

Novell Cluster Services™

1.7

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ADMINISTRATION GUIDE

February 28, 2005



Novell®

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Novell Cluster Services 1.7 Administration Guide

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About This Guide

This guide describes how to install, upgrade, configure, and manage Novell® Cluster Services™. The guide is intended for cluster administrators and is divided into the following sections:

- ♦ [Chapter 1, “Overview,” on page 9](#)
- ♦ [Chapter 2, “Installation and Setup,” on page 15](#)
- ♦ [Chapter 3, “Managing Novell Cluster Services,” on page 45](#)

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In this documentation, a greater-than symbol (>) is used to separate actions within a step and items in a cross-reference path.

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When a single pathname can be written with a backslash for some platforms or a forward slash for other platforms, the pathname is presented with a backslash. Users of platforms that require a forward slash, such as UNIX* or Linux*, should use forward slashes as required by your software.

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1

Overview

Novell® Cluster Services™ is a server clustering system that ensures high availability and manageability of critical network resources including data (volumes), applications, and services. It is a multinode clustering product for NetWare® that is enabled for Novell eDirectory™ and supports failover, failback, and migration (load balancing) of individually managed cluster resources.

Licenses for two cluster nodes are included with NetWare 6.5. Licenses for additional cluster nodes can be purchased separately.

Product Features

Novell Cluster Services includes several important features to help you ensure and manage the availability of your network resources. These include:

- ◆ Support for shared SCSI, iSCSI or fibre channel storage area networks.
- ◆ Multinode all-active cluster (up to 32 nodes). Any NetWare server in the cluster can restart resources (applications, services, IP addresses, and volumes) from a failed server in the cluster.
- ◆ Single point of administration through the browser-based Novell iManager or Novell Remote Manager, or a Java-based ConsoleOne® cluster configuration and monitoring GUI. Both Novell Remote Manager and iManager also let you remotely manage your cluster.
- ◆ The ability to tailor a cluster to the specific applications and hardware infrastructure that fit your organization.
- ◆ Dynamic assignment and reassignment of server storage on an as-needed basis.
- ◆ The ability to automatically notify administrators through e-mail of cluster events and cluster state changes.

Product Benefits

Novell Cluster Services allows you to configure up to 32 NetWare servers into a high-availability cluster, where resources can be dynamically switched or moved to any server in the cluster. Resources can be configured to automatically switch or be moved in the event of a server failure, or can be moved manually to troubleshoot hardware or balance the workload.

Novell Cluster Services provides high availability from commodity components. Lower costs are obtained through the consolidation of applications and operations onto a cluster. The ability to manage a cluster from a single point of control and to adjust resources to meet changing workload requirements (thus, manually “load balance” the cluster) are also important benefits of Novell Cluster Services.

An equally important benefit of implementing Novell Cluster Services is that you can reduce unplanned service outages and reduce planned outages for software and hardware maintenance and upgrades.

Reasons you would want to implement Novell Cluster Services include:

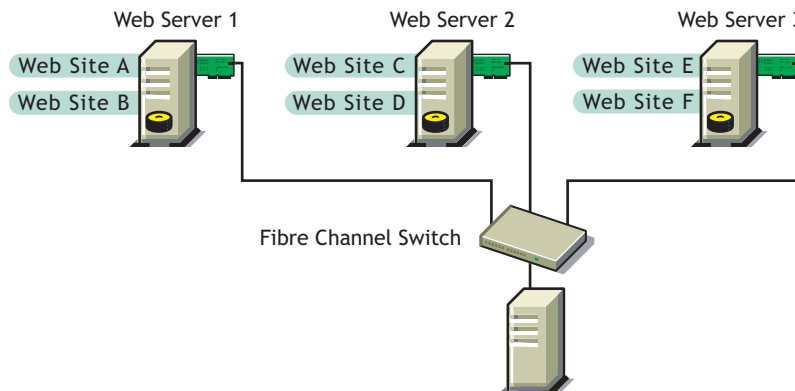
- ◆ Increased availability
- ◆ Improved performance
- ◆ Low cost of operation
- ◆ Scalability
- ◆ Disaster recovery
- ◆ Data protection
- ◆ Server Consolidation
- ◆ Storage Consolidation

Shared disk fault tolerance can be obtained by implementing RAID on the shared disk subsystem.

An example of the benefits Novell Cluster Services provides can be better understood through the following scenario.

Suppose you have configured a three-server cluster, with a Web server installed on each of the three servers in the cluster. Each of the servers in the cluster hosts two Web sites. All the data, graphics, and Web page content for each Web site is stored on a shared disk subsystem connected to each of the servers in the cluster. The following figure depicts how this setup might look.

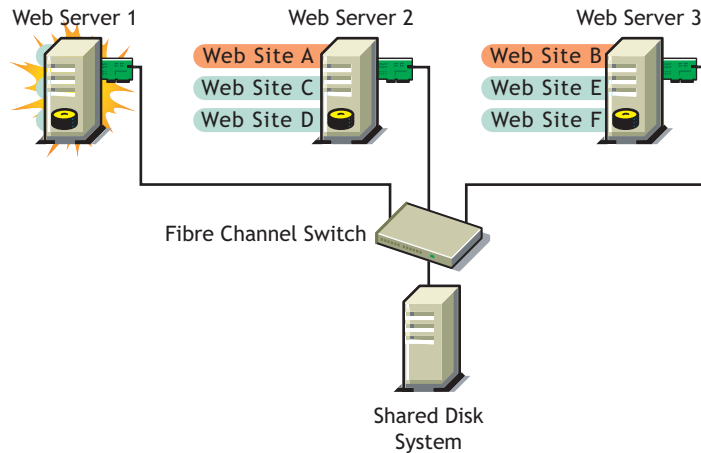
Figure 1 Three-Server Cluster



During normal cluster operation, each server is in constant communication with the other servers in the cluster and performs periodic polling of all registered resources to detect failure.

Suppose Web Server 1 experiences hardware or software problems and the users depending on Web Server 1 for Internet access, e-mail, and information lose their connections. The following figure shows how resources are moved when Web Server 1 fails.

Figure 2 Three-Server Cluster after One Server Fails



Web Site A moves to Web Server 2 and Web Site B moves to Web Server 3. IP addresses and certificates also move to Web Server 2 and Web Server 3.

When you configured the cluster, you decided where the Web sites hosted on each Web server would go should a failure occur. In the previous example, you configured Web Site A to move to Web Server 2 and Web Site B to move to Web Server 3. This way, the workload once handled by Web Server 1 is evenly distributed.

When Web Server 1 failed, Novell Cluster Services software

- ◆ Detected a failure.
- ◆ Remounted the shared data volumes (that were formerly mounted on Web server 1) on Web Server 2 and Web Server 3 as specified.
- ◆ Restarted applications (that were running on Web Server 1) on Web Server 2 and Web Server 3 as specified.
- ◆ Transferred IP addresses to Web Server 2 and Web Server 3 as specified.

In this example, the failover process happened quickly and users regained access to Web site information within seconds, and in most cases, without having to log in again.

Now suppose the problems with Web Server 1 are resolved, and Web Server 1 is returned to a normal operating state. Web Site A and Web Site B will automatically fail back, or be moved back to Web Server 1, and Web Server operation will return back to the way it was before Web Server 1 failed.

Novell Cluster Services also provides resource migration capabilities. You can move applications, Web sites, etc. to other servers in your cluster without waiting for a server to fail.

For example, you could have manually moved Web Site A or Web Site B from Web Server 1 to either of the other servers in the cluster. You might want to do this to upgrade or perform scheduled maintenance on Web Server 1, or just to increase performance or accessibility of the Web sites.

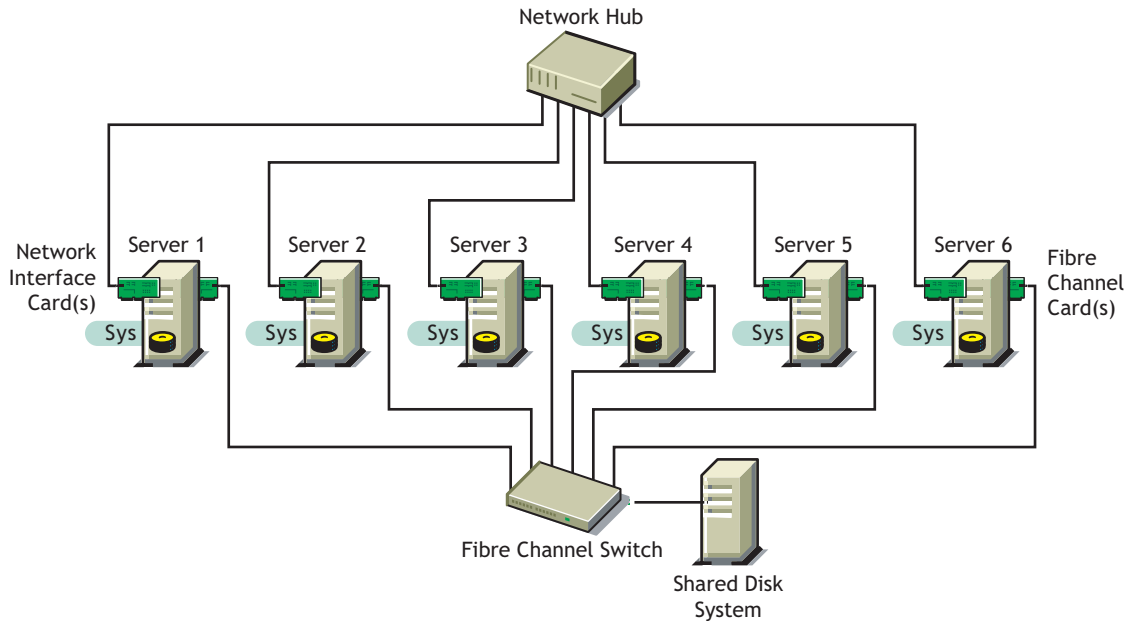
Cluster Configuration

Typical cluster configurations normally include a shared disk subsystem connected to all servers in the cluster. The shared disk subsystem can be connected via high-speed fibre channel cards, cables, and switches, or be configured to use shared SCSI or iSCSI. If a server fails, another

designated server in the cluster automatically mounts the shared disk volumes previously mounted on the failed server. This gives network users continuous access to the volumes on the shared disk subsystem.

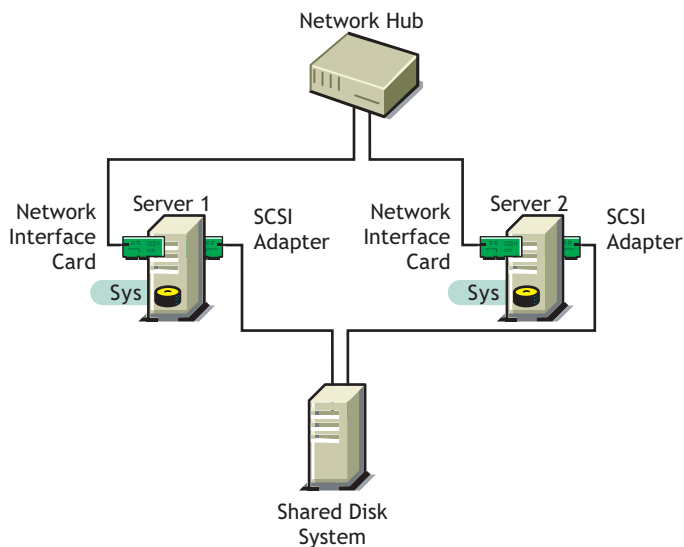
Typical resources might include data (volumes), applications, and services. The following figure shows how a typical fibre channel cluster configuration might look.

