

Setup for Microsoft Cluster Service

Update 2 Release for
ESX Server 3.5, ESX Server 3i version 3.5, VirtualCenter 2.5



Setup for Microsoft Cluster Service

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About This Book

This book, *Setup for Microsoft Cluster Service*, first discusses the types of clusters you can implement using virtual machines with Microsoft Cluster Service. It then gives step-by-step instructions for each type of cluster, and concludes with a checklist of clustering requirements and recommendations.

Setup for Microsoft Cluster Service covers both ESX Server 3.5 and ESX Server 3i version 3.5. For ease of discussion, this book uses the following product naming conventions:

- For topics specific to ESX Server 3.5, this book uses the term “ESX Server 3.”
- For topics specific to ESX Server 3i version 3.5, this book uses the term “ESX Server 3i.”
- For topics common to both products, this book uses the term “ESX Server.”
- When the identification of a specific release is important to a discussion, this book refers to the product by its full, versioned name.
- When a discussion applies to all versions of ESX Server for VMware Infrastructure 3, this book uses the term “ESX Server 3.x.”

Intended Audience

This book is for system administrators who are familiar with both VMware technology and Microsoft Cluster Service.

NOTE This is not a guide to using Microsoft Cluster Service. Use your Microsoft documentation for information on installation and configuration of Microsoft Cluster Service.

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VMware Infrastructure Documentation

The VMware Infrastructure documentation consists of the combined VMware VirtualCenter and ESX Server documentation set.

Abbreviations Used in Figures

The figures in this book use the abbreviations listed in [Table 1](#).

Table 1. Abbreviations

Abbreviation	Description
FC	Fibre Channel
SAN	Storage area network type datastore shared between managed hosts
VM#	Virtual machines on a managed host

Technical Support and Education Resources

The following sections describe the technical support resources available to you. To access the current versions of this book and other books, go to:

<http://www.vmware.com/support/pubs>.

Online and Telephone Support

Use online support to submit technical support requests, view your product and contract information, and register your products. Go to:

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Customers with appropriate support contracts should use telephone support for the fastest response on priority 1 issues. Go to:

http://www.vmware.com/support/phone_support.html

Support Offerings

Find out how VMware support offerings can help meet your business needs. Go to:

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VMware Education Services

VMware courses offer extensive hands-on labs, case study examples, and course materials designed to be used as on-the-job reference tools. For more information about VMware Education Services, go to:

<http://mylearn1.vmware.com/mgrreg/index.cfm>

Getting Started

This chapter introduces clustering, discusses the different types of clusters and prerequisites for each type, and includes some caveats and recommendations in the following sections:

- [“Introduction”](#) on page 9
- [“Clustering Configurations”](#) on page 10
- [“Prerequisites for Clustering”](#) on page 13
- [“Caveats, Restrictions, and Recommendations”](#) on page 16
- [“Recommendations for Using MSCS and Boot from SAN”](#) on page 17
- [“Setting up a Clustered Continuous Replication Environment for Microsoft Exchange”](#) on page 18

Introduction

This document discusses traditional clustering (hot standby) using MSCS in a VMware Infrastructure environment. Clustering virtual machines can reduce hardware costs of traditional high availability clusters.

VMware also supports a cold standby clustering solution using VMware HA in conjunction with VirtualCenter clusters. VMware HA functionality, as well as the differences between the two approaches, is discussed in the *Resource Management Guide*.

A number of different applications use clustering:

- Stateless applications, such as Web servers and VPN servers.
- Applications that have built-in recovery features, such as database servers, mail servers, and file servers.
- VirtualCenter Server can be used as a clustered application. See http://www.vmware.com/pdf/VC_MSCS.pdf.

Clustering Software

Several clustering software products can be used in conjunction with virtual machines. However, VMware tests clustering only with MSCS and supports only MSCS.

Clustering Hardware

A typical clustering setup includes:

- Disks that are shared between nodes. A shared disk is required as a quorum disk. In a cluster across boxes, the shared disk must be on an FC SAN.
- A private heartbeat network between nodes.

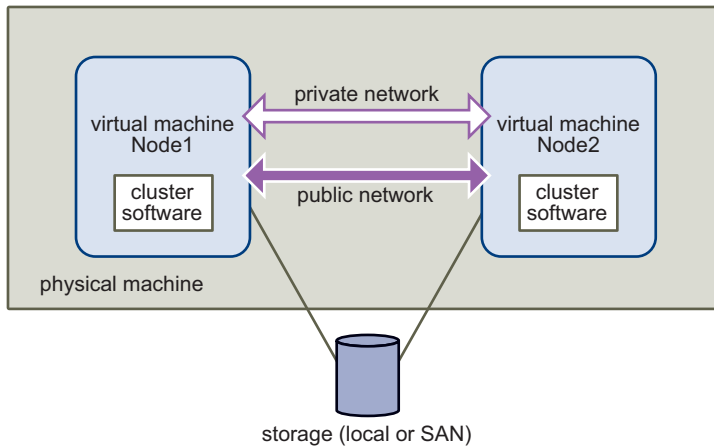
Clustering Configurations

Several clustering configurations are possible in a VMware Infrastructure environment and are briefly discussed below:

- “[Clustering Virtual Machines on a Single Host \(Cluster in a Box\)](#)” on page 10
- “[Clustering Virtual Machines Across Physical Hosts \(Cluster Across Boxes\)](#)” on page 11
- “[Clustering Physical Machines with Virtual Machines \(Standby Host\)](#)” on page 13

Clustering Virtual Machines on a Single Host (Cluster in a Box)

A cluster in a box consists of two clustered virtual machines on the same ESX Server host connected to the same storage (either local or remote). See [Figure 1-1](#) for an example.

Figure 1-1. Cluster in a Box

This configuration protects against failures at the operating system and application level, but it does not protect against hardware failures.

[Chapter 2, “Clustering Virtual Machines on One Physical Host,”](#) discusses how to set up a cluster in a box using MSCS.

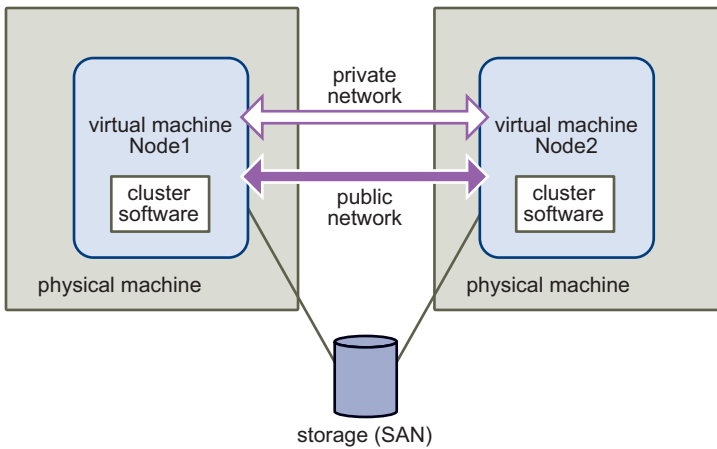
Clustering Virtual Machines Across Physical Hosts (Cluster Across Boxes)

A cluster across boxes configuration provides both hardware and software-level protection by placing the cluster nodes on separate ESX Server hosts, as shown in [Figure 1-2](#). This configuration requires shared storage on an FC SAN for the quorum disk.

This configuration protects against software failures and hardware failures on the physical machine.

[Chapter 3, “Clustering Virtual Machines Across Physical Hosts,”](#) discusses how to set up a cluster across boxes using MSCS.

