

Dell™ Failover Clusters With  
Microsoft® Windows Server® 2003

# Software Installation and Troubleshooting Guide

# Notes, Notices, and Cautions



**NOTE:** A NOTE indicates important information that helps you make better use of your computer.



**NOTICE:** A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.



**CAUTION:** A CAUTION indicates a potential for property damage, personal injury, or death.

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# Introduction

Clustering uses specific hardware and software to join multiple systems together to function as a single system and provide an automatic failover solution. If one of the clustered systems (also known as cluster nodes, or nodes) fails, resources running on the failed system are moved (or failed over) to one or more systems in the cluster by the Microsoft® Cluster Service (MSCS) software. MSCS is the failover software component in specific versions of the Windows® operating system.

When the failed system is repaired and brought back online, resources automatically transfer back (or fail back) to the repaired system or remain on the failover system, depending on how MSCS is configured. For more information, see "Configuring Active and Passive Cluster Nodes" on page 46.



**NOTE:** Reference to Microsoft Windows Server® 2003 in this guide implies reference to Windows Server 2003 Enterprise Edition, Windows Server 2003 R2 Enterprise Edition, Windows Server 2003 Enterprise x64 Edition, and Windows Server 2003 R2 Enterprise x64 Edition unless explicitly stated.

## Virtual Servers and Resource Groups

In a cluster environment, users do not access a physical server; they access a virtual server, which is managed by MSCS. Each virtual server has its own IP address, name, and hard drive(s) in the shared storage system. MSCS manages the virtual server as a *resource group*, which contains the cluster resources. Ownership of virtual servers and resource groups is transparent to users. For more information on resource groups, see "Cluster Resources" on page 39.

When MSCS detects a failed application that cannot restart on the same server node or a failed server node, MSCS moves the failed resource group(s) to one or more server nodes and remaps the virtual server(s) to the new network connection(s). Users of an application in the virtual server experience only a momentary delay in accessing resources while MSCS re-establishes a network connection to the virtual server and restarts the application.

## Quorum Resource

A single shared disk, which is designated as the quorum resource, maintains the configuration data (including all the changes that have been applied to a cluster database) necessary for recovery when a node fails.

The quorum resource can be any resource with the following attributes:

- Enables a single node to gain and defend its physical control of the quorum resource
- Provides physical storage that is accessible by any node in the cluster
- Uses the Microsoft Windows NT® file system (NTFS)

See "Quorum Resource" on page 42 and the MSCS online documentation for more information located at the Microsoft Support website at [support.microsoft.com](http://support.microsoft.com).



**NOTE:** Dell™ Windows Server Failover clusters do not support the Majority Node Set Quorum resource type.

## Cluster Solution

The Windows Server 2003 failover cluster implements up to eight cluster nodes, depending on the storage array in use and provides the following features:

- A shared storage bus featuring Fibre Channel, Serial Attached SCSI (SAS), or Internet Small Computer System Interface(iSCSI) technology
- High availability of resources to network clients
- Redundant paths to the shared storage
- Failure recovery for applications and services
- Flexible maintenance capabilities, allowing you to repair, maintain, or upgrade a node or storage system without taking the entire cluster offline

### Supported Cluster Configurations

For the list of Dell-validated hardware, firmware, and software components for a Windows Server 2003 failover cluster environment, see *Dell Cluster Configuration Support Matrices* located on the Dell High Availability Clustering website at [www.dell.com/ha](http://www.dell.com/ha).




## Cluster Components and Requirements

Your cluster requires the following components:

- Operating System
- Cluster nodes(servers)
- Cluster Storage


## Operating System


Table 1-1 provides an overview of the supported operating systems. See your operating system documentation for a complete list of features.


 **NOTE:** Some of the core services are common to all the operating systems.

**Table 1-1. Windows Operating System Features**

<b>Windows Server 2003 Enterprise Edition/Windows Server 2003 R2 Enterprise Edition</b>	<b>Windows Server 2003 Enterprise x64 Edition/Windows Server 2003 R2 Enterprise x64 Edition</b>
Supports up to eight nodes per cluster	Supports up to eight nodes per cluster
Supports up to 64 GB of RAM per node	Supports up to 1 TB RAM per node
Cluster configuration and management using Configure Your Server (CYS) and Manage Your Server (MYS) wizards	Cluster configuration and management using CYS and MYS wizards
Metadirectory Services	Metadirectory Services

 **NOTE:** The amount of RAM supported per node also depends on your cluster platform.

 **NOTE:** Running different operating systems in a cluster is supported only during a rolling upgrade. You cannot upgrade to Windows Server 2003, Enterprise x64 Edition/Windows Server 2003 R2, Enterprise x64 Edition. Only a new installation is permitted for Windows Server 2003, Enterprise x64 Edition/Windows Server 2003 R2, Enterprise x64 Edition.

 **NOTE:** MSCS and Network Load Balancing (NLB) features cannot coexist on the same node, but can be used together in a multi-tiered cluster. For more information, see the Dell High Availability Clusters website at [www.dell.com/ha](http://www.dell.com/ha) or the Microsoft website at [www.microsoft.com](http://www.microsoft.com).

## Cluster Nodes

Table 1-2 lists the hardware requirements for the cluster nodes.

**Table 1-2. Cluster Node Requirements**

Component	Minimum Requirement
Cluster nodes	Two to eight Dell PowerEdge™ systems running the Windows Server 2003 operating system.
RAM	At least 256 MB of RAM installed on each cluster node for Windows Server 2003, Enterprise Edition or Windows Server 2003 R2, Enterprise Edition.  At least 512 MB of RAM installed on each cluster node for Windows Server 2003, Enterprise x64 Edition, or Windows Server 2003 R2, Enterprise x64 Edition.
NICs	At least two NICs: one NIC for the public network and another NIC for the private network.  <b>NOTE:</b> It is recommended that the NICs on each public network are identical, and that the NICs on each private network are identical.
Internal disk controller	One controller connected to at least two internal hard drives for each node. Use any supported RAID controller or disk controller.  Two hard drives are required for mirroring (RAID 1) and at least three are required for disk striping with parity (RAID 5).  <b>NOTE:</b> It is strongly recommended that you use hardware-based RAID or software-based disk-fault tolerance for the internal drives.
HBA ports	<ul style="list-style-type: none"><li>• For clusters with Fibre Channel storage, two Fibre Channel HBAs per node, unless the server employs an integrated or supported dual-port Fibre Channel HBA.</li><li>• For clusters with SAS storage, one or two SAS 5/E HBAs per node.</li></ul> <b>NOTE:</b> Where possible, place the HBAs on separate PCI buses to improve availability and performance. For information about supported systems and HBAs, see <i>Dell Cluster Configuration Support Matrices</i> located on the Dell High Availability Clustering website at <a href="http://www.dell.com/ha">www.dell.com/ha</a> .

**Table 1-2. Cluster Node Requirements (continued)**

<b>Component</b>	<b>Minimum Requirement</b>
iSCSI Initiator and NICs for iSCSI Access	<p>For clusters with iSCSI storage, install the Microsoft iSCSI Software Initiator (including iSCSI port driver and Initiator Service) on each cluster node.</p> <p>Two iSCSI NICs or Gigabit Ethernet NIC ports per node. NICs with a TCP/IP Off-load Engine (TOE) or iSCSI Off-load capability may also be used for iSCSI traffic.</p> <p><b>NOTE:</b> Where possible, place the NICs on separate PCI buses to improve availability and performance. For information about supported systems and HBAs, see <i>Dell Cluster Configuration Support Matrices</i> located on the Dell High Availability Clustering website at <a href="http://www.dell.com/ha">www.dell.com/ha</a>.</p>

## Cluster Storage

You must attach all the nodes to a common shared system for your Dell failover cluster solutions with Windows Server 2003. The type of storage array and topology in which the array is deployed can influence the design of your cluster. For example, a direct-attached SAS storage array may offer support for two cluster nodes whereas a SAN-attached Fibre Channel or iSCSI array has the ability to support eight cluster nodes.

A shared storage array enables data for clustered applications and services to be stored in a common location that is accessible by each cluster node. Although only one node can access or control a given disk volume at a particular point in time, the shared storage array enables other nodes to gain control of these volumes in the event that a node failure occurs. This also helps facilitate the ability of other cluster resources, which may depend upon the disk volume to failover to the remaining nodes.

Additionally, it is recommended that you attach each node to the shared storage array using redundant paths. Providing multiple connections (or paths) between the node and the storage array reduces the number of single points of failure that could otherwise impact the availability of the clustered applications or services.

For details and recommendations related to deploying a Dell Windows Server failover cluster solution with a particular storage array, see "Cabling Your Cluster Hardware" section in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

## Other Documents You May Need



**CAUTION:** The safety information that is shipped with your system provides important safety and regulatory information. Warranty information may be included within this document or as a separate document.



**NOTE:** To configure Dell blade server modules in a Dell PowerEdge cluster, see the *Using Dell Blade Servers in a Dell PowerEdge High Availability Cluster* document located on the Dell Support website at [support.dell.com](http://support.dell.com).


- The *Dell Windows Server Failover Cluster Hardware Installation and Troubleshooting Guide* provides information on specific configuration tasks that enable you to deploy the shared storage for your cluster.
- The *Dell Cluster Configuration Support Matrices* lists the Dell-validated hardware, firmware, and software components for a Windows Server 2003 failover cluster environment.
- The *Rack Installation Guide* included with your rack solution describes how to install your system into a rack.
- The *Getting Started Guide* provides an overview to initially set up your system.
- The HBA documentation provides installation instructions for the HBAs.
- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.
- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install those options.
- The Dell PowerVault™ tape library documentation provides information for installing, troubleshooting, and upgrading the tape library.
- Any other documentation that came with your server and storage system.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.




**NOTE:** Always read the updates first because they often supersede information in other documents.

- Release notes or readme files may be included to provide last-minute updates to the system or documentation, or advanced technical reference material intended for experienced users or technicians.


# Preparing Your Systems for Clustering

 **CAUTION:** Only trained service technicians are authorized to remove and access any of the components inside the system. See the safety information shipped with your system for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

## Cluster Configuration Overview

 **NOTE:** For more information on step 1, step 2 and step 9, see "Preparing Your Systems for Clustering" section of the *Dell Failover Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com). For more information on step 3 to step 7 and step 10 to step 13, see this chapter.