Figure 3 Typical Fibre Channel Cluster Configuration



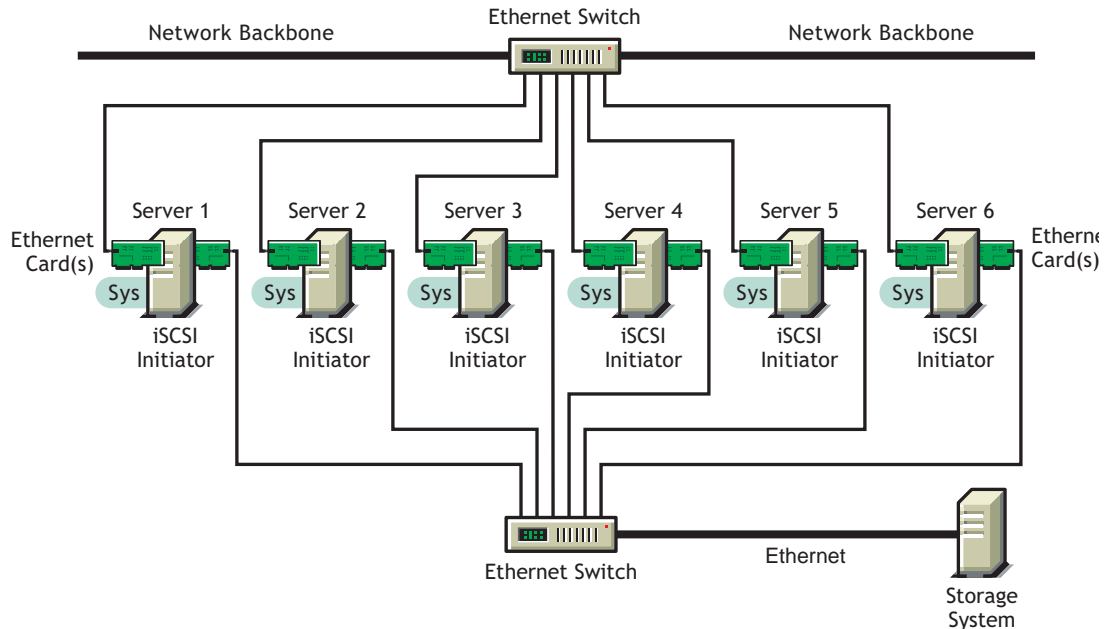
Although fibre channel provides the best performance, you can also configure your cluster to use shared SCSI or iSCSI. The following figure shows how a typical shared SCSI cluster configuration might look.

Figure 4 Typical Shared SCSI Cluster Configuration



iSCSI software is included with NetWare 6.5. The following figure shows how a typical iSCSI cluster configuration might look.

Figure 5 Typical iSCSI Cluster Configuration



Cluster Components

The following components make up a Novell Cluster Services cluster:

- ♦ From 2 to 32 NetWare servers configured to use IP, each containing at least one local disk device (used for a local SYS: volume).
- ♦ Novell Cluster Services software running on each NetWare server in the cluster.
- ♦ A shared disk subsystem connected to all servers in the cluster (optional, but recommended for most configurations).
- ♦ High-speed fibre channel cards, cables, and switch or SCSI cards and cables used to connect the servers to the shared disk subsystem.

2 Installation and Setup

This section contains information to help you install, set up, and configure Novell® Cluster Services™ for your specific needs.

Hardware Requirements

The following list specifies hardware requirements for installing Novell® Cluster Services™. These requirements represent the minimum hardware configuration. Additional hardware might be necessary depending on how you intend to use Novell Cluster Services.

- A minimum of two NetWare® servers
- At least 512 MB of memory on all servers in the cluster.
- One non shared volume for the SYS: volume for each server

Software Requirements

You must have NetWare 6.5 running on each cluster server. Ensure that the following requirements are met:

- All servers in the cluster are configured with the IP protocol and on the same IP subnet
- An additional IP address for the cluster and each cluster resource and cluster-enabled volume
- All servers in the cluster are in the same Novell eDirectory™ tree
- All servers in the cluster are configured to use the NSS file system
NSS is the only file system supported for Novell Cluster Services.

Shared Disk System Requirements

A shared disk system (Storage Area Network or SAN) is required for each cluster if you want data to be highly available. If a shared disk subsystem is used, ensure the following:

- At least 15 MB of free disk space on the shared disk system for creating a special cluster partition

The Novell Cluster Services installation automatically allocates one cylinder on one drive of the shared disk system for the special cluster partition. Depending on the location of the cylinder, the actual amount of space used by the cluster partition may be less than 15 MB.

- The shared disk system is properly set up and functional according to the manufacturer's instructions

Prior to installation, verify that all the drives in your shared disk system are recognized by NetWare by running the LIST DEVICES command on each server you intend to add to your cluster. If any of the drives in the shared disk system do not show up in the list, consult your NetWare documentation or the shared disk system documentation for troubleshooting information.

- ❑ The disks contained in the shared disk system are configured to use mirroring or RAID to add fault tolerance to the shared disk system

Rules for Operating a Novell Cluster Services SAN

When you create a Novell Cluster Services system that utilizes shared storage space (a Storage Area Network or SAN), it is important to remember that all servers attached to the shared device, whether in the cluster or not, have access to all of the volumes on the shared storage space unless you specifically prevent such access. Novell Cluster Services arbitrates access to shared volumes for all cluster nodes, but cannot protect shared volumes from being corrupted by noncluster servers.

When working with shared storage, do not attach a noncluster server to the same shared storage device as a cluster unless you have isolated the storage so that the noncluster server has access only to its own volumes. Failure to do so will result in data corruption or volume loss.

Installing Novell Cluster Services

It is necessary to run the Novell Cluster Services installation program when you

- ◆ Create a new cluster
- ◆ Add new nodes to an existing cluster
- ◆ Upgrade cluster software on servers being upgraded from NetWare 5.1 to NetWare 6.5

If you are running the Novell Cluster Services installation program to create a new cluster, the program automatically

- ◆ Creates a new Cluster object in eDirectory
- ◆ Installs Novell Cluster Services software on the servers you specify to be part of your cluster

After running the Novell Cluster Services installation the first time to create a new cluster, you will need to run the Novell Cluster Services installation again each time you want to add new servers to your cluster or upgrade Novell Cluster Services software on cluster servers being upgraded from NetWare 5.1 to NetWare 6.5.

Prior to running nwdeploy.exe to install Novell Cluster Services, you must have a client connection established from the workstation running the Novell Deployment Manager to each server where Novell Cluster Services will be installed or upgraded.

The easiest way to do this is to use Windows Explorer to browse the eDirectory tree to the sys: volume of each server in your cluster to be upgraded or installed. Opening the sys: volume folder on a server automatically creates a connection to that server.

Novell Cluster Services Licensing

Novell Cluster Services requires a Cluster Server License for each server that is part of the cluster. The Cluster Server License allows a server to join a cluster. Cluster Server License objects are created in the same eDirectory context as the Cluster object.

Cluster Server Licenses for a two-node cluster are automatically added during the Novell Cluster Services installation. You only need additional Cluster Server Licenses if you have a three-node or larger cluster. Additional Cluster Server Licenses can be obtained from Novell or from your Novell Authorized ResellerSM

Previous versions of Cluster Services required a Cluster User Access License (CUAL). NetWare 6.5 now uses User Access Licensing, which eliminates the need for a CUAL.

Running the Installation Program

To install Novell Cluster Services, insert the *NetWare 6.5 Operating System CD* in a NetWare client workstation and run `nwdeploy.exe` from the root of the CD to launch the NetWare Deployment Manager, then complete the following steps:

- 1** In the NetWare Deployment Manager, open the Post-Install Tasks folder, click Install/Upgrade Cluster, and then click Install or Upgrade a Cluster.
- 2** Continue through the installation screens until you get to the screen that prompts you to create a new cluster, add new nodes to an existing cluster, or upgrade software in an existing cluster.
- 3** Click Create a New Cluster, Add New Nodes to Existing Cluster, or Upgrade Software in Existing Cluster, and then click Next.

The Skip File Copy check box is checked by default and prevents Novell Cluster Services files from being copied during the installation. The NetWare 6.5 installation program automatically copies all Novell Cluster Services files to every NetWare 6.5 server. If you want to refresh Novell Cluster Services files on cluster servers you should uncheck the Skip File Copy check box. Even though Novell Cluster Services files already exist on each NetWare 6.5 server, you still need to run the Novell Cluster Services installation program to configure and set up cluster nodes.

Leaving the Skip File Copy check box unchecked will cause existing Novell Cluster Services files to be copied over, but will not otherwise affect the installation.

- 4** Do one of the following:
 - ◆ (If creating) Enter the name for the new Cluster object you are creating and specify the Directory tree and context where you want it created. Then click Next and continue with [Step 5 on page 18](#).
 - ◆ (If adding new nodes) Specify the eDirectory tree, context, and name of the cluster you will add servers to. If you don't know a cluster name or its context, browse and select one. Then click Next and continue with [Step 5 on page 18](#).
 - ◆ (If upgrading software) Specify the Directory tree, context, and name of the cluster where software will be upgraded. Then click Next and go to [Step 6 on page 18](#).

NOTE: When running the Cluster Services installation, you occasionally might be unable to see the Novell eDirectory tree you want to install into from the installation browser. If this happens, enter the name of the tree in the browser address (URL) field: `treename/cluster.context`.

- 5 Enter the name of the server you want to add to the cluster, or browse and select one from the list, and then click Add to Cluster. Repeat this step for every server you want to add to the cluster. Then click Next.

You can also remove servers you just added to the cluster by selecting them from the NetWare Servers in Cluster list and clicking Remove.

When you add a server to a cluster, Novell Cluster Services automatically detects the server's IP address. If the server you are adding has more than one IP address, you will be prompted to select the IP address you want Novell Cluster Services to use.

- 6 Enter a unique IP address for the cluster.

The cluster IP address is separate from the server IP address and is required for certain external network management programs to get cluster status alerts. The cluster IP address provides a single point of cluster access for Novell Remote Manager. A Master IP Address resource is created automatically during the Cluster Services installation that makes this possible.

The cluster IP address will be bound to the master node and will remain with the master node regardless of which server is the master node.

- 7 (Conditional) If you are creating a new cluster, specify whether your cluster has a shared disk system and, if so, select the drive where you want the small cluster partition created. Then click Next.

Novell Cluster Services requires a small cluster partition on the shared disk system. You are also given the option of mirroring the partition for greater fault tolerance.

IMPORTANT: You must have at least 10 MB of free space that is not part of an NSS partition on one of the shared disk drives to create the cluster partition. If no free space is available, the shared disk drives can't be used by Novell Cluster Services.

If you previously installed Novell Cluster Services and created a cluster with the same name, the installation program will detect that a cluster partition has already been created and this screen will not appear.

- 8 Choose whether or not you want the servers you are upgrading or adding to your cluster to start Novell Cluster Services software after the installation. Then click Next.

If you choose to not start Novell Cluster Services software on each server that you upgrade or add to your cluster, you will need to manually start it after the installation or you will need to reboot cluster servers to automatically start it.

You can manually start Novell Cluster Services by running LDNCS at the server console on each cluster server.

If you are installing or upgrading a two-node cluster or not adding additional nodes to a two-node cluster, continue with [Step 10](#).

- 9 (Conditional) Specify the location of the Cluster Server License files or browse and select a path, then click Add.