Figure 1-2. Cluster Across Boxes



You can expand the cluster-across-boxes model and place multiple virtual machines on multiple physical machines. For example, you can consolidate four clusters of two physical machines each to two physical machines with four virtual machines each. This setup protects you from both hardware and software failures. At the same time, this setup results in significant hardware cost savings.

Figure 1-3. Clustering Multiple Virtual Machines Across Hosts

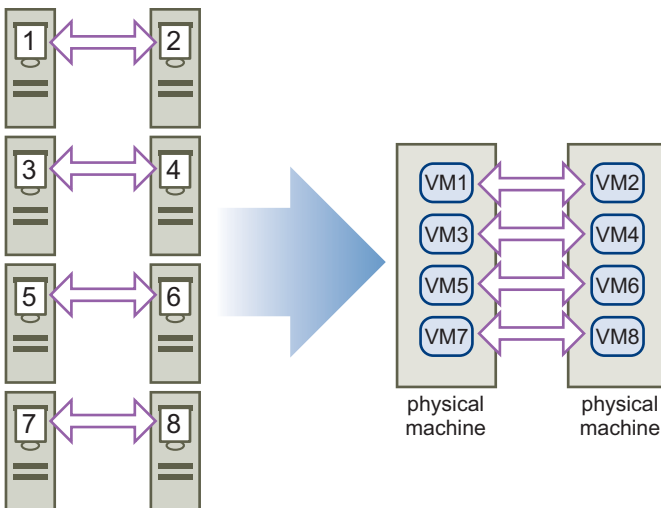


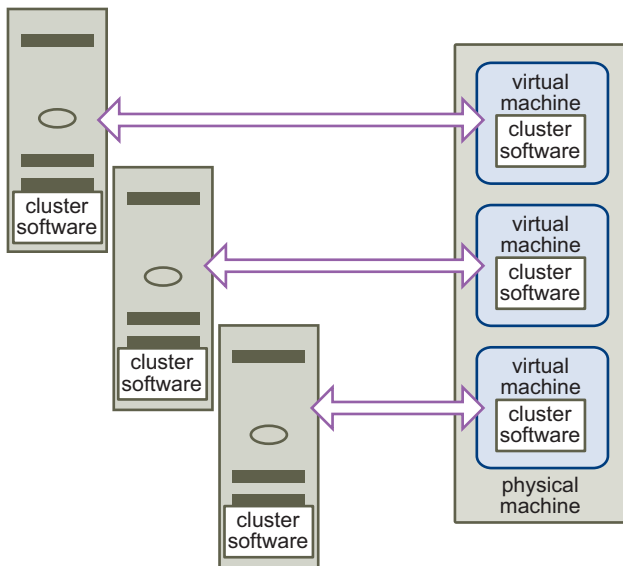
Figure 1-3 shows how four two-node clusters can be moved from eight physical machines to two.

Clustering Physical Machines with Virtual Machines (Standby Host)

For a simple clustering solution with low hardware requirements, you might choose to have one standby host. Set up your system to have a virtual machine corresponding to each physical machine on the standby host, and then create clusters, one each for each physical machine and its corresponding virtual machine. In case of hardware failure in one of the physical machines, the virtual machine on the standby host can take over for that physical host.

Figure 1-4 shows a standby host using three virtual machines on a single physical machine. Each virtual machine is running clustering software.

Figure 1-4. Clustering Physical and Virtual Machines



Prerequisites for Clustering

Using MSCS in any of the configurations discussed requires preparation. This section lists the prerequisites for the ESX Server host and the virtual machine. For additional software prerequisite information, see the *Guide to Creating and Configuring a Server Cluster under Windows Server 2003* on the Microsoft Web site.

[“Appendix: Setup Checklist”](#) on page 43 summarizes prerequisites for different types of clusters.

Prerequisites for Cluster in a Box

To set up a cluster in a box, you must have:

- ESX Server host, one of the following:
 - **ESX Server 3** – An ESX Server host with a physical network adapter for the service console. If the clustered virtual machines need to connect with external hosts, then an additional network adapter is highly recommended.
 - **ESX Server 3i** – An ESX Server host with a physical network adapter for the VMkernel. If the clustered virtual machines need to connect with external hosts, a separate network adapter is recommended.
- A local SCSI controller. If you plan to use a VMFS volume that exists on a SAN, you need an FC HBA (QLogic or Emulex).

You can set up shared storage for a cluster in a box either by using a virtual disk or by using a remote raw device mapping (RDM) LUN in virtual compatibility mode (non-pass-through RDM).

When you set up the virtual machine, you need to configure:

- Two virtual network adapters.
- A hard disk that is shared between the two virtual machines (quorum disk).
- Optionally, additional hard disks for data that are shared between the two virtual machines if your setup requires it. When you create hard disks, as described in this document, the system creates the associated virtual SCSI controllers.

Prerequisites for Clustering Across Boxes

The prerequisites for clustering across boxes are similar to those for cluster in a box. You must have:

- ESX Server host. VMware recommends three network adapters per host for public network connections. The minimum configuration is:
 - **ESX Server 3** – An ESX Server host configured with at least two physical network adapters dedicated to the cluster, one for the public and one for the private network, and one network adapter dedicated to the service console.
 - **ESX Server 3i** – An ESX Server host configured with at least two physical network adapters dedicated to the cluster, one for the public and one for the private network, and one network adapter dedicated to the VMkernel.
- Shared storage must be on an FC SAN.
- You must use an RDM in physical or virtual compatibility mode (pass-through RDM or non-pass-through RDM). You cannot use virtual disks for shared storage.

Prerequisites for Standby Host Clustering

The prerequisites for standby host clustering are similar to those for clustering across boxes. You must have:

- ESX Server host. VMware recommends three network adapters per host for public network connections. The minimum configuration is:
 - **ESX Server 3** – An ESX Server host configured with at least two physical network adapters dedicated to the cluster, one for the public and one for the private network, and one network adapter dedicated to the service console.
 - **ESX Server 3i** – An ESX Server host configured with at least two physical network adapters dedicated to the cluster, one for the public and one for the private network, and one network adapter dedicated to the VMkernel.
- You must use RDMs in physical compatibility mode (pass-through RDM). You cannot use virtual disk or RDM in virtual compatibility mode (non-pass-through RDM) for shared storage.
- You cannot have multiple paths from the ESX Server host to the storage.
- Running third-party multipathing software is not supported. Because of this limitation, VMware strongly recommends that there only be a single physical path from the native Windows host to the storage array in a configuration of standby-host clustering with a native Windows host. The ESX Server host automatically uses native ESX Server multipathing, which can result in multiple paths to shared storage.
- Use the STORport Miniport driver for the FC HBA (QLogic or Emulex) in the physical Windows machine.

Shared Storage Summary

[Table 1-1](#) illustrates which shared storage setup is supported for which clustering solution. The setup for each solution is shown **in bold**.

Table 1-1. Shared Storage Summary

	Cluster in a Box	Cluster Across Boxes	Standby Host Clustering
Virtual disks	Yes	No	No
Pass-through RDM (physical compatibility mode)	No	Yes	Yes
Non-pass-through RDM (virtual compatibility mode)	Yes	Yes	No

Caveats, Restrictions, and Recommendations

This section summarizes caveats, restrictions, and recommendation for using MSCS in a VMware Infrastructure environment.