- 1 Ensure that your site can handle the cluster's power requirements.  
Contact your sales representative for information about your region's power requirements.
- 2 Install the servers, the shared storage array(s), and the interconnect switches (example: in an equipment rack), and ensure that all these components are powered on.
- 3 Deploy the operating system (including any relevant service pack and hotfixes), network adapter drivers, and storage adapter drivers (including MPIO drivers) on each of the servers that will become cluster nodes.  
Depending on the deployment method that is used, it may be necessary to provide a network connection to successfully complete this step.

 **NOTE:** You can record the Cluster configuration and Zoning configuration (if relevant) to the Cluster Data Form and Zoning Configuration Form, respectively to help in planning and deployment of your cluster. For more information, see "Cluster Data Form" and "Zoning Configuration Form" of *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

- 4 Establish the physical network topology and the TCP/IP settings for network adapters on each server node to provide access to the cluster public and private networks.

- 5 Configure each server node as a member server in the same Windows Active Directory Domain.



**NOTE:** It may also be possible to have cluster nodes serve as Domain controllers. For more information, see “Selecting a Domain Model”.

- 6 Establish the physical storage topology and any required storage network settings to provide connectivity between the storage array and the servers that will be configured as cluster nodes. Configure the storage system(s) as described in your storage system documentation.
- 7 Use storage array management tools to create at least one logical unit number (LUN). The LUN is used as a cluster quorum disk for Windows Server 2003 Failover cluster and as a witness disk for Windows Server 2008 Failover cluster. Ensure that this LUN is presented to the servers that will be configured as cluster nodes.



**NOTE:** It is highly recommended that you configure the LUN on a single node, for security reasons, as mentioned in step 8 when you are setting up the cluster. Later, you can configure the LUN as mentioned in step 9 so that other cluster nodes can access it.

- 8 Select one of the servers and form a new failover cluster by configuring the cluster name, cluster management IP, and quorum resource.



**NOTE:** For Windows Server 2008 Failover Clusters, run the **Cluster Validation Wizard** to ensure that your system is ready to form the cluster.

- 9 Join the remaining node(s) to the failover cluster.
- 10 Configure roles for cluster networks. Take any network interfaces that are used for iSCSI storage (or for other purposes outside of the cluster) out of the control of the cluster.
- 11 Test the failover capabilities of your new cluster.



**NOTE:** For Windows Server 2008 Failover Clusters, the Cluster Validation Wizard may also be used.

- 12 Configure highly-available applications and services on your failover cluster. Depending on your configuration, this may also require providing additional LUNs to the cluster or creating new cluster resource groups. Test the failover capabilities of the new resources.
- 13 Configure client systems to access the highly-available applications and services that are hosted on your failover cluster.

# Installation Overview

This section provides installation overview procedures for configuring a cluster running the Microsoft® Windows Server® 2003 operating system.



**NOTE:** Storage management software may vary and use different terms than those in this guide to refer to similar entities. For example, the terms "LUN" and "Virtual Disk" are often used interchangeably to designate an individual RAID volume that is provided to the cluster nodes by the storage array.

- 1 Ensure that the cluster meets the requirements as described in "Cluster Configuration Overview."
- 2 Select a domain model that is appropriate for the corporate network and operating system.  
See "Selecting a Domain Model" on page 19.
- 3 Reserve static IP addresses for the cluster resources and components, including:
  - Public network
  - Private network
  - Cluster virtual servers

Use these IP addresses when you install the Windows® operating system and MSCS.

- 4 Configure the internal hard drives.  
See "Configuring Internal Drives in the Cluster Nodes" on page 20.
- 5 Install and configure the Windows operating system.

The Windows operating system must be installed on all of the nodes. Each node must have a licensed copy of the Windows operating system, and a Certificate of Authenticity.

See "Installing and Configuring the Microsoft Windows Operating System" on page 20.

**6** Install or update the storage connection drivers.

For more information on connecting your cluster nodes to a shared storage array, see "Preparing Your Systems for Clustering" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* that corresponds to your storage array. For more information on the corresponding supported adapters and driver versions, see *Dell Cluster Configuration Support Matrices* located on the Dell High Availability Clustering website at [www.dell.com/ha](http://www.dell.com/ha).

**7** Install and configure the storage management software.

See the documentation included with your storage system or available at the Dell Support website at [support.dell.com](http://support.dell.com).

**8** Configure the hard drives on the shared storage system(s).

See "Preparing Your Systems for Clustering" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* corresponding to your storage array.

**9** Configure the MSCS software.

See "Configuring Your Failover Cluster" on page 29.

**10** Verify cluster functionality. Ensure that:

- The cluster components are communicating properly.
- MSCS is started.

See "Verifying Cluster Functionality" on page 33.

**11** Verify cluster resource availability.

Use Cluster Administrator to check the running state of each resource group. See "Verifying Cluster Resource Availability."

The following subsections provide detailed information about some steps in the "Installation Overview" that is specific to the Windows Server 2003 operating system.



## Selecting a Domain Model

On a cluster running the Microsoft Windows operating system, all nodes must belong to a common domain or directory model. The following configurations are supported:

- All nodes are member servers in an Active Directory® domain.
- All nodes are domain controllers in an Active Directory domain.
- At least one node is a domain controller in an Active Directory and the remaining nodes are member servers.

### Configuring the Nodes as Domain Controllers

If a node is configured as a domain controller, client system access to its cluster resources can continue even if the node cannot contact other domain controllers. However, domain controller functions can cause additional overhead, such as log on, authentication, and replication traffic.

If a node is not configured as a domain controller and the node cannot contact a domain controller, the node cannot authenticate client system requests.

## Configuring Internal Drives in the Cluster Nodes


If your system uses a hardware-based RAID solution and you have added new internal hard drives to your system, or you are setting up the RAID configuration for the first time, you must configure the RAID array using the RAID controller's BIOS configuration utility before installing the operating system.

For the best balance of fault tolerance and performance, use RAID 1. See the RAID controller documentation for more information on RAID configurations.




**NOTE:** If you are not using a hardware-based RAID solution, use the Microsoft Windows Disk Management tool to provide software-based redundancy.

# Installing and Configuring the Microsoft Windows Operating System

 **NOTE:** Windows standby mode and hibernation mode are not supported in cluster configurations. Do not enable either mode.

- 1 Ensure that the cluster configuration meets the requirements listed in "Cluster Configuration Overview."
- 2 Cable the hardware.

 **NOTE:** Do not connect the nodes to the shared storage systems yet.

For more information on cabling your cluster hardware and the storage array that you are using, see "Cabling Your Cluster Hardware" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

- 3 Install and configure the Windows Server 2003 operating system with the latest service pack on each node.

For more information about the latest supported service pack, see *Dell Cluster Configuration Support Matrices* located on the Dell High Availability Clustering website at [www.dell.com/ha](http://www.dell.com/ha).

- 4 Ensure that the latest supported version of network adapter drivers is installed on each cluster node.
- 5 Configure the public and private network adapter interconnects in each node, and place the interconnects on separate IP subnetworks using static IP addresses. See "Configuring Windows Networking" on page 22.

For information on required drivers, see *Dell Cluster Configuration Support Matrices* located on the Dell High Availability Clustering website at [www.dell.com/ha](http://www.dell.com/ha).

- 6 Shut down both nodes and connect each node to the shared storage.

For more information on cabling your cluster hardware and the storage array that you are using, see "Cabling Your Cluster Hardware" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

- 7 If required, configure the storage software.

- 8 Reboot node 1.
- 9 From node 1, write the disk signature and then partition, format, and assign drive letters and volume labels to the hard drives in the storage system using the Windows Disk Management application.

For more information, see "Preparing Your Systems for Clustering" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

- 10 On node 1, verify disk access and functionality on all shared disks.
- 11 Shut down node 1.
- 12 Verify disk access by performing the following steps on the other node:
  - a Turn on the node.
  - b Modify the drive letters to match the drive letters on node 1.  
This procedure allows the Windows operating system to mount the volumes.
  - c Close and reopen Disk Management.
  - d Verify that Windows can see the file systems and the volume labels.
- 13 Turn on node 1.
- 14 Install and configure the Cluster Service.  
See "Configuring Microsoft Cluster Service (MSCS) With Windows Server 2003" on page 29.
- 15 Install and set up the application programs (optional).
- 16 Enter the cluster configuration information on the **Cluster Data Form** provided as an Appendix in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for your corresponding storage array (optional).

# Configuring Windows Networking

You must configure the public and private networks in each node before you install MSCS. The following subsections introduce you to some procedures necessary for the networking prerequisites.

## Assigning Static IP Addresses to Cluster Resources and Components

A static IP address is an Internet address that a network administrator assigns exclusively to a system or a resource. The address assignment remains in effect until it is changed by the network administrator.

The IP address assignments for the cluster's public LAN segments depend on the environment's configuration. Configurations running the Windows operating system require static IP addresses assigned to hardware and software applications in the cluster, as listed in Table 2-1.

**Table 2-1. Applications and Hardware Requiring IP Address Assignments**

<b>Application/Hardware</b>	<b>Description</b>
Cluster IP address	The cluster IP address is used for cluster management and must correspond to the cluster name. Because each server has at least two network adapters, the minimum number of static IP addresses required for a cluster configuration is two (one for public network and one for the public network). Additional static IP addresses are required when MSCS is configured with application programs that require IP addresses, such as file sharing.
Cluster-aware applications running on the cluster	These applications include Microsoft SQL Server, Enterprise Edition, Microsoft Exchange Server, and Internet Information Server (IIS). For example, Microsoft SQL Server, Enterprise Edition requires at least one static IP address for the virtual server (Microsoft SQL Server does not use the cluster's IP address). Also, each IIS Virtual Root or IIS Server instance configured for failover needs a unique static IP address.

**Table 2-1. Applications and Hardware Requiring IP Address Assignments (continued)**

<b>Application/Hardware</b>	<b>Description</b>
Cluster node network adapters	<p>For cluster operation, two network adapters are required: one for the public network (LAN/WAN) and another for the private network (sharing heartbeat information between the nodes).</p> <p>For more information on cabling your cluster hardware and the storage array that you are using, see "Cabling Your Cluster Hardware" in the <i>Dell Failover Cluster Hardware Installation and Troubleshooting Guide</i> for the specific storage array on the Dell Support website at <a href="http://support.dell.com">support.dell.com</a>.</p> <p><b>NOTE:</b> To ensure operation during a DHCP server failure, use static IP addresses.</p>

## Configuring IP Addresses for the Private Network

Use the static IP address assignments for the network adapters used for the private network (cluster interconnect).




