

Microsoft Cluster Installation Documentation

To assist you in installing your HP NetServer Microsoft Cluster, this file contains three separate documents combined into one pdf file.

- **Configuration Guide** - This guide provides configuration information specific to your cluster configuration that you will need during the installation of your cluster.
- **HP NetServer Microsoft Cluster Installation Guide** - Use this document to install the cluster.



18 November 1998
(See next page)

Version History

18 November 1998	Revised the Configuration Guide to add, “6 maximum per NetRAID adapter” to Logical Disks in Shared Storage.
15 September 1998	Revised the Configuration Guide to add, “Logical Disks – 1 per RAID array” to Shared Storage.
10 June 1998	Package released

HP NetServer LH Pro with NetRAID (HP Storage System/6) Cluster Configuration Guide

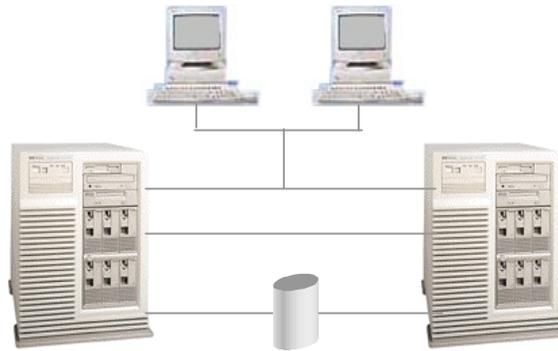
17 November 1998

Introduction

This document defines the supported HP NetServer LH Pro configurations for Microsoft Cluster Server. These configurations minimize single points of failure, provide maximum availability, and have been certified by Hewlett-Packard and Microsoft. This guide is prescriptive; it describes the HP NetServer LH Pro configurations supported by HP. Any configuration not expressly allowed by this guide will not be supported by HP.

What's Defined

- *Cluster*
- *SPUs*
- *Local and Shared Storage*
- *Intra-cluster and Client LANs*



Cluster

Type of SPUs	HP NetServer LH Pro 6/200 Model 1 Each node must be the same model SPU, but may have different size main memory and cache.
Number of nodes	2
Shared Storage	HP Storage System/6 with HP NetRAID controller and HP disks. See <i>Shared Storage</i> below.
LANs:	
Client LAN	Any NIC that is HP and Microsoft approved. See <i>Client LAN</i> below.
Intra-cluster (Heartbeat) LAN	HP D5013A or J3171A only with crossover cable. See <i>Intra-cluster LAN</i> below.
Power source	Direct from power mains, power conditioner or uninterruptable power supply (UPS) using any power conditioner or UPS.
System software:	
Navigator version	G.00.80 or later
Operating System	Microsoft Windows NT Server 4.0, Enterprise Edition or later.
Service pack	SP3 and hotfix "clusfixi", or later. The hotfix is not required but is recommended for clusters using 9.1GB and higher capacity drives.

SPU

Model	HP NetServer LH Pro 6/200 Model 1
Clock speed	200 MHz
No. of CPUs	2 (at least two are required)
BIOS version	4.05.14 PF or later
CPU cache	Any size
RAM	128 MB minimum. Must be HP.
No. of power supplies	2
Hot swap cages	May use for local storage; but not use for shared storage.
Local storage	Internal or external, using any controller. Must use HP disks. See <i>Local Storage</i> below.
I/O slots:	P9 - Shared storage controller (P8 if using NetRAID for local storage.) P7 - Intra-cluster (Heartbeat) LAN P6 - Client LAN All others - Any other plug-in cards.

Storage

Local

Physical drive location	SPU internal drive bays, or HP external drive cabinet (e.g., HP Storage System/6), or any combination.
Disk drives	Must be HP
Cables	Must be HP and < 3 m total length for external drive cabinet.
Controller	SPU embedded controller or any controller (any number, manufacturer or driver) in any available I/O slot. Use P9 for NetRAID local storage. See <i>SPU I/O slots</i> above.

Shared

Controller

Model	HP NetRAID D4943A Use with HP Storage System/6 and HP Cluster Adapter only.
No. of controllers	1 maximum
Firmware	S.01.00
Driver	2.03
NetRAID Assistant	A.01.09
SPU I/O slot	P9 (P8 if using NetRAID for local storage.)
SCSI ID	6, 7
Channels	0 and 1 only Do not use channel 2 for any purpose.
RAID level	1, 5, 10, and 50 only
Logical disks	1 per RAID array 6 maximum per NetRAID adapter
Configuration options:	Cluster mode on (cache write-through, no hot spare) Ultra SCSI disabled Termination: wide channel or automatic Set any other options as you prefer