- VMware only supports third-party cluster software that is specifically listed as supported in the hardware compatibility guides. For latest updates to VMware support for Microsoft operating system versions for MSCS, or for any other hardware-specific support information, see the *Storage/SAN Compatibility Guide for ESX Server 3.5 and ESX Server 3i*.
- Each virtual machine has five PCI slots available by default. A cluster uses four of these slots (two network adapters and two SCSI host bus adapters), leaving one PCI slot for a third network adapter (or other device), if needed.
- VMware virtual machines currently emulate only SCSI-2 reservations and do not support applications using SCSI-3 persistent reservations.
- Use LSILogic virtual SCSI adapter.
- Use Windows Server 2003 SP2 (32 bit or 64 bit) or Windows 2000 Server SP4. VMware recommends Windows Server 2003.
- Use two-node clustering.
- Clustering is not supported on iSCSI or NFS disks.
- NIC teaming is not supported with clustering.
- The boot disk of the ESX Server host should be on local storage.
- Mixed HBA environments (QLogic and Emulex) on the same host are not supported.
- Mixed environments using both ESX Server 2.5 and ESX Server 3.x are not supported.
- Clustered virtual machines cannot be part of VMware clusters (DRS or HA).
- You cannot use migration with VMotion on virtual machines that run cluster software.
- Set the I/O time-out to 60 seconds or more by modifying HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Disk\TimeoutValue.

The system might reset this I/O time-out value if you recreate a cluster. You must reset the value in that case.

- Use the `eagerzeroedthick` format when you create disks for clustered virtual machines. By default, the VI Client or `vmkfstools` create disks in `zeroedthick` format. You can convert a disk to `eagerzeroedthick` format by importing, cloning, or inflating the disk. Disks deployed from a template are also in `eagerzeroedthick` format.
- Add disks before networking, as explained in the VMware Knowledge Base article at <http://kb.vmware.com/kb/1513>.

Recommendations for Using MSCS and Boot from SAN

(SEE UPDATE) This section gives some recommendations for clustered virtual machines that use boot from SAN. For general information about boot from SAN, see the *Fibre Channel SAN Configuration Guide*.

NOTE You cannot use clustered virtual machines that boot from an iSCSI SAN.

Booting from SAN is complex. Problems you encounter in physical environments extend to virtual environments. VMware recommends the following when you put the boot disk of a virtual machine you wish to use in a cluster setup on a SAN.

- Consider the best practices for boot from SAN that Microsoft publishes in the following knowledge base article:
<http://support.microsoft.com/kb/305547/en-us>
- Use StorPort lsilogic drivers instead of SCSIport drivers when running Microsoft Cluster Service for Windows Server 2003 guest operating systems.
- VMware does not recommend migration with VMotion of clustered virtual machines.
- Given the complexity of booting clustered virtual machines from SAN, VMware recommends you test clustered configurations in different failover scenarios before you put them into production environments.
- If your environment is susceptible to conditions that cause cluster node servers to lose all paths to the storage array, do the following (for all cluster configurations):
 - Set bus sharing for the boot disk (`scsi0`) to `None`.
 - Set `scsi0.returnBusyOnNoConnectStatus` to `FALSE` for each node. See *“To set scsi0.returnBusyOnNoConnectStatus”* on page 18.
 - Set up the guest operating system to restart automatically after a crash. See *“To set up automatic restart for the guest operating system”* on page 18.

When all paths to storage are lost, the active node will crash and attempt to reboot.

To set `scsi0.returnBusyOnNoConnectStatus`

- 1 Log in to a VI Client and select the virtual machine from the inventory panel.
The configuration page for this virtual machine appears.
- 2 In the **Summary** tab, click **Edit Settings**.
- 3 Click **Options > Advanced > General**, and then click **Configuration Parameters** to open the Configuration Parameters dialog box.
- 4 Click **Add Row**.
- 5 Type `scsi0.returnBusyOnNoConnectStatus` in the Name column and `FALSE` in the Value column.
- 6 Click **OK** to close the Configuration Parameters dialog box, and then click **OK** again to close the Virtual Machine Properties dialog box.

To set up automatic restart for the guest operating system

- 1 Right-click My Computer.
- 2 Choose Properties, then select the Advanced tab and click **Settings** under Startup and Recovery.
- 3 Choose **Automatically restart on system failure**.

Setting up a Clustered Continuous Replication Environment for Microsoft Exchange

You can set up a clustered continuous replication (CCR) environment for Microsoft Exchange in your VMware Infrastructure environment.

Microsoft discusses setup for Exchange Server 2007 on their Web site at:

<http://technet.microsoft.com/en-us/library/bb124558.aspx>

Microsoft discusses setup of CCR clusters on their Web site at:

<http://technet.microsoft.com/en-us/library/bb123996.aspx>

When working in a VMware Infrastructure environment, you use virtual machines instead of using physical machines as the cluster components. Use physical compatibility mode RDMs. If the boot disks of the CCR virtual machines are on a SAN, see [“Recommendations for Using MSCS and Boot from SAN”](#) on page 17.

Clustering Virtual Machines on One Physical Host

2

This chapter guides you through creating a two-node MSCS cluster on a single ESX Server machine. The process consists of four tasks, discussed in the following sections:

- [“Task 1: Creating the First Node”](#) on page 19
- [“Task 2: Creating the Second Node”](#) on page 20
- [“Task 3: Adding Hard Disks to Node1”](#) on page 21
- [“Task 4: Adding Hard Disks to Node2”](#) on page 24

NOTE Microsoft Cluster Service is already installed for Windows Server 2003. See the *Guide to Creating and Configuring a Server Cluster under Windows Server 2003* and other documentation on the Microsoft Website.

For Windows 2000 Server, you must install the Microsoft Cluster Service software.

Task 1: Creating the First Node

Creating the first node consists of these major steps, discussed in detail in this section.

- Creating the virtual machine for the first node with two virtual network adapters.
- Installing the operating system.
- Powering down the first node.

NOTE Before you create a virtual machine, create a virtual disk in `eagerzeroedthick` format using `vmkfstools`, and select that disk during virtual machine creation.

To create and configure the first node's virtual machine

- 1 Launch a VI Client and connect to the ESX Server host or a VirtualCenter Server. Use the user name and password of the user who will own the virtual machine.
- 2 In the inventory panel, right-click the host and choose **New Virtual Machine**.
- 3 Make the following selections using the wizard.

Table 2-1. New Virtual Machine Properties

Page	Selection
Wizard Type	Typical.
Name and Location	Choose a name (for example, Node1) and location.
Resource Pool	Select the resource pool for the virtual machine, or select the host if there are no resource pools.
Datastore	Choose a datastore as the location for the virtual machine configuration file and the virtual machine disk (.vmdk) file.
Guest Operating System	Choose the Windows 2000 Server or Windows Server 2003 operating system that you intend to install.
CPUs	Use the default unless you have special requirements.
Memory	Use the default unless you need additional memory and your server supports it.
Network	Change NICs to Connect to 2 , and select the second network for the second NIC. You need one NIC for the private network and the second NIC for the public network.
Virtual Disk Capacity	If you need a primary SCSI disk larger than 4GB, enter the appropriate value in the Capacity field.
Ready to Complete	Click OK to create the virtual machine.

- 4 Install a Windows Server 2000 or Windows Server 2003 operating system on the virtual machine.

Task 2: Creating the Second Node

Creating the second node involves cloning the Node1 virtual machine and adding disks that point to the shared storage. You can clone the node using a VI Client connected to a VirtualCenter Server, as described below, or using `vmkfstools`. See the *Server Configuration Guide* for a reference to `vmkfstools`.