**NOTE:** The IP addresses in Table 2-2 are used as examples only.

**Table 2-2. Examples of IP Address Assignments**

<b>Usage</b>	<b>Cluster Node 1</b>	<b>Cluster Node 2</b>
Public network static IP address (for client and domain controller communications)	192.168.1.101	192.168.1.102
Public network subnet mask	255.255.255.0	255.255.255.0
Default gateway	192.168.1.1	192.168.1.1
WINS servers	Primary 192.168.1.11	Primary 192.168.1.11
	Secondary 192.168.1.12	Secondary 192.168.1.12
DNS servers	Primary 192.168.1.21	Primary 192.168.1.21
	Secondary 192.168.1.22	Secondary 192.168.1.22


**Table 2-2. Examples of IP Address Assignments (continued)**

Usage	Cluster Node 1	Cluster Node 2
Private network static IP address cluster interconnect (for node-to-node communications)	10.0.0.1	10.0.0.2
Private network subnet mask	255.255.255.0	255.255.255.0

 **NOTE:** Do not configure Default Gateway, NetBIOS, WINS, and DNS on the private network. If you are running Windows Server 2003, disable NetBIOS on the private network.

If multiple cluster interconnect network adapters are connected to a network switch, ensure that all of the private network's network adapters have a unique address. You can continue the IP address scheme in Table 2-2 with 10.0.0.3, 10.0.0.4, and so on for the private network's network adapters or network adapter teams of the other clusters connected to the same switch.

You can improve fault tolerance by using network adapters that support adapter teaming or by having multiple LAN segments. To avoid communication problems, do not use dual-port network adapters for the cluster interconnect.

 **NOTE:** NIC teaming is supported only on a public network, not on a private network.

### **Creating Separate Subnets for the Public and Private Networks**

The public and private network's network adapters installed in the same cluster node must reside on separate IP subnetworks. Therefore, the private network used to exchange heartbeat information between the nodes must have a separate IP subnet or a different network ID than the public network, which is used for client connections.

## Setting the Network Interface Binding Order for Clusters Running Windows Server 2003

- 1 Click the **Start** button, select **Control Panel**, and double-click **Network Connections**.
- 2 Click the **Advanced** menu, and then click **Advanced Settings**.  
The **Advanced Settings** window appears.
- 3 In the **Adapters and Bindings** tab, ensure that the **Public** connection is at the top of the list and followed by the **Private** connection.  
To change the connection order:
  - a Click **Public** or **Private**.
  - b Click the up-arrow or down-arrow to move the connection to the top or bottom of the **Connections** box.
  - c Click **OK**.
  - d Close the **Network Connections** window.

## Dual-Port Network Adapters and Adapter Teams in the Private Network

Dual-port network adapters and network adapter teams are not supported in the private network. They are supported only in the public network.

## Verifying Communications Between Nodes

- 1 Open a command prompt on each cluster node.
- 2 At the prompt, type:  

```
ipconfig /all
```
- 3 Press <Enter>.  
All known IP addresses for each local server appear on the screen.
- 4 Issue the **ping** command from each remote system.

Ensure that each local server responds to the **ping** command. If the IP assignments are not set up correctly, the nodes may not be able to communicate with the domain. For more information, see "Troubleshooting" on page 63.

## Configuring the Internet Connection Firewall

The Windows Server 2003 operating system includes an enhanced Internet Connection Firewall that can be configured to block incoming network traffic to a PowerEdge system. To prevent the Internet Connection Firewall from disrupting cluster communications, additional configuration settings are required for PowerEdge systems that are configured as cluster nodes in an MSCS cluster.

Certain network communications are necessary for cluster operations, for applications and services hosted by the cluster, and for clients accessing those services. If the Internet Connection Firewall is enabled on the cluster nodes, install and run the Security Configuration Wizard and then configure access for the cluster service and for any applications or services hosted by the cluster and the operating system.

See the following Microsoft Knowledge Base articles located at the Microsoft Support website at [support.microsoft.com](http://support.microsoft.com) for more information:

- KB883398 - Internet Connection Firewall
- KB832017 - Network ports used by the Windows Server 2003 operating system

## Installing the Storage Connection Ports and Drivers

Ensure that an appropriate storage connection exists on the nodes before you attach each node to the shared storage array. Also ensure that the cluster nodes have a complimentary technology that enables proper interaction between the nodes and shared Fibre Channel, SAS, or iSCSI storage array. You may also require operating system drivers and Multipath Input/Output (MPIO) drivers to ensure proper interaction between the cluster nodes and the shared storage array.

For more information, see "Preparing Your Systems for Clustering" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).



# Installing and Configuring the Shared Storage System

The shared storage array consists of disk volumes that are used in your cluster. The management software for each supported shared storage array provides a way to create disk volumes and assigns these volumes to all the nodes in your cluster.

For more information, see "Preparing Your Systems for Clustering" section in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for your specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

## Assigning Drive Letters and Mount Points

A mount point is a drive attached to an empty folder on an NTFS volume. A mount point drive functions the same as a normal drive, but is assigned a label or name instead of a drive letter. Using mount points, a cluster can support more shared disks than the number of available drive letters.

The cluster installation procedure does not automatically add the mount point into the disks managed by the cluster. To add the mount point to the cluster, create a physical disk resource in the cluster resource group for each mount point. Ensure that the new physical disk resource is in the same cluster resource group and is dependent on the root disk.



**NOTE:** Mount points are only supported in MSCS on the Windows Server 2003 operating system. When mounting a drive to an NTFS volume, do not create mount points from the quorum resource or between the clustered disks and the local disks. Mount points must be in the same cluster resource group and must be dependent on the root disk.



**NOTICE:** If the disk letters are manually assigned from the remaining node(s), the shared disks are simultaneously accessible from both nodes. To ensure file system integrity and prevent possible data loss before you install the MSCS software, prevent any I/O activity to the shared drives by performing this procedure on one node at a time, and ensure that all other nodes are turned off.

The number of drive letters required by individual servers in a cluster may vary. It is recommended that the shared drives be named in reverse alphabetical order beginning with the letter z.

To assign drive letters, create mount points, and format the disks on the shared storage system:

- 1 Turn off the remaining node(s) and open **Disk Management** on node 1.
- 2 Allow Windows to enter a signature on all new physical or logical drives.



**NOTE:** Do not create dynamic disks on your hard drives.

- 3 Locate the icon for the first unnamed, unformatted drive on the shared storage system.
- 4 Right-click the icon and select **Create** from the submenu.

If the unformatted drives are not visible, verify the following:

- The HBA driver is installed.
- The storage system is properly cabled to the servers.
- The LUNs and hosts are assigned through a storage group (if **Access Control** is enabled).

- 5 In the dialog box, create a partition the size of the entire drive (the default) and then click **OK**.



**NOTE:** The MSCS software allows only one node to access a logical drive at a time. If a logical drive is partitioned into multiple disks, only one node is able to access all the partitions for that logical drive. If a separate disk is to be accessed by each node, two or more logical drives must be present in the storage system.

- 6 Click **Yes** to confirm the partition.
- 7 With the mouse pointer on the same icon, right-click and select **Change Drive Letter and Path** from the submenu.
- 8 Assign a drive letter to an NTFS volume or create a mount point.

To assign a drive letter to an NTFS volume:

- a Click **Edit** and select the letter you want to assign to the drive (for example, Z).
- b Click **OK**.
- c Go to step 9.

To create a mount point:

- a** Click **Add**.
- b** Click **Mount in the following empty NTFS folder**.
- c** Type the path to an empty folder on an NTFS volume, or click **Browse** to locate it.
- d** Click **OK**.
- e** Go to step 9.

**9** Click **Yes** to confirm the changes.

**10** Right-click the drive icon again and select **Format** from the submenu.

**11** Under **Volume Label**, enter a descriptive name for the new volume; for example, `Disk_Z` or `Email_Data`.

**12** In the dialog box, change the file system to **NTFS**, select **Quick Format**, and click **Start**.



**NOTE:** The NTFS file system is required for shared-disk resources under MSCS.

**13** Click **OK** at the warning.

**14** Click **OK** to acknowledge that the format is complete.

**15** Click **Close** to close the dialog box.

**16** Repeat step 3 through step 15 for each remaining drive.

**17** Close **Disk Management**.

**18** Turn off node 1.

**19** Perform the following steps on the remaining node(s), one at a time:

**a** Turn on the node.

**b** Open **Disk Management**.

**c** Assign the drive letters to the drives.

This procedure allows Windows to mount the volumes.

**d** Reassign the drive letter, if necessary.

To reassign the drive letter, repeat step 7 through step 9.

**e** Turn off the node.

## Configuring Hard Drive Letters When Using Multiple Shared Storage Systems

Before installing MSCS, ensure that both nodes have the same view of the shared storage systems. Because each node has access to hard drives that are in a common storage array, each node must have identical drive letters assigned to each hard drive. Your cluster can access more than 22 volumes using volume mount points in Windows Server 2003.

 **NOTE:** Drive letters A through D are reserved for the local system.

To ensure that hard drive letter assignments are identical:

- 1 Ensure that your cables are attached to the shared storage devices in the proper sequence.

You can view all of the storage devices using Windows Server 2003 Disk Management.

- 2 To maintain proper drive letter assignments, ensure that each storage connection port is enumerated by each node and is connected to the same RAID controller, storage processor, or SAN switch.

For more information on the location of the RAID controllers or storage processors on your shared storage array, see "Cabling Your Cluster Hardware" in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

- 3 Go to Formatting and Assigning Drive Letters and Volume Labels to the Disks.

### Formatting and Assigning Drive Letters and Volume Labels to the Disks

- 1 Shut down all the cluster nodes except node 1.
- 2 Format the disks, assign the drive letters and volume labels on node 1 by using the Windows Disk Management utility.

For example, create volumes labeled "Volume Y" for disk Y and "Volume Z" for disk Z.

- 3 Shut down node 1 and perform the following steps on the remaining node(s), one at a time:
  - a Turn on the node.
  - b Open **Disk Management**.

- c** Assign the drive letters for the drives.  
This procedure allows Windows to mount the volumes.
- d** Reassign the drive letter, if necessary.  
To reassign the drive letter:
  - With the mouse pointer on the same icon, right-click and select **Change Drive Letter and Path** from the submenu.
  - Click **Edit**, select the letter you want to assign the drive (for example, Z), and then click **OK**.
  - Click **Yes** to confirm the changes.
- e** Power down the node.

If the cables are connected properly, the drive order is the same as is on each node, and the drive letter assignments of all the cluster nodes follow the same order as on node 1. The volume labels can also be used to double-check the drive order by ensuring that the disk with volume label "Volume Z" is assigned to drive letter Z and so on for each disk on each node. Assign drive letters on each of the shared disks, even if the disk displays the drive letter correctly.

