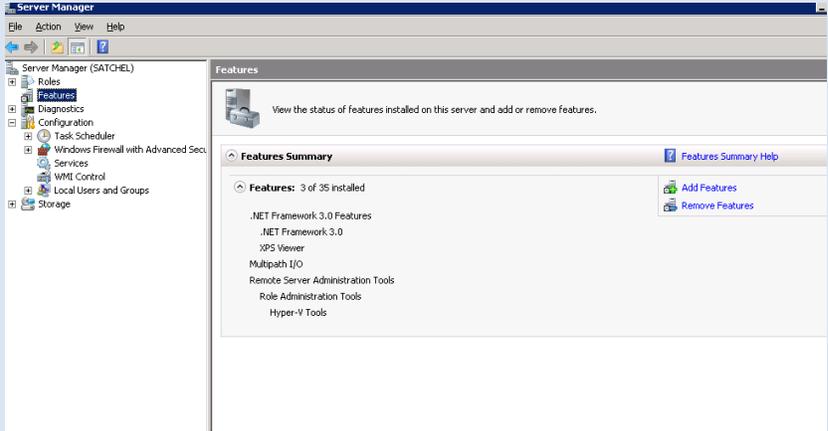
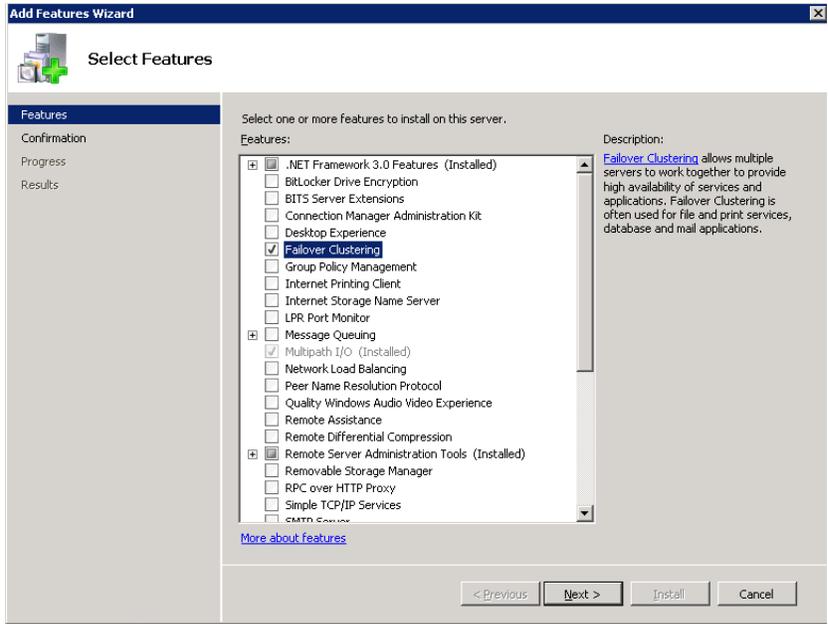
Step	Action
1.	<p>Use the following command to obtain the initiator (Windows Server 2008 server) IQN from the command line on the Windows Server 2008 server:</p> <pre>iscsicli</pre> 
2.	<p>Create initiator groups for all the Windows Server 2008 with server core installation on the NetApp storage by using FilerView: Filer View > LUN > Initiator Groups > Add.</p>
3.	<p>Enter the Initiator Group Name. Select iSCSI for the type, Windows for the operating system, and IQN for the initiator (Windows Server 2008 server core installation) obtained from the previous step. Click Add.</p> 

3.7 MICROSOFT WINDOWS FAILOVER CLUSTERING CONFIGURATION

3.7.1 Windows Server 2008 Full Installation

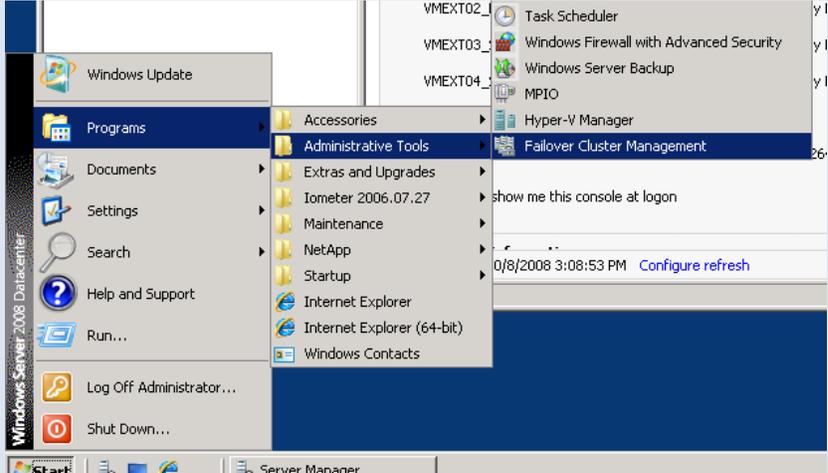
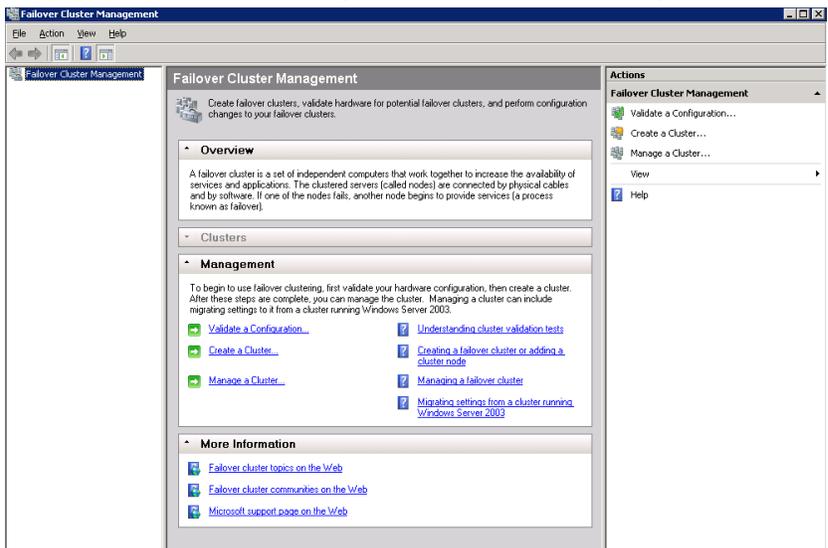
3.7.1.1 Installation Failover Clustering Feature

For the detailed procedure, follow the guidelines outlined in the Microsoft [documentation](#).

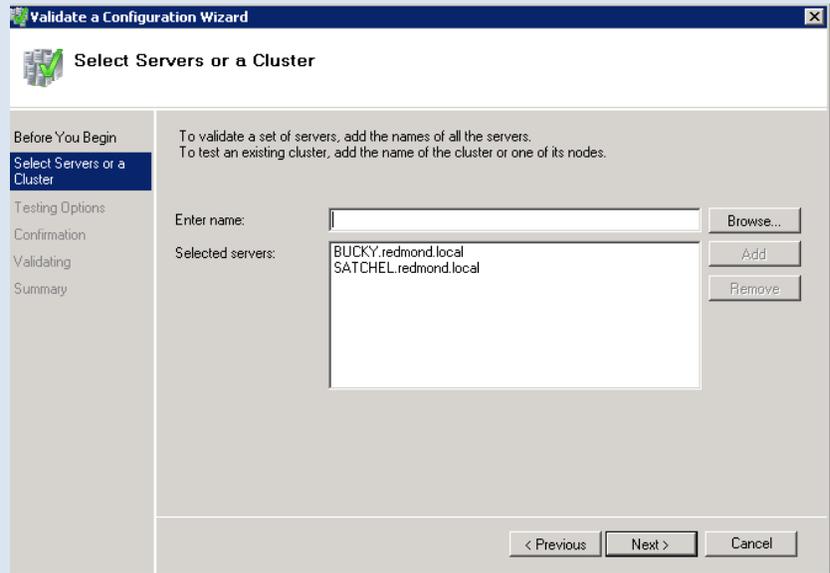
Step	Action
1.	<p>Open Server Manager, click Features, and click Add Features.</p> 
2.	<p>Check Failover Clustering and click Next.</p> 
3.	<p>Click Install to continue.</p>
4.	<p>When installation is complete, click Close.</p>

3.7.1.2 Windows Failover Cluster Validation

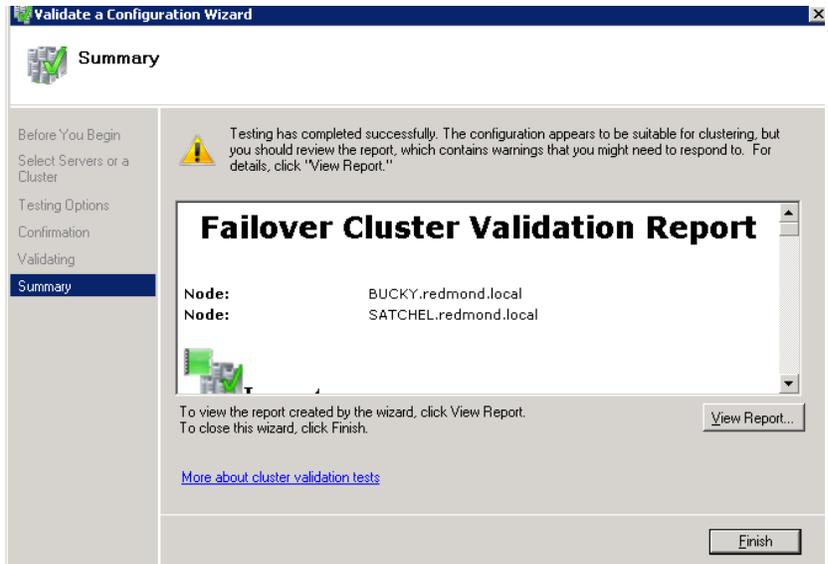
For the detailed procedure, follow the guidelines outlined in the Microsoft [documentation](#).

Step	Action
1.	<p>On the server, select Start > Programs > Administrative Tools > Failover Cluster Management.</p> 
2.	<p>In the center pane, under management, click Validate a Configuration.</p> 

3. Follow the wizard to validate the cluster before creating it.

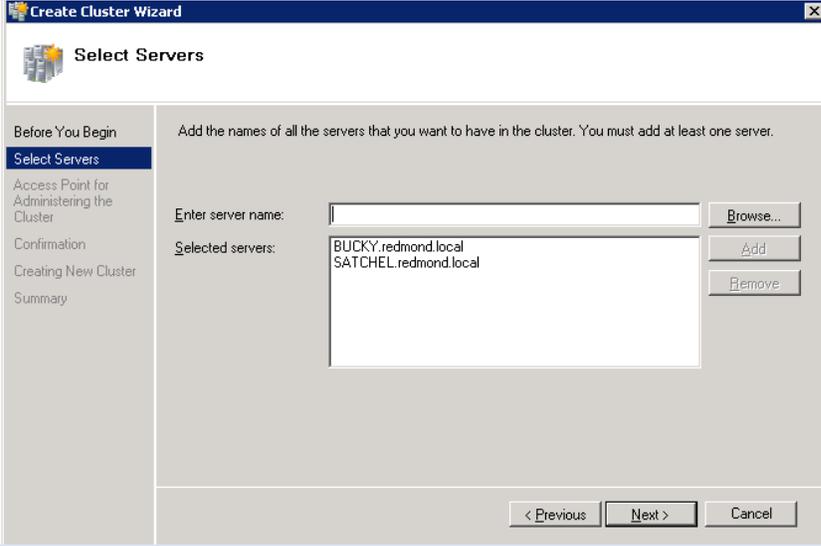
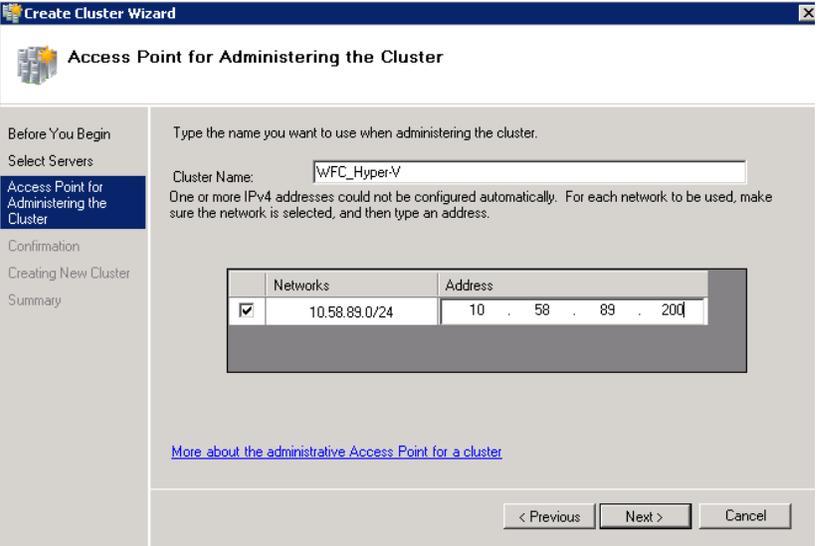


4. A summary page appears at the end of the procedure. Click View Report and analyze the test results for success and warnings.

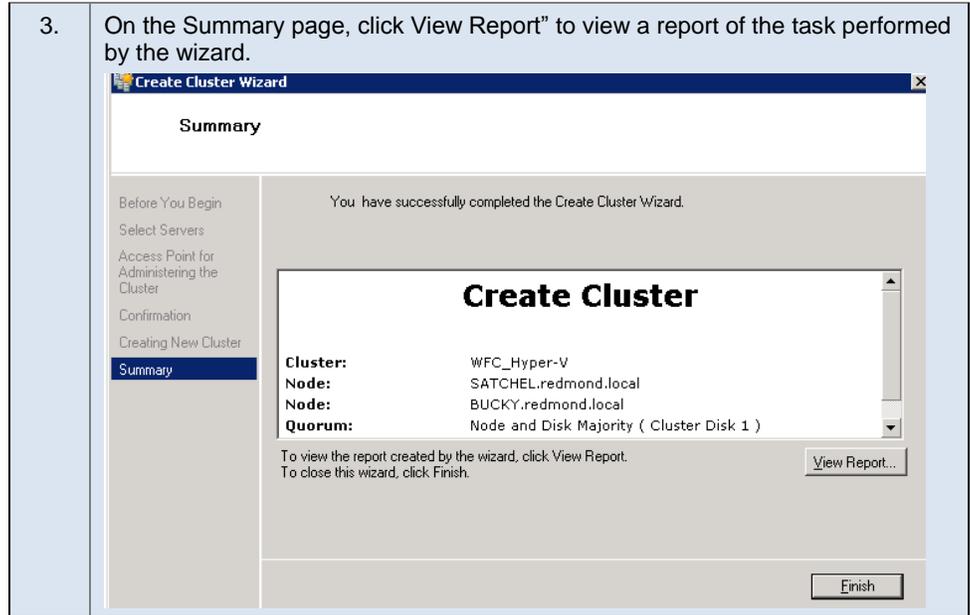


3.7.1.3 Create a Windows Failover Cluster

For the detailed procedure, follow the guidelines outlined in the Microsoft [documentation](#).

Step	Action
1.	<p>In the Failover Cluster Management window, click Create a Cluster. Enter the names of the servers that will be part of the cluster and click Next.</p> 
2.	<p>Enter a name and IP address for the cluster and click Next.</p> 

3. On the Summary page, click "View Report" to view a report of the task performed by the wizard.



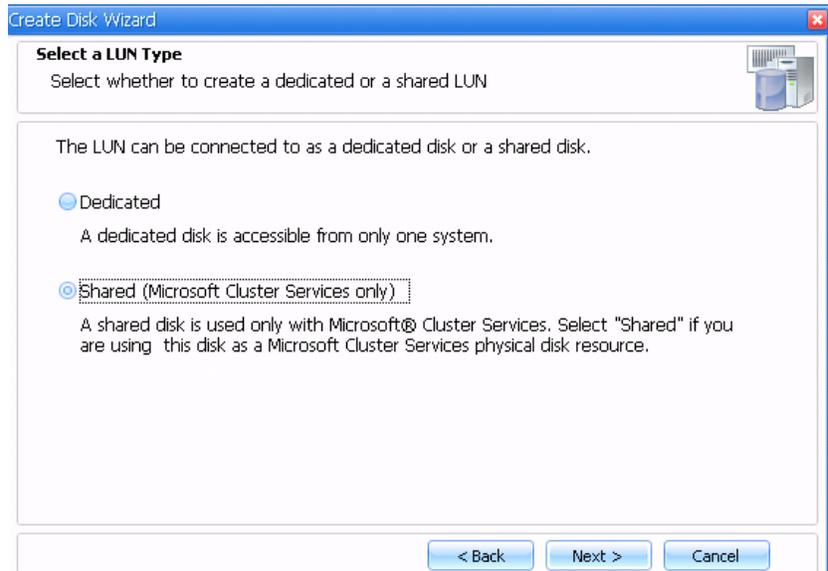
3.7.1.4 Configure Windows Failover Cluster Quorum

The quorum disk is a disk on the shared storage that is designated to hold a copy of the failover cluster configuration database.

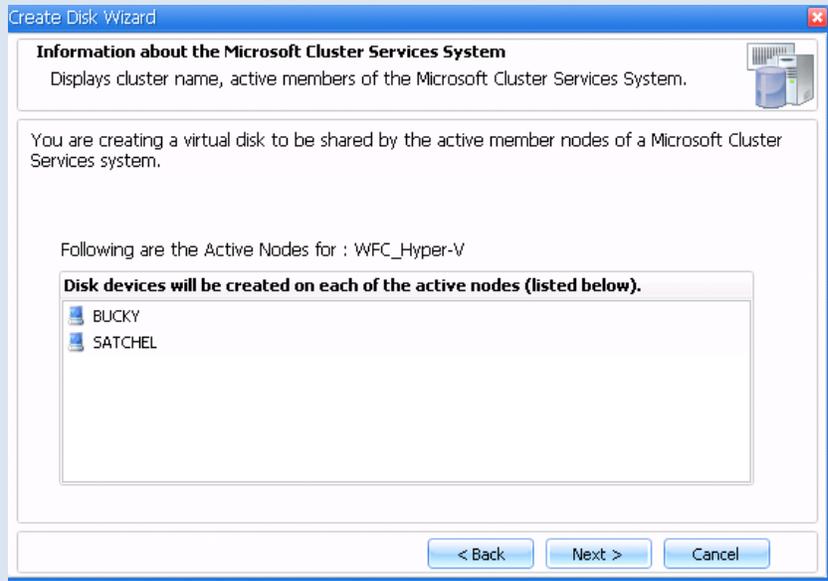
CREATE A SHARED LUN BY USING NETAPP SNAPDRIVE

Step	Action
1.	Open Server Manager and select Storage > SnapDrive > Server Name > Disks.
2.	Right-click and select Create a Disk.
3.	In the Create Disk wizard, select a storage system name, LUN path, and LUN name. Use the NetApp volume created in section 3.6.2.1 to host the witness disk.