Since licenses for a two-node cluster are included with NetWare 6.5, this screen only appears if you are installing or upgrading a three-node or larger cluster.

You are given the option of installing without licenses. If you choose to install without licenses and you have a cluster with more than two nodes, you will need to manually install the licenses at a later date using iManager. If you install licenses at a later date, after installing the licenses you must reboot each cluster server that you have added a license to. This will ensure that cluster licensing functions properly. Novell Cluster Services will not function without the proper licenses in place.

10 Continue through the final installation screen.

- ◆ If you are creating a new cluster, the installation program will create a new Cluster object in eDirectory and install Novell Cluster Services software on the servers you specified to be part of your cluster.
- ◆ If you are adding new nodes to an existing cluster, the installation program will install Novell Cluster Services software on the servers you are adding to your cluster.
- ◆ If you are upgrading Novell Cluster Services software on an existing cluster, the installation program will upgrade cluster software on all servers in the cluster.

Upgrading Novell Cluster Services

This section covers three upgrade scenarios:

- ◆ [“Upgrading Novell Cluster Services from NetWare 5.1 to NetWare 6.5” on page 19](#)
- ◆ [“Upgrading Novell Cluster Services from NetWare 6 to NetWare 6.5” on page 20](#)
- ◆ [“Performing a Rolling Cluster Upgrade from NetWare 6 to NetWare 6.5” on page 21](#)

Upgrading Novell Cluster Services from NetWare 5.1 to NetWare 6.5

To upgrade NetWare 5.1 servers running Cluster Services to NetWare 6.5 servers running Cluster Services, you need to

1. Run the Prepare Cluster for Upgrade program in the NetWare Deployment Manager on your NetWare 5.1 cluster servers.
2. Upgrade your NetWare 5.1 servers to NetWare 6.5.
3. Upgrade Cluster Services software on each server.
4. Complete the cluster upgrade for each server by using the Cluster State View option in ConsoleOne.

Preparing Cluster Servers for an Upgrade

If you are upgrading Novell Cluster Services from NetWare 5.1 to NetWare 6.5 and your cluster has shared storage, you must prepare your cluster servers before upgrading them to NetWare 6.5 and before upgrading Novell Cluster Services. This preparation is necessary to ensure existing shared-volume trustee assignments can be used after the upgrade.

NOTE: This is not necessary if you are upgrading from NetWare 6 to NetWare 6.5.

To prepare cluster servers for an upgrade, from a NetWare client run `nwdeploy.exe` from the root of the *NetWare 6.5 Operating System* CD to launch the NetWare Deployment Manager, and then complete the following steps:

- 1** In the NetWare Deployment Manager, open the Network Preparation Folder and then click Prepare Cluster for Upgrade>Prepare a Cluster.
- 2** Continue through the screens until you get to the screen that prompts you to select an existing cluster to prepare for upgrade.
- 3** Specify the cluster name, eDirectory tree, and context for the cluster you are preparing for upgrade.

- 4 Choose whether you want the servers you are going to upgrade to go down after completing the preparation for upgrading cluster servers, then click Next to run the program for preparing cluster servers for upgrade.

Bringing down all cluster servers before an upgrade ensures NSS volumes on shared storage (your SAN) are deactivated prior to upgrading to NetWare 6.5.

After you have completed the process for preparing cluster servers for an upgrade, continue with [“Upgrading NetWare 5.1 Servers to NetWare 6.5” on page 20](#).

Upgrading NetWare 5.1 Servers to NetWare 6.5

To upgrade your NetWare 5.1 servers to NetWare 6.5, follow the instructions in [“Upgrading to OES NetWare”](#) in the *NetWare 6.5 Overview and Installation Guide*.

After upgrading your servers to NetWare 6.5 and rebooting them, continue with [“Upgrading Novell Cluster Services Software” on page 20](#).

Upgrading Novell Cluster Services Software

The same installation program used to install Novell Cluster Services software is also used to upgrade it. To upgrade Novell Cluster Services software, follow the instructions in [“Running the Installation Program” on page 17](#).

After upgrading cluster software, continue with [“Completing Cluster Upgrade” on page 20](#).

Completing Cluster Upgrade

Complete the cluster upgrade by using the Cluster View option in ConsoleOne. This automatically edits cluster load and unload scripts to remove upgrade-specific commands that were added during the cluster upgrade. It also automatically renames NSS Pool objects that were created during the upgrade and modifies them to reference virtual server objects instead of physical server objects.

- 1 Start ConsoleOne and authenticate to the eDirectory tree where the Cluster object resides.
- 2 Browse and select the Cluster object for the cluster you just upgraded.
- 3 Go to the Cluster State View by clicking View > Cluster State from the menu at the top of the screen.

The cluster upgrade process will automatically complete when you open the Cluster State View.

Upgrading Novell Cluster Services from NetWare 6 to NetWare 6.5

To upgrade NetWare 6 servers running Cluster Services to NetWare 6.5 servers running Cluster Services you need to

1. Install NetWare 6.5 Cluster Server Licenses on your NetWare 6 cluster servers using iManage prior to upgrading them to NetWare 6.5.

Since licenses for a two-node cluster are included with NetWare 6 and with NetWare 6.5, this is only necessary if you are upgrading a three-node or larger cluster. Additional Cluster Server Licenses can be obtained from Novell or from your Novell Authorized Reseller.

2. Upgrade your NetWare 6 servers to NetWare 6.5. To do this, follow the instructions in [“Upgrading to OES NetWare”](#) in the *NetWare 6.5 Overview and Installation Guide*.

The latest Cluster Services files are automatically copied to each server during the server upgrade process. When each server reboots after being upgraded, new Cluster Services software will automatically load.

Performing a Rolling Cluster Upgrade from NetWare 6 to NetWare 6.5

Performing a rolling upgrade from NetWare 6 to NetWare 6.5 lets you keep your cluster up and running and lets your users continue to access the network while the upgrade is being performed.

During a rolling cluster upgrade, one server is upgraded to NetWare 6.5 while the other servers in the cluster continue running NetWare 6. Then another server is upgraded to NetWare 6.5, and then another, until all servers in the cluster have been upgraded to NetWare 6.5.

When the last server in the cluster has been upgraded (all the servers in the cluster are running NetWare 6.5) each cluster-enabled pool resource (or any resource on shared storage) is temporarily put into a new resource state called upgrade, and the following process occurs automatically:

1. All cluster resources on shared pools are temporarily brought offline.
2. Media Manager software is called to upgrade disk media on one server. Disk media is then refreshed on all remaining servers in the cluster.
3. All cluster resources on shared storage are moved back to their original nodes.
4. The load scripts for each cluster resource run and each cluster resource is brought online.

The amount of time users lose access to cluster resources is minimal because the process described above happens very quickly.

To perform a rolling cluster upgrade from NetWare 6 to NetWare 6.5

- 1** Install NetWare 6.5 Cluster Server Licenses on your NetWare 6 cluster servers using iManager prior to upgrading them to NetWare 6.5.

Since licenses for a two-node cluster are included with NetWare 6 and with NetWare 6.5, this is only necessary if you are upgrading a three-node or larger cluster. Additional Cluster Server Licenses can be obtained from Novell or from your Novell Authorized Reseller.

- 2** Upgrade one NetWare 6 server in the cluster to NetWare 6.5 by following the instructions in [“Upgrading to OES NetWare”](#) in the *NetWare 6.5 Overview and Installation Guide*.

The latest Cluster Services files are automatically copied to the server during the upgrade process. When the server reboots after being upgraded, new Cluster Services software will automatically load.

Cluster pools, volumes, and resources fail over from the server being upgraded to other servers in the cluster. After a cluster server is upgraded and brought back online, the pools, volumes, and resources that failed over to other servers during the upgrade process fail back to the upgraded server.

- 3** Upgrade another server in the cluster to NetWare 6.5, and continue this process until all servers in the cluster have been upgraded to NetWare 6.5

After a cluster server has been upgraded, you do not have to immediately upgrade another cluster server. The rolling upgrade process allows both NetWare 6 and NetWare 6.5 cluster servers to coexist in the same cluster.

Setting Up Novell Cluster Services

If you created a new cluster, you now need to create and configure cluster resources. You might also need to create shared disk partitions if they do not already exist and, if necessary, configure all shared disk system pools and volumes to work with Novell Cluster Services. You might also need to cluster enable the shared disk system pools and volumes.

You can use either the server-based NSS Management Utility (NSSMU), iManager, or Novell Remote Manager to create shared disk partitions, NSS pools, and volumes.

Create Shared Disk Partitions

Before creating disk partitions on shared storage (storage area network or SAN), Novell Cluster Services must be installed. You should carefully plan how you want to configure your shared storage prior to installing Novell Cluster Services.

Using NSSMU

- 1 Start NSSMU by entering **NSSMU** at the server console of a cluster server.
- 2 Select Partitions from the NSSMU main menu.
- 3 Press the Insert key and select the device on your shared storage system where you want to create a partition.

If a device is marked as sharable for clustering, all partitions on that device will automatically be sharable.

Device names are not changeable and might be labeled something like 0x2 or 0x1.

If Cluster Services was previously installed and shared disk partitions were already created, the Partitions List will include this information.

- 4 Select NSS as the partition type, then specify the partition size and, if desired, an NSS pool name and label.

If you specify a pool name, a pool by that name will automatically be created on the partition. If no pool name is specified, you will have to create a pool on the partition later.

- 5 If you chose to create a pool in Step 4, go to [Step 3 on page 24](#). If you chose not to create a pool in Step 4 go to [“Create NSS Pools” on page 24](#).

Using iManager

- 1 Start your browser and enter the URL for iManager.

The URL is `http://server_ip_address/nps/imanager.html`. Replace *server_ip_address* with the IP address or DNS name of a NetWare 6.5 server in the cluster or the IP address for Apache-based services.

- 2 Enter your username and password.
- 3 In the left column, locate Storage, then click the Pools link.
- 4 Enter a cluster server name or browse and select one, then click the New link.
- 5 Specify the new pool name, then click Next.
- 6 Check the box next to the device where you want to create the pool, then specify the size of the pool.

Because only one pool exists in each partition, the pool size you specify will be the size of the partition that is created.

- 7** Choose whether you want the pool to be activated and cluster-enabled when it is created, then click Next.

The Activate On Creation check box is used to determine if the pool you are creating is to be activated as soon as it is created. The Activate On Creation check box is checked by default. If you uncheck the check box, you must manually activate the pool later before it can be used.

If you want to cluster-enable the pool at the same time it is created, leave the Cluster Enable on Creation check box checked and continue with [Step 8 on page 23](#).

If you want to cluster-enable the pool at a later date, uncheck the check box, click Create, and continue with [“Cluster Enable Pools and Volumes” on page 27](#).

- 8** Specify the Virtual Server Name, Pool IP Address, Advertising Protocols and, if necessary, the CIFS Server Name, then click Finish.

When you cluster-enable a pool, a virtual Server object is automatically created and given the name of the Cluster object plus the cluster-enabled pool. For example, if the cluster name is cluster1 and the cluster-enabled pool name is pool1, then the default virtual server name will be cluster1_pool1_server. You can edit the field to change the default virtual server name.

Each cluster-enabled NSS pool requires its own IP address. The IP address is used to provide access and failover capability to the cluster-enabled pool (virtual server). The IP address you assign to the pool remains assigned to the pool regardless of which server in the cluster is accessing the pool.