For more information about the storage array management software, see your storage array documentation located on the Dell Support website at [support.dell.com](http://support.dell.com).

## Configuring Your Failover Cluster

MSCS is an integrated service in Windows Server 2003 which is required for configuring your failover cluster. MSCS performs the basic cluster functionality, which includes membership, communication, and failover management. When MSCS is installed properly, the service starts on each node and responds automatically in the event that one of the nodes fails or goes offline. To provide application failover for the cluster, the MSCS software must be installed on each cluster node. For more information, see "Understanding Your Failover Cluster" on page 37.

## Configuring Microsoft Cluster Service (MSCS) With Windows Server 2003

The cluster setup files are automatically installed on the system disk.

To create a new cluster:

- 1 Click the **Start** button, select **Programs**→**Administrative Tools**→**Cluster Administrator**.
- 2 From the **File** menu, select **Open Connection**.
- 3 In the **Action** box of the **Open Connection to Cluster**, select **Create new cluster**.

The **New Server Cluster Wizard** window appears.

- 4 Click **Next** to continue.
- 5 Follow the procedures in the wizard, and then click **Finish**.
- 6 Add the additional node(s) to the cluster.
  - a Turn on the remaining node(s).
  - b Click the **Start** button, select **Programs**→**Administrative Tools**, and then double-click **Cluster Administrator**.
  - c From the **File** menu, select **Open Connection**.
  - d In the **Action** box of the **Open Connection to Cluster**, select **Add nodes to cluster**.
  - e In the **Cluster or server name** box, type the name of the cluster or click **Browse** to select an available cluster from the list, and then click **OK**.

The **Add Nodes Wizard** window appears.

If the **Add Nodes Wizard** *does not* generate a cluster feasibility error, go to step f.

If the **Add Nodes Wizard** generates a cluster feasibility error, go to "Adding Cluster Nodes Using the Advanced Configuration Option."

- f Click **Next** to continue.
- g Follow the procedures in the wizard and click **Finish**.

## Adding Cluster Nodes Using the Advanced Configuration Option

If you are adding additional nodes to the cluster using the Add Nodes wizard and the nodes are not configured with identical internal storage devices, the wizard may generate one or more errors while checking cluster feasibility in the **Analyzing Configuration** menu. If this situation occurs, select **Advanced Configuration Option** in the Add Nodes wizard to add the nodes to the cluster.

To add the nodes using the **Advanced Configuration Option**:

- 1 From the **File** menu in Cluster Administrator, select **Open Connection**.
- 2 In the **Action** box of the **Open Connection to Cluster**, select **Add nodes to cluster**, and then click **OK**.

The **Add Nodes Wizard** window appears.

- 3 Click **Next**.
- 4 In the **Select Computers** menu, click **Browse**.
- 5 In the **Enter the object names to select (examples)**, type the names of one to seven systems to add to the cluster, with each system name separated by a semicolon.


- 6 Click **Check Names**.

The Add Nodes Wizard verifies and underlines each valid system name.

- 7 Click **OK**.
- 8 In the **Select Computers** menu, click **Add**.
- 9 In the **Advanced Configuration Options** window, click **Advanced (minimum) configuration**, and then click **OK**.
- 10 In the **Add Nodes** window, click **Next**.
- 11 In the **Analyzing Configuration** menu, Cluster Administrator analyzes the cluster configuration.

If Cluster Administrator discovers a problem with the cluster configuration, a warning icon appears in the **Checking cluster feasibility** window. Click the plus ("+") sign to review any warnings, if needed.

- 12 Click **Next** to continue.

- 13** In the **Password** field of the **Cluster Service Account** menu, type the password for the account used to run the Cluster Service, and click **Next**.  
The **Proposed Cluster Configuration** menu appears with a summary with the configuration settings for your cluster.
- 14** Click **Next** to continue.  
The new systems (hosts) are added to the cluster. When completed, **Tasks completed** appears in the **Adding Nodes to the Cluster** menu.  
 **NOTE:** This process may take several minutes to complete.
- 15** Click **Next** to continue.
- 16** In the **Completing the Add Nodes Wizard** window, click **Finish**.

## Verifying Cluster Readiness

To ensure that your server and storage systems are ready for MSCS installation, ensure that these systems are functioning correctly and verify the following:

- All cluster servers are able to log on to the same domain.
- The shared disks are partitioned and formatted, and the same drive letters that reference logical drives on the shared storage system are used on each node.

All IP addresses and network names for each cluster node are communicating with each other and the public network

## Installing Applications in the Cluster Group

The Cluster Group contains a network name and IP address resource, which is used to manage the cluster. Because the Cluster Group is dedicated to cluster management and for best cluster performance, it is recommended that you do not install applications in this group.

## Installing the Quorum Resource

When you install a Windows Server 2003 cluster, the installation wizard automatically selects an NTFS disk as the quorum resource for you, which you can modify later. When you complete the procedures in the wizard, you can select another disk for the quorum using **Cluster Administrator**.

To prevent quorum resource corruption, it is recommended that you do not place applications or data on the disk.



## Creating a LUN for the Quorum Resource

It is recommended that you create a separate LUN—approximately 1 GB in size—for the quorum resource.

When you create the LUN for the quorum resource:

- Format the LUN with NTFS.
- Use the LUN exclusively for your quorum logs.
- Do not store any application data or user data on the quorum resource.
- To easily identify the quorum resource, it is recommended that you assign the drive letter "Q" to the quorum resource.



**NOTE:** The Majority Node Set Quorum types for Windows Server 2003 are not supported.

## Preventing Quorum Resource Failure

Since the quorum resource plays a crucial role in cluster operation, losing a quorum resource causes the entire cluster to fail. To prevent cluster failure, configure the quorum resource on a RAID volume in the shared storage system.



**NOTE:** It is recommended that you use a RAID level other than RAID 0, which is commonly called striping. RAID 0 configurations provide very high performance, but they do not provide the level of availability required for the quorum resource.

## Configuring Cluster Networks Running Windows Server 2003

When you install and configure a cluster running Windows Server 2003, the software installation wizard automatically configures all networks for mixed (public and private) use in your cluster. You can rename a network, allow or disallow the cluster to use a particular network, or modify the network role using **Cluster Administrator**. It is recommended that you configure at least one network for the cluster interconnect (private network) and provide redundancy for the private network by configuring an additional network for mixed (public and private) use. If you have enabled network adapter teaming or are using dual-port NICs for use on your public network, you should change the configuration for these networks to support public communications only.

## Verifying MSCS Operation

After you install MSCS, verify that the service is operating properly.

If you selected **Cluster Service** when you installed the operating system, see "Obtaining More Information" on page 34.

If you did not select **Cluster Service** when you installed the operating system:

- 1 Click the **Start** button and select **Programs**→**Administrative Tools**, and then select **Services**.
- 2 In the **Services** window, verify the following:
  - In the **Name** column, **Cluster Service** appears.
  - In the **Status** column, **Cluster Service** is set to **Started**.
  - In the **Startup Type** column, **Cluster Service** is set to **Automatic**.

## Obtaining More Information

See Microsoft's online help for configuring the Cluster Service.

See "Understanding Your Failover Cluster" on page 37 for more information on the Cluster Service.

## Verifying Cluster Functionality

To verify cluster functionality, monitor the cluster network communications to ensure that your cluster components are communicating properly with each other. Also, verify that MSCS is running on the cluster nodes.

## Verifying Cluster Resource Availability

In the context of clustering, a resource is a basic unit of failover management. Application programs are made up of resources that are grouped together for recovery purposes. All recovery groups, and therefore the resources that comprise the recovery groups, must be online (or in a ready state) for the cluster to function properly.

To verify that the cluster resources are online:

- 1 Start **Cluster Administrator** on the monitoring node.
- 2 Click the **Start** button and select **Programs**→**Administrative Tools (Common)**→**Cluster Administrator**.

# Installing Your Cluster Management Software

This section provides information on configuring and administering your cluster using Microsoft® Cluster Administrator. Microsoft provides Cluster Administrator as a built-in tool for cluster management.

## Microsoft Cluster Administrator

Cluster Administrator is Microsoft's tool for configuring and administering a cluster. The following procedures describe how to run Cluster Administrator locally on a cluster node and how to install the tool on a remote console.

### Launching Cluster Administrator on a Cluster Node

Click **Start**→**Programs**→**Administrative Tools**→**Cluster Administrator** to launch the Cluster Administrator.

### Running Cluster Administrator on a Remote Console

You can administer and monitor the Cluster Service remotely by installing the Windows Administration Tools package and Cluster Administrator on a remote console (or management station) running the Microsoft Windows® operating system. Cluster Administrator is part of the Administration Tools package, which is included with the Windows Server® 2003 operating system.

The Windows Server 2003 Administrative Tools can only be installed on systems running Windows XP (with Service Pack 1 or later) and Windows Server 2003.

To install Cluster Administrator and the Windows Administration Tools package on a remote console:

- 1 Select a system that you wish to configure as the remote console.
- 2 Identify the operating system that is currently running on the selected system.
- 3 Insert the appropriate operating system CD into the system's CD drive:
  - *Windows Server 2003, Enterprise Edition CD*
  - *Windows Server 2003 R2, Enterprise Edition CD 1*
  - *Windows Server 2003, Enterprise x64 Edition CD*
  - *Windows Server 2003 R2, Enterprise x64 Edition CD 1*
- 4 Open an Explorer window, navigate to the system's CD drive and double-click the `\i386` directory.
- 5 If you inserted the *Windows Server 2003 R2, Enterprise Edition CD 1* or the *Windows Server 2003, Enterprise Edition CD*, double-click **ADMINPAK.MSI**.  
If you inserted the *Windows Server 2003 R2, Enterprise x64 Edition CD 1* or the *Windows Server 2003, Enterprise x64 Edition CD*, double-click **WADMINPAK.MSI**.
- 6 Follow the instructions on your screen to complete the installation.

## Launching Cluster Administrator on a Remote Console

Perform the following steps on the remote console:

- 1 Ensure that the Windows Administrative Tools package was installed on the system.
- 2 Click the **Start** button and select **Programs**.
- 3 Select **Administrative Tools**.
- 4 Select **Cluster Administrator**.

# Understanding Your Failover Cluster

## Cluster Objects

Cluster objects are the physical and logical units managed by a cluster. Each object is associated with the following:

- Properties that define the object and its behavior within the cluster
- A set of cluster control codes used to manipulate the object's properties
- A set of object management functions to manage the object through Microsoft® Cluster Services (MSCS)

## Cluster Networks

A cluster network provides a communications link between the cluster nodes (private network), the client systems in a local area network (public network), or a combination of the above (public-and-private network).