4. On the Select a LUN Type page, select Shared (Microsoft Cluster Services only) and click Next.



5. The next page displays all the active nodes in the cluster. Click Next to continue.



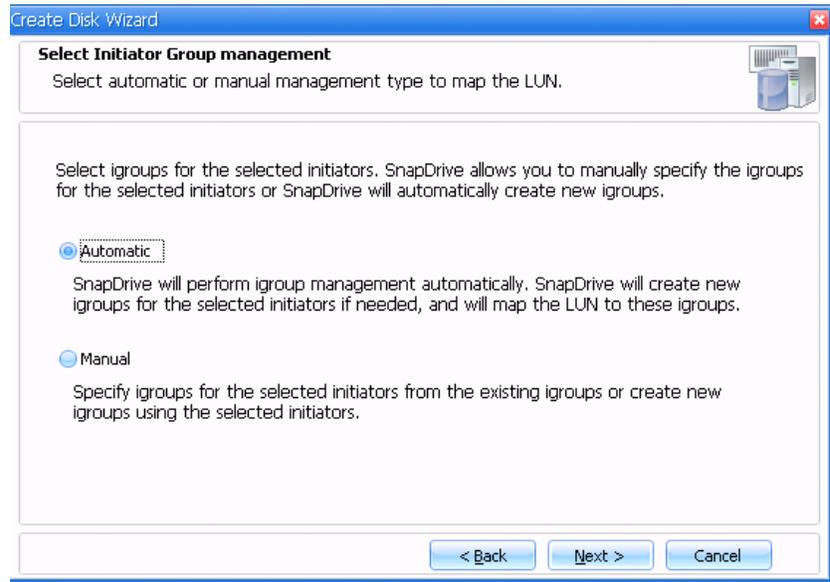
6. Assign a drive letter and a size. Click Next to continue.

The screenshot shows the 'Create Disk Wizard' window at the 'Select LUN Properties' step. The title bar reads 'Create Disk Wizard'. Below the title bar, the section is titled 'Select LUN Properties' with the instruction 'Provide the drive letter and the size of the LUN to create'. There are three main sections: 'Drive Parameters' with radio buttons for 'Assign a Drive Letter' (selected, with a dropdown showing 'W') and 'Use a Volume Mount Point'; 'Snapshot Copies' with a question 'Do you want to limit the maximum disk size to accommodate at least one snapshot on the volume?' and radio buttons for 'Limit' and 'Do not limit' (selected); and 'LUN Size' with fields for 'Maximum' (9 GB), 'Minimum' (64 MB), and 'LUN Size' (2 GB). At the bottom are '< Back', 'Next >', and 'Cancel' buttons.

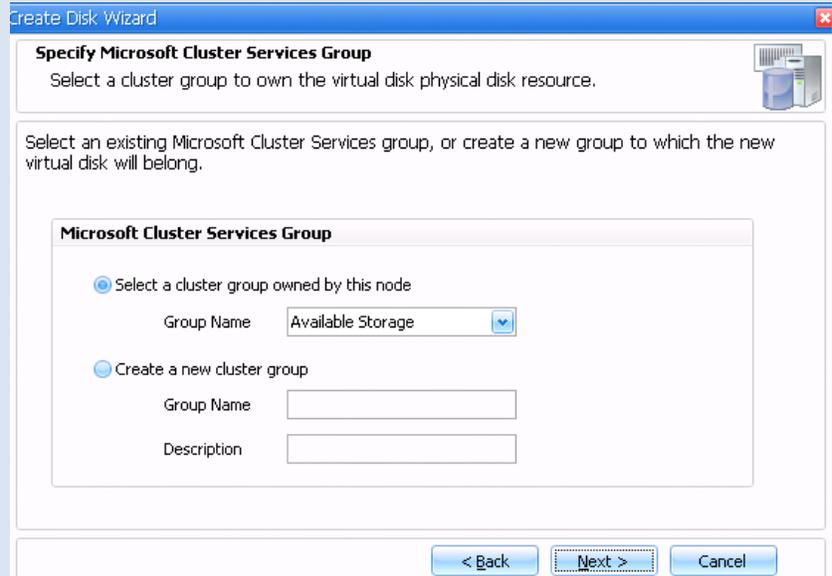
7. Continue through the wizard. On the Select Initiators page, check the WWN or IQN (based on the requirements) for all the servers in the cluster. Click Next to continue. For this exercise, we will use Fibre Channel initiators.

The screenshot shows the 'Create Disk Wizard' window at the 'Select Initiators' step. The title bar reads 'Create Disk Wizard'. Below the title bar, the section is titled 'Select Initiators' with the instruction 'Select initiators to be used by this LUN.'. Below this is a text box: 'Specify a cluster node, and then establish or remove the connection to the LUN for that node by selecting the initiator name from the initiator list.'. There are two main sections: 'Select the cluster node name' with a tree view showing 'WFC_Hyper-V' expanded to show 'SATCHEL' and 'BUCKY' (selected); and 'Initiator List for BUCKY' with a list of initiators: '21:00:00:1b:32:0b:4f:e3' (checked), '21:01:00:1b:32:2b:4f:e3', '21:00:00:1b:32:0b:e8:e1' (checked), '21:01:00:1b:32:2b:e8:e1', and 'iqn.1991-05.com.microsoft:ucky.redmond.local'. At the bottom are '< Back', 'Next >', and 'Cancel' buttons.

8. On the Select Initiator Group Management page, select either Automatic or Manual. For this exercise, we will select Automatic. Click Next.

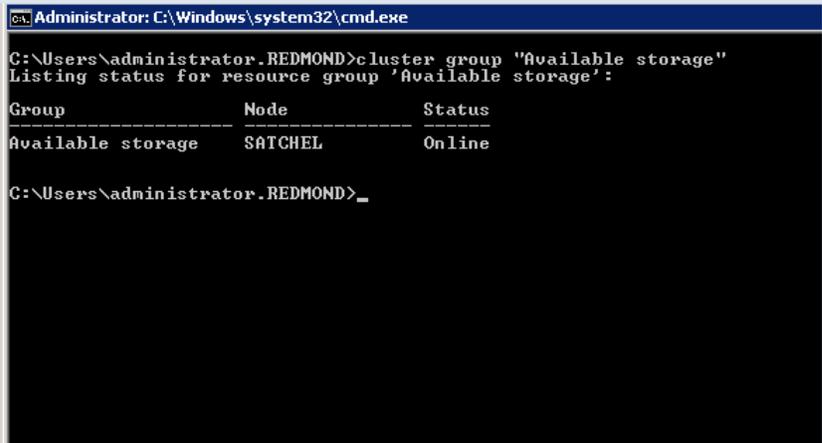


- On the Specify Microsoft Cluster Services Group page, select Available Storage for the group name and click Next to continue.



If Available Storage is not listed in the Group Name drop-down list, make sure that the Windows server that is creating the shared disk is the owner of the Available Storage cluster group. To find out the owner of the available storage, enter the following command at the command prompt.

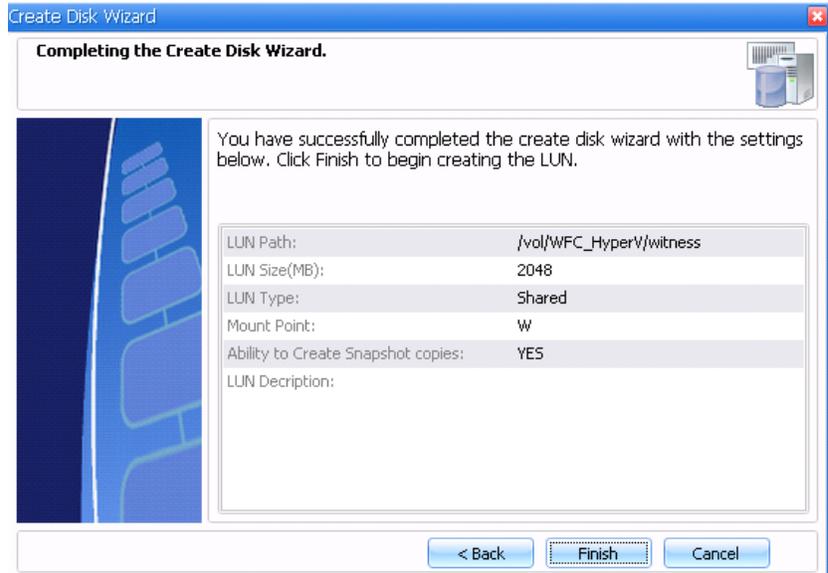
```
cluster group "Available Storage"
```



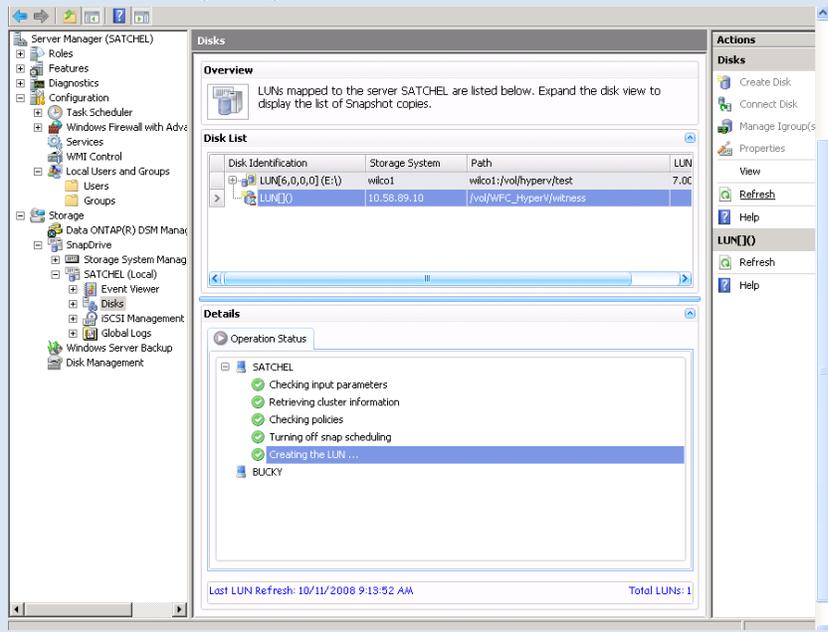
If the group is owned by a different server, you can either use that server to create the shared disk or use the failover cluster command line to move the Available Storage group between different nodes. The Failover Cluster MMC snap-in does not provide this feature.

```
cluster group "Available Storage" /MOVE
```

10. Continue through the wizard and click Finish to start the LUN provisioning process.



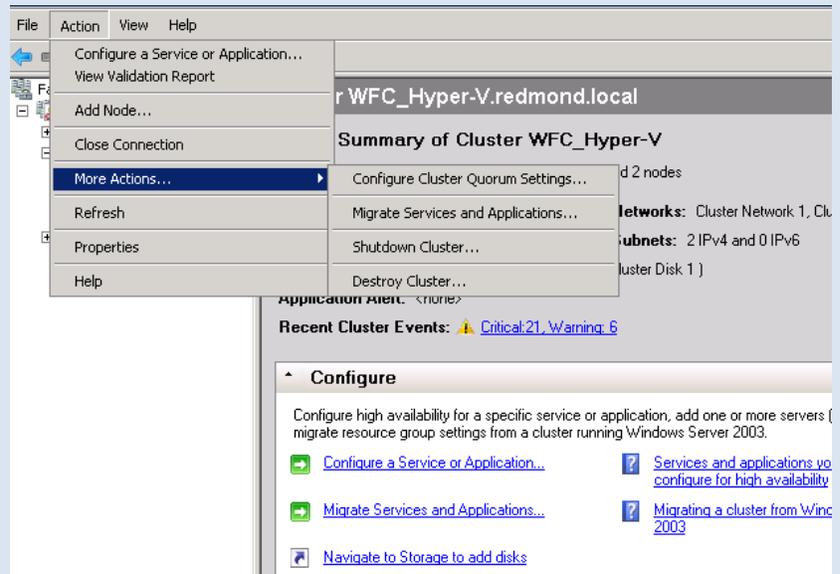
11. The Details section of the Disks MMC Snap-In for SnapDrive shows the steps as the disk is being configured.



CONFIGURE WINDOWS FAILOVER CLUSTER QUORUM DISK

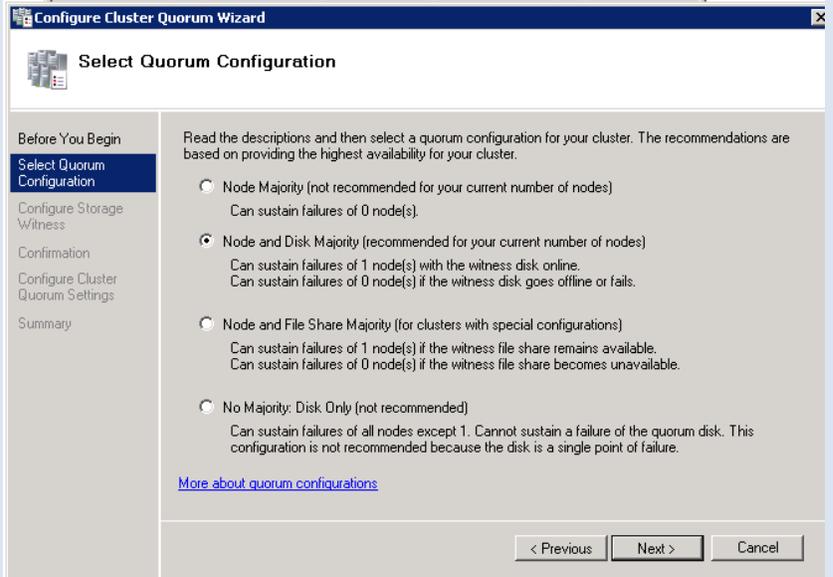
Step	Action
1.	To launch the Windows Server 2008 Failover Cluster Management snap-in: Start > Programs > Administrative Tools > Failover Cluster Management.
2.	Click the name of the failover cluster for which you want to configure the witness disk.

- From the menu choices at the top of the snap-in, select Action > More Actions > Configure Cluster Quorum Settings to launch the Configure Cluster Quorum Wizard.

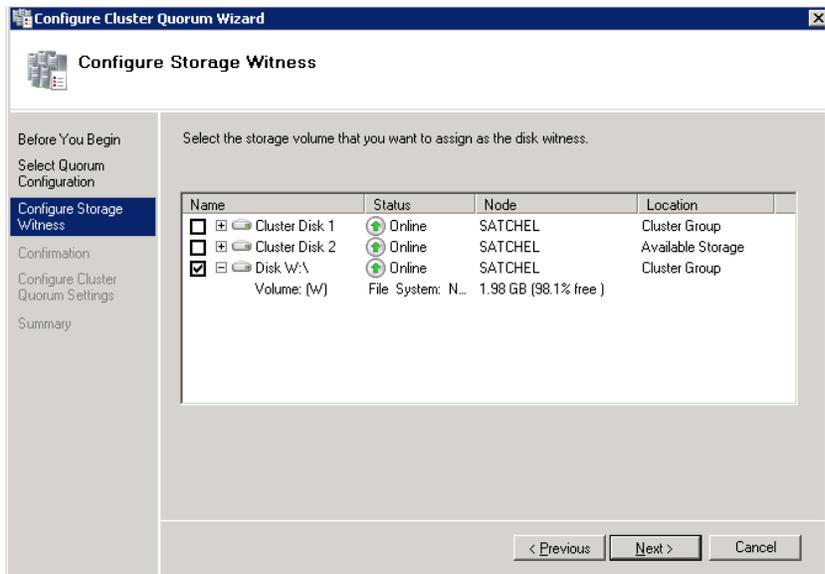


- In the Configure Cluster Quorum Wizard, click Next to display the Select Quorum Configuration page.

- On the Select Quorum Configuration page, select Node and Disk Majority and click Next to display the Configure Storage Witness page.

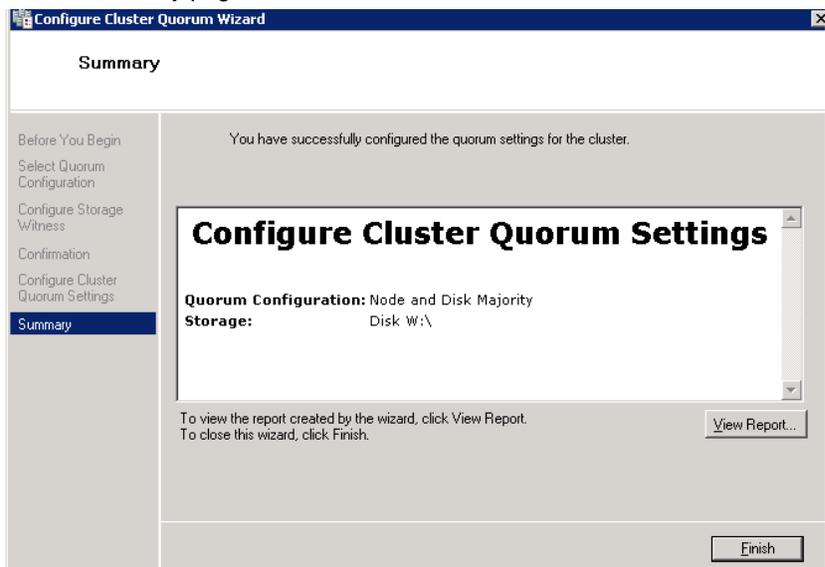


6. On the Configure Storage Witness page, select the shared LUN that you created in SnapDrive to be the witness disk and click Next. The Confirmation page is displayed.



7. In the Confirmation page, click Next to configure the cluster quorum settings. When the quorum settings are configured, the Summary page is displayed.

8. On the Summary page, click Finish to close the wizard.



3.7.2 Windows Server 2008 Server Core Installation

This step is required only if you plan to install Windows Server 2008 with the server core installation option. Otherwise, skip to section 3.8.

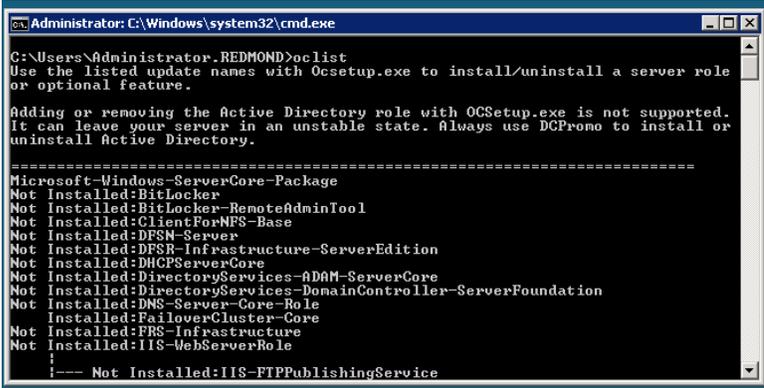
3.7.2.1 Install the Failover Clustering Feature

RDP to the Windows Server 2008 server core installation and run the following command to enable Windows failover clustering. Reboot the server when prompted.

Steps	Action
1.	<p>Enter the following command on both of the servers:</p> <pre>ocsetup FailoverCluster-Core</pre> 

3.7.2.2 Validate the Windows Failover Clustering Configuration

To verify the success of the installation, run the following command and verify that the Failover Cluster feature is installed.

Step	Action
1.	<p>Enter the following command on both of the servers:</p> <pre>oclist</pre> 

3.7.2.3 Create a Windows Failover Cluster

Create a Windows Failover Cluster for the server Core installation servers using the procedure outlined for the Windows Server 2008 full installation. To accomplish this procedure access the Failover Clustering MMC from one of the full installation servers.

3.7.2.4 Configure Windows Failover Cluster Quorum

The quorum disk is a disk on the shared storage that is designated to hold a copy of the failover cluster configuration database.

CREATE A SHARED LUN

To create a LUN using NetApp FilerView to be used as a Windows Failover cluster witness disk, follow these steps.