You can select one or all of the advertising protocols. NCP™ is the protocol used by Novell clients, CIFS is the protocol used by Microsoft* clients, and AFP is the protocol used by Macintosh* clients. Selecting any of the protocols will cause lines to be added to the pool resource load and unload scripts to activate the selected protocols on the cluster. This lets you ensure that the cluster-enabled pool you just created is highly available to all your clients.

If you check the CIFS check box, the Server Name field will become active. The CIFS server name is the server name CIFS clients see when they browse the network. A default server name is listed, but you can change the server name by editing the text in the field.

Using Novell Remote Manager

In Novell Remote Manager, the process for creating a shared disk partition is also used to create an NSS pool, and volume. Novell Remote Manager will create the partition, NSS pool, and volume and, if desired, it will also cluster enable the NSS pool all at the same time.

- 1** In the left column under the Manage Server section, click Partition Disks.

A screen appears displaying a list of devices that are currently accessible to servers in the cluster. For each device, the list displays the partitions, NSS pools, volumes, and free space on that device.
- 2** Find the device that corresponds to your shared storage system and click Create on the free space where you want to create the partition.
- 3** Select Novell Storage Services as the partition type and click Create a New Pool and Volume.
- 4** Specify the pool size and name, the volume name, and volume attributes.

Because only one pool exists in each partition, the pool size you specify will be the size of the partition that gets created. The volume that is created will be allowed to grow to the pool size.
- 5** Choose whether you want the pool to be cluster enabled when it is created.

The default is to cluster enable the pool at the time it is created. If you want to cluster enable the pool at the same time it is created, leave the Cluster Enable Pool check box checked and continue with [Step 6 on page 24](#).

If you want to cluster enable the pool at a later date, uncheck the check box, click Create, and continue with [“Cluster Enable Pools and Volumes” on page 27](#).

- 6 Specify the Virtual Server Name, Pool IP Address, Advertising Protocols and, if necessary, the CIFS Server Name and whether you want the pool to be activated upon creation.

When you cluster enable a pool, a virtual Server object is automatically created and given the name of the Cluster object plus the cluster-enabled pool. For example, if the cluster name is cluster1 and the cluster-enabled pool name is pool1, then the default virtual server name will be cluster1_pool1_server. You can edit the field to change the default virtual server name.

Each cluster-enabled NSS pool requires its own IP address. The IP address is used to provide access and failover capability to the cluster enabled-pool (virtual server). The IP address you assign to the pool remains assigned to the pool regardless of which server in the cluster is accessing the pool.

You can select one or all of the advertising protocols. NCP is the protocol used by Novell clients, CIFS is the protocol used by Microsoft clients, and AFP is the protocol used by Macintosh clients. Selecting any of the protocols will cause lines to be added to the pool resource load and unload scripts to activate the selected protocols on the cluster. This lets you ensure that the cluster-enabled pool you just created is highly available to all your clients.

If you check the CIFS check box, the CIFS Server Name field will become active. The CIFS server name is the server name CIFS clients see when they browse the network. A default server name is listed, but you can change the server name by editing the text in the field.

The Auto Pool Activate check box is used to determine if the pool you are creating is to be activated as soon as it is created. The Auto Pool Activate check box is checked by default. If you uncheck the check box, you will have to manually activate the pool later before it can be used.

- 7 Click Create to create the partition, NSS pool, and volume and to cluster enable the NSS pool.

Create NSS Pools

The Storage Pools feature in NSS gives you more flexibility in planning and configuring your storage to work with Novell Cluster Services. More than one cluster-enabled volume can be part of a single cluster resource, and volumes can dynamically grow as needed to take advantage of free disk space.

Only one NSS pool can be created on a partition. Storage pools can be cluster enabled at the same time they are created or they can be cluster enabled at a later time after they are created. To learn more about NSS pools, see [“Managing NSS Pools”](#) in the *Novell Storage Services Administration Guide*.

Using NSSMU

- 1 From the NSSMU main menu, select Pools, press Insert, and then type a name for the new pool you want to create.
- 2 Select the partition on your shared storage where you want the pool created.
- 3 Choose whether you want the pool to be activated and cluster enabled when it is created.

The Activate on Creation feature is enabled by default. This causes the pool to be activated as soon as it is created. If you choose not to activate the pool, you will have to manually activate it later before it can be used.

The Cluster Enable on Creation feature is also enabled by default. If you want to cluster enable the pool at the same time it is created, accept the default entry (Yes) and continue with [Step 4](#). If you want to cluster enable the pool at a later date, change the default entry from Yes to No, select Create, then go to [“Create Cluster Volumes” on page 25](#).

- 4 Specify the Virtual Server Name, IP Address, Advertising Protocols and, if necessary, the CIFS Server Name.

When you cluster enable a pool, a virtual Server object is automatically created and given the name of the Cluster object plus the cluster-enabled pool. For example, if the cluster name is cluster1 and the cluster-enabled pool name is pool1, then the default virtual server name will be cluster1_pool1_server. You can edit the field to change the default virtual server name.

Each cluster-enabled NSS pool requires its own IP address. The IP address is used to provide access and failover capability to the cluster-enabled pool (virtual server). The IP address you assign to the pool remains assigned to the pool regardless of which server in the cluster is accessing the pool.

You can select one or all of the advertising protocols. NCP is the protocol used by Novell clients, CIFS is the protocol used by Microsoft clients, and AFP is the protocol used by Macintosh clients. Selecting any of the protocols will cause lines to be added to the pool resource load and unload scripts to activate the selected protocols on the cluster. This lets you ensure that the cluster-enabled pool you just created is highly available to all your clients.

If you select CIFS as one of the protocols, a CIFS Server Name is also required. This is the server name CIFS clients see when they browse the network. A default server name is listed, but you can change the server name by editing the text in the field.

- 5 Select Create to create and cluster enable the pool.

Repeat the above steps for each additional pool you want to create on shared storage.

Continue with [“Create Cluster Volumes” on page 25](#).

Using iManager

The same procedure for creating shared disk partitions using iManager is used to create NSS pools. To create an NSS pool on shared storage using iManager go to [Step 1 on page 22](#).

Using Novell Remote Manager

The same procedure for creating shared disk partitions using Novell Remote Manager is used to create NSS pools. To create an NSS pool on shared storage using Novell Remote Manager go to [Step 1 on page 23](#).

Create Cluster Volumes

If you plan on using a shared disk system in your cluster and need to create new NetWare pools or volumes after installing Novell Cluster Services, the server used to create the volumes should already have NSS installed and running. NSS is the default file system for NetWare 6.5.

Using NSSMU

- 1 From the NSSMU main menu select Volumes, press Insert, then type a name for the new volume you want to create.

Each shared volume in the cluster must have a unique name.

- 2** Select the pool where you want the volume to reside.
- 3** Review and change volume attributes as necessary.

You might want to enable the Flush Files Immediately feature. This will help ensure the integrity of volume data. Enabling the Flush Files Immediately feature improves file system reliability but hampers performance. You should consider this option only if necessary.

- 4** Either specify a quota for the volume or accept the default of 0 to allow the volume to grow to the pool size, then select Create.

The quota is the maximum possible size of the volume. If you have more than one volume per pool, you should specify a quota for each volume rather than allowing multiple volumes to grow to the pool size.

- 5** Repeat the above steps for each cluster volume you want to create.

Depending on your configuration, the new volumes will either mount automatically when resources that require them start or will have to be mounted manually on individual servers after they are up.

Using iManager

- 1** Start your browser and enter the URL for iManager.

The URL is `http://server_ip_address/nps/imanager.html`. Replace *server_ip_address* with the IP address or DNS name of a NetWare 6.5 server in the cluster or the IP address for Apache-based services.

- 2** Enter your username and password.
- 3** In the left column, locate Storage, then click the Volumes link.
- 4** Enter a cluster server name or browse and select one, then click the New link.
- 5** Specify the new volume name, then click Next.
- 6** Check the box next to the cluster pool where you want to create the volume and either specify the size of the volume (Volume Quota) or check the box to allow the volume to grow to the size of the pool, then click Next.

The volume quota is the maximum possible size of the volume. If you have more than one volume per pool, you should specify a quota for each volume rather than allowing multiple volumes to grow to the pool size.

- 7** Review and change volume attributes as necessary.

The Flush Files Immediately feature helps ensure the integrity of volume data. Enabling the Flush Files Immediately feature improves file system reliability but hampers performance. You should consider this option only if necessary.

- 8** Choose whether you want the volume activated and mounted when it is created, then click Finish.

Using Novell Remote Manager

The same procedure for creating shared disk partitions using Novell Remote Manager is used to create cluster volumes. To create a cluster volume on shared storage using Novell Remote Manager go to [Step 1 on page 23](#).

Cluster Enable Pools and Volumes

If you have a shared disk system that is part of your cluster and you want the pools and volumes on the shared disk system to be highly available to NetWare clients, you will need to cluster enable those pools and volumes. Cluster enabling a pool or volume allows it to be moved or mounted on different servers in the cluster in a manner that supports transparent client reconnect.

With this release of Cluster Services, cluster-enabled volumes no longer appear as cluster resources. NSS pools are resources, and load and unload scripts apply to pools and are automatically generated for them. Each cluster-enabled NSS pool requires its own IP address. This means that each cluster-enabled volume does not have an associated load and unload script or an assigned IP address.

NSS pools can be cluster enabled at the same time they are created. If you did not cluster enable a pool at creation time, the first volume you cluster enable in the pool automatically cluster enables the pool where the volume resides. Once a pool has been cluster enabled, you will need to cluster enable the other volumes in the pool if you want them to be mounted on another server during a failover.

When a server fails, any cluster-enabled pools being accessed by that server will fail over to other servers in the cluster. Because the cluster-enabled pool fails over, all volumes in the pool will also fail over, but only the volumes that have been cluster enabled will be mounted. Any volumes in the pool that have not been cluster enabled will have to be mounted manually. For this reason, volumes that aren't cluster enabled should be in separate pools that are not cluster enabled.

If you want each cluster-enabled volume to be its own cluster resource, each volume must have its own pool.

Some server applications don't require NetWare client access to volumes, so cluster enabling pools and volumes might not be necessary. Pools should be deactivated and volumes should be dismounted before being cluster enabled.

Using iManager

- 1 Start your browser and enter the URL for iManager.

The URL is `http://server_ip_address/nps/manager.html`. Replace *server_ip_address* with the IP address or DNS name of a NetWare 6.5 server in the cluster or the IP address for Apache-based services.

- 2 Enter your username and password.
- 3 In the left column, locate Clusters, then click the Cluster Options link.

iManager displays three links under Clusters that you can use to configure and manage your cluster.

- 4 Enter the cluster name or browse and select it, then click the New link.
- 5 Specify Pool as the resource type you want to create by clicking the Pool radio button, then click Next.
- 6 Enter the name of the pool you want to cluster-enable, or browse and select one.
- 7 (Optional) Change the default name of the virtual Server object.

When you cluster-enable a pool, a virtual Server object is automatically created and given the name of the Cluster object plus the cluster-enabled pool. For example, if the cluster name is `cluster1` and the cluster-enabled pool name is `pool1`, then the default virtual server name will be `cluster1_pool1_server`.

If you are cluster-enabling a volume in a pool that has already been cluster-enabled, the virtual Server object has already been created, and you can't change the virtual Server object name.

- 8** (Optional) Change the default name of the CIFS server name.

If you check the CIFS check box in the Advertising Protocols section of this page, the CIFS Server Name field will become active. The CIFS server name is the server name CIFS clients see when they browse the network. A default server name is listed, but you can change the server name by editing the text in the field.