To clone the Node1 virtual machine

- 1 Shut down the guest operating system and power off the virtual machine.
- 2 In the VI Client inventory panel, select Node1 and choose **Clone** from the right-button menu.
- 3 Make the following selections with the wizard:

Table 2-2. Cloned Virtual Machine Properties

Page	Selection
Name and Location	Choose a name (for example, Node2) and location.
Resource Partition	Select the resource pool for the virtual machine, or select the host if there are no resource pools.
Datastore	Choose a datastore as the location for the virtual machine configuration file and the <code>.vmdk</code> file.
Customization	Choose Do not customize .
Ready to Complete	Click OK to create the virtual machine.

You have now created your second cluster node, a virtual machine with two network adapters on which the operating system is installed.

Task 3: Adding Hard Disks to Node1

After you have created two virtual machines as cluster nodes, you are ready to add a shared quorum disk. You can also add additional shared disks to the cluster if you plan on clustering additional data disks. After you have added disks, you can configure the cluster's public and private IP addresses.

To prepare for adding disks

You must zero out the disks you use with a cluster-in-a-box scenario. You can use `vmkfstools` to do so. If you run on an ESX Server 3i host, you use the `vmkfstools` Remote CLI, which you must execute with connection parameters. See the *ESX Server 3i Configuration Guide* for information on installing and using Remote CLI commands.



CAUTION When you zero out a disk, you lose all data.

- To create and zero out the disk, use the following command:

```
Service    vmkfstools -c <size> -d eagerzeroedthick -a lsilogic
Console    /vmfs/volumes/<mydir>/<myDisk>.vmdk

Remote    vmkfstools.pl --server <server_address> --username <user>
CLI        --password <user_password> -c <size>
           -d eagerzeroedthick -a lsilogic
           /vmfs/volumes/<mydir>/<myDisk>.vmdk
```

- To zero out an existing disk, use a the following command:

```
Service    vmkfstools [-w |--writezeroes]
Console    /vmfs/volumes/<mydir>/<myDisk>.vmdk

Remote    vmkfstools.pl --server <server_address> --username <user>
CLI        --password <user_password> [-w |--writezeroes]
           /vmfs/volumes/<mydir>/<myDisk>.vmdk
```

Repeat this process for each virtual disk you want to use as a shared disk in the cluster. For example, if you have one quorum disk and one shared storage disk, you must run the tool on both disks.

To add a quorum disk and optional shared storage disk

- 1 Select the virtual machine you created and choose **Edit Settings**.
- 2 Click **Add**, select **Hard Disk**, and click **Next**.
- 3 Select **Choose an existing virtual disk** and select one of the disks you prepared. See [“To prepare for adding disks”](#) on page 21.

NOTE You can also use a mapped SAN LUN set to virtual compatibility mode. In that case, you don't need to run the `vmkfstools` commands listed in [“To prepare for adding disks.”](#)

- 4 Choose a *new* virtual device node. For example, choose **SCSI(1:0)**, and use the default mode.

NOTE This must be a new controller. You cannot use SCSI 0.

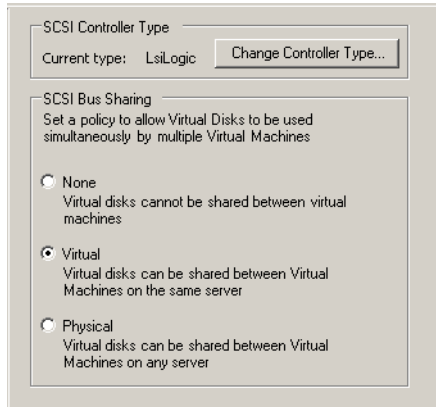
- 5 Click **Finish**.

The wizard creates both a new hard disk and a new SCSI controller.

- 6 Select the new SCSI controller and click **Change Controller Type**.

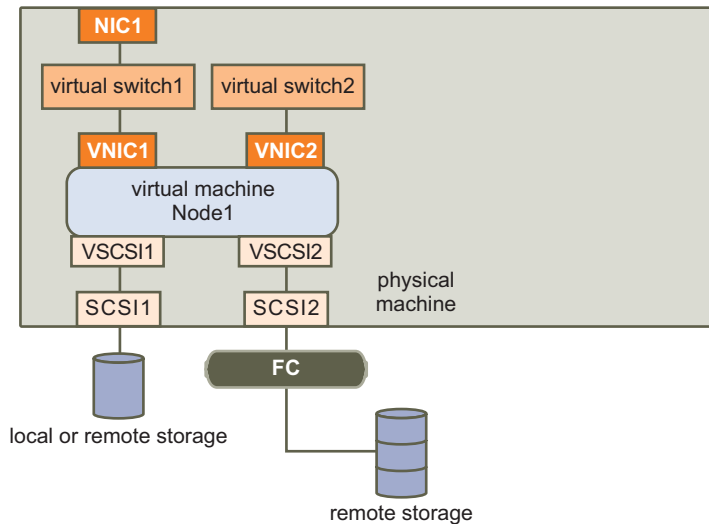
Make sure the controller is set to **LsiLogic** (the default). BusLogic is not supported when you use MSCS with ESX Server 3.0 or later.

- 7 In the same panel, set **SCSI Bus Sharing** to **Virtual** and click **OK**.



- 8 If you require additional shared data disks, repeat [Step 1](#) through [Step 6](#) but choose a new target device, such as **SCSI (1:1)**, on the controller that was just created. [Figure 2-1](#) shows your setup at this point.

Figure 2-1. Cluster in a Box Setup for One Node



Task 4: Adding Hard Disks to Node2

After you set up Node1, repeat the process to configure IP addresses and add one or more disks to Node2.

- Set up the IP addresses so the private and public networks match those of Node1.
- Point the quorum disk to the same location as the Node1 quorum disk. Point any shared storage disks to the same location as the Node1 shared storage disks.

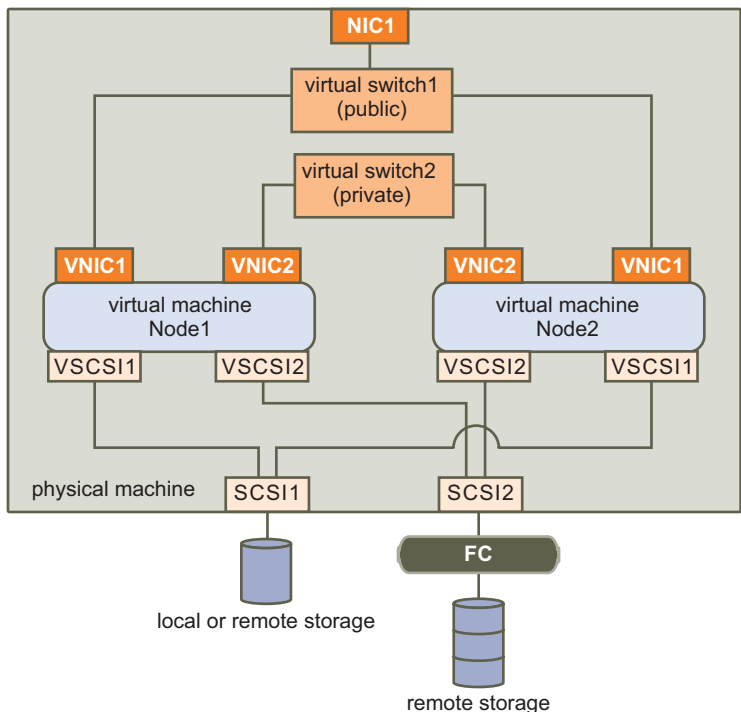
If you are adding an RDM or virtual disk to the second node, choose **Use existing disk**.