### Preventing Network Failure

When you install MSCS, identify the public and private network segments connected to your cluster nodes. To ensure cluster failover and non-interrupted communications, perform the following procedures:

- 1 Configure the private network for internal communications.
- 2 Configure the public network for all communications to provide a redundant path if all of the private networks fail.
- 3 Configure subsequent network adapters for client system use only or for all communications.

You can set priorities and roles of the networks when you install MSCS or when you use the Microsoft Cluster Administrator software.

## Node-to-Node Communication

If a network is configured for public (client) access only, the Cluster Service will not use the network for internal node-to-node communications. If all of the networks that are configured for private (or mixed) communication fail, the nodes cannot exchange information and one or more nodes will terminate MSCS and temporarily stop participating in the cluster.

## Network Interfaces

You can use Cluster Administrator or another cluster management application to view the state of all cluster network interfaces.

## Cluster Nodes

A cluster node is a system in a cluster running the Microsoft Windows® operating system and MSCS.

Each node in a cluster:

- Attaches to one or more cluster storage devices that store all of the cluster's configuration and resource data; nodes have access to all cluster configuration data
- Communicates with the other nodes through network adapters
- Is aware of systems that join or leave the cluster
- Is aware of the resources that are running on each node
- Is grouped with the remaining nodes under a common cluster name, which is used to access and manage the cluster

Table 4-1 defines states of a node during cluster operation

**Table 4-1. Node States and Definitions**

State	Definition
Down	The node is not actively participating in cluster operations.
Joining	The node is becoming an active participant in the cluster operations.
Paused	The node is actively participating in cluster operations but cannot take ownership of resource groups or bring resources online.
Up	The node is actively participating in all cluster operations, including hosting cluster groups.
Unknown	The node state cannot be determined.

When MSCS is configured on a node, the administrator chooses whether that node forms its own cluster or joins an existing cluster. When MSCS is started, the node searches for other active nodes on networks that are enabled for internal cluster communications.

## Forming a New Cluster

MSCS maintains a current copy of the cluster database on all active nodes. If a node cannot join a cluster, the node attempts to gain control of the quorum resource and form a cluster. The node uses the recovery logs in the quorum resource to update its cluster database.

## Joining an Existing Cluster

A node can join a cluster if it can communicate with another active node in the cluster. When a node joins a cluster, the node is updated with the latest copy of the cluster database. MSCS validates the node's name, verifies version compatibility, and the node joins the cluster.

# Cluster Resources

A cluster resource is any physical or logical component that can be:

- Brought online and taken offline
- Managed in a cluster
- Hosted by one managed system at a time

When MSCS makes a resource request through a dynamic link library (DLL), the Resource Monitor checks and controls the resource's state.


## Setting Resource Properties

Using the resource **Properties** dialog box, you can perform the following tasks:

- View or change the resource name, description, and possible owners.
- Assign a separate resource memory space.
- View the resource type, group ownership, and resource state.
- View which node currently owns the resource.
- View pre-existing dependencies and modify resource dependencies.
- Restart a resource and configure the resource settings (if required).


- Check the online state of the resource by configuring the **Looks Alive** (general check of the resource) and **Is Alive** (detailed check of the resource) polling intervals in MSCS.
- Specify the time requirement for resolving a resource in a pending state (**Online Pending** or **Offline Pending**) before MSCS places the resource in **Offline** or **Failed** status.
- Set specific resource parameters.

The **General**, **Dependencies**, and **Advanced** tabs are the same for every resource; however, some resource types support additional tabs.

 **NOTE:** Do not update cluster object properties on multiple nodes simultaneously. See the MSCS online documentation for more information.

## Resource Dependencies

MSCS uses the resource dependencies list when bringing resources online and offline. For example, if a group with a physical disk and a file share is brought online together, the physical disk containing the file share must be brought online before the file share. Table 4-2 shows resources and their dependencies.

 **NOTE:** You must configure the required dependencies before you create the resource.

**Table 4-2. Cluster Resources and Required Dependencies**

Resource	Required Dependencies
File share	Network name (only if configured as a distributed file system [DFS] root)
IP address	None
Network name	IP address that corresponds to the network name
Physical disk	None



## Setting Advanced Resource Properties

By using the **Advanced** tab in the **Properties** dialog box, you can perform the following tasks:

- Restart a resource or allow the resource to fail.  
See "Adjusting the Threshold and Period Values" on page 43 for more information.
- Adjust the **Looks Alive** or **Is Alive** parameters.
- Select the default number for the resource type.
- Specify the time parameter for a resource in a pending state.

## Resource Parameters

The **Parameters** tab in the **Properties** dialog box is available for most resources. Table 4-3 shows each resource and its configurable parameters.

**Table 4-3. Resources and Configurable Parameters**

<b>Resource</b>	<b>Configurable Parameters</b>
File share	Share permissions and number of simultaneous users Share name (clients systems detect the name in their browse or explore lists) Share comment Shared file path
IP address	IP address Subnet mask Network parameters for the IP address resource (specify the correct network)
Network name	Cluster name or virtual server
Physical disk	Hard drive for the physical disk resource (cannot be changed after the resource is created)

## Quorum Resource

Normally, the quorum resource is a common cluster resource that is accessible by all of the nodes. The quorum resource—typically a physical disk on a shared storage system—maintains data integrity, cluster unity, and cluster operations.

When the cluster is formed or when the nodes fail to communicate, the quorum resource guarantees that only one set of active communicating nodes is allowed to form a cluster. If a node fails and the node containing the quorum resource is unable to communicate with the remaining nodes, MSCS shuts down the node that does not control the quorum resource. If a node fails, the configuration database helps the cluster recover a failed resource or recreates the cluster in its current configuration.

The shared physical disk is the only resource supported by the solution that can act as a quorum resource.



**NOTE:** The Majority Node Set Quorum resource type is not supported.

Additionally, the quorum resource ensures cluster integrity. MSCS uses the quorum resource's recovery logs to update the private copy of the cluster database in each node, thereby maintaining the correct version of the cluster database and ensuring that the cluster is intact.

The operating system uses the quorum resource to ensure that only one set of active, communicating nodes is allowed to operate as a cluster. A node can form a cluster only if the node can gain control of the quorum resource. A node can join a cluster or remain in an existing cluster only if it can communicate with the node that controls the quorum resource.

## Resource Failure

MSCS periodically launches the Resource Monitor to check if a resource is functioning properly. Configure the **Looks Alive** and **Is Alive** polls to check for failed resources. The **Is Alive** poll interval is typically longer than the **Looks Alive** poll interval because MSCS requests a more thorough check of the resource's state.



**NOTE:** Do not adjust the **Looks Alive** and **Is Alive** settings unless instructed to do so by technical support.

## Adjusting the Threshold and Period Values

The **Threshold** value determines the number of attempts to restart the resource before the resource fails over. The **Period** value assigns a time requirement for the **Threshold** value to restart the resource.

If MSCS exceeds the maximum number of restart attempts within the specified time period and the failed resource has not been restarted, MSCS considers the resource to be failed.



**NOTE:** See "Setting Advanced Resource Properties" to configure the **Looks Alive, Is Alive, Threshold, and Period** values for a particular resource.



**NOTE:** Do not adjust the **Threshold and Period** settings unless instructed by technical support.

## Configuring Failover

You can configure a resource to affect the group and fail over an entire group to another node when a resource fails in that group. If the number of failover attempts exceeds the group's threshold and the resource is still in a failed state, MSCS attempts to restart the resource after a period of time specified by the resource's **Retry Period On Failure** property.



**NOTE:** Do not adjust the **Retry Period On Failure** settings unless instructed by technical support.

When you configure **Retry Period On Failure**, use the following guidelines:

- Select a unit value of minutes rather than milliseconds (the default value is milliseconds).
- Select a value that is greater than or equal to the value of the resource's restart period property.

## Resource Dependencies

A dependent resource requires another resource to operate. Table 4-4 describes resource dependencies.

**Table 4-4. Resource Dependencies**

Term	Definition
Dependent resource	A resource that depends on other resources.
Dependency	A resource on which another resource depends.
Dependency tree	A series of dependency relationships or hierarchy. The following rules apply to a dependency tree: <ul style="list-style-type: none"><li>• A dependent resource and its dependencies must be in the same group.</li><li>• A dependent resource is taken offline before its dependencies and brought online after its dependencies, as determined by the dependency hierarchy.</li></ul>

## Creating a New Resource

Before you add a resource to your cluster solution, verify that the following conditions exist in your cluster:

- The type of resource is either a standard resource provided with MSCS or a custom resource provided by Microsoft or a third party vendor.
- A group that will contain the resource already exists within your cluster.
- All dependent resources have been created.
- A separate Resource Monitor exists (recommended for any resource that has caused problems in the past).

To create a new resource:

- 1 Click the **Start** button and select **Programs→Administrative Tools→Cluster Administrator**.  
The **Cluster Administrator** window appears.
- 2 In the console tree, double-click the **Groups** folder.
- 3 Select the group to which you want the resource to belong.

- 4 On the **File** menu, point to **New** and click **Resource**.
- 5 In the **New Resource** wizard, type the appropriate information in the **Name** and **Description** fields and select the appropriate **Resource type** and **Group** for the new resource.
- 6 Click **Next**.
- 7 Add or remove possible owners of the resource and click **Next**.  
The **New Resource** window appears with **Available resources** and **Resource dependencies** selections.
  - To add dependencies, under **Available resources**, select a resource, and then click **Add**.
  - To remove dependencies, under **Resource dependencies**, select a resource, and then click **Remove**.
- 8 Repeat step 7 for all resource dependencies and click **Finish**.
- 9 Set the resource properties.  
For more information about setting resource properties, see the MSCS online help.

## Deleting a Resource

- 1 Click the **Start** button and select **Programs→Administrative Tools→Cluster Administrator**.  
The **Cluster Administrator** window appears.
- 2 In the console tree, double-click the **Resources** folder.
- 3 In the details pane, select the resource that you want to remove.
- 4 In the **File** menu, click **Offline**.  
The resource must be taken offline before it can be deleted.
- 5 In the **File** menu, click **Delete**.

When you delete a resource, Cluster Administrator deletes all of the resources that are dependent on the deleted resource.