- 9** Enter an IP address for the pool.

Each cluster-enabled NSS pool requires its own IP address. The IP address is used to provide access and failover capability to the cluster-enabled pool (virtual server). The IP address assigned to the pool remains assigned to the pool regardless of which server in the cluster is accessing the pool.

- 10** Select one or more advertising protocols.

You can select one or all of the advertising protocols. NCP is the protocol used by Novell clients, CIFS is the protocol used by Microsoft clients, and AFP is the protocol used by Macintosh clients. Selecting any of the protocols causes lines to be added to the pool resource load and unload scripts to activate the selected protocols on the cluster. This lets you ensure that the cluster-enabled pool is highly available to all your clients.

- 11** (Optional) Check the Online Resource after Create check box.

This will cause the volume to automatically mount once it is created.

- 12** Ensure the Define Additional Properties check box is checked, then click Next and continue with [“Set Start, Failover, and Failback Modes” on page 34](#).

NOTE: Cluster resource load and unload scripts are automatically generated for pools when they are cluster-enabled.

Using ConsoleOne

- 1** Browse and select the Cluster object.
- 2** Click File > New > Cluster > Cluster Volume.
- 3** Browse and select a volume on the shared disk system to cluster enable.
- 4** Enter an IP address for the volume.

This is only required for the first volume to be cluster enabled in the pool. This IP address will be assigned to the pool where the volume resides.

Checking the Online Resource after Create check box will cause the volume to automatically mount once it is created.

- 5** (Optional) Change the default name of the virtual Server object.

When you cluster enable a pool, a virtual Server object is automatically created and given the name of the Cluster object plus the cluster-enabled pool. For example, if the cluster name is cluster1 and the cluster-enabled pool name is pool1, then the default virtual server name will be cluster1_pool1_server.

If you are cluster enabling a volume in a pool that has already been cluster enabled, the virtual Server object has already been created, and you can't change the virtual Server object name.

- 6** (Optional) Change the default name of the cluster-enabled Volume object.

When you cluster enable a volume, a new object is automatically created and given the name of the Cluster object and the volume name. For example, if the cluster name is cluster1 and the volume name is voll, then the default cluster-enabled Volume object name will be cluster1_voll.

- 7 Ensure the Define Additional Properties check box is checked, click Create and then continue with [“Set Start, Failover, and Failback Modes” on page 34](#).

Using Novell Remote Manager

- 1 In Novell Remote Manager, in the left column under the Clustering section, select Cluster Config.
- 2 At the bottom of the screen under Create New Objects, click New Cluster Volume.
- 3 Select the volume you created in the previous section and click Select.
- 4 Enter the IP address you want to assign to the cluster-enabled volume.

All other fields on this screen should be automatically updated. You can change or edit the information in the fields as desired. See [Step 5 on page 28](#) and [Step 6 on page 28](#) for more information.

This is only required for the first volume to be cluster enabled in the pool. This IP address will be assigned to the pool where the volume resides.

Checking the Auto-Online check box will cause the resource to automatically start once it is created.

- 5 Click the Save button to create the volume resource and then continue with [“Set Start, Failover, and Failback Modes” on page 34](#).

When the volume resource is brought online, the pool will automatically be activated. You don't need to activate the pool at the server console.

If you delete a cluster-enabled volume, Novell Cluster Services will automatically remove the volume mount command from the resource load script. If you delete a cluster-enabled pool, Novell Cluster Services will automatically remove the pool resource object and the virtual server object from eDirectory. If you rename a cluster-enabled pool, Novell Cluster Services will automatically update the pool resource load and unload scripts to reflect the name change. Also, NSS will automatically change the pool object name in eDirectory.

Create Cluster Resource Templates

Templates simplify the process of creating similar or identical cluster resources. For example, templates are helpful when you want to create multiple instances of the same resource on different servers. You can create templates for any server application or resource you want to add to your cluster.

Novell Cluster Services currently provides templates for DHCP, iFolder, and MySQL, as well as a generic IP SERVICE template. The generic IP SERVICE template can be used when configuring certain server applications to run on your cluster. You can edit and customize any of the templates for your specific needs.

Using iManager

- 1 Start your browser and enter the URL for iManager.

The URL is `http://server_ip_address/nps/manager.html`. Replace *server_ip_address* with the IP address or DNS name of a NetWare 6.5 server in the cluster or the IP address for Apache-based services.

- 2** Enter your username and password.
- 3** In the left column, locate Clusters, then click the Cluster Options link.
iManager displays three links under Clusters that you can use to configure and manage your cluster.
- 4** Enter the cluster name or browse and select it, then click the New link.
- 5** Specify Template as the resource type you want to create by clicking the Template radio button, then click Next.
- 6** Enter the name of the template you want to create.
- 7** Ensure the Define Additional Properties check box is checked, then continue with **“Configure Load Scripts” on page 32**.

To finish creating a cluster resource template, you need to configure load and unload scripts, set failover and failback modes and, if necessary, change the node assignments for the resource template.

Using ConsoleOne

- 1** Browse and select the Cluster object where you want to create a cluster resource template.
- 2** From the menu bar, click File > New > Cluster > Cluster Resource.
- 3** Enter a name for the new cluster resource template.
- 4** Check the Create Resource Template check box.
This option lets you create a cluster resource template instead of a cluster resource.
- 5** Check the Define Additional Properties check box, and then continue with **“Configure Load Scripts” on page 32**.

To finish creating a cluster resource template, you need to configure load and unload scripts, set failover and failback modes and, if necessary, change the node assignments for the resource template.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Config.
- 2** At the bottom of the screen above Create New Objects, click New Cluster Resource.
- 3** Enter a name for the new cluster resource template.
- 4** Check the Create Resource and the Define Additional Properties check boxes and then click Apply.
- 5** Continue with **“Configure Load Scripts” on page 32**.

Create Cluster Resources

Cluster resources must be created for every resource or application you run on servers in your cluster. Cluster resources can include Web sites, e-mail servers, databases, and any other server-based applications or services you want to make available to users at all times.

Using iManager

- 1 Start your browser and enter the URL for iManager.

The URL is `http://server_ip_address/nps/manager.html`. Replace *server_ip_address* with the IP address or DNS name of a NetWare 6.5 server in the cluster or the IP address for Apache-based services.

- 2 Enter your username and password.

- 3 In the left column, locate Clusters, then click the Cluster Options link.

iManager displays three links under Clusters that you can use to configure and manage your cluster.

- 4 Enter the cluster name or browse and select it, then click the New link.

- 5 Specify Resource as the resource type you want to create by clicking the Resource radio button, then click Next.

- 6 Enter the name of the resource you want to create.

IMPORTANT: Do not use periods in cluster resource names. NetWare and NetWare clients interpret a period as a delimiter.

- 7 If a template exists for the resource you are creating, enter the template name in the Inherit From Template field, or browse and select it from the list. If a template does not exist, check the Define Additional Properties check box.

- 8 (Conditional) If you are not using a template for the resource, continue with [“Configure Load Scripts” on page 32](#).

Using ConsoleOne

- 1 Browse and select the Cluster object you want to create resources for.

- 2 Click File > New > Cluster > Cluster Resource.

- 3 Enter a name for the new cluster resource.

IMPORTANT: Do not use periods in cluster resource names. NetWare and NetWare clients interpret a period as a delimiter.

- 4 If a template exists for the resource you are creating, enter the template name in the Inherit From Template field, or browse and select it from the list. If a template does not exist, check the Define Additional Properties check box.

- 5 (Conditional) Check the Online Resource after Create check box if you want the resource to automatically start on the master node as soon as it is created and configured.

- 6 Click Create.

- 7 (Conditional) If you are not using a template for the resources, continue with [“Configure Load Scripts” on page 32](#).

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.

- 2 At the bottom of the screen under Create New Objects, click New Cluster Resource.

- 3 Enter a name for the new cluster resource.

- 4 If a template exists for the resource you are creating, select it from the list and then click Apply. If a template does not exist, check the Define Additional Properties check box and then click Apply.

The default selection for this field is No Template.

- 5** (Conditional) If you are not using a template for the resource, continue with “[Configure Load Scripts](#)” on page 32.

If you are not using a template, you must complete the process for creating the cluster resource by configuring load and unload scripts, setting failover and failback modes and, if necessary, changing the node assignments for the resource.

If you are using a template for this resource, additional resource configuration is performed automatically by the template.

More information on configuring GroupWise, NDPS[®], iFolder and many other applications is available at the [Novell Cluster Services Documentation Web site \(http://www.novell.com/documentation/lg/ncs65\)](http://www.novell.com/documentation/lg/ncs65).

Configure Load Scripts

A load script is required for each resource, service, or disk pool in your cluster. The load script specifies the commands to start the resource or service on a server, or to mount the volume on a server.

You can use any commands in the load script that would be used in a .NCF file run from the server console. If you don't know which commands to add to your load script, consult the documentation for the application or resource.

Load scripts are automatically created for disk pools when you cluster enable them. Because of this, it might not be necessary to configure or change the load script for a pool.

Using iManager

If you are creating a new cluster resource, the load script page should already be displayed. You can start with [Step 4](#).

- 1** In the left column of the main iManager page, locate Clusters and click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, check the box next to the resource whose load script you want to edit, then click the Properties link.
- 3** Click the Scripts tab, then click the Load Script link.
- 4** Edit or add the necessary commands to the script to load the resource on the server.
For more details on load script commands see the instructions below on configuring load scripts using ConsoleOne.
- 5** Specify the Load Script Timeout value, then click Apply to save the script; or, if you are creating a new cluster resource, click Next.

The timeout value determines how much time the script is given to complete. If the script does not complete within the specified time, the resource becomes comatose.

Using ConsoleOne

- 1** Select the Load Script tab on the resource property page.
- 2** Edit or add the necessary commands to the script to load the resource on the server.

Some commands might require command line input. You can add << to a command to indicate command line input. For example, a script command might read


```
LOAD SLPDA <<Y
```

This means that when SLPDA is loaded, it will receive a Y at the command line, presumably to a question that needs a Yes answer. If more inputs are required, they can be continued on subsequent lines, as follows:

```
LOAD SLPDA <<Y
<<Y
<<N
```

The string can be up to 32 characters.

3 Specify a timeout value.

The default is 600 seconds, or 10 minutes. The timeout value determines how much time the script is given to complete. If the script does not complete within the specified time, the resource becomes comatose.

Using Novell Remote Manager

1 On the left column under the Clustering section, click Cluster Config.

2 From the list of Resources, select the desired resource or resource template.

3 On the Resource Information screen, click Loading.

4 Edit or add the necessary commands to the script to load the resource on the server.

For more details on load script commands see the instructions above on configuring load scripts using ConsoleOne.

5 Specify the Load Timeout and click Apply to save the script.

This is the same as the timeout value described in the above instructions on configuring load scripts using ConsoleOne.

Configure Unload Scripts

Depending on your cluster application or resource, you can add an unload script to specify how the application or resource should terminate. An unload script is not required by all resources or applications, but it can ensure that during a failback or manual migration, a resource unloads before it loads on another node. Consult your application vendor or documentation to determine if you should add commands to unload the resource.

Unload scripts are automatically created for disk pools when you cluster enable them. Because of this it might not be necessary to configure or change the load script for a pool.

Using iManager

If you are creating a new cluster resource, the unload script page should already be displayed. You can start with [Step 4 on page 33](#).

1 In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.

2 Enter the cluster name or browse and select it, check the box next to the resource whose unload script you want to edit, then click the Properties link.