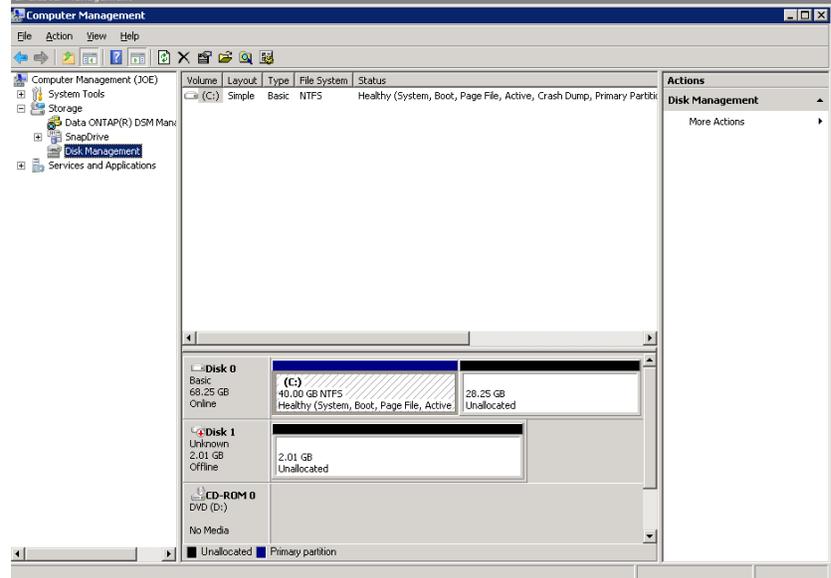
Step	Action
1.	Log in to the NetApp console using an SSH, Telnet, or Console connection.
2.	Enter the following at the prompt: <code>lun setup</code>
3.	For Do you want to create a LUN? [y], enter the following at the prompt: <code>Y</code>
4.	Enter the LUN type. For Windows Server 2008 (including Hyper-V), enter the following at the prompt: <code>windows_2008</code>
5.	Enter the LUN path. Example: <code>/vol/<volume_name>/<lun_name></code>
6.	Select whether the LUN is to be space reserved. For this exercise, we will leave this value at the default, Yes.
7.	Enter the LUN size. For this exercise, we created a 2GB LUN for the quorum.
8.	Enter the comment string.
9.	Enter the name of the initiator group for the server, created in section 3.6.4.
10.	Select the LUN ID at which the initiator group sees the LUN. Leaving this blank autoselects the LUN ID.
11.	Accept the configuration by entering the following at the prompt: <code>Y</code>
12.	Map the initiator groups for additional Windows Server 2008 servers that will be part of the Windows Failover Cluster to this LUN: <code>lun map [-f] <lun_path> <initiator_group> [<lun_id>]</code>

CONNECT THE WINDOWS SERVER 2008 SERVER CORE INSTALLATION SYSTEM TO LUNS PROVISIONED ON A NETAPP STORAGE SYSTEM

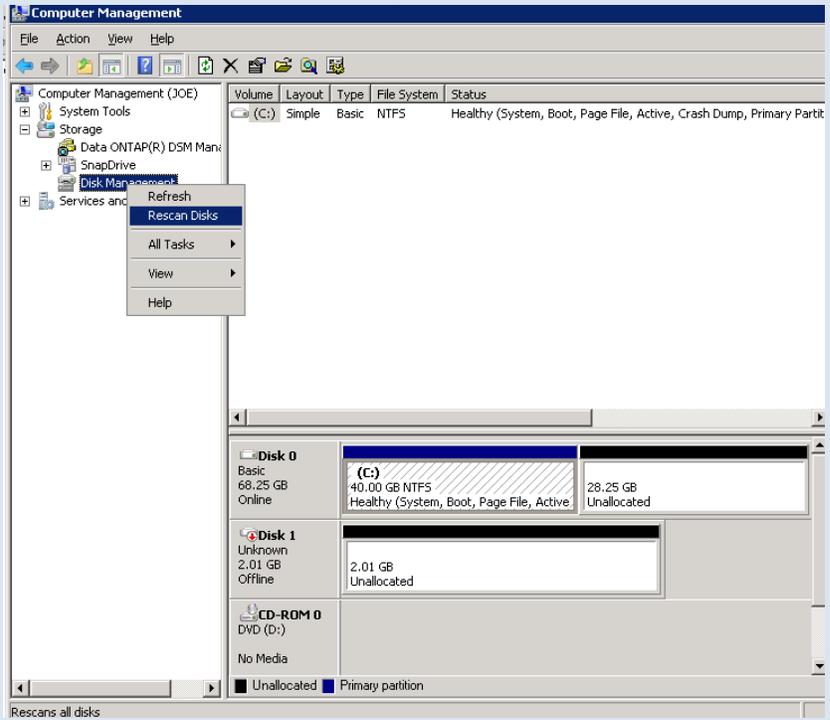
To connect a previously created LUN, follow these steps.

Step	Action
1.	Open the Computer Management window from either the server with Windows Server 2008 full installation or any other Windows server and connect to one of the Windows Server 2008 servers with server core installation.

2. Open Disk Management: Storage >Disk Management.

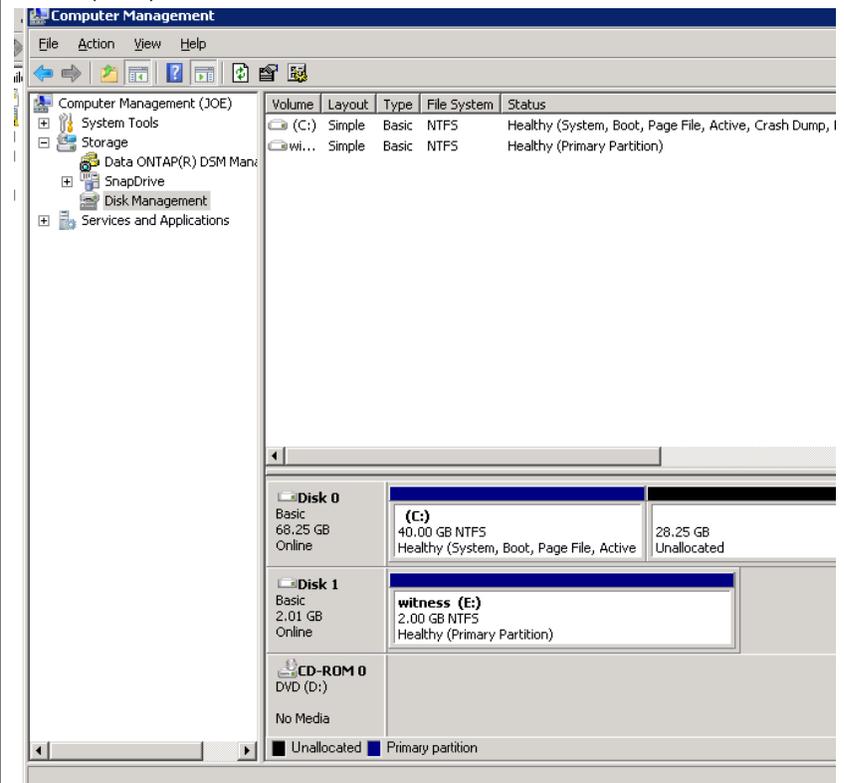


3. Rescan disks: Right-click Disk Management and select Rescan Disks.

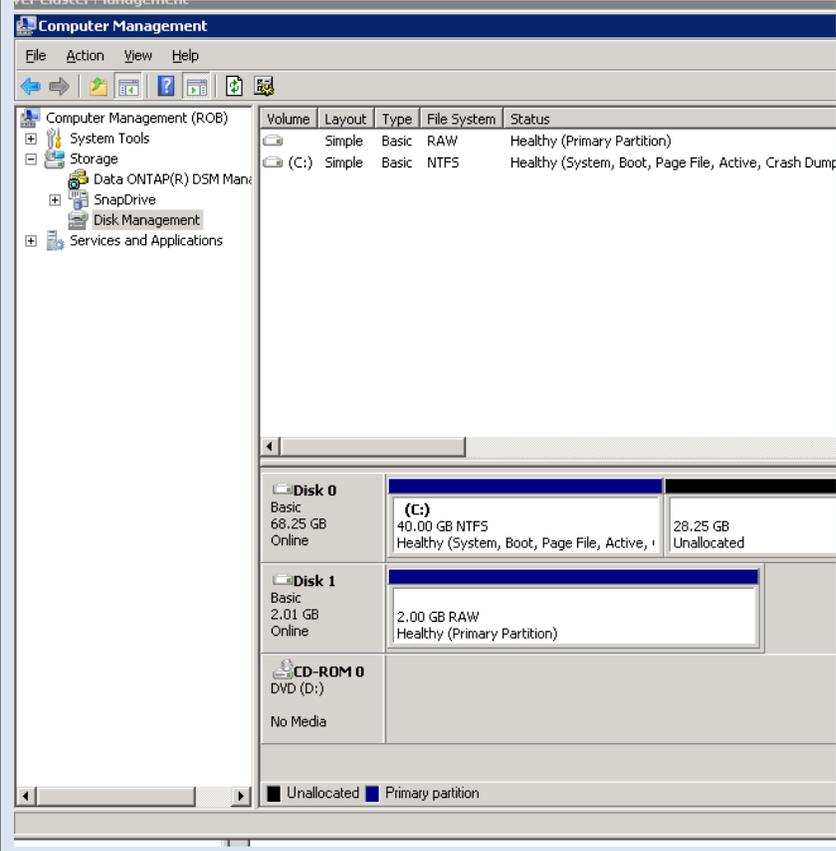


A rescan forces the rescanning of all HBAs (FC and iSCSI) to discover changes in the storage that is available to the Windows Server 2008 server.

4. When the LUN has been identified, bring it online and format with the NTFS file system. When initializing disks, use the default partition style, master boot record (MBR).



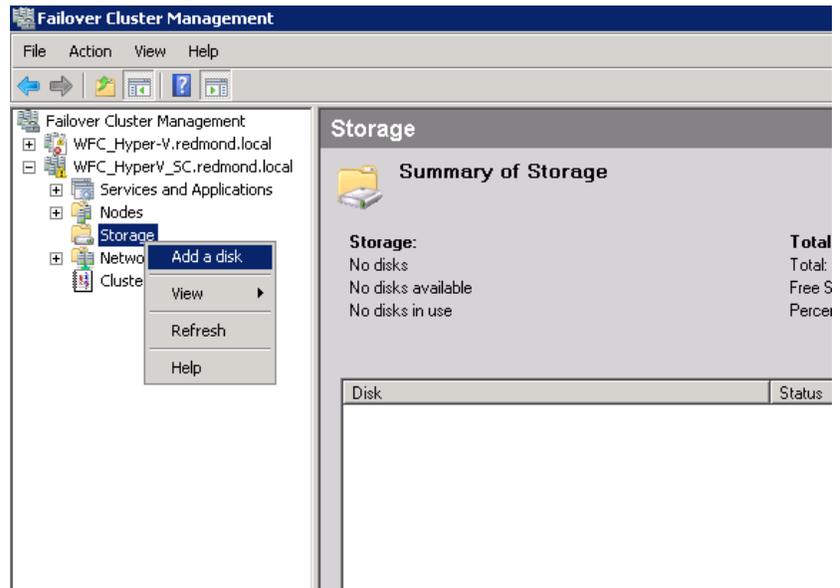
5. Connect to the other Windows Server 2008 nodes in the failover cluster, rescan disks, and bring the disk (shared LUN) online.



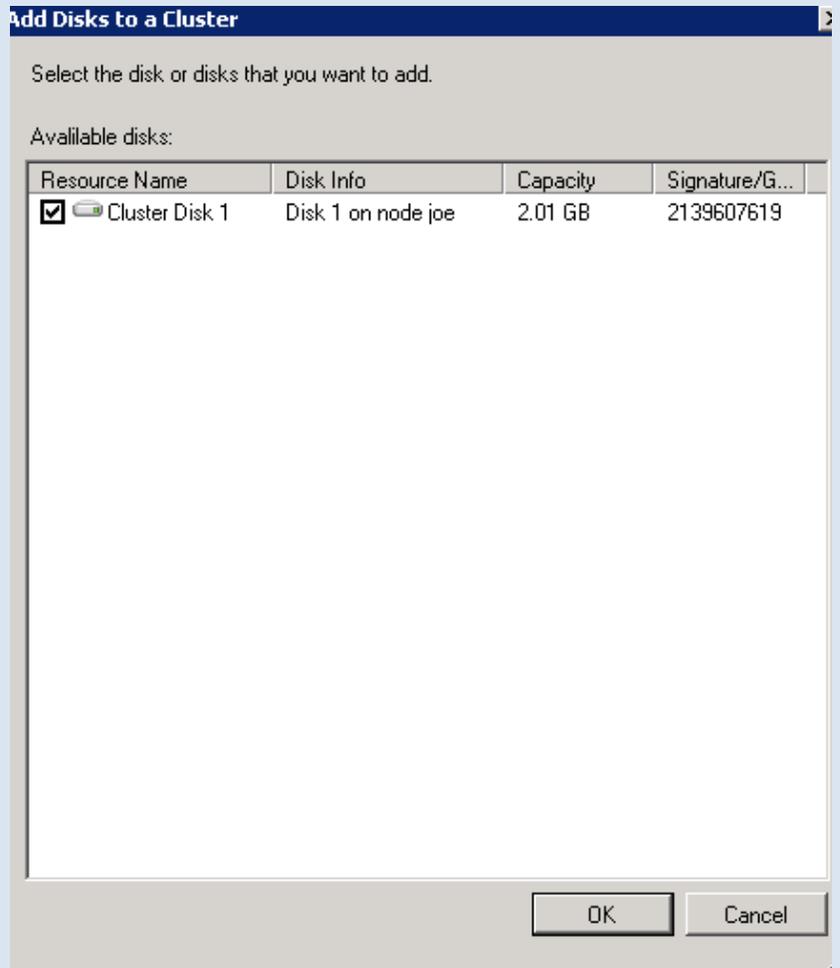
CONFIGURE THE WINDOWS FAILOVER CLUSTER QUORUM DISK

Step	Action
1.	Open the Windows Failover Cluster Management snap-in by accessing the Failover Clustering MMC from one of the Windows Server 2008 servers with full installation.
2.	Expand the failover cluster for the server core installation servers for which you want to configure the witness disk.

3. Right click Storage and select Add a Disk.



4. Select the disk created earlier and click OK.



5. The remaining steps are the same as described in section 3.7.1.4.

3.8 DISK PROVISIONING ON WINDOWS SERVER 2008 SERVERS

3.8.1 Windows Server 2008 Full Installation

3.8.1.1 Create a Shared LUN by Using NetApp SnapDrive to host Production VMs Configured by Using Hyper-V Manager

Follow the procedure described in section 3.7.1.4 to create a LUN to host the production VMs configured by using the Hyper-V Manager. Also make sure that the disk is removed from the Cluster Resource Group.

3.8.1.2 Create a Shared LUN by Using NetApp SnapDrive to host VMs Configured Through SCVMM

Repeat the process described in section 3.7.1.4 to create a LUN to host the production VMs configured through SCVMM. Also make sure that the disk is removed from the Cluster Resource Group.

3.8.2 Windows Server 2008 Server Core Installation

This procedure is required only if you plan to install with the Windows Server 2008 server core installation. Otherwise, skip to section 4.

3.8.2.1 Create a Shared LUN

Follow the procedure in section 3.7.2.4 to create a shared LUN to host the VMs configured through Hyper-V Manager.

4 VIRTUAL MACHINE PROVISIONING

4.1 PROVISIONING USING HYPER-V MANAGER

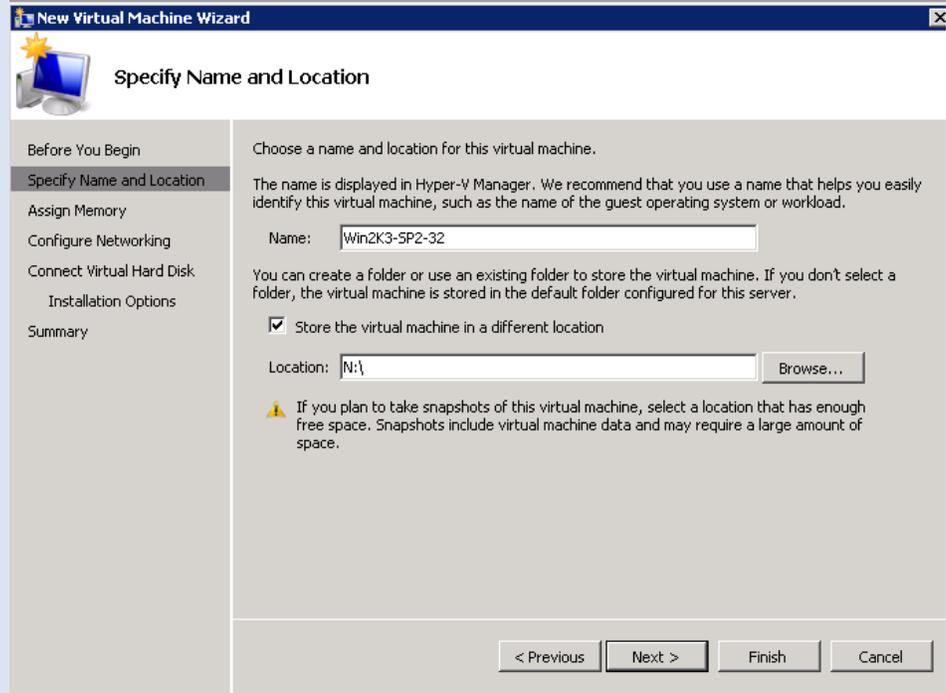
This procedure is the same for both Windows Server 2008 full and server core installation options. For the detailed procedure, refer to the Microsoft [documentation](#).

Note: Use the Hyper-V Manager on Windows Server 2008 with full installation to access the Windows Server 2008 with server core installation. Open Hyper-V Manager, right-click Hyper-V Manager, select Connect to Server, select Another Computer, and enter the name of the Windows Server 2008 with server core installation.

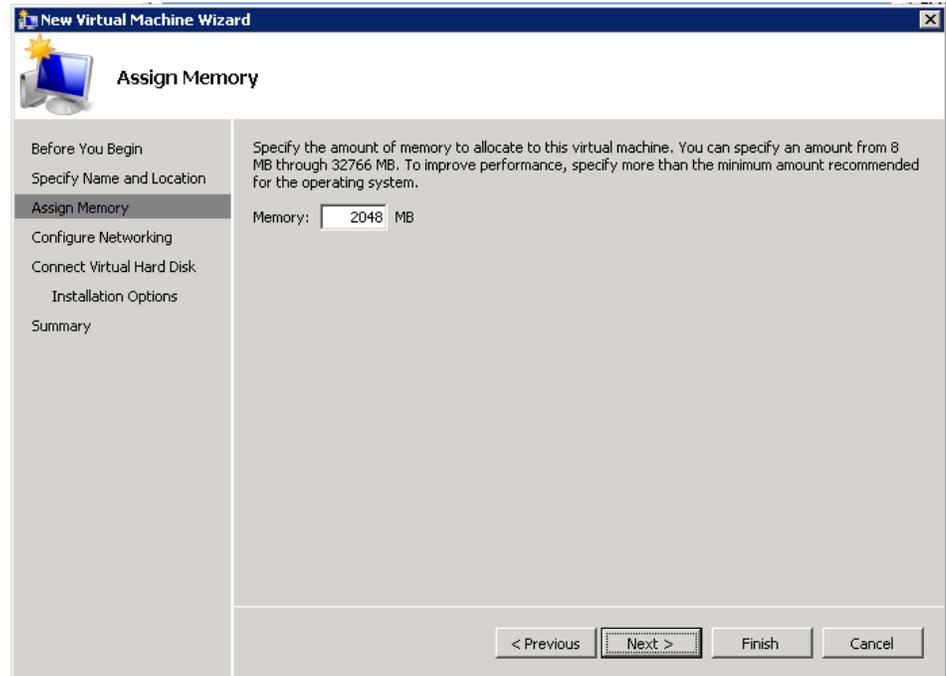
4.1.1 Create a Virtual Machine

Step	Action
1.	Open Hyper-V Manager: Start > Programs > Administrative Tools > Hyper-V Manager.
2.	From the Actions menu on the right, select New and then click Virtual Machine.

3. In the New Virtual Machine Wizard window, enter the name of the VM. Specify the disk drive created in section 3.8.1 as the location to store the virtual machine configuration file. For backup and recovery purposes, it is best to store the virtual machine configuration file with the virtual machine virtual hard disks (VHDs).