CAUTION If you clone a virtual machine with an RDM setup, all RDMs are converted to virtual disks. Unmap all RDMs before cloning, and remap them after cloning is complete.

The completed setup is shown in [Figure 2-2](#).

Figure 2-2. Cluster in a Box Complete Setup



Clustering Virtual Machines Across Physical Hosts

3

This chapter guides you through creating an MSCS cluster that consists of two virtual machines on two ESX Server hosts.

Although this process is similar to the process for setting up a cluster in a box, steps are repeated for ease of use. The chapter consists of the following sections:

- [“Task 1: Creating the First Node”](#) on page 25
- [“Task 2: Creating the Second Node”](#) on page 27
- [“Task 3: Adding Hard Disks to Node1”](#) on page 28
- [“Task 4: Adding Hard Disks to Node2”](#) on page 30

NOTE Microsoft Cluster Service is already installed for Windows Server 2003 so you don't need to install it. See the *Guide to Creating and Configuring a Server Cluster under Windows Server 2003* and other documentation on the Microsoft Website.

For Windows 2000 Server, you must install the Microsoft Cluster Service software.

Task 1: Creating the First Node

Creating the first node consists of these major steps, discussed in this section:

- Creating the virtual machine for Node1. See “Prerequisites for Clustering Across Boxes” on page 14 for requirements.
- Installing the operating system on Node1.

NOTE Before you create a virtual machine, create a virtual disk in `eagerzeroedthick` format using `vmkfstools`. Then point to that disk during virtual machine creation.

To create the first node's virtual machine

- 1 Launch a VI Client and connect to the VirtualCenter Server that manages the cluster's ESX Server hosts.

Use the user name and password of the user who will administer the virtual machine.

- 2 In the inventory panel, right-click the ESX Server host and choose **New Virtual Machine**.
- 3 Make the following selections with the wizard:

Table 3-1. New Virtual Machine Properties

Page	Selection
Wizard Type	Typical.
Name and Location	Choose a name (for example Node1) and location.
Resource Pool	Select the resource pool for the virtual machine, or the host if there are no resource pools.
Datastore	Choose a datastore as the location for the virtual machine configuration file and the .vmdk file.
Guest Operating System	Choose the Windows 2000 Server or Windows Server 2003 operating system you intend to install.
CPUs	Use the default suggested for your operating system.
Memory	Use the default unless you need additional memory and your server supports it.
Network	Change NICs to Connect to 2 , and select the second network for the second NIC.
Virtual Disk Capacity	If you need a primary SCSI disk larger than 4GB, enter the appropriate value in the Capacity field.
Ready to Complete	Click OK to create the virtual machine.

- 4 Install a Windows 2000 Server or Windows Server 2003 operating system on the virtual machine.

Task 2: Creating the Second Node

Creating the second node involves cloning the Node1 virtual machine onto a second ESX Server host, adding disks to that virtual machine, and ensuring that the disks point to the storage shared with Node1. You can clone the node by using a VI Client connected to a VirtualCenter Server, described in the following procedure, or by using `vmkfstools`. See the *Server Configuration Guide* for a reference to `vmkfstools`.

NOTE If you clone a virtual machine with RDMs, the RDMs are converted to virtual disks during the conversion process. Remove all RDMs before cloning, and remap them after cloning is complete.

To clone the Node1 virtual machine

- 1 Shut down the guest operating system and power off the virtual machine.
- 2 In the VI Client inventory panel, select Node1 and choose **Clone** from the right-button menu. Make the following selections with the wizard:

Table 3-2. Cloned Virtual Machine Properties

Page	Selection
Name and Location	Choose a name (for example Node2) and location.
Host or Cluster	Choose the second host for the cluster setup.
Resource Partition	Select the resource pool for the virtual machine, or select the host if there are no resource pools.
Datastore	Choose a datastore as the location for the virtual machine configuration file and the <code>.vmdk</code> file. This must be a disk in <code>eagerzeroedthick</code> format.
Customization	Choose Do not customize .
Ready to Complete	Click OK to create the virtual machine.

You have now created a virtual machine with two network adapters on which the operating system you chose for Node1 is installed.

Task 3: Adding Hard Disks to Node1

After you have created the two virtual machines with the operating system installed, you need perform the following tasks:

- Configuring the guest operating system's private and public IP addresses.

See the documentation for the Microsoft 2003 operating system for configuration information.

- Adding a virtual hard disk that is shared by the two virtual machines as the quorum disk, and optionally, one or more shared data disks to Node1.

NOTE These disks must point to SAN LUNs. Both RDM in physical compatibility mode (pass-through RDM) and RDM in virtual compatibility mode (non-passthrough RDM) are supported.

The procedure below uses physical compatibility mode.

To add a quorum disk and optional shared storage disks

- 1 Select the virtual machine you created and choose **Edit Settings**.
- 2 Click **Add**, select **Hard Disk**, and click **Next**.
- 3 In the Select a Disk page, choose **Mapped SAN LUN** and click **Next**.

Your hard disk points to a LUN that uses RDM.

- 4 In the LUN selection page, choose an unformatted LUN and click **Next**.

Ask your SAN administrator which of the LUNs are unformatted. You can also see all formatted LUNs in the host's Configuration tab and deduce which LUNs are unformatted by comparing the list of formatted LUNs with the list in the LUN selection page.

- 5 In the Select Datastore page, select a datastore and click **Next**.

This datastore must be on a SAN because you need a single shared RDM file for each shared LUN on the SAN.

- 6 Select **Physical** as the compatibility mode, and click **Next**.

A SCSI controller is created when the virtual hard disk is created.

- 7 Choose a *new* virtual device node, for example choose **SCSI(1:0)**, and use the default mode.

NOTE This must be a new SCSI Controller. You cannot use SCSI 0.

- 8 Click **Finish** to complete creating the disk.

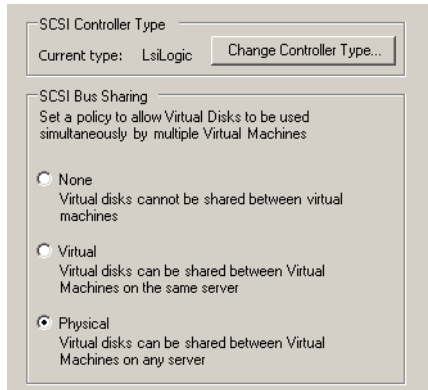
The wizard creates both a new SCSI controller and a new hard disk.

- 9 Select the new SCSI controller and click **Change Controller Type**.

- 10 Select **LsiLogic** in the dialog box that appears.

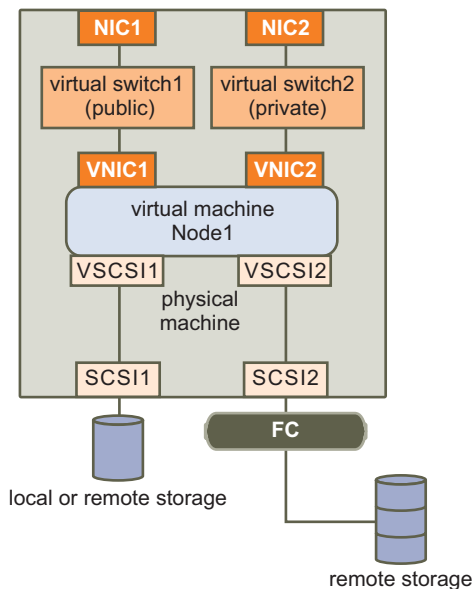
MSCS on ESX Server 3.x is not supported in conjunction with BusLogic.