3 Click the Scripts tab, then click the Unload Script link.

4 Edit or add the necessary commands to the script to unload the resource on the server.

You can use any commands used in a .ncf file run from the server console. If you don't know which commands to add, consult the documentation for the application or resource you want to unload.

- 5 Specify the Unload Script Timeout value, then click Apply to save the script; or, if you are creating a new cluster resource, click Next.

The timeout value determines how much time the script is given to complete. If the script does not complete within the specified time, the resource becomes comatose.

Using ConsoleOne

- 1 Select the Unload Script tab on the resource property page.
- 2 Edit or add the necessary commands to the script to unload the intended resource on the server.

You can use any commands used in a .ncf file run from the server console. If you don't know which commands to add, consult the documentation for the application or resource you want to unload.

- 3 Specify a timeout value and click Apply to save the script.

The default is 600 seconds, or 10 minutes. The timeout value determines how much time the script is given to complete. If the script does not complete within the specified time, the resource becomes comatose.

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.
- 2 From the list of Resources, select the desired resource.
- 3 On the Resource Information screen, click Unloading.
- 4 Edit or add the necessary commands to the script to unload the intended resource on the server.
- 5 Specify the Load Wait Time and click Apply to save the script.

Set Start, Failover, and Failback Modes

You can configure the start, failover, and failback of cluster resources to happen manually or automatically. With the resource Start Mode set to AUTO, the resource automatically starts on a server when the cluster is first brought up. If the resource Start Mode is set to MANUAL, you can manually start the resource on a server when you want, instead of having it automatically start when servers in the cluster are brought up.

With the resource Failover Mode set to AUTO, the resource automatically starts on the next server in the Assigned Nodes list in the event of a hardware or software failure. If the resource Failover Mode is set to MANUAL, you can intervene after a failure occurs and before the resource is moved to another node.

With the resource Failback Mode set to DISABLE, the resource does not fail back to its most preferred node when the most preferred node rejoins the cluster. If the resource Failback Mode is set to AUTO, the resource automatically fails back to its most preferred node when the most preferred node rejoins the cluster. Set the resource Failback Mode to MANUAL to prevent the resource from moving back to its preferred node when that node is brought back online, until you are ready to allow it to happen.

The preferred node is the first server in the list of the assigned nodes for the resource.

Using iManager

If you are creating a new cluster resource, the Resource Policies page should already be displayed. You can start with [Step 4](#).

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, check the box next to the resource whose start, failover, or failback modes you want to view or edit, then click the Properties link.
- 3** Click the General tab.
- 4** (Conditional) Check the Resource Follows Master check box if you want to ensure that the resource runs only on the master node in the cluster.

If the master node in the cluster fails, the resource will fail over to whichever node becomes the master.

- 5** (Conditional) Check the Ignore Quorum check box if you don't want the cluster-wide timeout period and node number limit enforced.

The quorum default values were set when you installed Novell Cluster Services. You can change the quorum default values by accessing the properties page for the Cluster object.

Checking this box will ensure that the resource is launched immediately on any server in the Assigned Nodes list as soon as any server in the list is brought online.

- 6** Choose the Start, Failover, and Failback modes for this resource.

The default for both Start and Failover modes is AUTO, and the default for Failback mode is DISABLE.

- 7** Continue with [“Assign Nodes to a Resource” on page 36](#), or if you are creating a new cluster resource, click Next, then continue with [“Assign Nodes to a Resource” on page 36](#).

Using ConsoleOne

- 1** In ConsoleOne, right-click the resource object and select Properties, then select the Policies tab on the property page.
- 2** (Conditional) Check the Ignore Quorum check box if you don't want the cluster-wide timeout period and node number limit enforced.

The quorum default values were set when you installed Novell Cluster Services. You can change the quorum default values by accessing the properties page for the Cluster object.

Checking this box will ensure the resource is launched immediately on any server in the Assigned Nodes list as soon as any server in the list is brought online.

- 3** Choose the Start, Failover, and Failback modes for this resource.

The default for both Start and Failover modes is AUTO, and the default for Failback mode is DISABLE.

- 4** Check the Master Only check box to ensure the resource runs only on the master node in the cluster.

If the master node in the cluster fails, the resource will fail over to whichever node becomes the master.

- 5** Click Apply to save changes.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Config.
- 2** From the list of Resources, select the desired resource.
- 3** On the Resource Information screen, click Policies.
- 4** Check or uncheck the Ignore Quorum check box as desired.
See the instructions above on setting resource Start, Failover, and Failback modes using ConsoleOne for more details.
- 5** Select the Start, Failover, and Failback modes for this resource.
- 6** Check or uncheck the Master Only check box.
If the Master Only box is checked, the resource will run only on the server designated as the Master node in the cluster.
- 7** Click Apply.

Assign Nodes to a Resource

When you create a resource on a cluster or cluster enable a volume or pool, the nodes in the cluster are automatically assigned to the resource or the volume or pool. The order of assignment is the order the nodes appear in the resource list. You can assign or unassign nodes to the resource or the volume or pool, or change the failover order.

Using iManager

If you are creating a new cluster resource, the Preferred Nodes page should already be displayed. If you have just set start, failover, and failback modes, the Preferred Nodes page will be displayed as part of the Resource Policies page. You can start with [Step 4](#).

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, check the box next to the resource whose start, failover, or failback modes you want to view or edit, then click the Properties link.
- 3** Click the General tab.
- 4** From the list of unassigned nodes, select the server you want the resource assigned to, then click the right-arrow button to move the selected server to the Assigned Nodes list.
Repeat this step for all servers you want assigned to the resource. You can also use the left-arrow button to unassign servers from the resource.
- 5** Click the up-arrow and down-arrow buttons to change the failover order of the servers assigned to the resource or volume.
- 6** Click Apply or Finish to save node assignment changes.

Using ConsoleOne

- 1** Select the Nodes tab on the resource property page.
- 2** From the list of unassigned nodes, select the server you want the resource assigned to and click the right-arrow button to move the selected server to the Assigned Nodes list.
Repeat this step for all servers you want assigned to the resource. You can also use the left-arrow button to unassign servers from the resource.

- 3 Click the up-arrow and down-arrow buttons to change the failover order of the servers assigned to the resource or volume.
- 4 Click Apply to save node assignment changes.

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.
- 2 From the list of Resources, select the desired resource.
- 3 On the Resource Information screen, click Nodes.
- 4 Select or type in the nodes that you want assigned to this resource.
- 5 Click Apply to save node assignment changes.

Configuration Settings

Depending on your needs and cluster setup, some additional configuration may be required for you to effectively use Novell Cluster Services. This additional configuration might consist of changing the values on some of the properties for the Cluster object and the Cluster Node objects.

Edit Quorum Membership and Timeout Properties

You can edit Quorum Membership and Timeout properties using iManager, ConsoleOne, or Novell Remote Manager.

Using iManager

- 1 In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2 Enter the cluster name or browse and select it, then click the Properties button under the cluster name.
- 3 Click the General tab.

In iManager, the same page used to edit quorum membership and timeout is also used for the cluster IP address and port properties and for cluster e-mail notification.

Using ConsoleOne

- 1 Right-click the Cluster object.
- 2 Click Properties.
- 3 Select the Quorum tab on the Cluster Object Property page.

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.
- 2 Select the Cluster object name.
- 3 Click Quorum.

Membership (Number of Nodes)

The Quorum Membership is the number of nodes that must be running in the cluster before resources will start to load. When you first bring up servers in your cluster, Novell Cluster Services reads the number specified in the Membership field and waits until that number of servers is up and running in the cluster before it starts loading resources.

Set the Membership value to a number greater than 1 so that all resources don't automatically load on the first server that is brought up in the cluster. For example, if you set the Membership value to 4, there must be four servers up in the cluster before any resource will load and start.

Timeout

Timeout specifies the amount of time to wait for the number of servers defined in the Membership field to be up and running. If the timeout period elapses before the quorum membership reaches its specified number, resources will automatically start loading on the servers that are currently up and running in the cluster. For example, if you specify a Membership value of 4 and a timeout value equal to 30 seconds, and after 30 seconds only two servers are up and running in the cluster, resources will begin to load on the two servers that are up and running in the cluster.

Cluster Protocol Properties

You can use the Cluster Protocol property pages to view or edit the transmit frequency and tolerance settings for all nodes in the cluster, including the master node. The master node is generally the first node brought online in the cluster, but if that node fails, any of the other nodes in the cluster can become the master.

If you change any protocol properties, you should restart all servers in the cluster to ensure the changes take effect.

Using iManager

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, then click the Properties button under the cluster name.
- 3** Click the Protocols tab.

This page also lets you view the script used to configure the cluster protocol settings, but not change it. Changes made to the protocols setting will automatically update the script.

Using ConsoleOne

- 1** Right-click the Cluster object.
- 2** Click Properties.
- 3** On the Cluster Object property page, select the Protocol tab.

This tab has two pages: Settings and Internals. The Internals page lets you view the script used to configure the cluster protocol settings, but not change it. Use the Settings page to make changes to cluster protocol properties.

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.
- 2 Select the Cluster object name.
- 3 Click Protocol.

Heartbeat

Heartbeat specifies the amount of time between transmits for all nodes in the cluster except the master. For example, if you set this value to 1, nonmaster nodes in the cluster send a signal that they are alive to the master node every second.

Tolerance

Tolerance specifies the amount of time the master node gives all other nodes in the cluster to signal that they are alive. For example, setting this value to 4 means that if the master node does not receive an “I’m alive” signal from a node in the cluster within four seconds, that node is removed from the cluster.

Master Watchdog

Master Watchdog specifies the amount of time between transmits for the master node in the cluster. For example, if you set this value to 1, the master node in the cluster transmits an “I’m alive” signal to all the other nodes in the cluster every second.

Slave Watchdog

Slave Watchdog specifies the amount of time the master node has to signal that it is alive. For example, setting this value to 5 means that if the nonmaster nodes in the cluster do not receive an “I’m alive” signal from the master within five seconds, the master node is removed from the cluster and one of the other nodes becomes the master node.

Max Retransmits

This option is not currently used with Novell Cluster Services but will be used for future versions.

Cluster IP Address and Port Properties

The Cluster IP address is assigned when you install Novell Cluster Services. The Cluster IP address normally does not need to be changed, but can be if needed.

The default cluster port number is 7023, and is automatically assigned when the cluster is created. The cluster port number does not need to be changed unless a conflict is created by another resource using the same port number. If there is a port number conflict, change the Port number to any other value that doesn’t cause a conflict.

Using iManager

- 1 In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2 Enter the cluster name or browse and select it, then click the Properties button under the cluster name.
- 3 Click the General tab.

In iManager, the same page used to view or edit the cluster IP address and port properties is also used for quorum membership and timeout and for cluster e-mail notification.

Using ConsoleOne

- 1** Right-click the cluster object.
- 2** Click Properties.
- 3** On the Cluster Object property page, select the Management tab.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Config.
- 2** Select the Cluster object name.
- 3** Click IP Address.

Resource Priority

The Resource Priority allows you to control the order in which multiple resources start on a given node when the cluster is brought up or during a failover or failback. For example, if a node fails and two resources fail over to another node, the resource priority determines which resource loads first.

This is useful for ensuring that the most critical resources load first and are available to users before less critical resources.

Using iManager

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, then click the Properties button under the cluster name.
- 3** Click the Priorities tab.
- 4** To change the priority for a resource, select the resource in the list by clicking it, then click the up-arrow or down-arrow to move the resource up or down in the list. This lets you change the load order of the resource relative to other cluster resources on the same node.
- 5** Click the Apply button to save changes made to resource priorities.