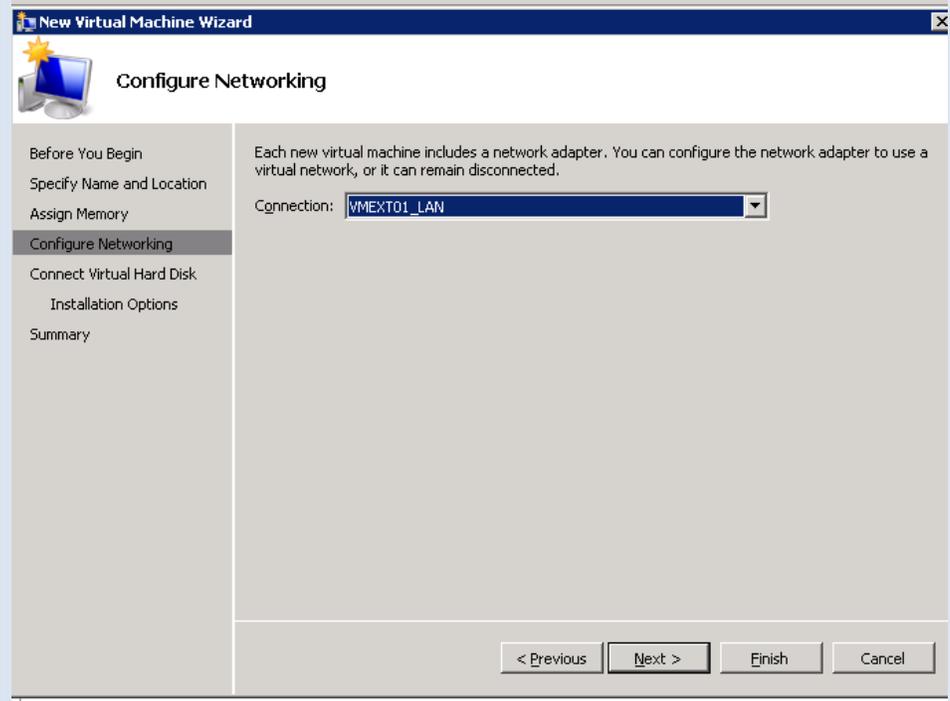


4. Specify the amount of memory for the VM and click Next.



5. Specify the Hyper-V virtual network to which to connect the virtual machine, if desired, and click Next.

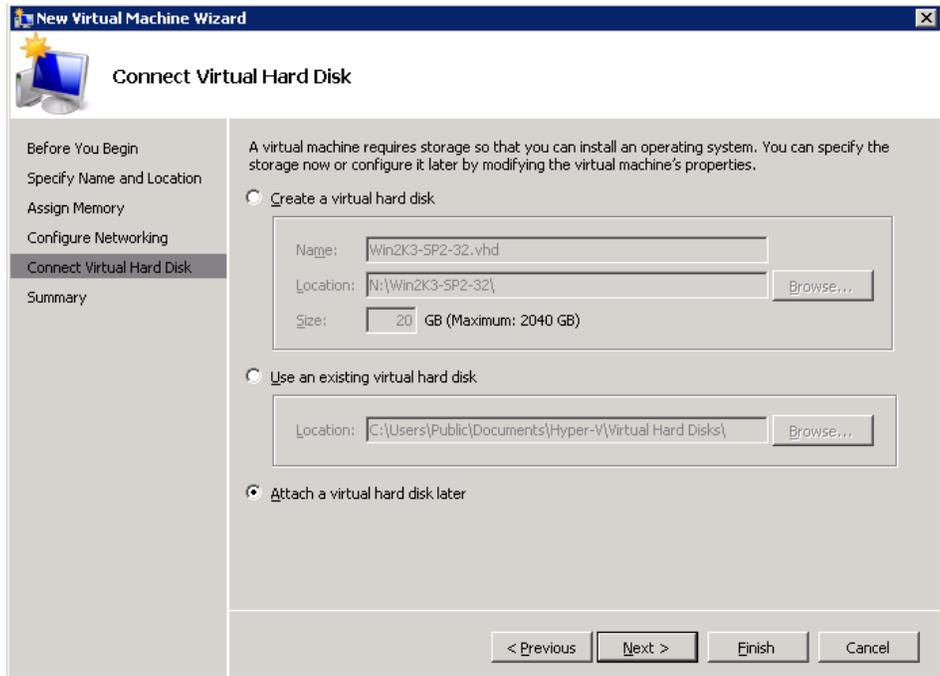
For this exercise, we will connect the VM to the external network VMEXT01_LAN.



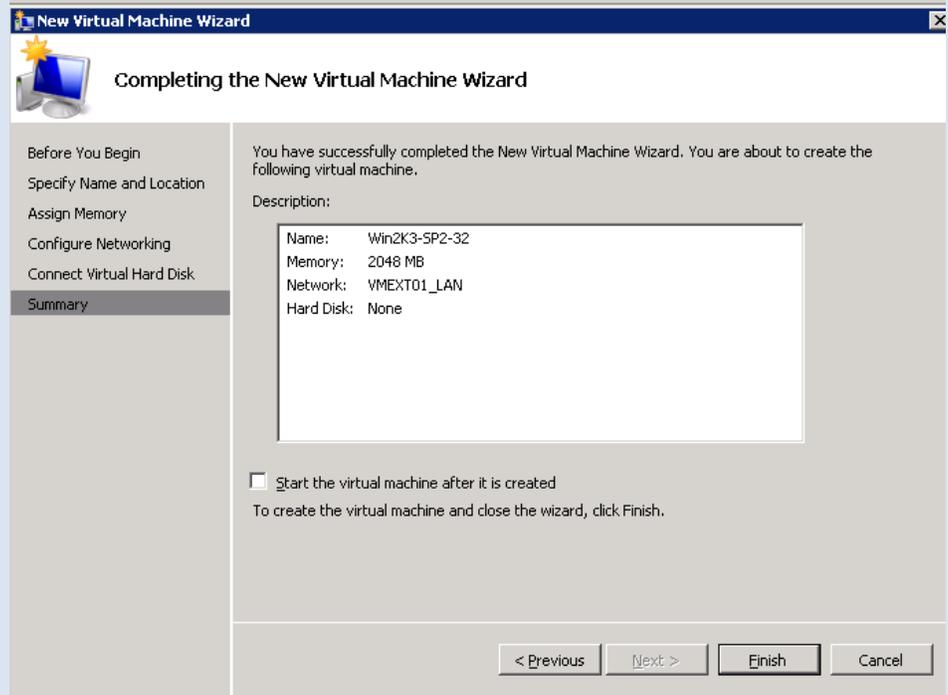
6. On the Connect Virtual Hard Disk configuration page, specify the VM virtual hard disk (VHD) configuration.

- Select “Attach a virtual hard disk later.” When creating a new VHD, by default Hyper-V Manager uses the dynamically expanding VHD type. NetApp best practice is to use the fixed-size VHD. For more information, see [NetApp TR 3702](#).
- To use a golden image of a virtual machine by attaching the VM to an existing VHD, select “Use an existing virtual hard disk.”

When specifying the location, only the virtual machine VHDs is placed in that location, not the virtual machine configuration file as well. To configure the location of the virtual machine configuration file to be the same as for VHDs, please make sure that the correct location is specified in step 3. For this exercise, we will select “Attach a virtual hard disk later” and click Next.

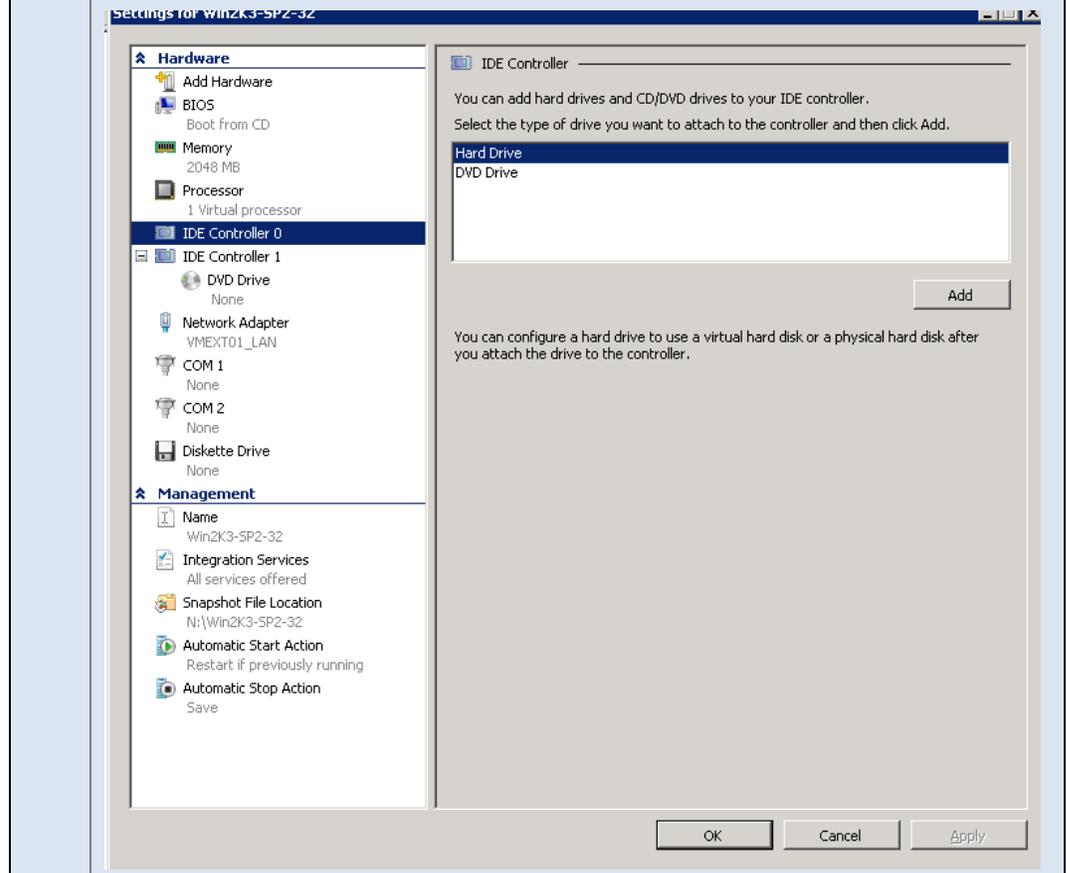


7. Verify the configuration and click Finish.

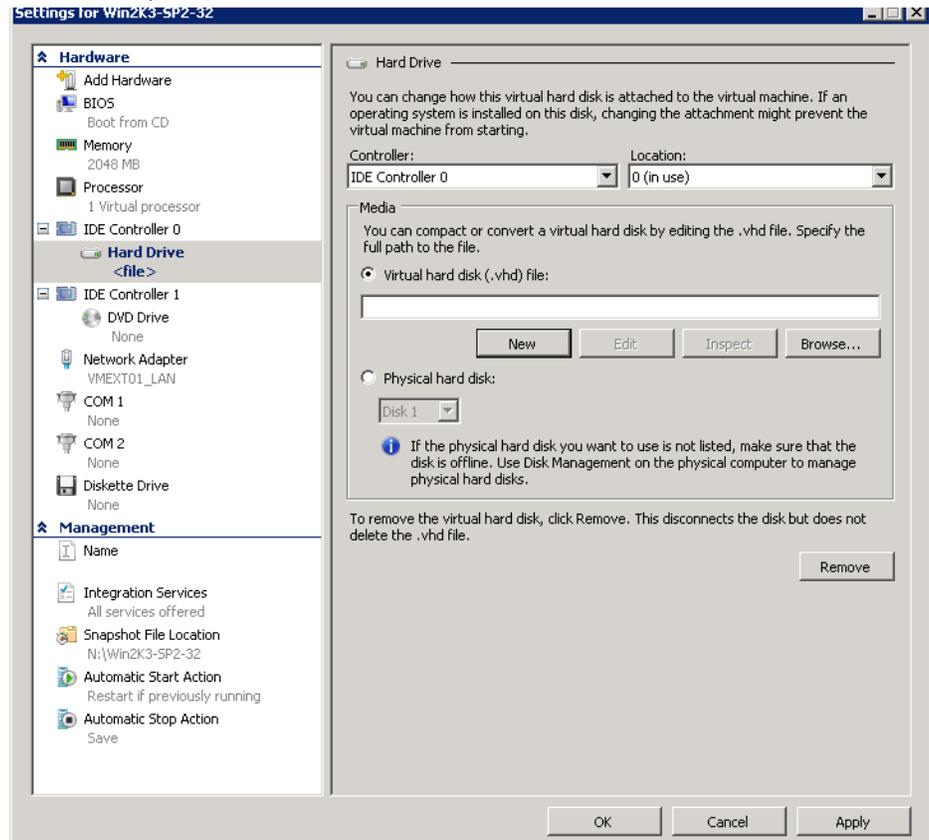


8. In Hyper-V Manager, select the newly created VM and click Settings in the right pane to open the Settings wizard.

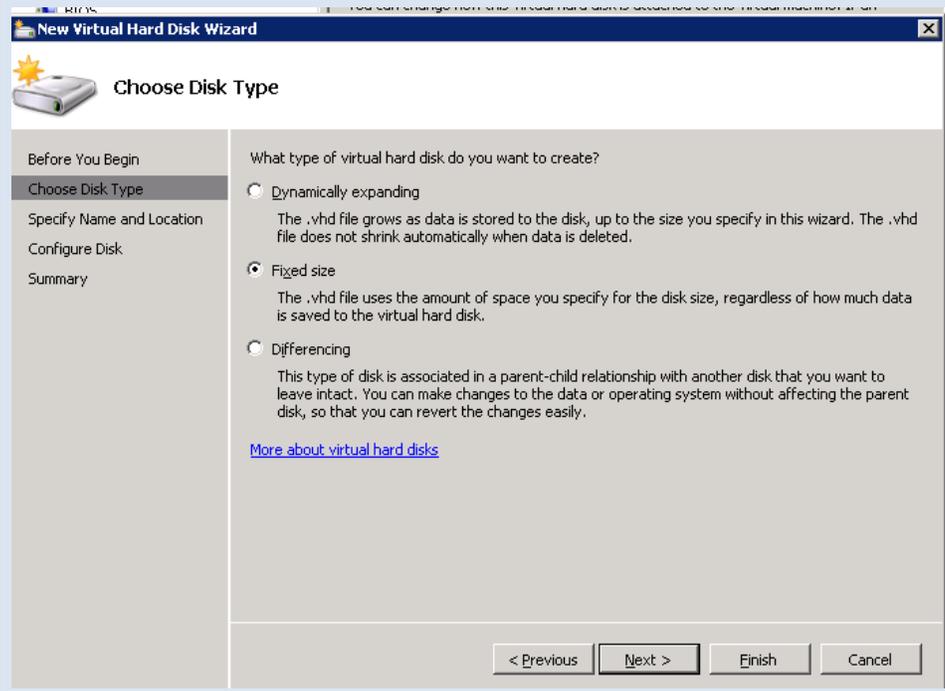
9. In the Settings window, click IDE Controller 0, make sure that Hard Drive is selected, and click Add.



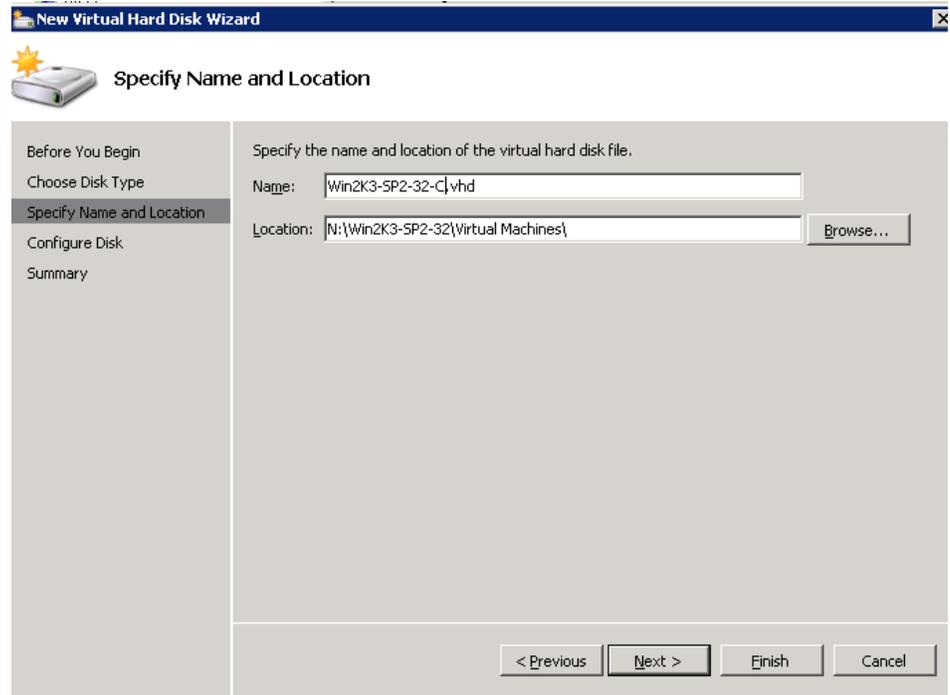
10. Click New to open the New Virtual Hard Disk Wizard.



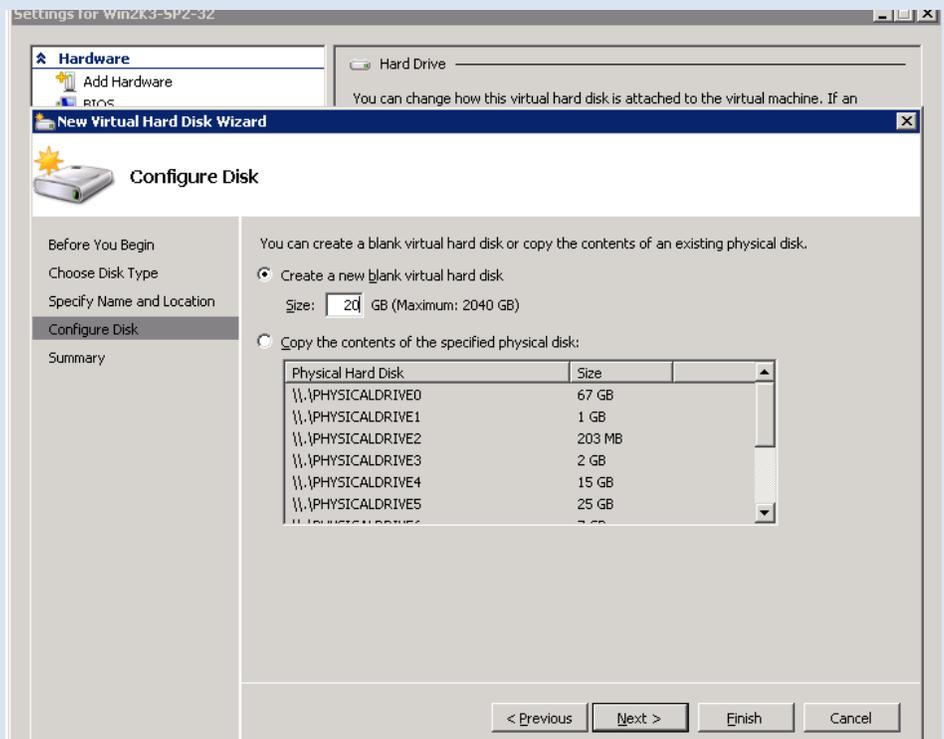
11. In the New Virtual Hard Disk Wizard, click Next. On the Choose Disk Type page, select Fixed Size.