- 11 In the same panel, set **SCSI Bus Sharing** to **Physical** and click **OK**.



- 12 If you need additional shared data disks in your configuration, repeat [Step 1](#) through [Step 8](#) but choose a new Virtual Device Node, such as SCSI (1:1).

[Figure 3-1](#) shows the setup at this point.

Figure 3-1. Cluster Across Boxes, Node1 Setup

Task 4: Adding Hard Disks to Node2

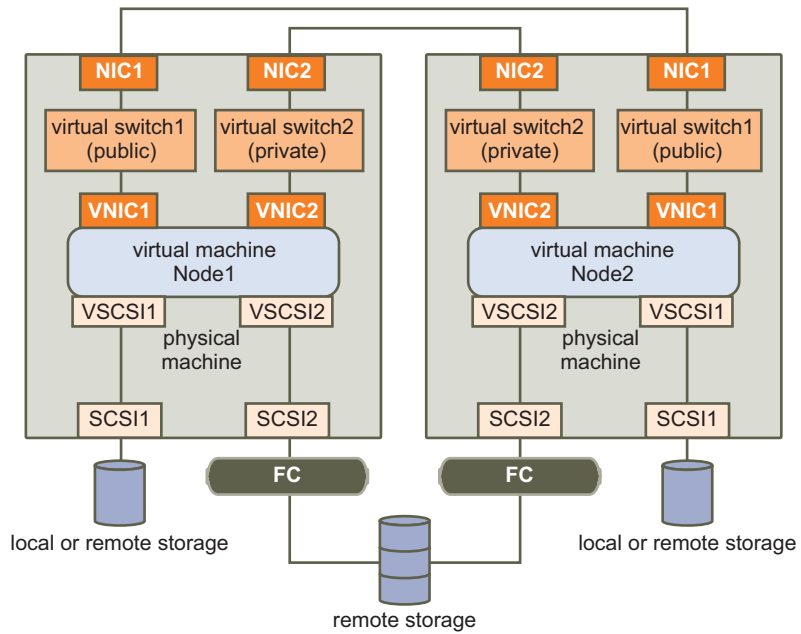
After you have set up Node1, set up Node2 so the private and public networks match. Then share the quorum and any shared data disks for Node1 with Node2. Using the RDM that you created when setting up the first cluster node.

To reuse a SAN-based RDM

- 1 On Node2, click **Add**, select **Hard Disk**, and click **Next**.
- 2 In the Select a Disk page, choose **Use Existing Disk**, and click **Next**.
- 3 Select the RDM created on the shared datastore in [Step 5](#) for Node1.
- 4 Continue with [Step 6](#) through [Step 10](#) for the quorum disk (see “[To add a quorum disk and optional shared storage disks](#)” on page 28).
- 5 (Optional) Continue with [Step 6](#) through [Step 8](#) for each additional shared data disk (see “[To add a quorum disk and optional shared storage disks](#)” on page 28).

The completed setup looks like [Figure 3-2](#).

Figure 3-2. Cluster Across Boxes Complete Setup



Clustering Physical and Virtual Machines

4

This chapter guides you through creating an MSCS cluster in which each physical machine has a corresponding virtual machine.

The chapter consists of the following sections:

- [“Task 1: Creating the First Node”](#) on page 33
- [“Task 2: Creating the Second Node”](#) on page 34
- [“Task 3: Installing Microsoft Cluster Service”](#) on page 36
- [“Task 4: Creating Additional Physical/Virtual Pairs”](#) on page 36

Task 1: Creating the First Node

Because the first node is a physical machine, no detailed instructions for creating the first node are included in this chapter. See the Microsoft Cluster Service documentation for all prerequisites and caveats. You should set up your system as follows:

- Choose the Advanced Minimum configuration within the Windows Cluster Administrator application.
- Set up the physical machine to have at least two network adapters.
- Set up the physical machine to have access to the same storage on a SAN as the ESX Server host on which you will run the corresponding virtual machine.
- Install the operating system you want to use throughout the cluster.

NOTE VMware recommends that you don't run multipathing software in the physical or virtual machines.

Task 2: Creating the Second Node

Creating the second node consists of the following major steps:

- Creating a virtual machine that is set up for clustering across boxes.
- Making sure the shared storage visible from Node1 (the physical machine) is also visible from Node2 (the virtual machine).
- Installing the operating system.
- Network adapter setup of the node depends on the type of ESX Server you are using. VMware recommends three network adapters per host for connections to the outside. See [“Prerequisites for Standby Host Clustering”](#) on page 15 for information on the minimum configuration.

NOTE Before you create a virtual machine, create a virtual disk in `eagerzeroedthick` format using `vmkfstools`. Then point to that disk during virtual machine creation.

To create the second node

- 1 Launch a VI Client and connect to the ESX Server host.
Use the user name and password of the user who will own the virtual machine.
- 2 In the inventory panel, right-click the host and choose **New Virtual Machine**.
- 3 Make the following selections with the wizard:

Table 4-1. New Virtual Machine Properties

Page	Selection
Wizard Type	Typical.
Name and Location	Choose a name (for example, Node2) and location.
Resource Pool	Select the resource pool for the virtual machine, or the host if there are no resource pools.
Datastore	Choose a datastore as the location for the virtual machine configuration file and the <code>.vmdk</code> file.
Guest Operating System	Choose the Windows 2000 Server or Windows Server 2003 operating system you want to install later.
CPUs	Use the default.
Memory	Use the default unless you need additional memory and your server supports it.
Network	Change NICs to Connect to 2 , and select the second network for the second NIC.

Table 4-1. New Virtual Machine Properties (Continued)

Page	Selection
Virtual Disk Capacity	If you need a primary SCSI disk larger than 4GB, enter the appropriate value in the Capacity field.
Ready to Complete	Click OK to create the virtual machine.

You need a shared SCSI controller and shared SCSI disks for shared access to clustered services and data. The next section sets up the disks for Node2 to point to the quorum disk and shared storage disks, if any, for Node1.

To add a quorum disk and optional shared storage disk

- 1 Select the virtual machine you created and choose **Edit Settings**.
- 2 Click **Add**, select **Hard Disk**, and click **Next**.
- 3 In the Select a Disk page, choose **Mapped SAN LUN** and click **Next**.
Your hard disk points to a LUN using RDM.
- 4 In the LUN selection page, choose the LUN that is used by Node1.
- 5 In the Select Datastore page, select the datastore, which is also the location of the boot disk, and click **Next**.
- 6 Select **Physical compatibility mode** and click **Next**.
- 7 Select a virtual device node on a different SCSI Controller than the one that was created when you created the virtual machine.
This SCSI Controller is created when the virtual hard disk is created.
- 8 Click **Finish** to complete creating the disk.
The wizard creates both a new device node and a new hard disk.
- 9 Select the new SCSI controller, set **SCSI Bus Sharing** to **Physical**, and click **OK**.
- 10 (Optional) For additional storage disks, repeat [Step 1](#) through [Step 6](#) but choose a disk. Use the same virtual adapter.
- 11 Install Windows 2000 Server or Windows Server 2003 on the virtual machine.