## File Share Resource Type

If you want to use your cluster solution as a high-availability file server, select one of the following types of file share for your resource:

- Basic file share — Publishes a file folder to the network under a single name.
- Share subdirectories — Publishes several network names—one for each folder and all of its immediate subfolders. This method is an efficient way to create large numbers of related file shares on a file server.
- Distributed File System (DFS) root — Creates a resource that manages a stand-alone DFS root. Fault-tolerant DFS roots cannot be managed by this resource. A DFS root file share resource has required dependencies on a network name and an IP address. The network name can be either the cluster name or any other network name for a virtual server.

## Configuring Active and Passive Cluster Nodes

Active nodes process application requests and provide client services. Passive nodes are backup nodes that ensure that client applications and services are available if a hardware or software failure occurs. Cluster configurations may include both active and passive nodes.



**NOTE:** Passive nodes must be configured with appropriate processing power and storage capacity to support the resources that are running on the active nodes.

Your cluster solution supports variations of active/active (active<sup>x</sup>) and active/passive (active<sup>x</sup>/passive<sup>x</sup>) configurations. The variable *x* indicates the number of nodes that are active or passive.

Cluster solutions running the Windows Server 2003 operating system can support up to eight nodes in multiple configurations as shown in Table 4-6.

An active/active (active<sup>x</sup>) configuration contains virtual servers running separate applications or services on each node. When an application is running on node 1, the remaining node(s) do not have to wait for node 1 to fail. Those node(s) can run their own cluster-aware applications (or another instance of the same application) while providing failover for the resources on node 1. For example, multiway failover is an active/active failover solution because running applications from a failed node can migrate to multiple active nodes in the cluster. However, you must ensure that adequate resources are available on each node to handle the increased load if one node fails.

In an active/passive (active<sup>x</sup>/passive<sup>x</sup>) configuration, one or more *active* cluster nodes are processing requests for a clustered application while the *passive* cluster nodes only wait for the active node(s) to fail.

Table 4-5 provides a description of active/active configuration types.

**Table 4-5. Active/Active Configuration Types**

Configuration Type	Active Cluster Node(s)	Definition
Active <sup>2</sup>	2	The active node(s) processes requests and provides failover for each other, depending on node resources and your configuration.
Active <sup>3</sup>	3	
Active <sup>4</sup>	4	
Active <sup>5</sup>	5	
Active <sup>6</sup>	6	
Active <sup>7</sup>	7	
Active <sup>8</sup>	8	

Table 4-6 provides a description of some active/passive configuration types.

**Table 4-6. Active/Passive Configuration Types**

Configuration Type	Active Cluster Node(s)	Passive Cluster Node(s)	Description
Active <sup>1</sup> /Passive <sup>1</sup>	1	1	The active node(s) processes requests while the passive node waits for the active node to fail.
Active <sup>2</sup> /Passive <sup>1</sup>	2	1	
Active <sup>2</sup> /Passive <sup>2</sup>	2	2	
Active <sup>3</sup> /Passive <sup>1</sup>	3	1	
Active <sup>3</sup> /Passive <sup>2</sup>	3	2	
Active <sup>4</sup> /Passive <sup>1</sup>	4	1	
Active <sup>4</sup> /Passive <sup>2</sup>	4	2	
Active <sup>5</sup> /Passive <sup>1</sup>	5	1	
Active <sup>5</sup> /Passive <sup>2</sup>	5	2	
Active <sup>6</sup> /Passive <sup>1</sup>	6	1	
Active <sup>6</sup> /Passive <sup>2</sup>	6	2	
Active <sup>7</sup> /Passive <sup>1</sup>	7	1	

# Failover Policies

When implementing a failover policy, configure failback if the cluster node lacks the resources (such as memory or processing power) to support cluster node failures.

## Windows Server 2003 Cluster Configurations

Cluster configurations running Windows Server 2003 provide the following failover policies:

- $N$  (number of active nodes) +  $I$  (number of inactive nodes) failover
- Failover pair
- Multiway failover
- Failover ring

Table 4-7 provides an overview of the failover policies implemented with Windows Server 2003. For more information, see the sections that follow this table.

**Table 4-7. Windows Server 2003 Failover Policies**

Failover Policy	Description	Advantage	Disadvantage(s)
$N + I$	One or more nodes provides backup for multiple servers.	Highest resource availability.	<ul style="list-style-type: none"><li>• May not handle more than one backup node failure.</li><li>• May not fully utilize all of the nodes.</li></ul>
Failover pair	Applications can fail over between the two nodes.	Easy to plan the capacity of each node.	Applications on the pair cannot tolerate two node failures.
Multiway	Running applications migrate to multiple nodes in the cluster.	Application load balancing.	Must ensure that the failover nodes have ample resources available to handle the additional workload.
Failover ring	Running applications migrate to the next preassigned node.	Easy to scope node capacity for one server failure.	The next node for failover may not have ample resources to handle the workload.

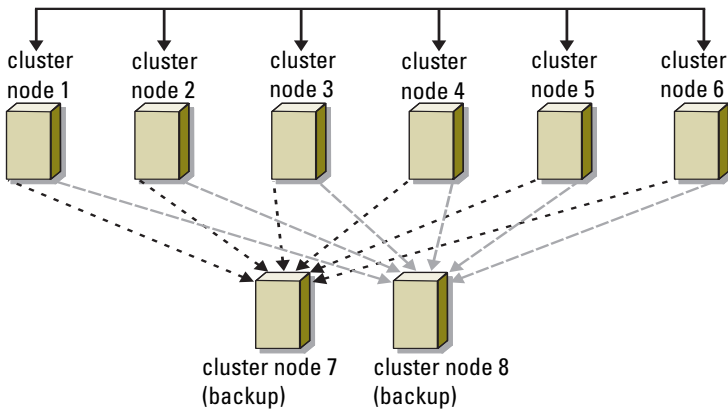


## N + I Failover

N + I failover is an active/passive policy where dedicated passive cluster node(s) provide backup for the active cluster node(s). This solution is best for critical applications that require dedicated resources. However, backup nodes add a higher cost of ownership because they remain idle and do not provide the cluster with additional network resources.

Figure 4-1 shows an example of a 6 + 2 (N + I) failover configuration with six active nodes and two passive nodes. Table 4-8 provides an N + I failover matrix for Figure 4-1.

**Figure 4-1. Example of an N+I Failover Configuration for an Eight-Node Cluster**



**Table 4-8. Example of an N+I Failover Configuration for an Eight-Node Cluster**

Cluster Resource Group	Primary Node	AntiAffinityClassNames Value
A	Node 1	AString
B	Node 2	AString
C	Node 3	AString
D	Node 4	AString
E	Node 5	AString
F	Node 6	AString

## Configuring Group Affinity

On  $N + I$  (active/passive) failover clusters running Windows Server 2003, some resource groups may conflict with other groups if they are running on the same node. For example, running more than one Microsoft Exchange virtual server on the same node may generate application conflicts. Use Windows Server 2003 to assign a public property (or attribute) to a dependency between groups to ensure that they fail over to similar or separate nodes. This property is called *group affinity*.

Group affinity uses the `AntiAffinityClassNames` public property, which ensures that designated resources are running on *separate nodes*, if possible.

For example, in Table 4-8, the `AntiAffinityClassNames` string for cluster resource group A and group B are identical (AString), which indicates that these groups are assigned to run on separate nodes, if possible. If node 1 fails, resource group A will fail over to the next backup node (node 7). If node 2 then fails, because their `AntiAffinityClassNames` string value (AString) identifies group A and group B as conflicting groups, group B will skip node 7 and instead fail over to node 8.

To set the public property for the cluster groups shown in Table 4-8:

- 1 Open a command prompt.
- 2 Type the following:

```
cluster group "A" /prop AntiAffinityClassNames=
"AString"
```

- 3 Repeat step 2 for the remaining cluster groups.

To specify group affinity in your  $N + I$  cluster configuration, use the **Cluster Data Form** in the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).

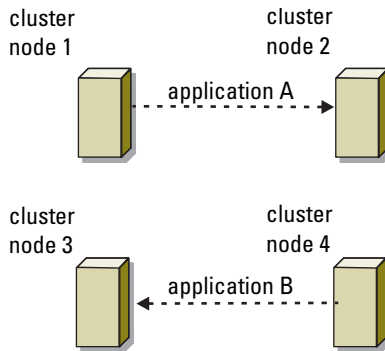
## Failover Pair

Failover pair is a policy in which each application can fail over between two specific nodes in a multinode cluster. The **Possible Owners** list in Cluster Administrator determines which nodes run the failed over applications.

If you have applications that run well on two-node, and you want to migrate these applications to Windows Server 2003, failover pair is a good policy. This solution is easy to plan and administer, and applications that do not run well on the same server can easily be moved into separate failover pairs. However, in a failover pair, applications on the pair cannot tolerate two node failures.

Figure 4-2 shows an example of a failover pair configuration. Table 4-9 provides a failover configuration for the cluster shown in Figure 4-2.

**Figure 4-2. Example of a Failover Pair Configuration**



**Table 4-9. Example of a Failover Pair Configuration for a Four-Node Cluster**

Cluster Resource Group	Possible Owners List
App1	1, 2
App2	3, 4

### Multiway Failover

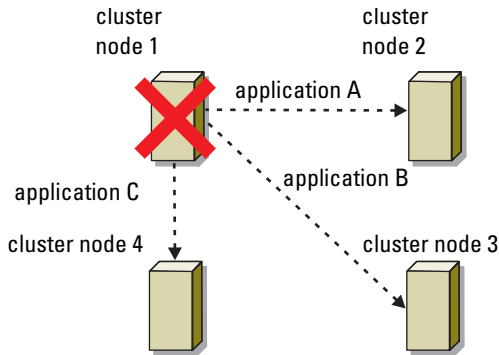
Multiway failover is an active/active policy where running applications from a failed node migrate to multiple nodes in the cluster. This solution provides automatic failover and load-balancing. Ensure that the failover nodes have sufficient resources to handle the workload. Figure 4-3 shows an example of four-node multiway failover configuration.

Table 4-10 shows a four-node multiway failover configuration for the cluster shown in Figure 4-3. For each resource group, the failover order in the **Preferred Owners** list in Cluster Administrator outlines the order that you want that

resource group to fail over. In this example, node 1 owns applications A, B, and C. If node 1 fails, applications A, B, and C fail over to cluster nodes 2, 3, and 4. Configure the applications similarly on nodes 2, 3, and 4.

When implementing multiway failover, configure failback to avoid performance degradation. See "Understanding Your Failover Cluster" on page 37 for more information.