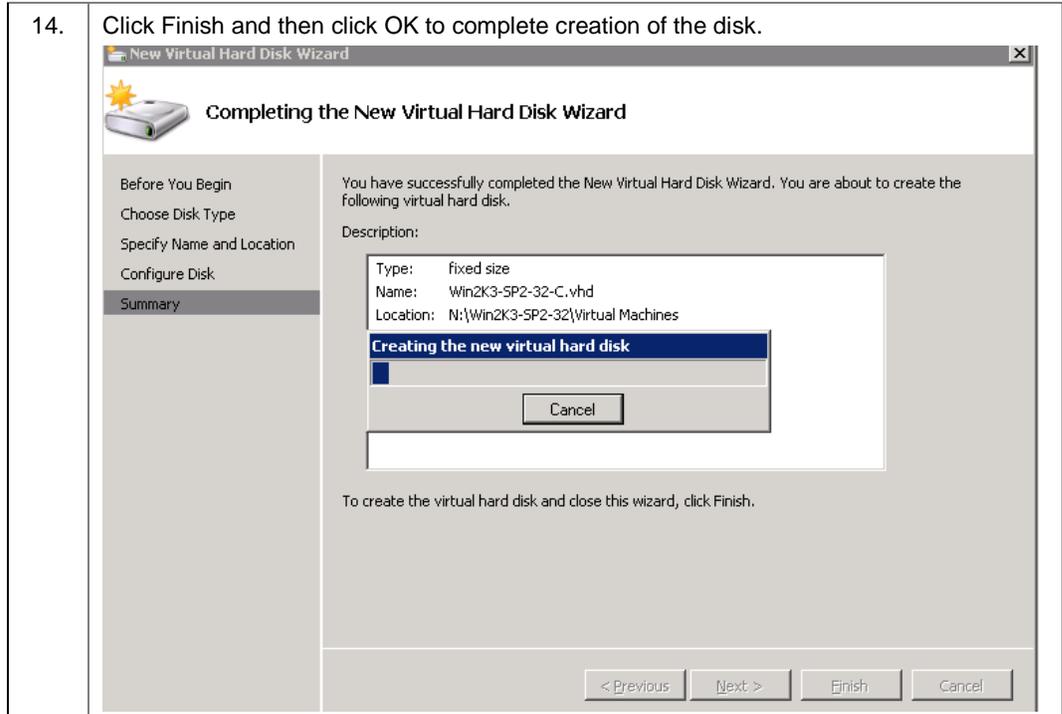
12. Specify the name and location where the fixed size VHD will be stored and click Next. For this exercise, we will select the location to be the same disk that was created using SnapDrive.



13. Select the size of the new blank VHD and click Next.



14. Click Finish and then click OK to complete creation of the disk.

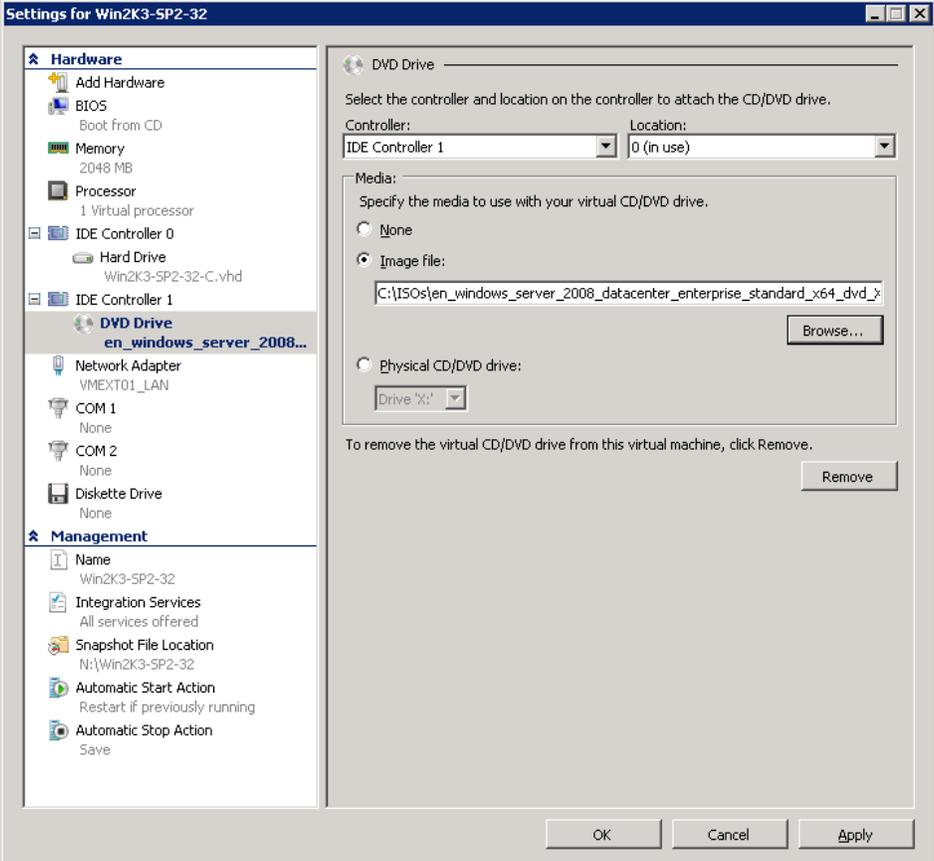
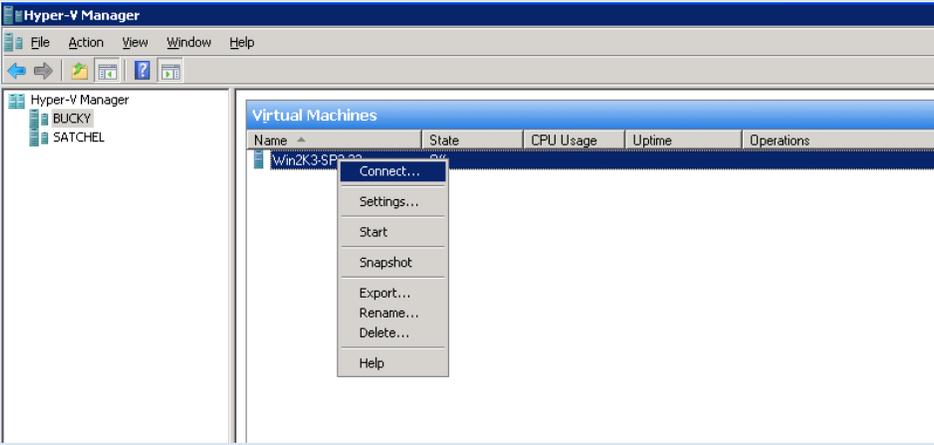


4.1.2 Child VM Partition Alignment

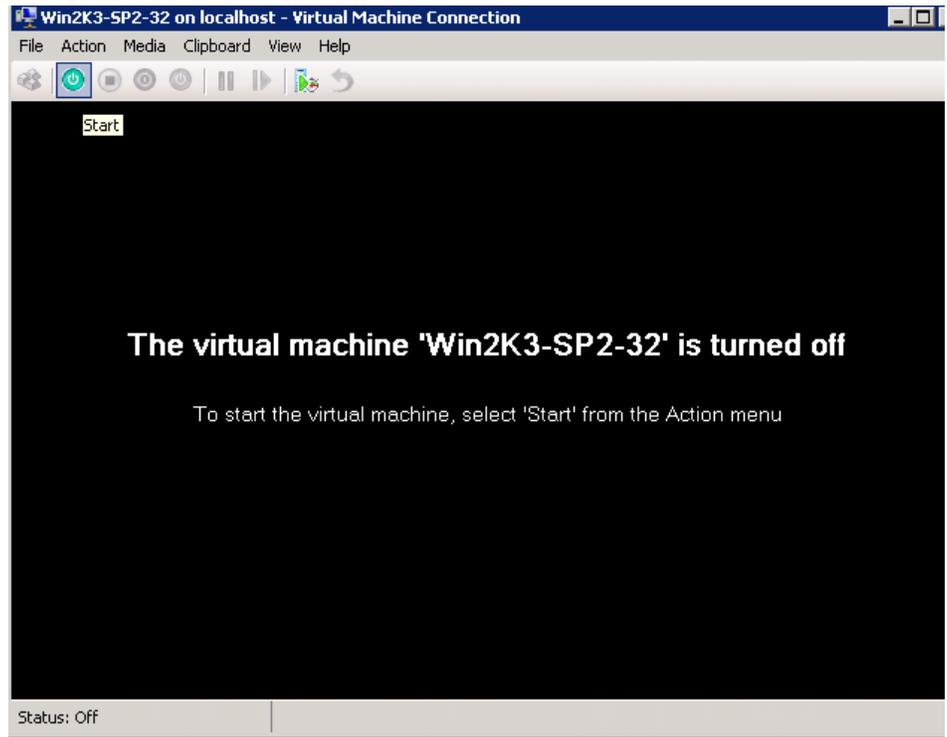
For fixed-size VHDs, NetApp strongly recommends aligning the file system of the VHD to the file system of the underlying physical disk for best performance as the system scales out. For more details on this recommendation, see [NetApp TR 3702](#).

Step	Action
1.	Boot the newly created VM with the Windows Preinstall Environment boot CD.
2.	Enter Alt+M, select Run, type cmd to enter the command prompt, and enter the following at the prompt: diskpart
3.	Enter the following at the prompt: select disk 0 Enter the following at the prompt: create partition primary align=32 
4.	Shut down the child VM with the Windows Preinstall Environment boot CD.

4.1.3 Install Operating System

Step	Action
1.	<p>To install the operating system, go back to the VM Settings window by using the steps described earlier. Click DVD Drive, select Image File, and specify a location for the ISO. Then click OK.</p> 
2.	<p>In the Hyper-V Manager, click the newly created VM, right-click, and select Connect.</p> 

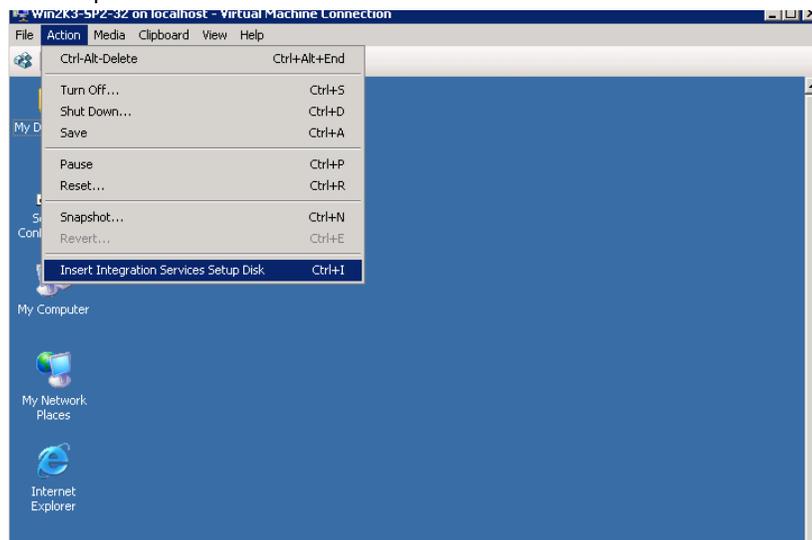
3. Click the green Start button.



4. Install the operating system as you would install the OS on a physical system.
Note: You will not be able to use your mouse throughout the installation because the Hyper-V Integrated Services component of Hyper-V is not yet installed on the VM.

4.1.4 Install Hyper-V Integrated Services

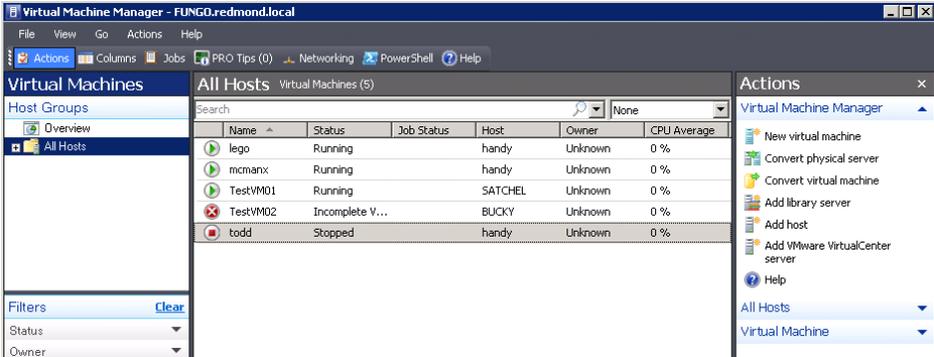
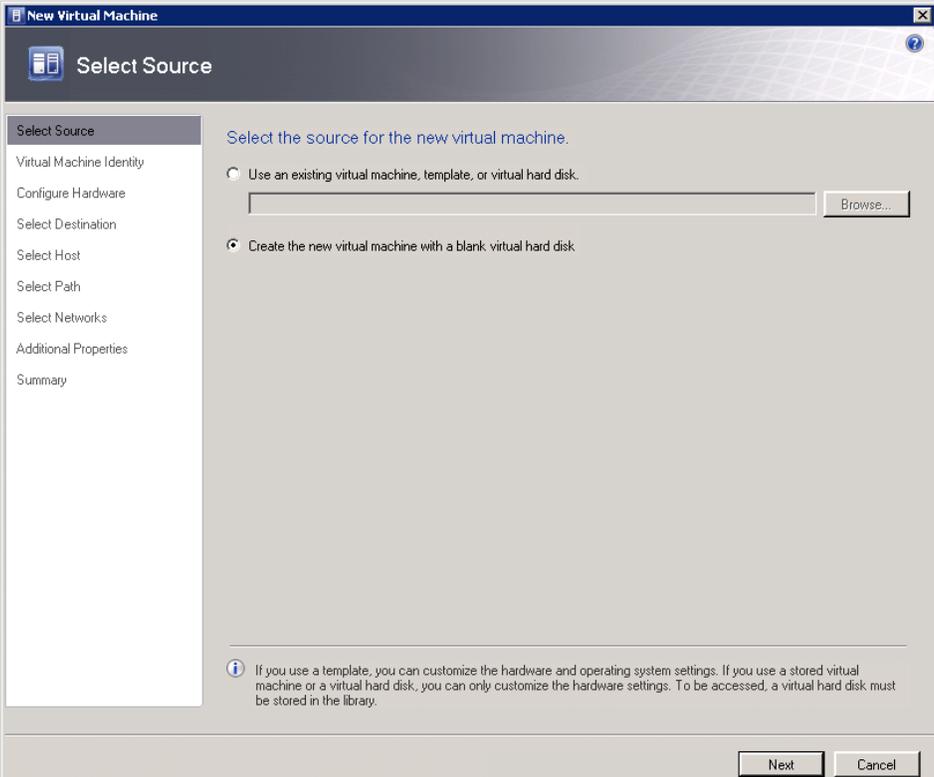
Step	Action
1.	Log in to the newly created VM.
2.	Select Action > Insert Integration Services Setup Disk to install the Hyper-V Integration Services. If the installation does not begin immediately, navigate to the CD drive and run the setup from there.



3.	Reboot the VM to complete installation.
4.	Once the Hyper-V Integrated Services is installed, you can use your mouse in the environment.

4.2 PROVISIONING BY USING SCVMM 2008

4.2.1 Create a Virtual Machine

Step	Action																																				
1.	Open Virtual Machine Manager Administration Console: Start > Programs > Microsoft System Center > Virtual Machine Manager > Virtual Machine Manager Administration Console.																																				
2.	<p>Select a host group.</p> <p>In the right pane, select New Virtual Machine to begin creating a new VM.</p>  <p>The screenshot shows the Virtual Machine Manager Administration Console interface. The 'All Hosts' table lists several virtual machines with their names, statuses, job statuses, hosts, owners, and CPU averages. The 'Actions' pane on the right is open, and the 'New virtual machine' option is selected.</p> <table border="1"> <thead> <tr> <th>Name</th> <th>Status</th> <th>Job Status</th> <th>Host</th> <th>Owner</th> <th>CPU Average</th> </tr> </thead> <tbody> <tr> <td>lego</td> <td>Running</td> <td></td> <td>handy</td> <td>Unknown</td> <td>0 %</td> </tr> <tr> <td>mcmamx</td> <td>Running</td> <td></td> <td>handy</td> <td>Unknown</td> <td>0 %</td> </tr> <tr> <td>TestVM01</td> <td>Running</td> <td></td> <td>SATCHEL</td> <td>Unknown</td> <td>0 %</td> </tr> <tr> <td>TestVM02</td> <td>Incomplete V...</td> <td></td> <td>BUCKY</td> <td>Unknown</td> <td>0 %</td> </tr> <tr> <td>todd</td> <td>Stopped</td> <td></td> <td>handy</td> <td>Unknown</td> <td>0 %</td> </tr> </tbody> </table>	Name	Status	Job Status	Host	Owner	CPU Average	lego	Running		handy	Unknown	0 %	mcmamx	Running		handy	Unknown	0 %	TestVM01	Running		SATCHEL	Unknown	0 %	TestVM02	Incomplete V...		BUCKY	Unknown	0 %	todd	Stopped		handy	Unknown	0 %
Name	Status	Job Status	Host	Owner	CPU Average																																
lego	Running		handy	Unknown	0 %																																
mcmamx	Running		handy	Unknown	0 %																																
TestVM01	Running		SATCHEL	Unknown	0 %																																
TestVM02	Incomplete V...		BUCKY	Unknown	0 %																																
todd	Stopped		handy	Unknown	0 %																																
3.	<p>Select "Create the new virtual machine with a blank virtual hard disk."</p>  <p>The screenshot shows the 'New Virtual Machine' wizard in the 'Select Source' step. The 'Create the new virtual machine with a blank virtual hard disk' option is selected. The 'Use an existing virtual machine, template, or virtual hard disk' option is also visible but not selected.</p>																																				

4. Specify the virtual machine name and the owner of the VM. Add a description of the VM and any notes and then click Next.

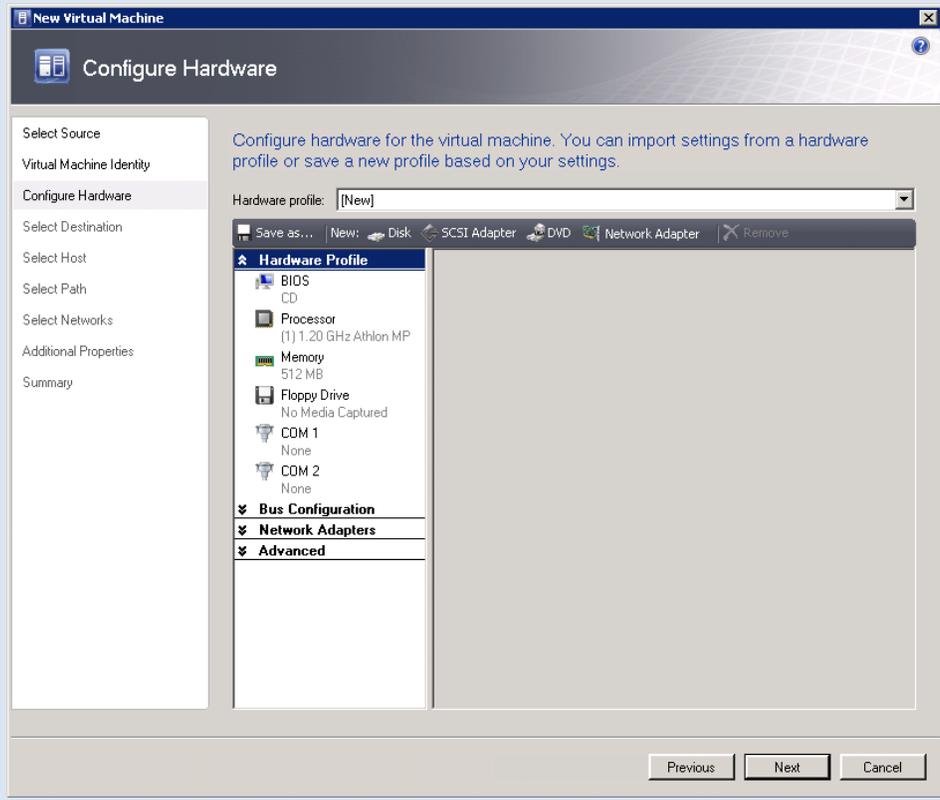
The screenshot shows the 'New Virtual Machine' wizard in System Center Operations Manager, specifically the 'Virtual Machine Identity' step. The window title is 'New Virtual Machine'. On the left, a navigation pane lists steps: 'Select Source', 'Virtual Machine Identity' (selected), 'Configure Hardware', 'Select Destination', 'Select Host', 'Select Path', 'Select Networks', 'Additional Properties', and 'Summary'. The main area contains the following fields:

- Virtual machine name:** A text box containing 'New Virtual Machine'.
- Owner:** A text box containing 'REDMOND\Administrator' with a 'Browse...' button to its right.
- Format:** 'domain\username'.
- Description:** A large empty text area.