Task 3: Installing Microsoft Cluster Service

The final task is to configure Microsoft Cluster Service.

See the *Guide to Creating and Configuring a Server Cluster under Windows Server 2003* and other information on the Microsoft Website.

In some complex storage solutions, such as an FC switched fabric, a particular storage unit might have a different identity (target ID or raw disk ID) on each computer in the cluster. Although this is a valid storage configuration, it causes a problem when you want to add a node to the cluster.

To avoid identity target problems

- 1 Within the Microsoft Cluster Administrator utility, disable the storage validation heuristics by clicking the **Back** button to return to the Select Computer page.
- 2 Click the **Advanced** button and select the **Advanced** (minimum) configuration option.

Microsoft Cluster Service should operate normally in the virtual machine after it is installed.

Task 4: Creating Additional Physical/Virtual Pairs

For each physical machine:

- Repeat Task1 to set up an additional virtual machine on the ESX Server host.
- Cluster the physical machine with that virtual machine.

Upgrading Clustered Virtual Machines

5

This chapter discusses how to upgrade clusters that use VMFS2 to VMFS3. It presents a comprehensive discussion of all cases in the following sections:

- [“Legacy Cluster Setup Options”](#) on page 37
- [“Upgrading Cluster in a Box \(CIB\)”](#) on page 38
- [“Upgrading Cluster Across Boxes”](#) on page 40
- [“Upgrading Clusters Using Physical to Virtual Clustering”](#) on page 42

NOTE Upgrading is supported only from ESX Server 2.5.2 or higher.

You can upgrade from ESX Server 2.5.2 to ESX Server 3.0.x or ESX Server 3.5, and you can upgrade from ESX Server 3.0.x to ESX Server 3.5.

Because there are no earlier versions of ESX Server 3i, this chapter does not apply to that platform.

Legacy Cluster Setup Options

Using VMFS2, you had a number of options for setting up your MSCS cluster:

- For virtual machines clustered on a single physical host (cluster in a box), you could use a public VMFS in one of two ways:
 - Using non-pass-through RDMs
 - Using shared virtual disks

- For virtual machines clustered on multiple physical hosts (cluster across boxes), you had three options:
 - Shared disks on shared VMFS
 - Two pass-through RDMs backed by the same LUN on public volume
 - A single pass-through RDM on a shared VMFS volume
- For clusters of physical and virtual machines (standby host clustering), you used a public volume using pass-through RDM.

This chapter steps you through the upgrade process for each of these options.

Upgrading Cluster in a Box (CIB)

With VMFS2, a cluster in a box setup uses a public VMFS. By default, the general upgrade process, discussed in the *Upgrade Guide*, includes information about upgrading of public VMFS2 volumes to VMFS3. If you did not upgrade the VMFS used by the cluster during the upgrade process, you can upgrade using the VI Client later.

Upgrading CIB: Shared RDMs and Boot Disks in Separate VMFS Volumes

This section steps you through upgrading a cluster in a box that uses shared non-pass-through RDMs that reside in a different VMFS2 volume than the boot disks for the cluster virtual machines.

To perform the upgrade

- 1 Power off all clustered virtual machines.
- 2 Upgrade the ESX Server host from ESX Server 2.5.2 to ESX Server 3.x.
- 3 If you did not upgrade the VMFS2 volume where your cluster .vmdk files are kept to VMFS3 during upgrade of the host, upgrade now:
 - a Select the upgraded host in a VI Client and click the **Configuration** tab.
 - b Click **Storage**.
 - c Select the volume.
 - d Click **Upgrade to VMFS3**.
- 4 If necessary, upgrade the volume where your shared RDM files are located and upgrade those files, as in [Step 3](#).

- 5 Right-click each cluster virtual machine in the inventory panel and click **Upgrade Virtual Hardware**.
- 6 Power on each virtual machine and verify the cluster setup.

If the virtual machine fails to power on with error message `Invalid Argument`, you have a misconfigured cluster setup. The virtual disk used in ESX 2.x is not allowed to power on in ESX 3.x because ESX 3.x checks for invalid disk types.

Upgrading CIB: RDMs and Boot Disks in Same VMFS Volume

This section steps you through upgrading a cluster in a box that uses shared non-pass-through RDMs that reside in the same VMFS2 volume as the boot disks for the cluster virtual machines.

To perform the upgrade

- 1 Upgrade the ESX Server host from ESX Server 2.5.2 to ESX Server 3.x.
- 2 In the VI Client inventory panel, select the upgraded host in a VI Client.
- 3 Click the **Configuration** tab, and click **Storage**.
- 4 Upgrade the VMFS2 volume where your cluster .vmdk files and your shared RDM files are located to VMFS3, as follows:
 - a Select the volume where the files are located.
 - b Click **Upgrade to VMFS3**.

This action upgrades the VMFS2 volumes to VMFS3 and relocates the .vmx file for the cluster virtual machines into the upgraded VMFS3 volume in a directory structure.

- 5 Right-click the second cluster node's virtual machine in the inventory panel and click **Upgrade Virtual Hardware**.

An error like the following results:

```
VMware ESX Server could not completely upgrade your virtual disk
"/vmfs/volumes/2a3330116-da-11...vmdk due to the following error:
The system cannot find the file specified."
```

The error is the result of [Step 3](#), where the cluster's virtual machines were relocated to the first node's directory.

- 6 Ignore the error.

The system updates your virtual hardware regardless of the error. You can verify this by viewing the .vmx file entries of the second cluster node.

- 7 Manually edit the `.vmx` file of the second cluster virtual machine so that the entries of the quorum disk and any other shared disk point to the shared RDM files that are inside the first node's directory inside the VMFS3 partition.
- 8 Power on each virtual machine and verify the cluster setup.

Upgrading CIB: Virtual Disks

This section steps you through upgrading a cluster in a box (CIB) that uses shared virtual disks for the cluster virtual machines.

To perform the upgrade

- 1 Import the old virtual disk to the new virtual disk, as follows:

```
vmkfstools -I /vmfs/volumes/vol1/<old-virtdisk>.vmdk  
           /vmfs/volumes/vol2/<myVMDir>/<new-virtdisk>.vmdk
```

 - `old-virtdisk.vmdk` – the virtual disk from which you are importing
 - `new-virtdisk.vmdk` – the new virtual disk to which you are importing
- 2 Rename `old-virtdisk.vmdk`.
- 3 Edit the `.vmx` file to point to `new-virtdisk.vmdk`.
- 4 Power on the node and verify that the cluster service starts without problems.

Upgrading Cluster Across Boxes

There are two types of clusters across boxes. This section explains how to upgrade clusters across boxes using shared pass-through RDMs and how to upgrade clusters across boxes with shared file systems.

Using Shared Pass-Through RDMs

This section explains how to upgrade a cluster with pass-through RDMs for each node.

To upgrade the cluster

- 1 Upgrade the ESX Server host from ESX Server 2.5.2 to ESX Server 3.x.
- 2 In the VI Client inventory panel, select the upgraded host.
- 3 Click the **Configuration** tab, and then click **Storage**.

- 4 Upgrade the VMFS2 volume where your shared pass-through RDM files are kept to VMFS3:
 - a Select the volume.
 - b Click **Upgrade to VMFS3**.
- 5 Select the volume where the boot disk for the cluster virtual machine is located and upgrade it as in [Step 3](#).
This upgrades the volume and relocates the .vmx files related to the virtual machines inside the volume. The new directory structure is organized for easy management.
- 6 Right-click on the cluster virtual machine in the inventory panel on the left.
- 7 Choose **Upgrade Virtual Hardware** from the right-button menu.
- 8 Repeat the steps for the Node2 host.
- 9 Power on the virtual machines and verify the cluster.