**Figure 4-3. Example of a Four-Node Multiway Failover Configuration**



**Table 4-10. Example of a Four-Node Multiway Failover Configuration**

Application	Failover Order in the Preferred Owners List
A	Node 2
B	Node 3
C	Node 4

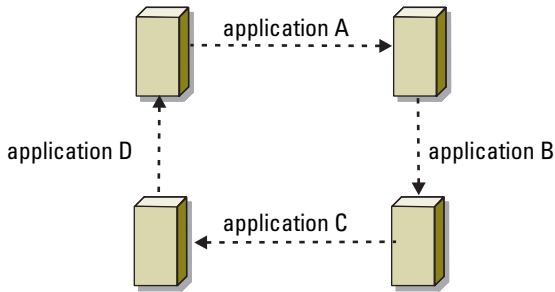
**Failover Ring**

Failover ring is an active/active policy where all running applications migrate from the failed node to the next preassigned node in the Preferred Owners List. If the failing node is the last node in the list, the failed node’s applications fail over to the first node.

While this type of failover provides high availability, ensure that the next node for failover has sufficient resources to handle the additional workload.

Figure 4-4 shows an example of a failover ring configuration.

**Figure 4-4. Example of a Four-Node Failover Ring Configuration**



## Failover and Failback Capabilities

### Failover

When an application or cluster resource fails, MSCS detects the failure and attempts to restart the resource. If the restart fails, MSCS takes the application offline, moves the application and its resources to another node, and restarts the application on the other node.

See "Setting Advanced Resource Properties" for more information.

Cluster resources are placed in a group so that MSCS can move the resources as a combined unit, ensuring that the failover and/or failback procedures transfer all resources.

After failover, Cluster Administrator resets the following recovery policies:

- Application dependencies
- Application restart on the same node
- Workload rebalancing (or failback) when a failed node is repaired and brought back online

### Failback

Failback returns the resources back to their original node. When the system administrator repairs and restarts the failed node, MSCS takes the running application and its resources offline, moves them from the failover cluster node to the original node, and then restarts the application.

You can configure failback to occur immediately, at any given time, or not at all. To minimize the delay until the resources come back online, configure the failback time during off-peak hours.

### **Modifying Your Failover Policy**


Use the following guidelines when you modify your failover policy:

- Define how MSCS detects and responds to group resource failures.
- Establish dependency relationships between the resources to control the order in which the resources are taken offline.
- Specify time-out, failover threshold, and failover period for your cluster resources.  
See "Setting Advanced Resource Properties" for more information.
- Specify a Possible Owner List in Microsoft Cluster Administrator for cluster resources. The Possible Owner List for a resource controls which nodes are allowed to host the resource.


See the Cluster Administrator documentation for more information.

# Maintaining Your Cluster


## Adding a Network Adapter to a Cluster Node

 **NOTE:** To perform this procedure, Microsoft® Windows Server® 2003 (including the latest service packs) and Microsoft Cluster Services (MSCS) must be installed on both nodes.

- 1 Move all resources from the node you are upgrading to another node.  
See the MSCS documentation for information about moving cluster resources to a specific node.
- 2 Shut down the node you are upgrading.
- 3 Install the additional network adapter.  
See the system's *Installation and Troubleshooting Guide* for expansion card installation instructions.
- 4 Turn on the node and allow the Windows® operating system to boot.  
Windows detects the new adapter and installs the appropriate drivers.

 **NOTE:** If Windows *does not* detect the new network adapter, the network adapter is not supported.

- 5 Update the network adapter drivers (if required).
- 6 Configure the network adapter addresses:
  - a Click the **Start** button, select **Control Panel**, and then double-click **Network Connections**.
  - b In the **Connections** box, locate the new adapter that you installed in the system.
  - c Right-click the new adapter and select **Properties**.
  - d Assign a unique static IP address, subnet mask, and gateway.

 **NOTE:** Ensure that the host ID portion of the new network adapter's IP address is different from that of the first network adapter. For example, if the first network adapter in the node had an address of 192.168.1.101 with a subnet mask of 255.255.255.0, for the second network adapter you might assign the IP address 192.168.2.102 and the subnet mask 255.255.255.0.

- 7 Click **OK** and exit the network adapter properties.
- 8 Click the **Start** button and select **Programs**→**Administrative Tools**→**Cluster Administrator**.
- 9 Click the **Network** tab.
- 10 Verify that a new resource labeled "New Cluster Network" appears in the window.  
To rename the new resource, right-click the resource and enter a new name.
- 11 Move all cluster resources back to the original node.
- 12 Repeat step 2 through step 11 on each node.



**NOTE:** For each node, ensure that you assign the IP address on the same subnet as you did on the first node.

If the installation and IP address assignments have been performed correctly, all of the new network adapter resources appear online and respond successfully to ping commands.

## Changing the IP Address of a Cluster Node on the Same IP Subnet



**NOTE:** If you are migrating your nodes to a different subnet, take all cluster resources offline and then migrate all nodes together to the new subnet.

- 1 Open **Cluster Administrator**.
- 2 Stop **MSCS** on the node.  
The Cluster Administrator utility running on the second node indicates that the first node is down by displaying a red icon in the **Cluster Service** window.
- 3 Reassign the IP address.
- 4 If you are running **DNS**, verify that the **DNS** entries are correct (if required).
- 5 Restart **MSCS** on the node.

The nodes re-establish their connection and Cluster Administrator changes the node icon back to blue to show that the node is back online.



## Removing Nodes From Clusters Running Microsoft Windows Server 2003

- 1 Move all resource groups to another cluster node.
- 2 Click the **Start** button, select **Programs**→**Administrative Tools**→**Cluster Administrator**.
- 3 In Cluster Administrator, right-click the icon of the node you want to uninstall and then select **Stop Cluster Service**.
- 4 In Cluster Administrator, right-click the icon of the node you want to uninstall and then select **Evict Node**.

If you cannot evict the node or the node is the last node in the cluster:

- a Open a command prompt.
  - b Type `cluster node <node_name> /force`  
where `<node_name>` is the cluster node you are evicting from the cluster.
- 5 Close Cluster Administrator.

## Running `chkdsk /f` on a Quorum Resource



**NOTE:** You cannot run the `chkdsk` command with the `/f` (fix) option on a device that has an open file handle active. Because MSCS maintains an open file handle on the quorum resource, you cannot run `chkdsk /f` on the hard drive that contains the quorum resource.

- 1 Move the quorum resource temporarily to another drive.
- 2 Right-click the cluster name and select **Properties**.
- 3 Click the **Quorum** tab.
- 4 Select another disk as the quorum resource and press `<Enter>`.
- 5 Run `chkdsk /f` on the drive that previously stored the quorum resource.
- 6 Move the quorum resource back to the original drive.

## Recovering From a Corrupt Quorum Disk

The quorum disk maintains the configuration data necessary for recovery when a node fails. If the quorum disk resource is unable to come online, the cluster does not start and all of the shared drives are unavailable. If this situation occurs and you must run **chkdsk** on the quorum disk, start the cluster manually from the command line.

To start the cluster manually from a command line prompt:

- 1** Open a command line window.
- 2** Select the cluster directory by typing the following:  
`cd \windows\cluster` (for Windows Server 2003)
- 3** Start MSCS in manual mode (on one node only) with no quorum logging by typing the following:  
`Clussvc -debug -noquorumlogging`  
MSCS starts.
- 4** Run **chkdsk /f** on the disk designated as the quorum resource:
  - a** Open a second command line window.
  - b** Type `chkdsk /f`.
- 5** After the **chkdsk** utility completes, stop MSCS by pressing <Ctrl><c> in the first command line window.
- 6** Restart MSCS from the Services console:
  - a** Click the **Start** button and select **Programs**→**Administrative Tools**→**Services**.
  - b** In the **Services** window, right-click **Cluster Service**.
  - c** In the drop-down menu, click **Start**.
  - d** At the command line prompt in either window, type `Net Start Clussvc`.  
The Cluster Service restarts.

See the Microsoft Knowledge Base article 258078 located on the Microsoft support website at [www.microsoft.com](http://www.microsoft.com) for more information on recovering from a corrupt quorum disk.

# Changing the MSCS Account Password in Windows Server 2003

To change the service account password for all nodes running Microsoft Windows Server 2003, type the following at a command line prompt:

```
Cluster /cluster:[cluster_name] /changePASS
```

where *cluster\_name* is the name of your cluster

For help changing the password, type:

```
cluster /changePASS /help
```



**NOTE:** Windows Server 2003, does not accept blank passwords for MSCS accounts.

## Reformatting a Cluster Disk



**NOTICE:** Ensure that all client systems are disconnected from the cluster disk before you perform this procedure.

- 1 Click the **Start** button and select **Programs**→**Administrative Tools**→**Cluster Administrator**.
- 2 In the **Cluster Administrator** left pane, expand the **Groups** directory.
- 3 In the **Groups** directory, right-click the cluster resource group that contains the disk to be reformatted and select **Take Offline**.
- 4 In the **Cluster Administrator** right pane, right-click the physical disk you are reformatting and select **Bring Online**.
- 5 In the **Cluster Administrator** right pane, right-click the physical disk you are reformatting and select **Properties**.  
The **Properties** window appears.
- 6 Click the **Advanced** tab.
- 7 In the "Looks Alive" poll interval box, select **Specify value**.
- 8 In the **Specify value** field, type:  
6000000  
where 6000000 equals 6,000,000 milliseconds (100 minutes)
- 9 Click **Apply**.

- 10** On the Windows desktop, right-click the **My Computer** icon and select **Manage**.  
The **Computer Management** window appears.
- 11** In the **Computer Management** left pane, click **Disk Management**.  
The physical disk information appears in the right pane.
- 12** Right-click the disk you want to reformat and select **Format**.  
**Disk Management** reformats the disk.
- 13** In the **File** menu, select **Exit**.
- 14** In the "Looks Alive" poll interval box, select **Use value from resource type** and click **OK**.
- 15** In the **Cluster Administrator** left pane, right-click the cluster group that contains the reformatted disk and select **Bring Online**.
- 16** In the **File** menu, select **Exit**.