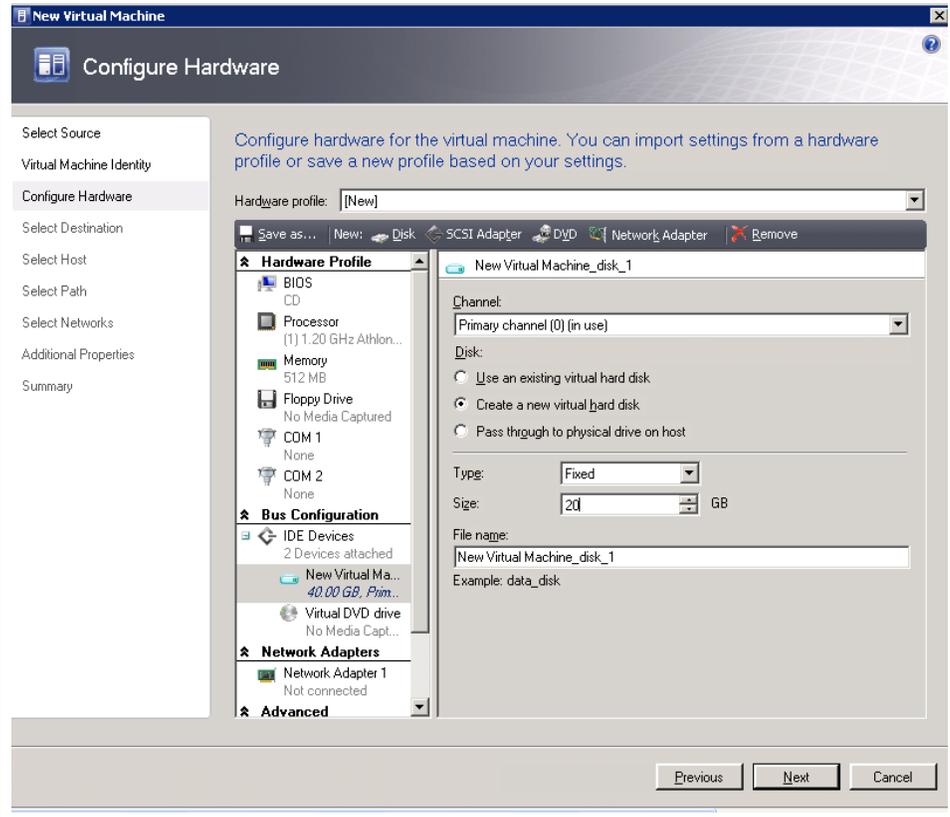
At the bottom, there is an information icon and a note: 'The virtual machine name identifies the virtual machine to VMM. The name does not have to match the computer name of the virtual machine. However, using the same name ensures consistent displays in System Center Operations Manager.' Below this note are three buttons: 'Previous', 'Next', and 'Cancel'.

5. To configure VM hardware, select to use a new or existing hardware profile. To create this VM, we will use a new hardware profile.

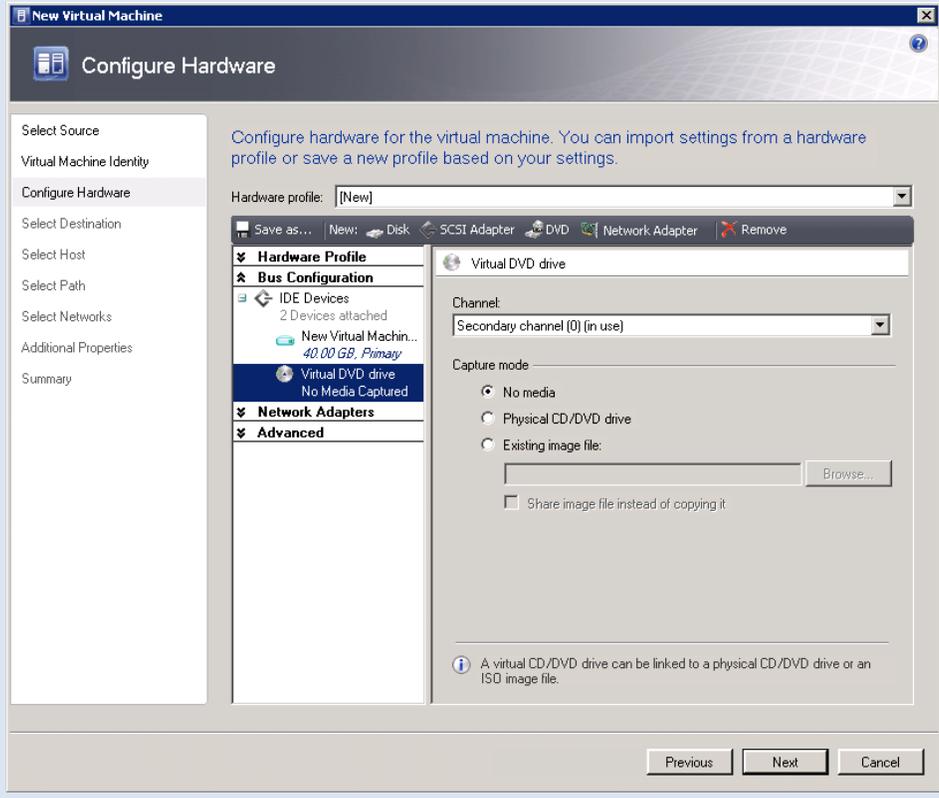
- Configure the processor and memory for the VM.



6. Specify the Virtual Hard Disk configuration for the Virtual Machine.
- To use a golden image of a virtual machine by attaching the VM to an existing VHD, select “Use an existing virtual hard disk.”

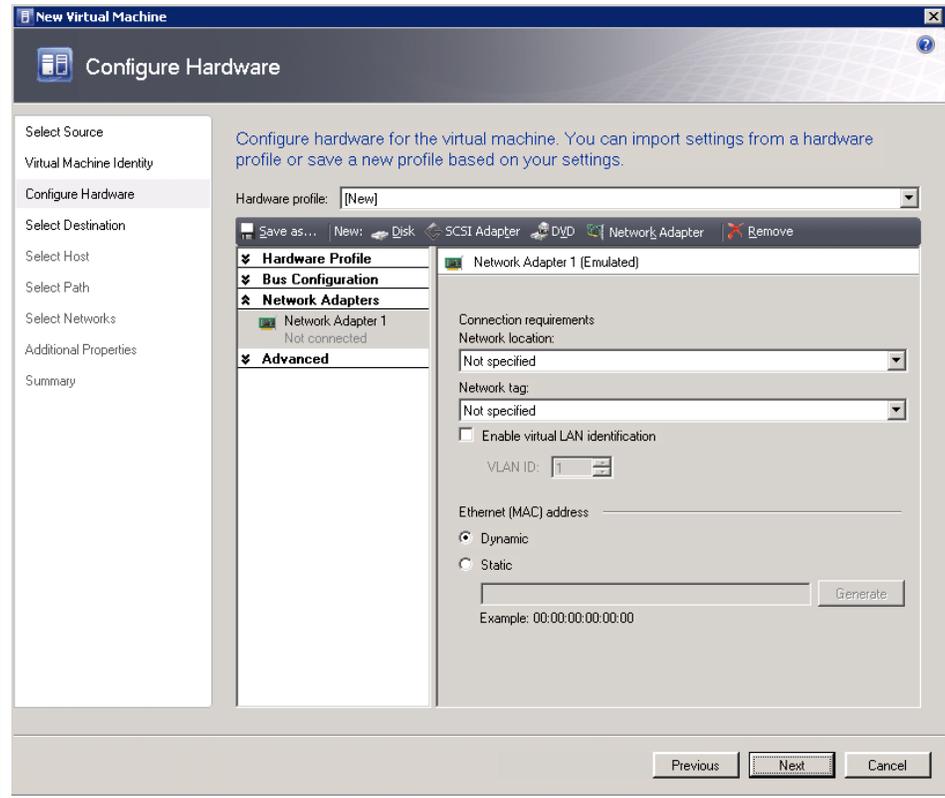


7. Specify the virtual CD/DVD drive configuration for the virtual machine:
- Select “Existing image file” to browse for an existing ISO image.
 - Select “Physical CD/DVD drive” to use the Windows Server 2008 server’s physical CD/DVD-ROM drive.

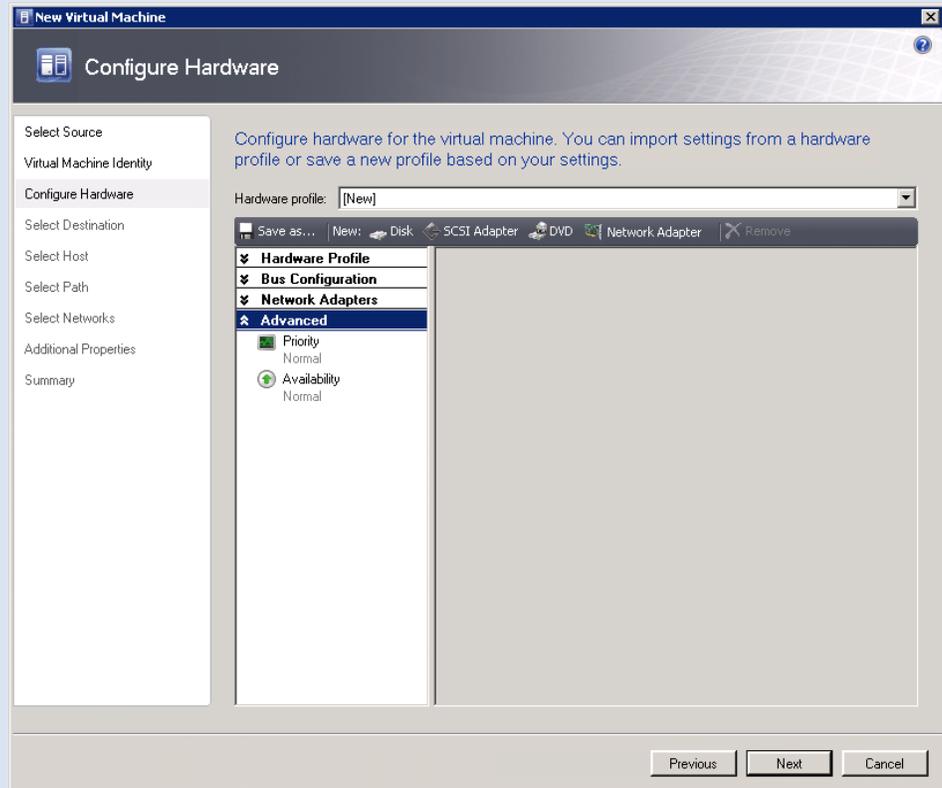


8. Configure the network adapter for the virtual machine.

Note: In step 13 you will specify the Hyper-V virtual network to which to connect each configured network adapter for the VM.

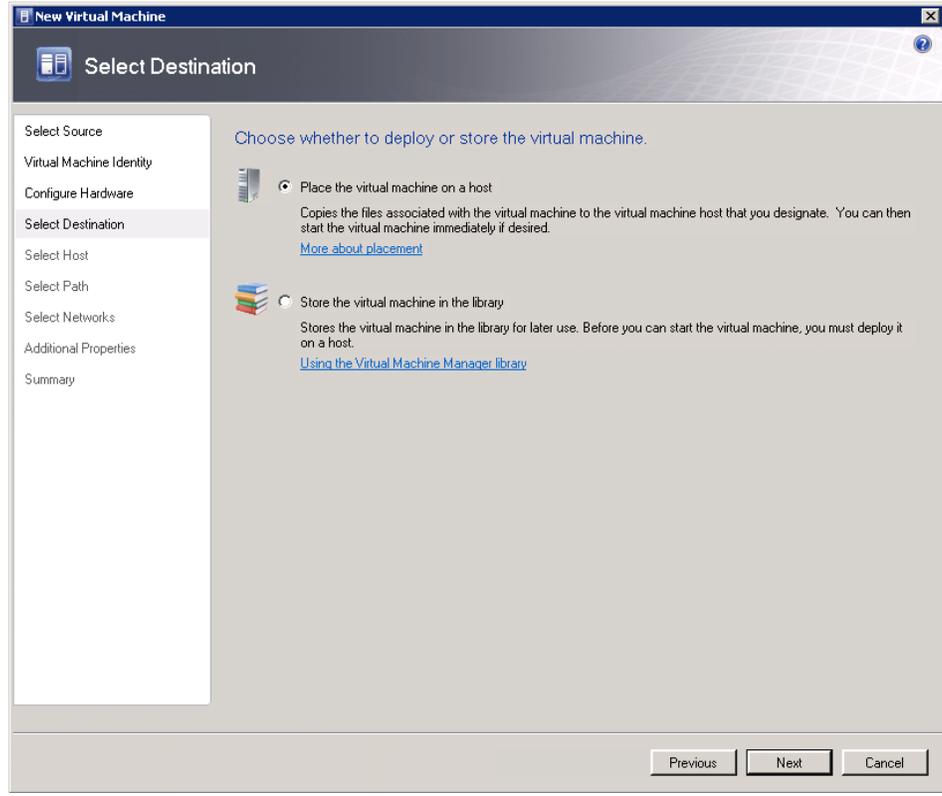


9. Select the priority of the virtual machine based on CPU resources relative to other VMs residing on the same Windows Server 2008 server.



Note: You must have a Hyper-V cluster configured in SCVMM in order to make the virtual machine highly available.

10. Select "Place the virtual machine on a host" to continue creating the virtual machine.

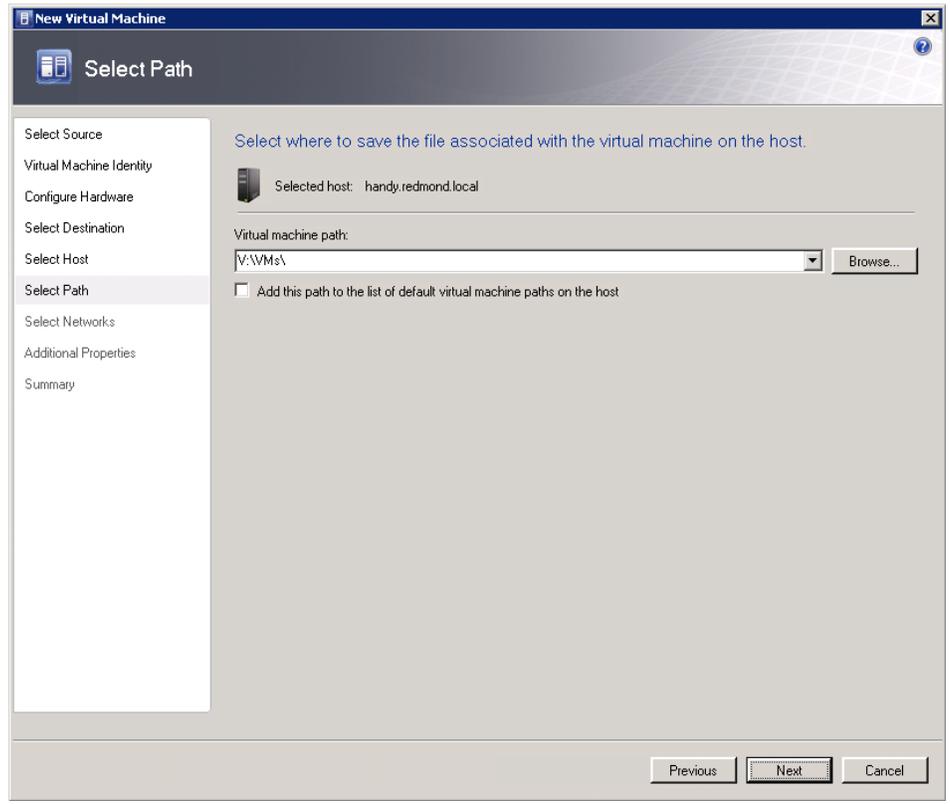


11. Select the Windows Server 2008 host on which to place the newly created virtual machine. If the server is a clustered host (part of the failover cluster), you are prompted to make the VM highly available.

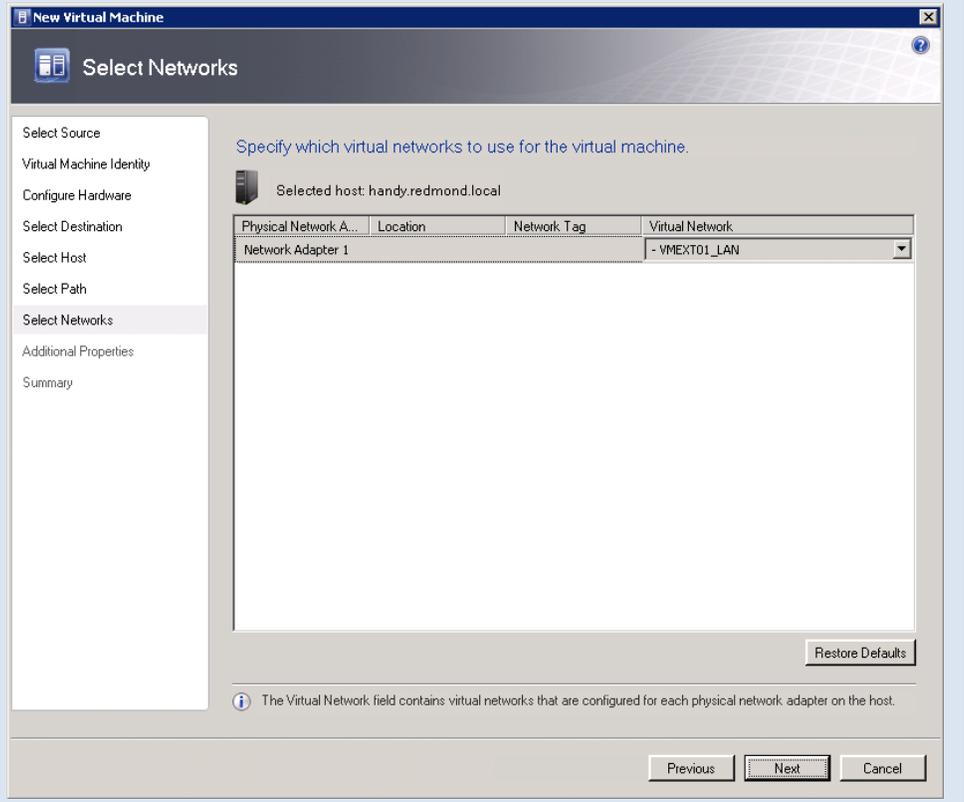
The screenshot shows the 'New Virtual Machine' wizard in the Hyper-V console, specifically the 'Select Host' step. The wizard's progress bar indicates the current step. On the left, a navigation pane lists steps: Select Source, Virtual Machine Identity, Configure Hardware, Select Destination, Select Host (selected), Select Path, Select Networks, Additional Properties, and Summary. The main area displays a table of hosts with columns for Rating, Host, and Transfer Type. Below the table are 'Details', 'Rating Explanation', and 'SAN Explanation' tabs. A 'Virtual Machine Manager' dialog box is open, displaying a warning icon and the text: 'You have selected a clustered host for placing a non-highly available virtual machine. Non-highly available virtual machines cannot be placed on a clustered host. Do you want to continue and make this virtual machine highly available?' with 'Yes' and 'No' buttons. At the bottom of the wizard are 'Previous', 'Next', and 'Cancel' buttons.