Using ConsoleOne

- 1** Right-click the cluster object.
- 2** Click Properties.
- 3** On the Cluster Object property page, select the Resource Priority tab.
- 4** To change the priority for a resource, select the resource in the list and then click the Increase or Decrease button to move the resource up or down in the list.

This lets you change the load order of the resource relative to other cluster resources on the same node.

You can also select a resource and then click the Selected button to reset the resource back to its default load order.

- 5** Click the Apply button to save changes made to resource priorities.

Using Novell Remote Manager

- 1 On the left column under the Clustering section, click Cluster Config.
- 2 Select the Cluster object name.
- 3 Click Resource Priorities.
- 4 To change the priority for a resource, assign it a number between 0 and 65535.

65535 is the maximum value and 0 is the minimum value. Setting a resource priority to 65535 ensures the resource loads before other resources with lower priority settings. Setting the resource priority to 0 ensures the resource loads last after all other resources have loaded. The default resource priority setting is 0.

If you assign multiple resources the same priority, the start order of those resources is random.

- 5 Click the Apply button to save changes made to resource priorities.

Cluster E-Mail Notification

Novell Cluster Services can automatically send out e-mail messages for certain cluster events like cluster and resource state changes or nodes joining or leaving the cluster.

In order for cluster e-mail notification to work, you must first configure e-mail notification for server health status using Novell Remote Manager. For instructions on how to do this, go to [“Configuring E-Mail Notification for Server Health Status”](#) in the *Novell Remote Manager Administration Guide*.

You can enable or disable e-mail notification for the cluster and specify up to eight administrator e-mail addresses for cluster notification.

IMPORTANT: If you add or delete an administrator e-mail address or change the type of cluster events you want administrators to receive messages for (verbose to XML, etc.), you must reload `cma.nlm` (the Cluster Management Agent) on all servers in the cluster for the changes to take effect.

Using iManager

- 1 In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2 Enter the cluster name or browse and select it, then click the Properties button under the cluster name.
- 3 Click the General tab.
- 4 Check or uncheck the Enable Cluster Notification Events check box to enable or disable e-mail notification.
- 5 If you enable e-mail notification, add the desired e-mail addresses in the field provided.

You can click the buttons next to the field to add, delete, or edit e-mail addresses. Repeat this process for each e-mail address you want on the notification list.

- 6 If you enable e-mail notification, specify the type of cluster events you want administrators to receive messages for.

To only receive notification of critical events like a node failure or a resource going comatose, click the Receive Only Critical Events radio button.

To receive notification of all cluster state changes including critical events, resource state changes, and nodes joining and leaving the cluster, click the Verbose Messages radio button.

To receive notification of all cluster state changes in XML format, choose the XML Messages option. XML format messages can be interpreted and formatted with a parser that lets you customize the message information for your specific needs.

- 7** Click the Apply button to save changes.

Using ConsoleOne

- 1** Right-click the cluster object
- 2** Click Properties.
- 3** On the Cluster Object property page, select the Notification tab.
- 4** Check or uncheck the Enable Cluster Notification Events check box to enable or disable e-mail notification.
- 5** If you enable e-mail notification, add the desired e-mail address in the field provided and click the button next to the field to add the address to the list. Repeat this process for each address you want on the notification list.

It is not necessary to add quotes to e-mail address names.

- 6** If you enable e-mail notification, specify the type of cluster events you want administrators to receive messages for.

To only receive notification of critical events like a node failure or a resource going comatose, click the Receive Only Critical Events radio button .

To receive notification of all cluster state changes including critical events, resource state changes, and nodes joining and leaving the cluster, click the Verbose Messages radio button.

To receive notification of all cluster state changes in XML format, choose the XML Messages option. XML format messages can be interpreted and formatted with a parser that lets you customize the message information for your specific needs.

- 7** Click the Apply button to save changes made.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Config.
- 2** Select the Cluster object name and click Email Reporting.
- 3** Add the desired email addresses in the fields provided.

It is not necessary to add quotes to e-mail address names.

- 4** Specify the type of cluster events you want administrators to receive messages for.

Specify a 1 or a 0 to disable email notification.

Specify a 2 (Critical) to only receive notification of critical events like a node failure or a resource going comatose.

Specify a 4 (Verbose) to receive notification of all cluster state changes including critical events, resource state changes, and nodes joining and leaving the cluster.

Specify an 8 to receive notification of all cluster state changes in XML format. XML format messages can be interpreted and formatted with a parser that lets you customize the message information for your specific needs.

- 5** Click the Apply button to save your changes.

Cluster Node Properties

You can view or edit the cluster node number or IP address of the selected node or view the context for the NetWare Server object.

Using iManager

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Options link.
- 2** Enter the cluster name or browse and select it, check the box next to the cluster node whose properties you want to view or edit, then click the Properties link.
- 3** View or edit the IP address, then click Apply to update the information in eDirectory.
If the IP address changes for this server, the new information is not automatically updated in eDirectory.

Using ConsoleOne

- 1** Select the Cluster object and right-click the desired cluster node on the right side of the ConsoleOne display screen.
- 2** Click Properties.
- 3** On the Cluster Node property page, select the Node tab.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Config.
- 2** Select the Cluster node name.
- 3** Click IP Address or Node Number.

(Node) Number+IP Address

Number+IP Address specifies the cluster node number and IP address for the selected node. If the cluster node number or IP address changes for the selected node, the new information is not automatically updated in eDirectory. Edit the information and click Apply to update the information in eDirectory.

NCP Server

The NCP Server field is used to view the context for the NetWare Server object. This field cannot be edited.

Additional Information on Managing Novell Cluster Services

For additional information on managing Novell Cluster Services, see [Chapter 3, “Managing Novell Cluster Services,”](#) on page 45.

3

Managing Novell Cluster Services

After you have installed, set up, and configured Novell® Cluster Services™ for your specific needs, some additional information can be useful to help you effectively manage your cluster. This information consists of instructions for migrating resources, identifying cluster and resource states, customizing cluster management, and using cluster console commands, as well as some additional cluster operating instructions.

Migrating Resources

You can migrate resources to different servers in your cluster without waiting for a failure to occur. You might want to migrate resources to lessen the load on a specific server, to free up a server so it can be brought down for scheduled maintenance, or to increase the performance of the resource or application by putting it on a faster machine.

Migrating resources allows you to balance the load and evenly distribute applications among the servers in your cluster.

Using iManager

- 1** In the left column of the main iManager page, locate Clusters, then click the Cluster Manager link.
- 2** Enter the cluster name or browse and select it, check the box next to the resource you want to migrate, then click Migrate.
A page appears, displaying a list of possible servers that you can migrate this resource to.
- 3** Select a server from the list to migrate the resource to, then click OK to migrate the resource to the selected server.

Using ConsoleOne

- 1** Browse and select the Cluster object that contains the resource you want to migrate.
Resources must be in a running state to be migrated.
- 2** Ensure that the right half of ConsoleOne® displays the Cluster State View by selecting View > Cluster State from the menu at the top of the screen.
- 3** From the Cluster Resource List, select the resource you want to migrate.
The Cluster Resource Manager screen appears, displaying the server the selected resource is currently running on and a list of possible servers that you can migrate resources to.
- 4** Select a server from the list, then click Migrate to move the resource to the selected server.

Using Novell Remote Manager

- 1** On the left column under the Clustering section, click Cluster Management.

- 2** Select the cluster resource you want to migrate.
- 3** Select a server from the list and then click Migrate to move the resource to the selected server.

If you select a resource and click Offline, the resource will be unloaded from the server. It will not load on any other servers in the cluster and will remain unloaded until you load it again. This option is useful for editing resources because resources can't be edited while loaded or running on a server.

Identifying Cluster and Resource States

The Cluster State view in ConsoleOne, the Cluster Management link in NetWare® Remote Manager, and the Management link in iManager give you important information about the status of servers and resources in your cluster.

Cluster servers and resources display in different colors, depending on their operating state. When servers and resources are green, they are in a normal operating condition. When a server that has been part of the cluster is red with a break in the icon, it has failed. When a resource is red, it is waiting for administrator intervention. When a server is gray with no break in the icon, either that server is not currently a member of the cluster or its state is unknown. When a resource is blank or has no colored icon, it is unassigned, offline, changing state, or in the process of loading or unloading.

The yellow ball in the middle of the server icon designates the master server in the cluster. The master server is initially the first server in the cluster, but another server can become the master if the first server fails.

The Epoch number indicates the number of times the cluster state has changed. The cluster state will change every time a server joins or leaves the cluster.

Clicking the Event Log tab in ConsoleOne gives you a detailed history of your cluster. Every time the cluster state changes, a new event is added to the event log. You can sort the events in the log by clicking on the column headings of the table. You can reverse the sort order by pressing the Shift key while clicking a column heading. The event log is stored on the special cluster partition that was created during the Novell Cluster Services installation, which ensures it is always available. You can also save the event log to a file.

Clicking the HTML Report tab in ConsoleOne in the Cluster State view screen launches a more detailed report of the state of your cluster. You can view this report or save it to an HTML file for printing or viewing with a browser.

The following table identifies the different resource states and gives descriptions and possible actions for each state. The possible actions describe steps for using ConsoleOne to complete each action. You can also use iManager or Novell Remote Manager to perform the same actions. In Novell Remote Manager, in the left column under the Clustering section, click Cluster Management and then select the desired resource. In iManager, click Clusters, then click Cluster Manager to view a list of resources and resource states.

Resource State	Description	Possible Actions
Alert	Either the Start, Failover, or Failback mode for the resource has been set to Manual. The resource is waiting to start, fail over, or fail back on the specified server.	Click the Alert status indicator. Depending on the resource state, you will be prompted to start, fail over, or fail back the resource.

Resource State	Description	Possible Actions
Comatose	The resource is not running properly and requires administrator intervention.	Click the Comatose status indicator and offline the resource. After resource problems have been resolved, the resource can be put back online (returned to the running state).
Loading	The resource is in the process of loading on a server.	None.
NDS_Sync	The properties of the resource have changed and the changes are still being synchronized in Novell eDirectory™.	None.
Offline	Offline status indicates the resource is shut down or is in a dormant or inactive state.	Click the Offline status indicator and, if desired, click the Online button to load the resource on the best node possible, given the current state of the cluster and the resource's preferred nodes list.
Quorum Wait	The resource is waiting for quorum to be established so it can begin loading.	None.
Running	The resource is in a normal running state.	Click the Running status indicator and choose to either migrate the resource to a different server in your cluster or unload (offline) the resource.
Unassigned	There isn't an assigned node available that the resource can be loaded on.	Click the Unassigned status indicator and, if desired, offline the resource. Offlining the resource will prevent it from running on any of its preferred nodes should any of them join the cluster.
Unloading	The resource is in the process of unloading from the server it was running on.	None.
Upgrade	The cluster is in a temporary upgrade state. This is a normal part of the rolling upgrade process from NetWare 6 to NetWare 6.5.	None.

Additional Cluster Operating Instructions

The following instructions provide additional information for operating Novell Cluster Services.

Installing NetWare on a Server That Will Be Added to an Existing Cluster

- 1** Install fibre channel hardware.
NetWare will automatically detect and load the proper drivers when it installs.
- 2** Install NetWare, including the latest Service Pack, on the new server.
- 3** Reboot the server.
- 4** Install Novell Cluster Services on the new server.
- 5** (Conditional) If you have changed the failover order, add the new server to the failover list.

By default, Novell Cluster Services will include all nodes on the failover list, including newly added nodes.