# Upgrading to a Cluster Configuration

## Before You Begin

Before you upgrade your non-clustered system to a cluster solution:

- Back up your data.
- Verify that your hardware and storage systems meet the minimum system requirements for a cluster as described in "System Requirements" section of *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array on the Dell Support website at [support.dell.com](http://support.dell.com).
- Verify that your hardware and storage systems are installed and configured as explained in the following sections:
  - **Cabling Your Cluster Hardware** section of the *Dell Failover Cluster Hardware Installation and Troubleshooting Guide* for the specific storage array
  - "Preparing Your Systems for Clustering"
  - "Installing Your Cluster Management Software"

## Supported Cluster Configurations

Dell certifies and supports only solutions that are configured with the Dell products described in this guide. For more information on the corresponding supported adapters and driver versions, see *Dell Cluster Configuration Support Matrices* located on the Dell High Availability Clustering website at [www.dell.com/ha](http://www.dell.com/ha).

## Completing the Upgrade

After installing the required hardware and network adapter upgrades, set up and cable the system hardware.



**NOTE:** You may need to reconfigure your switch or storage groups so that both nodes in the cluster can access their logical unit numbers (LUNs).

The final phase for upgrading to a cluster solution is to install and configure Windows Server 2003 with MSCS.

# Troubleshooting

This appendix provides troubleshooting information for your cluster configuration.

**Table A-1** describes general cluster problems you may encounter and the probable causes and solutions for each problem.

**Table A-1. General Cluster Troubleshooting**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
The nodes cannot access the storage system, or the cluster software is not functioning with the storage system.	The storage system is not cabled properly to the nodes or the cabling between the storage components is incorrect.	Ensure that the cables are connected properly from the node to the storage system. For more information, see the <i>Dell Failover Cluster Hardware Installation and Troubleshooting Guide</i> for the specific storage array on the Dell Support website at <a href="http://support.dell.com">support.dell.com</a> .
	One of the cables is faulty.	Replace the faulty cable.
	You are using iSCSI storage array, the challenge handshake authentication protocol (CHAP) password entered is wrong.	Enter correct user-name and password for CHAP, if used.

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
	You are using a Dell PowerVault MD3000 or MD3000i storage array and the Host Group or Host-to-Virtual Disk Mappings is not correctly created.	Verify the following: <ul style="list-style-type: none"><li>• Host Group is created and the cluster nodes are added to the Host Group.</li><li>• Host-to-Virtual Disk Mapping is created and the virtual disks are assigned to the Host Group containing the cluster nodes.</li></ul>
	You are using a Dell EMC storage array and Access control is not enabled correctly	Verify the following: <ul style="list-style-type: none"><li>• EMC® Access Logix™ software is enabled on the storage system.</li><li>• All logical unit numbers (LUNs) and hosts are assigned to the proper storage groups.</li></ul>
	You are using a Fibre Channel storage array in a SAN, and one or more zones are not configured correctly.	Verify the following: <ul style="list-style-type: none"><li>• Each zone contains only one initiator (Fibre Channel daughter card).</li><li>• Each zone contains the correct initiator and the correct storage port(s).</li></ul>
	You are using a Fibre Channel storage array and the length of the interface cables exceeds the maximum allowable length.	Ensure that the fibre optic cables do not exceed 300 m (multimode) or 10 km (single mode switch-to-switch connections only)



**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
One of the nodes takes a long time to join the cluster. or	The node-to-node network has failed due to a cabling or hardware failure.	Check the network cabling. Ensure that the node-to-node interconnection and the public network are connected to the correct NICs.
One of the nodes fail to join the cluster.	Long delays in node-to-node communications may be normal.  One or more nodes may have the Internet Connection Firewall enabled, blocking Remote Procedure Call (RPC) communications between the nodes.	Verify that the nodes can communicate with each other by running the <b>ping</b> command from each node to the other node. Try both the host name and IP address when using the <b>ping</b> command.  Configure the Internet Connection Firewall to allow communications that are required by the Microsoft® Cluster Service (MSCS) and the clustered applications or services.  See Microsoft Knowledge Base article KB883398 at the Microsoft Support website at <a href="http://support.microsoft.com">support.microsoft.com</a> for more information.

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
Attempts to connect to a cluster using Cluster Administrator fail.	<p>The Cluster Service has not been started.</p> <p>A cluster has not been formed on the system.</p> <p>The system has just been booted and services are still starting.</p>	<p>Verify that the Cluster Service is running and that a cluster has been formed. Use the Event Viewer and look for the following events logged by the Cluster Service:</p> <p>Microsoft Cluster Service successfully formed a cluster on this node.</p> <p>or</p> <p>Microsoft Cluster Service successfully joined the cluster.</p> <p>If these events do not appear in Event Viewer, see the Microsoft Cluster Service Administrator's Guide for instructions on setting up the cluster on your system and starting the Cluster Service.</p>
	<p>The cluster network name is not responding on the network because the Internet Connection Firewall is enabled on one or more nodes.</p>	<p>Configure the Internet Connection Firewall to allow communications that are required by MSCS and the clustered applications or services.</p> <p>See Microsoft Knowledge Base article KB883398 at the Microsoft Support website at <a href="http://support.microsoft.com">support.microsoft.com</a> for more information.</p>

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
You are prompted to configure one network instead of two during MSCS installation.	The TCP/IP configuration is incorrect.	The node-to-node network and public network must be assigned static IP addresses on different subnets. See "Assigning Static IP Addresses to Cluster Resources and Components" for information about assigning the network IPs.
	The private (point-to-point) network is disconnected.	Ensure that all systems are powered on so that the NICs in the private network are available.
Unable to add a node to the cluster.	The new node cannot access the shared disks. The shared disks are enumerated by the operating system differently on the cluster nodes.	Ensure that the new cluster node can enumerate the cluster disks using Windows Disk Administration. If the disks do not appear in Disk Administration, check the following: <ul style="list-style-type: none"><li>• Check all cable connections</li><li>• For Fibre Channel storage arrays, check all zone configurations</li><li>• Check the Access Control settings on the attached storage systems. Verify that the node in question is a member of the correct Storage Group or Host Group.</li><li>• Use the "Advanced" with "Minimum" option</li></ul>

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
	One or more nodes may have the Internet Connection Firewall enabled, blocking RPC communications between the nodes.	Configure the Internet Connection Firewall to allow communications that are required by the MSCS and the clustered applications or services.  See Microsoft Knowledge Base article KB883398 at the Microsoft Support website at <a href="http://support.microsoft.com">support.microsoft.com</a> for more information.
The disks on the shared cluster storage appear unreadable or uninitialized in Windows Disk Administration	This situation is normal if you stopped the Cluster Service. If you are running Windows Server 2003, this situation is normal if the cluster node does not own the cluster disk.	No action required.

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
Cluster Services may not operate correctly on a cluster running Windows Server 2003 when the Internet Firewall enabled.	The Windows Internet Connection Firewall is enabled, which may conflict with Cluster Services.	<p>Perform the following steps:</p> <ol style="list-style-type: none"><li><b>1</b> On the Windows desktop, right-click <b>My Computer</b> and click <b>Manage</b>.</li><li><b>2</b> In the <b>Computer Management</b> window, double-click <b>Services</b>.</li><li><b>3</b> In the <b>Services</b> window, double-click <b>Cluster Services</b>.</li><li><b>4</b> In the <b>Cluster Services</b> window, click the <b>Recovery</b> tab.</li><li><b>5</b> Click the <b>First Failure</b> drop-down arrow and select <b>Restart the Service</b>.</li><li><b>6</b> Click the <b>Second Failure</b> drop-down arrow and select <b>Restart</b> the service.</li><li><b>7</b> Click <b>OK</b>.</li></ol> <p>For information on how to configure your cluster with the Windows Internet Connection Firewall enabled, see Microsoft Base (KB) articles 258469 and 883398 at the Microsoft Support website at <a href="http://support.microsoft.com">support.microsoft.com</a> and the Microsoft Windows Server 2003 Technet website at <a href="http://www.microsoft.com/technet">www.microsoft.com/technet</a>.</p>

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
Public network clients cannot access the applications or services that are provided by the cluster.	One or more nodes may have the Internet Connection Firewall enabled, blocking RPC communications between the nodes.	Configure the Internet Connection Firewall to allow communications that are required by the MSCS and the clustered applications or services.  See Microsoft Knowledge Base article KB883398 at the Microsoft Support website at <a href="http://support.microsoft.com">support.microsoft.com</a> for more information.
You are using a Dell PowerVault MD3000 or MD3000i storage array and Virtual Disks fail over continuously between the two storage controllers when a storage path fails.	The failback mode for the cluster node(s) is not set properly.	Set the correct failback mode on each cluster node: <ul style="list-style-type: none"><li>• For PowerVault™ MD3000, you must merge the PowerVault MD3000 Stand Alone to <b>Cluster.reg</b> file located in the <code>\utility</code> directory of the Dell PowerVault MD3000 Resource Media into the registry of each node.</li><li>• For PowerVault™ MD3000i, you must merge the PowerVault MD3000i Stand Alone to <b>Cluster.reg</b> file located in the <code>windows\utility</code> directory of the Dell PowerVault MD3000i resource media into the registry of each node.</li></ul>
You are using a Dell PowerVault MD3000 or MD3000i storage array and Virtual Disk Copy operation fails.	The Virtual Disk Copy operation uses the cluster disk as the source disk.	To perform a Virtual Disk Copy operation on the cluster share disk, create a snapshot of the disk, and then perform a Virtual Disk Copy of the snapshot virtual disk.

**Table A-1. General Cluster Troubleshooting (continued)**

<b>Problem</b>	<b>Probable Cause</b>	<b>Corrective Action</b>
<p>You are using a Dell PowerVault MD3000 or MD3000i storage array and one of the following occurs:</p> <ul style="list-style-type: none"><li>• Unable to assign the drive letter to the snapshot virtual disk.</li><li>• Unable to access the snapshot virtual disk.</li><li>• System Error Log displays a warning with event 59 from <b>partmgr</b> stating that the snapshot virtual disk is a redundant path of a cluster disk.</li></ul>	<p>The snapshot virtual disk has been erroneously mapped to the node that does not own the source disk.</p>	<p>Unmap the snapshot virtual disk from the node not owning the source disk, then assign it to the node that owns the source disk. For more information, see "Using Advanced (Premium) PowerVault Modular Disk Storage Manager Features" section of the <i>Dell™ PowerVault™ Storage Arrays With Microsoft® Windows Server® Failover Clusters Hardware Installation and Troubleshooting Guide</i>.</p>
<p>You are using a Dell PowerVault MD3000 or MD3000i storage array in a non-redundant configuration, the Recovery Guru in the Modular Disk Storage Manager Client reports virtual disks not on the preferred controller, and the enclosure status LED is blinking amber.</p>	<p>The NVSRAM for the non-redundant configuration has not been loaded.</p>	<p>For MD3000 storage array, load the correct NVSRAM for the non-redundant configuration.</p>





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