Rating	Host	Transfer Type
★★★★★	rob.redmond.local	SAN
★★★★★	joe.redmond.local	SAN
★★★★★	handy.redmond.local	SAN
★★★☆☆	SATCHEL.redmond.local	SAN
★★★☆☆	BUCKY.redmond.local	SAN

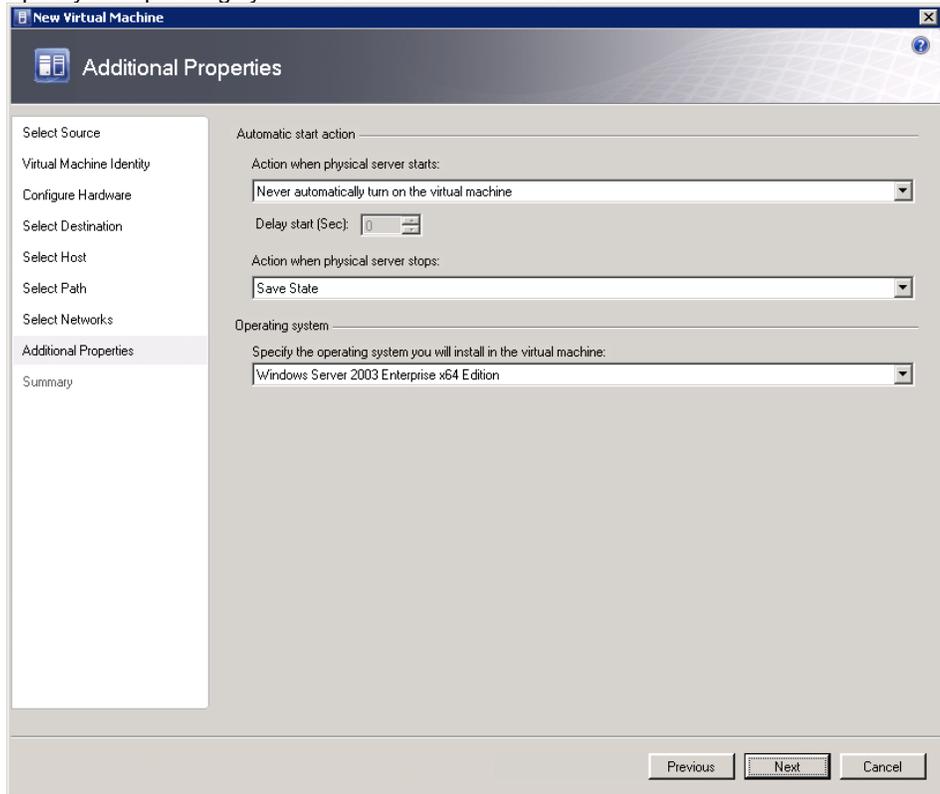
12. Specify the path/location for storing the virtual machine configuration file and VHDs.



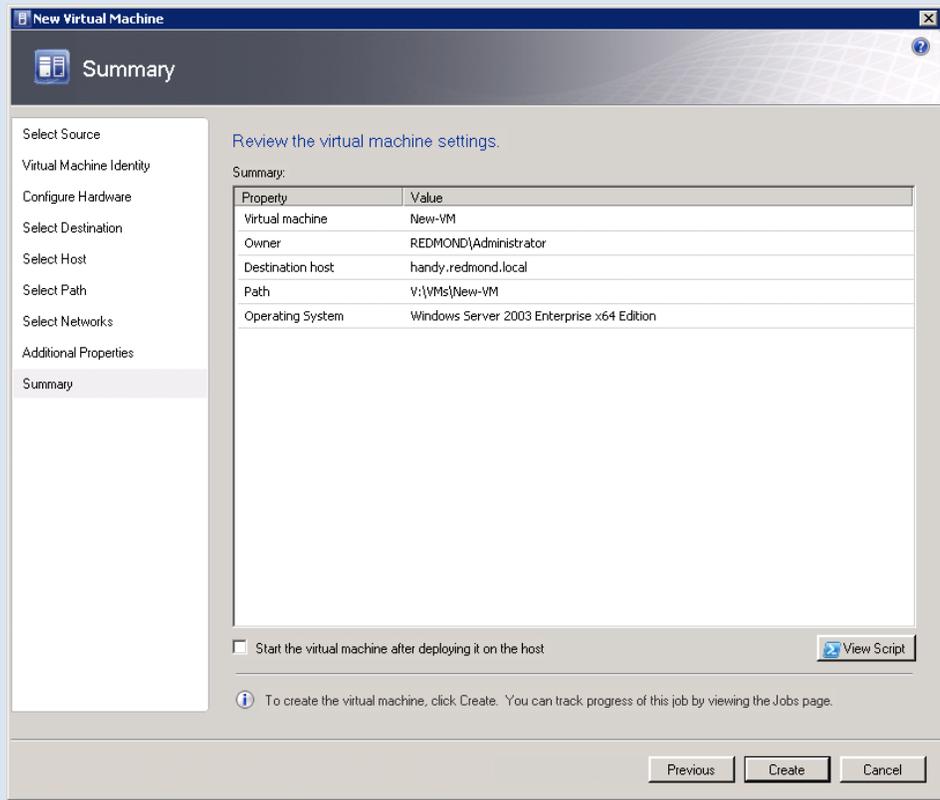
13. Specify the virtual network on the Hyper-V host to which each configured network adapter for the VM should be connected.



14. Specify the operating system to be installed in the VM.



15. Click Create to complete the creation of the new virtual machine.



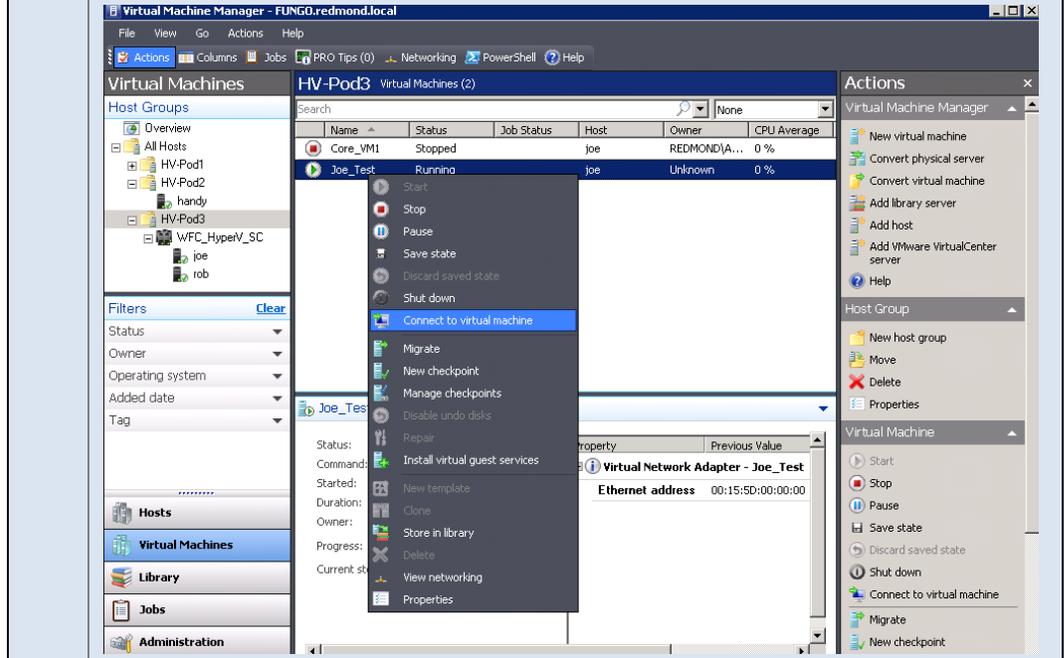
4.2.2 Child VM Partition Alignment

For fixed-size VHDs, NetApp strongly recommends aligning the file system of the VHD to the file system of the underlying physical disks for best performance as the system scales out. To align the child VM partition, follow the procedure described in section 4.1.2.

4.2.3 Install Operating System

To connect to the VM directly from SCVMM, follow this step.

Step	Action
1.	To connect to the VM directly from SCVMM, select the VM, right-click, and select Connect to Virtual Machine.



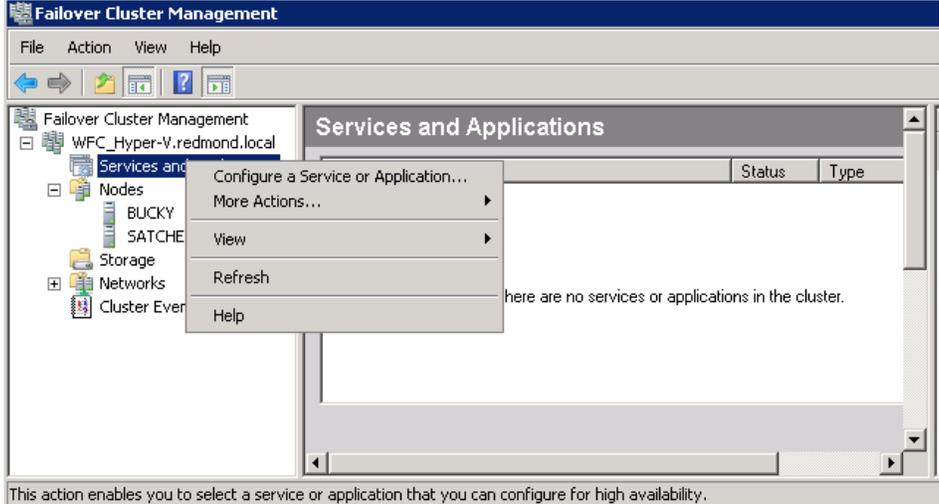
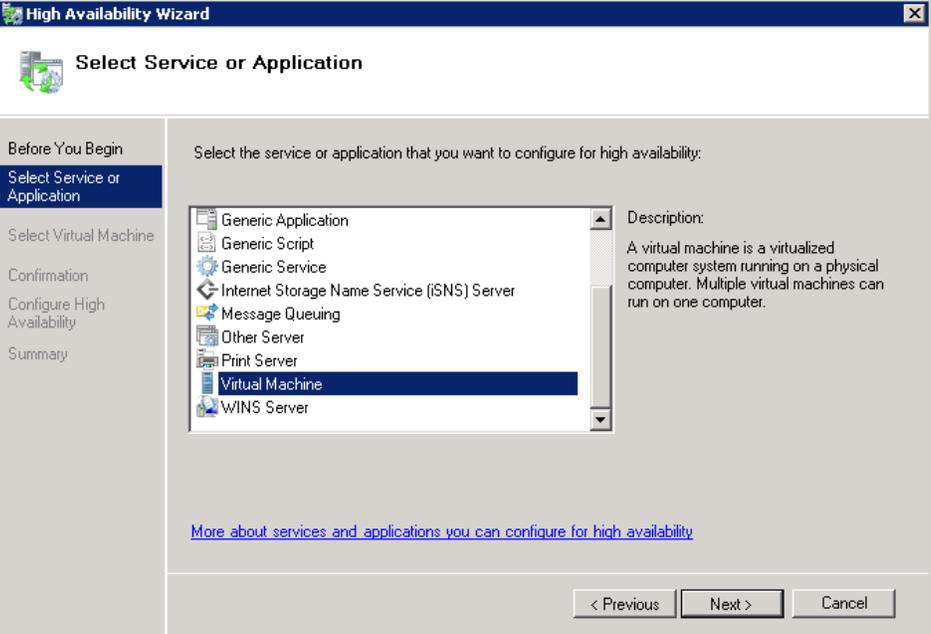
The screenshot displays the Microsoft Hyper-V Manager interface. The main window title is 'Virtual Machine Manager - FUNGO.redmond.local'. The left-hand navigation pane shows a tree view of 'Host Groups' including 'All Hosts', 'HV-Pod1', 'HV-Pod2', 'HV-Pod3', and 'handy'. Under 'HV-Pod3', there are sub-items for 'WFC_HyperV_SC', 'joe', and 'rob'. The 'Filters' section on the left includes 'Status', 'Owner', 'Operating system', 'Added date', and 'Tag'. The main area shows a table of virtual machines under the 'HV-Pod3' host group. The table has columns for 'Name', 'Status', 'Job Status', 'Host', 'Owner', and 'CPU Average'. Two VMs are listed: 'Core_VM1' (Stopped) and 'Joe_Test' (Running). A context menu is open over the 'Joe_Test' VM, with the 'Connect to virtual machine' option highlighted. The context menu includes options such as Start, Stop, Pause, Save state, Discard saved state, Shut down, Migrate, New checkpoint, Manage checkpoints, Disable undo disks, Repair, Install virtual guest services, New template, Clone, Store in library, Delete, View networking, and Properties. On the right side of the interface, there is an 'Actions' pane with a list of actions for the selected VM, including Start, Stop, Pause, Save state, Discard saved state, Shut down, Connect to virtual machine, Migrate, and New checkpoint.

5 QUICK MIGRATION SETUP AND CONFIGURATION

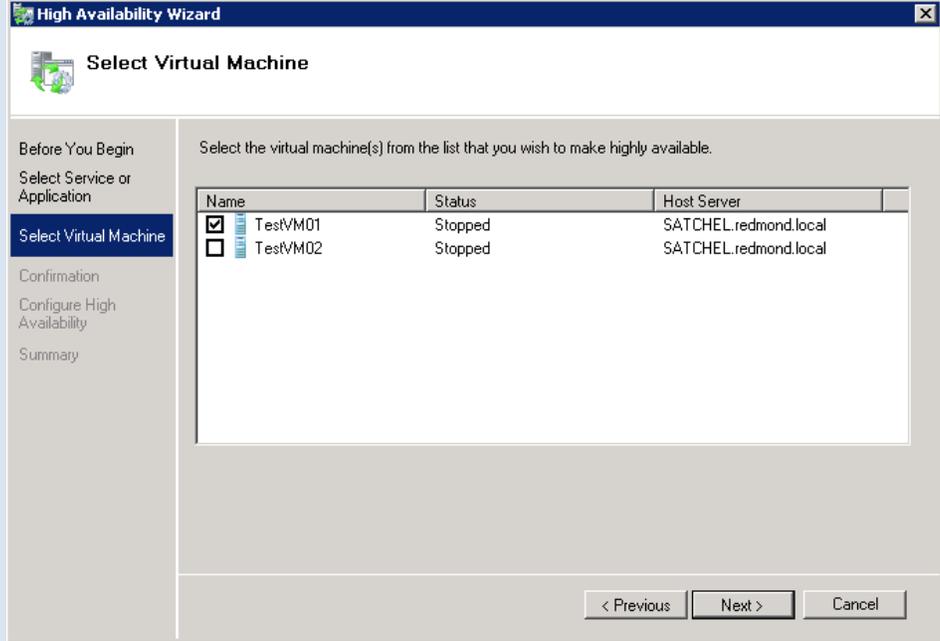
5.1 ENABLE HIGH AVAILABILITY FOR A VIRTUAL MACHINE

5.1.1 VMs Provisioned by Using Hyper-V Manager (for Both Full and Server Core Installations)

Now that we have created the VMs, the next step is to configure them for high availability by creating a VM resource group.

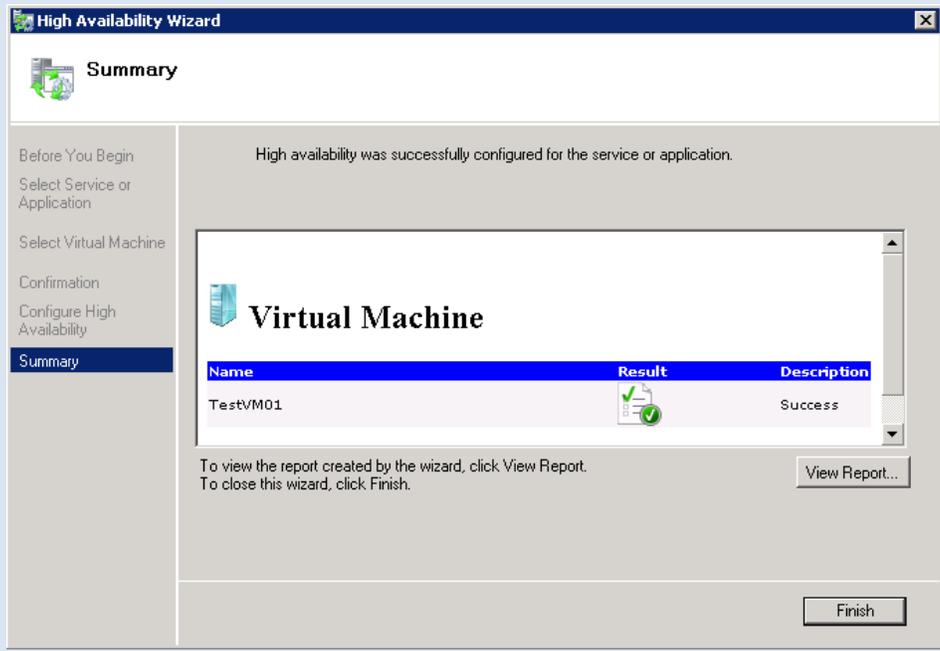
Step	Action
1.	Open the Failover Cluster Manager.
2.	<p>Right-click Services and Applications in the left pane and select Configure a Service or Application.</p>  <p>The screenshot shows the Failover Cluster Management console. The left pane shows a tree view with 'Services and Applications' selected. A context menu is open over it, listing options: 'Configure a Service or Application...', 'More Actions...', 'View', 'Refresh', and 'Help'. The main pane shows a table with columns 'Status' and 'Type', and a message: 'There are no services or applications in the cluster.'</p>
3.	Skip the introduction page and click Next.
4.	<p>Select Virtual Machine as the service or application type.</p>  <p>The screenshot shows the 'High Availability Wizard' window. The 'Select Service or Application' step is active. On the left, a navigation pane lists steps: 'Before You Begin', 'Select Service or Application', 'Select Virtual Machine', 'Confirmation', 'Configure High Availability', and 'Summary'. The main area has a list of service types: 'Generic Application', 'Generic Script', 'Generic Service', 'Internet Storage Name Service (iSNS) Server', 'Message Queuing', 'Other Server', 'Print Server', 'Virtual Machine', and 'WINS Server'. 'Virtual Machine' is selected. A description on the right states: 'A virtual machine is a virtualized computer system running on a physical computer. Multiple virtual machines can run on one computer.' At the bottom, there are buttons for '< Previous', 'Next >', and 'Cancel'.</p>

5. Select the virtual machine to make highly available.

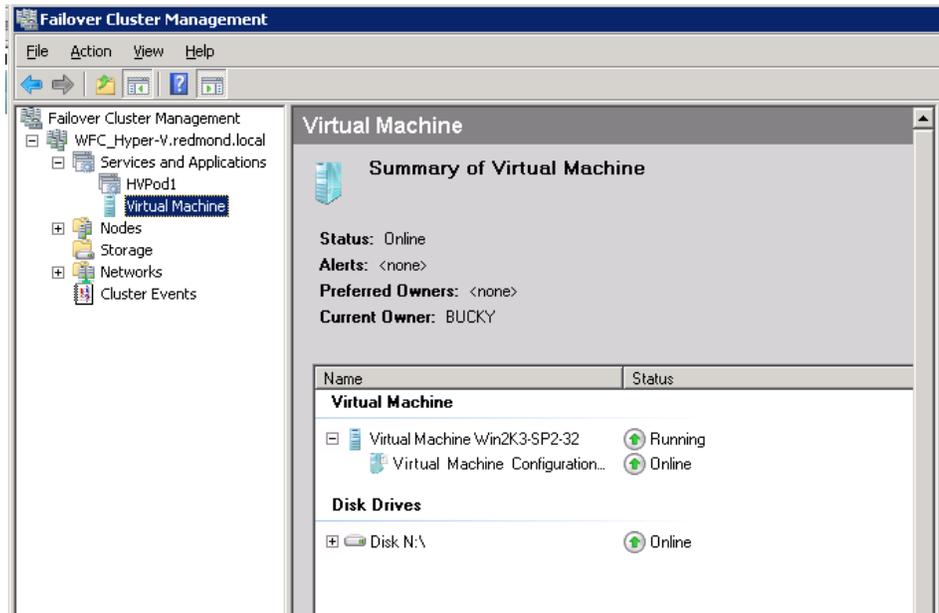


6. Review the summary and click Next to continue the creation of the virtual machine resource group.

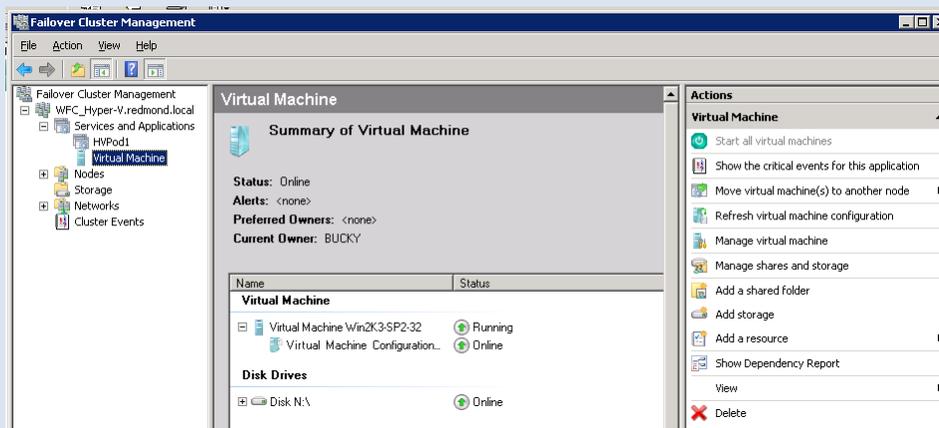
7. Click Finish to complete the creation of the Virtual Machine resource group.