Upgrading a Cluster with Files in Shared VMFS2 Volumes

This section explains how to upgrade a cluster across boxes if you used shared files in a shared VMFS2 volume.

To upgrade the cluster

- 1 Before upgrading to VMFS3, change the shared VMFS2 volume from shared to public, as follows:


```
vmkfstools -L lunreset vmhba<C:T:L>:0
vmkfstools -F public vmhba<C:T:L>P>
```
- 2 Perform the host upgrades from ESX Server 2.5.2 to ESX Server 3.x.
- 3 Select the first upgraded host in a VI Client inventory panel.
- 4 Click the **Configuration** tab, and click **Storage**.
- 5 Upgrade the VMFS2 volume where your cluster .vmdk files are kept to VMFS3:
 - a Select the volume.
 - b Click **Upgrade to VMFS3**.
- 6 Create LUNs for each shared disk (that is, one LUN for each shared disk).

- 7 For each disk, create a separate RDM for each cluster node backed by the same physical device. Create the RDM and import the virtual disk to this RDM.

```
vmkfstools -i /vmfs/volumes/vol1/<old-virtdisk>.vmdk
           /vmfs/volumes/vol2/<myVMDir>/<rdm-for-vm1>/<myrdm.vmdk>
           -d rdmp:/vmfs/devices/disks/vmhbaC:T:L:P
```

Where

- `old-virtdisk` = the source virtual disk.
 - `myVMDir` = the target virtual machine directory.
 - `rdm-for-vm1` = an optional directory in which to store RDM files for that virtual machine.
 - `myrdm.vmdk` = the target RDM file that this command creates.
 - `vmhbaC:T:L:P` = the device representing the raw LUN that you are mapping
 - C = controller number (the FC HBA).
 - T = the storage array's target number through which the LUN is accessed.
 - L = LUN number.
 - P = partition number. In this example you *must* use 0 as the value to address the whole LUN
- 8 Edit the `.vmx` file to point to the RDM instead of the shared file:


```
scsi<X>:<Y>.filename =
           "/vmfs/volumes/vol2/<myVMDir>/<rdm-for-vm1>/<myrdm.vmdk>"
scsi<X>:<Y>.deviceType = "scsi-passthru-rdm"
```
 - 9 Right-click the cluster virtual machine in the inventory panel and select **Upgrade Virtual Machine**.
 - 10 Repeat [Step 8](#) and [Step 9](#) for Node2.
 - 11 Power on the nodes and verify that the cluster service starts without problems.

Upgrading Clusters Using Physical to Virtual Clustering

If you are using a physical to virtual cluster using VMFS2, you use a public disk that is mapped using RDM from the virtual machine.

By default, the upgrade process converts your VMFS2 disks to VMFS3. You can also explicitly convert VMFS2 volumes later if you did not convert them as part of the default conversion.

Appendix: Setup Checklist

Administrators who are setting up Microsoft Cluster Service on ESX Server 3.x can use this appendix as a checklist.

The appendix includes information in the following tables:

- [Table A-1 “Requirements for Clustered Disks”](#)
- [Table A-2 “Other Clustering Requirements and Recommendations”](#)

[Table A-1](#) lists the requirements for clustered disks.

Table A-1. Requirements for Clustered Disks

Component	Single-host Clustering	Multihost Clustering
Clustered virtual disk (.vmdk)	SCSI bus sharing mode must be set to Virtual .	Not supported.
Clustered disks, virtual compatibility mode (non pass-through RDM)	Device type must be Virtual compatibility mode. SCSI bus sharing mode must be set to Virtual . A single, shared RDM mapping file for each clustered disk is required.	Device type must be Virtual compatibility mode for cluster across boxes, but not for standby host clustering. SCSI bus sharing mode must be set to Physical . Requires a single, shared RDM mapping file for each clustered disk.

Table A-1. Requirements for Clustered Disks (Continued)

Component	Single-host Clustering	Multihost Clustering
Clustered disks, physical compatibility mode (pass-through RDM).	Not supported.	Device type must be Physical compatibility mode. This is set during hard disk creation. SCSI bus sharing mode must be set to Physical (the default). A single, shared RDM mapping file for each clustered disk is required.
All types	All clustered nodes must use the same target ID (on the virtual SCSI adapter) for the same clustered disk. A separate virtual adapter must be used for clustered disks.	

[Table A-2](#) lists other clustering requirements.

Table A-2. Other Clustering Requirements and Recommendations

Component	Requirement
Disk	If you place the boot disk on a virtual disk, create that disk using <code>vmkfstools</code> , specifying the <code>eagerzeroedthick</code> option. The only disks that you should not create with the <code>eagerzeroedthick</code> option are RDM files (both physical and virtual compatibility mode) and the boot disks of native Windows hosts in standby clustering.
Windows	Use Windows Server 2003 SP2 (32 bit), Windows Server 2003 (64 bit) SP2, or Windows 2000 Server SP4. VMware recommends Windows Server 2003. Only two cluster nodes. Disk I/O time-out is sixty seconds or more (<code>HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Disk\TimeOutValue</code>). Note: If you recreate the cluster, this value might be reset to its default, so you must change it again. Cluster service must restart automatically on failure (first, second, and subsequent times).
ESX Server configuration	VMware recommends that you don't overcommit memory, that is, set Memory Reservation (minimum memory) to the same as Memory Limit (maximum memory). If you must overcommit memory, the swap file must be local, not on the SAN.

Table A-2. Other Clustering Requirements and Recommendations (Continued)

Component	Requirement
Information required by technical support to analyze clustering related issues	<p>Verify that the setup complies with the checklist.</p> <p>vm-support tarball (vmkernel log, virtual machine configuration files and logs, ...)</p> <p>Application and system event logs of all virtual machines with the problem.</p> <p>Cluster log of all virtual machines with the problem (that is, %ClusterLog%, which is usually set to %SystemRoot%\cluster\cluster.log).</p> <p>Disk I/O timeout (HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Disk\TimeOutValue)</p> <p>VI Client display names and Windows NETBIOS names of the virtual machines experiencing the problem.</p> <p>Date and time and the problem occurred.</p> <p>SAN configuration of the ESX Server system (LUNs, paths, and adapters).</p>
Multipathing	Running third-party multipathing software is not supported.

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Updates for Setup for Microsoft Cluster Service

Last Updated: October 17, 2008

This document provides updates to the book, *Setup for Microsoft Cluster Service*, written for the Update 2 release for ESX Server 3.5, ESX Server 3i version 3.5, and VirtualCenter 2.5. The updated description is listed by page number so that you can easily locate the area of the guide that has changes. If the change spans multiple sequential pages, this document provides the starting page number only.

The following is an update to *Setup for Microsoft Cluster Service*:

[Update for the Recommendations for Using MSCS and Boot from SAN Section on Page 17](#)

Update for the Recommendations for Using MSCS and Boot from SAN Section on [Page 17](#)

In the [Recommendations for Using MSCS and Boot from SAN](#) section, the description of boot from SAN does not indicate which version of the Microsoft Windows operating system is supported. The document should state that boot from SAN is only supported on Windows Server 2003, and is not supported on Windows Server 2000 operating systems.