Readding a Node to a Cluster That Was Previously in the Cluster

- 1** If necessary, install NetWare, including the latest Service Pack on the server using the same node name and IP address.
- 2** If the Cluster object for the server is still present, use ConsoleOne to delete the object.
You can do this by going to the Cluster container, selecting the node in the right frame, and pressing Delete.
- 3** Run the Novell Cluster Services installation.
The node will assume its former identity.

Cluster-Enabled Volume Connection Required for Some Utilities

Because Novell Cluster Services uses eDirectory to find objects and resolve names, you must first establish a client connection to a cluster-enabled volume for it to be visible to certain utilities.

Do this by browsing to and selecting the eDirectory Volume object using Windows Explorer.

Some Applications Do Not Fail Over

Although all NetWare 6.5 applications will run on a cluster node, not all applications are capable of being configured as a cluster application and failed over to a new node.

Cluster Services Fails to Start

If you chose to have Novell Cluster Services software start automatically after installation, you might encounter a problem with Cluster Services software starting on some servers immediately after the installation. This problem is due to Cluster Services software starting prior to cluster-related eDirectory objects being created and replicated.

To resolve this problem, wait for a few minutes and then manually start Cluster Services software by entering **ldnscs** at the server console.

Preventing Cascading Failovers

Cascading failover occurs when a bad cluster resource causes a server to fail, then fails over to another server causing it to fail, and then continues failing over to and bringing down additional cluster servers until possibly all servers in the cluster have failed.

Novell Cluster Services now incorporates functionality that detects if a node has failed because of a bad cluster resource and prevents that bad resource from failing over to other servers in the cluster.

This functionality is enabled by default when you install Novell Cluster Services. Cascading failover prevention can be disabled by adding the */hmo=off* parameter to the **clstrlib** command in the `sys:\system\ldnscs.nef` file.

After adding the parameter, the line should appear as follows:

```
clstrlib /hmo=off
```


If you disable cascading failover prevention on one cluster server, you must do it on all servers in the cluster.

You must manually unload and reload Novell Cluster Services software on every cluster server in order for this change to take effect. To do this, use the `uldncs` command to unload cluster software and the `ldncs` command to reload cluster software.

Resource Quarantine

If cascading failover protection is enabled, a resource may be put into quarantine if it causes server abends for a three day period. If Novell Cluster Services software determines that the resource is likely responsible for abends, and loading the resource will put the cluster in grave danger, it will cause the resource to go into a comatose state (quarantine it) rather than letting it load on (and potentially cause to fail) other cluster nodes.

The resource can still be manually brought online and manually migrated to other cluster nodes. To get the resource out of quarantine, you can disable cascading failover prevention. Cascading failover prevention can then be re-enabled by removing the `clstrlib /hmo=off` line from the `sys:\system\ldncs.ncf` file, and then unloading and reloading Novell Cluster Services software.

Novell Cluster Services does the following to determine if a resource should be put into quarantine:

1. Traces back the history of node failures for the suspected bad resource. This includes
 - ◆ What node the resource was running or loading on.
 - ◆ If the node failed.
 - ◆ The state the resource was in when the node failed.
 - ◆ If there were other resources trying to load when the node failed.
2. Repeats the above process until one of the following happens
 - ◆ The end of the cluster log file is reached
 - ◆ Enough node failures are found
 - ◆ Found that the node did not fail
 - ◆ The entries in the log file are more than three days old

If the resource attempts to load on a node where it was previously loaded and there are additional nodes still available in the cluster, it will not be quarantined and will be allowed to load. Also, a resource is not quarantined when it is initially brought online.

Factors that might contribute to a resource being quarantined include:

- ◆ A large number of node failures
- ◆ No other resources are causing node failures
- ◆ The resource never reaches a running state

Factors that might help prevent a resource from being quarantined include:

- ◆ A small number of node failures
- ◆ Other resources are causing node failures
- ◆ The resource reaches a running state
- ◆ There is one node left up and running in the cluster

Resource quarantine is disabled if

- ◆ Cascading failover prevention is turned off.
This is done by adding the `/hmo=off` parameter to the `clstrlib` command in the `sys:\system\ldncc.ncf` file.
- ◆ There is no shared storage (SAN) or SBD partition
- ◆ There are enough nodes in the cluster to form a quorum

Cluster Maintenance Mode

Cluster maintenance mode lets you temporarily suspend the cluster heartbeat while hardware maintenance is being performed. This is useful if you want to reset or power down the LAN switch without bringing down cluster servers. See “[Novell Cluster Services Console Commands](#)” on [page 50](#) for more information.

Unload Cluster Services Software When Servicing Shared Storage

If you need to power down or recycle your shared storage system, you must unload Cluster Services software prior to doing so. You can unload the software using the `uldncs` command at the server console of each cluster server.

Displaying Bound Virtual IP Addresses

To verify that a virtual IP address is bound, enter `display secondary ipaddress` at the server console of the cluster server where the virtual IP address is assigned. This will display all bound virtual IP addresses. A maximum of 256 virtual IP addresses can be bound.

Novell Cluster Services Console Commands

Novell Cluster Services provides several server console commands to help you perform certain cluster-related tasks. The following table lists the cluster-related server console commands and gives a brief description of each command. To execute a cluster console command, enter `cluster` followed by the command. For example, if you want to display cluster statistics, enter `cluster stats display` at the server console. You can also enter `help cluster` at the console prompt to get information on the commands and their functions.

Cluster Console Command	Description
ALERT {resource}{YES NO}	The resource start, failover, or failback mode is set to manual and the resource is waiting to start on a node, or fail over or fail back to another node. Specify the resource name in the command and use the YES or NO switch to specify whether you want the resource to fail over, fail back, or start.
CLUSTER SCAN FOR NEW DEVICES	Equivalent of running <code>scan all</code> , scan for new devices, and scan for new partitions on <code>0xffff</code> on every node in the cluster. Running this command will cause the cluster to discover new LUNs, devices, and partitions on shared media.

Cluster Console Command	Description
CVB REBUILD	Causes Cluster Services to disregard the current Cluster Volume Broker (CVB) database. Rebuilds the CVB database to allow the use of duplicate pool names.
CVSBIND {ADD, DEL}{resource}{IP address}	Enables applications that rely on the bindery or bindery emulation to access a virtual server on the cluster. Specify the virtual server name for the cluster resource and the IP address for the virtual server. Use the ADD or DEL switch to enable or disable bindery access to the virtual server.
DHCP {context}	Specifies the eDirectory context where DHCP configuration information is stored. This command is useful if you have problems getting DHCP to function properly on a cluster.
DOWN	Removes all cluster nodes from the cluster. Has the same effect as executing the CLUSTER LEAVE command on every server in the cluster.
JOIN	Adds the node where the command is executed to the cluster and makes the node visible to other servers in the cluster. Cluster Services software must already be installed on a node for it to join the cluster.
LEAVE	Removes the node where the command is executed from the cluster. The node will not be visible to other servers in the cluster.
MAINTENANCE {ON/OFF}	Turning this switch on lets you temporarily suspend the cluster heartbeat while hardware maintenance is being performed. This is useful if you want to reset or power down the LAN switch without bringing the cluster servers down.
MIGRATE {resource}{node name}	Migrates the specified resource from the node where it is currently running to the node you specify in the command. The node you migrate the resource to must be running in the cluster and also be in the resource's assigned nodes list.
OFFLINE {resource}	Unloads the specified resource from the node where it is currently running.
ONLINE {resource}{node name}	Starts the specified resource on the most preferred node that is currently active. You can start the resource on a different node by specifying that node in the command.
POOLS	Lists the NSS pools on the shared disk system that are accessible by Novell Cluster Services.
RESOURCES	Lists all resources that currently exist in the cluster. The resources do not need to be online or running.
RESTART {seconds}	Restarts Cluster Services software on all servers in the cluster.

Cluster Console Command	Description
STATS {Display, Clear}	Reports the node number, node name, and heartbeat information. You must switch to the log console screen to see cluster statistics.
STATUS {resource}	Reports the status of the specified resource. This includes the number of times the resource has been migrated or failed over to another server, the resource state, and the node where the resource is currently running.
VIEW	Displays the node name, cluster epoch number, master node name, and a list of nodes that are currently members of the cluster.

Additional cluster and cluster-related commands that are useful for troubleshooting but might require assistance from Novell Technical ServicesSM can be found by going to the [Cluster Troubleshooting documentation \(http://www.novell.com/documentation/lg/ncs65\)](http://www.novell.com/documentation/lg/ncs65).

Customizing Cluster Services Management

Some portions of Novell Cluster Services management can be performed and customized using virtual XML files that exist on the `_admin` volume. These files are created automatically on each server when `cma.nlm` is loaded. See [Virtual File Services for NetWare \(http://developer.novell.com/ndk/vfs.htm\)](http://developer.novell.com/ndk/vfs.htm) for more information on virtual files and the `_admin` volume.

The cluster-related virtual XML files (management access points) are created on each server's `_admin` volume and on the `_admin` volume of the cluster's virtual NCP™ server when `cma.nlm` is loaded. These files let you manage the cluster from any node in the cluster and also from the cluster's virtual NCP server (which is dynamically created on the current master node in the cluster). Using the cluster's virtual NCP server ensures cluster management is possible regardless of which physical servers happen to be available at the time. This means that as long as the cluster is running, you can always access the cluster-related XML virtual files in the `\\cluster_admin\manage_cluster` directory.

There are two types of virtual files in the `_admin:\manage_cluster` directory, XML files and CMD files. The XML files are read-only and contain cluster configuration or cluster state information. The CMD files are write-then-read command files that are used to issue commands to the cluster and retrieve resulting status.

A customizable PERL script named `cluster.pl` is included with NetWare 6.5 and is located in the `sys:perl\scripts` directory. This script can be used with `node.cmd`, `cluster.cmd`, and `resource.cmd` to perform custom cluster management. See [Virtual File Services for NetWare \(http://developer.novell.com/ndk/perl5.htm\)](http://developer.novell.com/ndk/perl5.htm) for more information on creating and using PERL scripts with NetWare.

The following table lists the cluster-related virtual XML files and gives a brief description of each.

Table 1 Cluster-Related Virtual XML Files

Virtual XML Filename	Description
Config.xml	Provides the combined information from ClusterConfig.xml, NodeConfig.xml, ResourceConfig.xml, and PoolConfig.xml.

Virtual XML Filename	Description
ClusterConfig.xml	Provides cluster configuration information.
NodeConfig.xml	Provides node configuration information for all nodes in the cluster that were active at the time the cluster was brought up.
ResourceConfig.xml	Provides resource configuration information for each resource in the cluster.
PoolConfig.xml	Provides cluster-enabled pool and volume configuration information for each pool and volume.
State.xml	Provides the combined information from NodeState.xml, ResourceState.xml, and PoolState.xml.
NodeState.xml	Provides current information on the state of each node in the cluster (cluster membership).
ResourceState.xml	Provides current information on the state of each resource in the cluster.
PoolState.xml	Provides current information on the state of each cluster-enabled pool in the cluster.
Node.cmd	Write-then-read command file used in conjunction with a PERL script to issue node-specific commands to the cluster and retrieve resulting node status and configuration information.
Cluster.cmd	Write-then-read command file used in conjunction with a PERL script to issue cluster-specific commands to the cluster and retrieve resulting cluster status and configuration information.
Resource.cmd	Write-then-read command file used in conjunction with a PERL script to issue resource-specific commands to the cluster and retrieve resulting resource status and configuration information.