- To review the details of the virtual machine resource group, select it under Services and Applications in the left pane.



- Select Show Dependency Report to review the dependencies of each resource in the virtual machine resource group.



10. Under Storage in the left pane, note the creation of the Virtual Machine cluster resource group for the disk where the VM is stored. The cluster places a reservation on this disk and the disk is removed from Available Storage.

Failover Cluster Management

File Action View Help

Summary of Storage

Storage:	Total Capacity:	Available Capacity:
4 Total Disks - 4 online	Total: 52.7 GB	Total: 25.85 GB
2 Available Disks - 2 online	Free Space: 16.12 GB	Free Space: 11.42 GB
2 In Use Disks - 2 online	Percent Free: 30.6%	Percent Free: 44.2%

Disk	Status	Node
Witness Disk in Quorum		
Disk W:\	Online	BUCKY
Available Storage		
Disk J:\	Online	BUCKY
Disk M:\	Online	BUCKY
Virtual Machine		
Disk N:\	Online	BUCKY

11. Creating the virtual machine resource group caused the VM to be powered off. To power on the virtual machine by using Failover Cluster Manager, select “Bring this service or application online” in the right pane or right-click the virtual machine resource and select “Bring this resource online.”

Failover Cluster Management

File Action View Help

Virtual Machine

Summary of Virtual Machine

Status: Offline
 Alerts: <none>
 Preferred Owners: <none>
 Current Owner: BUCKY

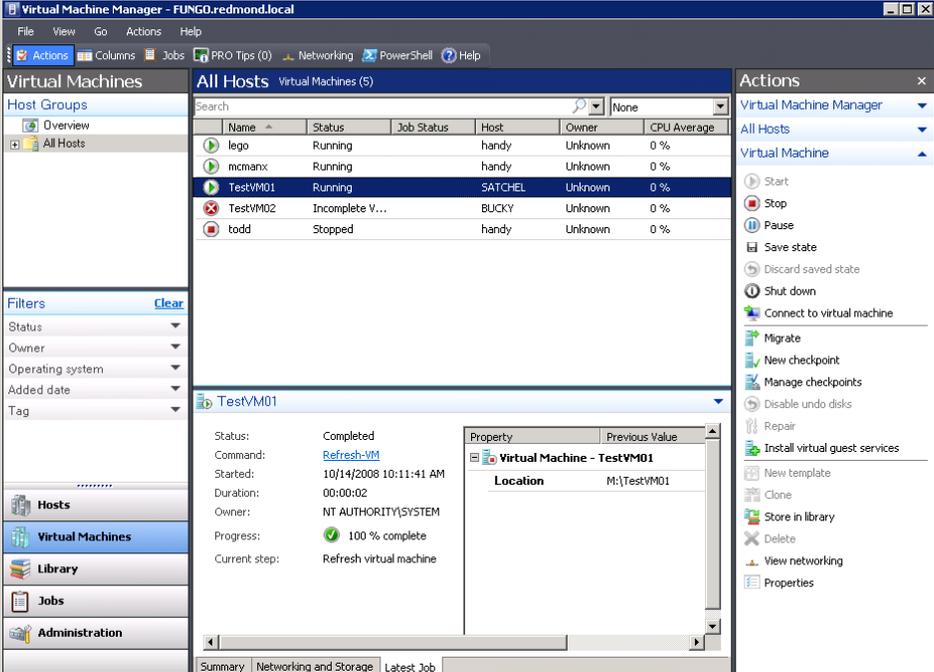
Name	Status
Virtual Machine	
Virtual Machine Win2K3-SP2-32	Off
Disk Drives	
Disk N:\	

- Bring this resource online
- Take this resource offline
- Show the critical events for this resource
- Show Dependency Report
- More Actions...
- Delete
- Properties
- Help

5.1.2 VMs Provisioned by Using SCVMM

If the Windows Server 2008 server is not part of the Windows Failover Cluster, follow these steps to configure the VM to be highly available.

Step	Action
1.	Select the virtual machine. From the right pane select Properties; or right-click the virtual machine and select Properties.

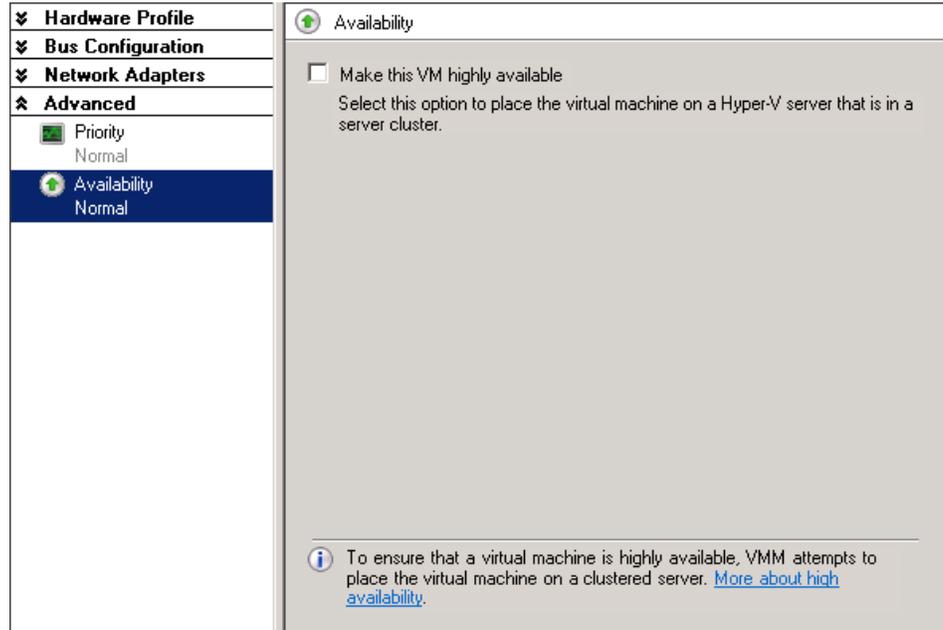


The screenshot displays the Microsoft Virtual Machine Manager (VMM) interface. The main window shows a list of virtual machines under the 'All Hosts' group. The selected VM, 'TestVM01', is highlighted in blue. The 'Properties' pane on the right shows the details for 'Virtual Machine - TestVM01', including its location (M:\TestVM01) and a 'Refresh' button. The 'Actions' pane on the right lists various operations such as Start, Stop, Pause, Save state, and Shut down.

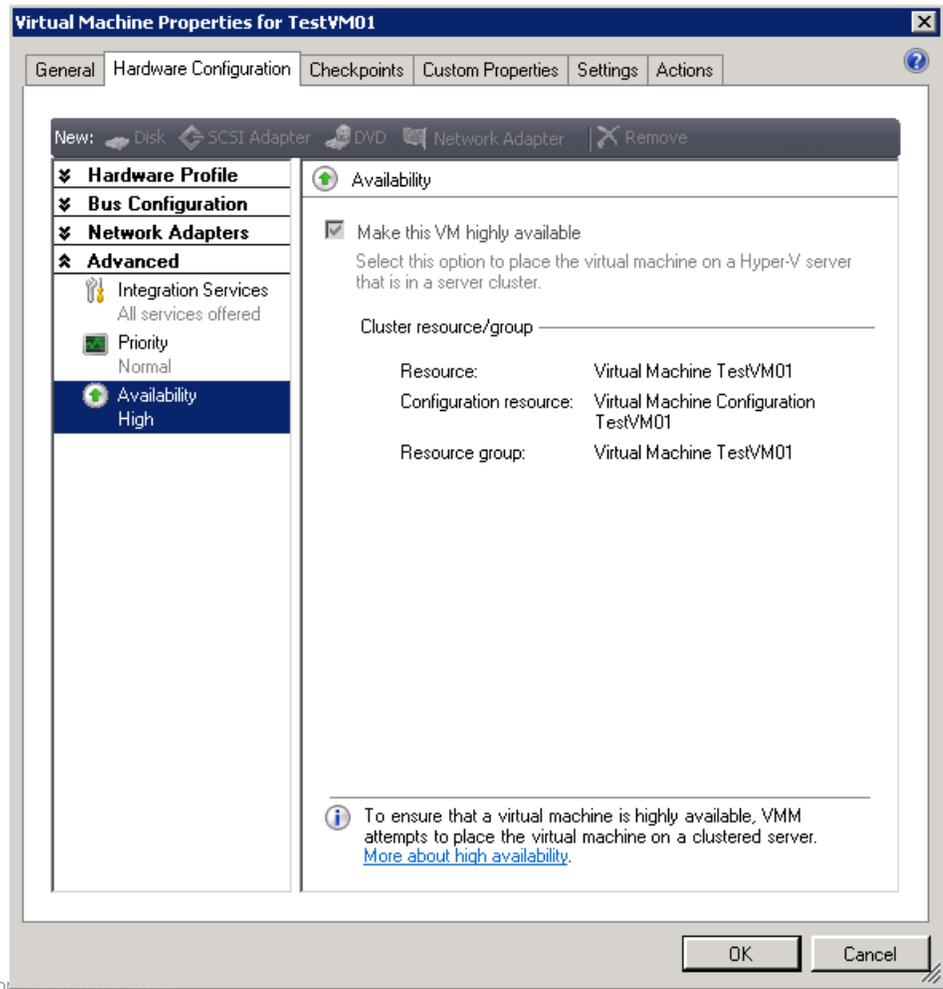
Name	Status	Job Status	Host	Owner	CPU Average
lego	Running		handy	Unknown	0 %
mcmancx	Running		handy	Unknown	0 %
TestVM01	Running		SATCHEL	Unknown	0 %
TestVM02	Incomplete V...		BUCKY	Unknown	0 %
todd	Stopped		handy	Unknown	0 %

Property	Previous Value
Location	M:\TestVM01

2. On the Hardware Configuration tab, select Advanced > Availability. Select “Make this VM highly available” and click OK to apply the changes to the virtual machine configuration.



This is what a configuration looks like for a highly available virtual machine.



6 NETAPP DEDUPLICATION ON PRIMARY STORAGE

With NetApp deduplication, Hyper-V deployments can eliminate the duplicate data in their environments, enabling greater storage utilization. Deduplication is enabled on the NetApp volume, and the amount of data deduplication realized is based on the commonality of the data stored in a deduplication-enabled volume.

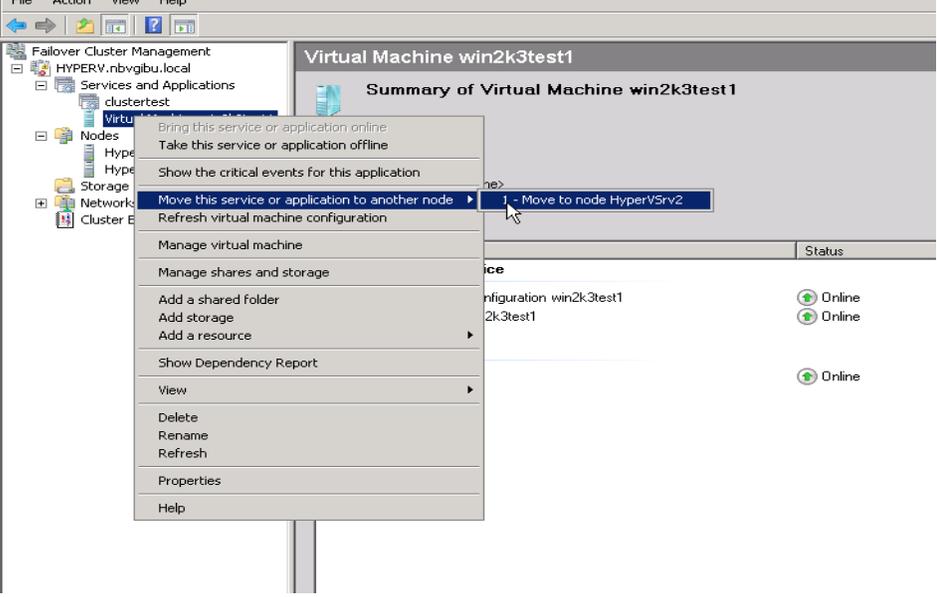
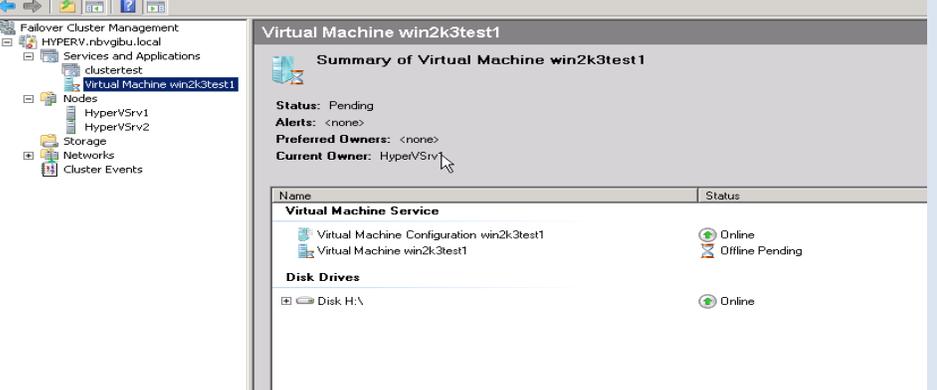
When you have created multiple VMs on the NetApp volume, follow these steps to deduplicate data on the volume.

Step	Action
1.	Connect to the NetApp controller's system console by using SSH, telnet, or serial console.
2.	Enter the following command to enable deduplication for the gold volume: <pre>sis on <volume path></pre>
3.	Enter the following command to start processing existing data: <pre>sis start -s <volume path></pre>
4.	Enter the following command to monitor the status of the deduplication operation: <pre>sis status</pre>
5.	When the deduplication has finished, enter the following command to see the savings: <pre>df -s</pre>
6.	To schedule deduplication to run at regular intervals, use the following command: <pre>sis config -s <schedule> <volume_path></pre> <p>Where <schedule> can be in the following format: schedule is [day_list][@hour_list] or [hour_list][@day_list] or - or auto The day_list specifies which days of the week SIS operations should run. It is a comma-separated list of the first three letters of the day: sun, mon, tue, wed, thu, fri, sat. The names are not case sensitive. Day ranges such as mon-fri can also be given. The default day_list is sun-sat. The hour_list specifies which hours of the day SIS operations should run on each scheduled day. The hour_list is a comma-separated list of the integers from 0 to 23. Hour ranges such as 8-17 are allowed. Step values can be used in conjunction with ranges. For example, 0-23/2 means "every two hours." The default hour_list is 0; that is, midnight on the morning of each scheduled day.</p>

7 QUICK MIGRATION

Use quick migration to quickly move the VMs between Windows Server 2008 Hyper-V servers, supported on both full and server core installations.

The Hyper-V Manager provides information about the host server.

Step	Action
1.	Open the Failover Cluster Management console to view the virtual machines running on the individual Windows Server 2008 nodes.
2.	<p>Right-click the virtual machine name to open the Actions menu. You have the option to move the virtual machine to another node, and you can select the destination node.</p> 
3.	<p>When the command has been run, the virtual machine enters a pending state before it is moved.</p> 

4. After a few seconds, the virtual machine appears on the destination node and the status returns to Online.

The screenshot displays the Hyper-V Manager interface. On the left, a tree view shows the hierarchy: Failover Cluster Management > HYPERV.nbvqbu.local > Services and Applications > clustertest > Virtual Machine win2k3test1. The main pane shows the 'Summary of Virtual Machine win2k3test1' with the following details:

- Status: Online
- Alerts: <none>
- Preferred Owners: <none>
- Current Owner: HyperVSRV2

Below the summary is a table with two columns: 'Name' and 'Status'.

Name	Status
Virtual Machine Service	
Virtual Machine Configuration win2k3test1	Online
Virtual Machine win2k3test1	Online
Disk Drives	
Disk H:\	Online

8 TESTING AND VALIDATION OF THE HYPER-V AND NETAPP ENVIRONMENT

Here is a checklist to help you determine that the environment is working correctly. Run these tests as appropriate for your environment and document the results.

Item	Description	Completed (Y/N)
1.	Test Ethernet connectivity for Windows Server 2008 servers and NetApp. If using NIC teams or VIFs, pull network cables or down the interfaces and verify network functionality.	
2.	If running in a cluster, test SAN multipathing by pulling the cable or by disabling a switch port (if applicable).	
3.	Test SCVMM functionality for appropriate access control, authentication, and communication with Windows Server 2008 servers	
4.	Perform NetApp cluster failover testing and verify that physical disks remain connected.	

9 ACKNOWLEDGEMENTS

The authors of this document would like to thank Preetom Goswami, Sitakanta Chaudhury, and Ravi B. for their contributions to this document

ABOUT MICROSOFT VIRTUALIZATION SOLUTIONS

Microsoft provides a complete suite of technologies to enable an integrated, end-to-end, virtualized infrastructure. Using products that span the desktop to the data center, Microsoft technologies bring capacities online in real time, as needed; streamline and provision applications, services, and data on demand; accelerate backup and recovery; and enhance availability to protect against system failure and service interruptions. Microsoft's extensive partner ecosystem complements and extends the Microsoft virtualization toolset with products for desktops, servers, applications, storage, and networks. Together with our partners, we deliver the most robust, complete solutions for the virtualized infrastructure. For more information about Microsoft Joint Virtualization Solutions, visit <http://www.microsoft.com/virtualization/partners.mspix>.



© 2008 NetApp. All rights reserved. Specifications are subject to change without notice. NetApp, the NetApp logo, Go further, faster, Data ONTAP, FilerView, FlexVol, NOW, RAID-DP, SnapDrive, SnapRestore, and Snapshot are trademarks or registered trademarks of NetApp, Inc. in the United States and/or other countries. Intel is registered trademark of Intel Corporation. Microsoft, SQL Server, Windows, and Windows Server are registered trademarks and Hyper-V is a trademark of Microsoft Corporation. All other brands or products are trademarks or registered trademarks of their respective holders and should be treated as such. **TR-3733**