Cabinet

Model	HP Storage System/6 D3604B
No. of cabinets	1, 2 A cluster with a single storage cabinet has only one SCSI bus connected to HP NetRAID channel 0. A cluster with 2 storage cabinets must have one cabinet connected to NetRAID channel 0 and the other cabinet connected to NetRAID channel 1.
SCSI IDs	Any SCSI IDs except 6 or 7
SPU hot swap cages	May not be used for shared storage.
Disk drives:	HP 2.1 GB Hot-Swap Ultra SCSI Disk Module D3582B or D3582C HP 4.2 GB Hot-Swap Ultra SCSI Disk Module D3583C HP 4.2 GB 10K rpm Hot-Swap Ultra SCSI Disk Module D4903A HP 9.1 GB Hot-Swap Ultra SCSI Disk Module D4289A HP 9.1 GB 10K rpm Hot-Swap Ultra SCSI Disk Module D6019A HP 18.2 GB Hot-Swap Ultra SCSI Disk Module D5039A
Cables	HP Cluster Adapter D5957A
RAID arrays	A RAID array (logical disk) must be composed of all the same disk model. Different size or speed disks are not allowed in the same RAID array. Any combination of disk models is allowed on a SCSI channel. Any combination of disk models is allowed in a cluster.

LANs

	<u>Intra-cluster (Heartbeat) LAN</u>	<u>Client LAN</u>
LAN connection	HP D5954A crossover cable or any equivalent only The intra-cluster LAN may only be used for cluster node communication via a crossover cable. It may not be used for client communication.	Any LAN
NIC:		
Model	HP D5013A (10/100TX PCI) (or HP J3171A)	Any that is on both the HP Tested Products List and the Microsoft Hardware Compatibility List.
Driver	2.24.00.0000 or later	Any driver
SPU I/O slot	P7	P6

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HP NetServer LH Pro Microsoft Cluster Installation Guide

1 October 1997

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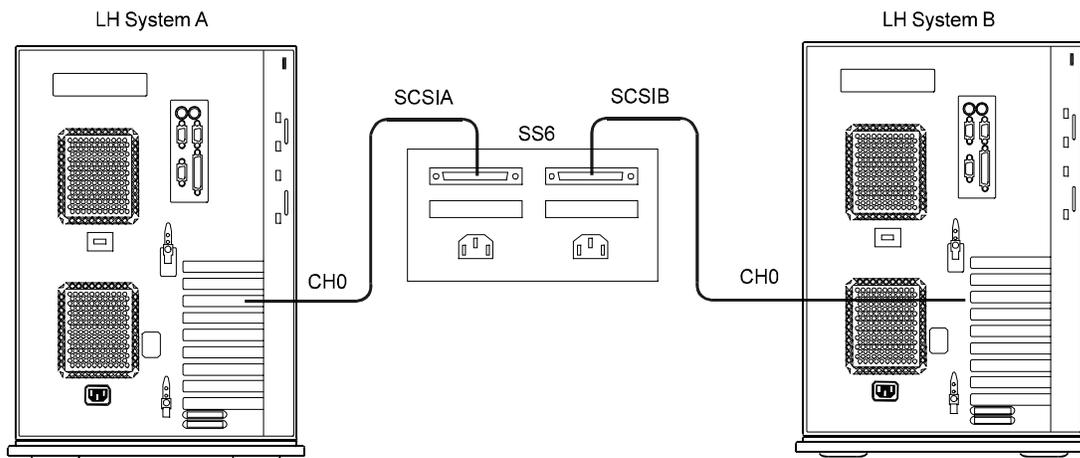
Overview of an HP NetServer LH Pro Cluster Installation

NOTE

Hewlett-Packard does not support nor recommend the installation of clustered HP NetServer systems using Microsoft Cluster Server software unless installed by an HP Cluster Certified Installer.

An HP NetServer LH Pro cluster provides a reliable low-cost, increased-availability solution for critical applications. The basic cluster consists of two HP NetServer LH Pro systems coupled to one (or two) HP Storage System/6 using HP NetRAID adapters. Both HP NetServers run Microsoft Windows NT Server, Enterprise Edition, which includes Microsoft Cluster Server software.

The operating system files, application files, and any other files local to one system are stored on a hot swap disk on each system. Both the LH Pro cluster "nodes," referred to throughout this document as System A and System B (see the following illustration), share the drives located in the HP Storage System/6. The two HP NetServers share the drives using an HP NetRAID adapter housed in each system.



Base Configuration for an HP NetServer LH Pro Cluster

Required Hardware and Software

In addition to the required hardware and software components listed below, you will, during the course of cluster installation, be required to supply the following:

- Minimum of three IP addresses, one for each System (A and B), and one for the HP NetServer cluster
- Cluster and node names (limited to 15 or less alphanumeric characters)
- Subnet mask
- MS domain account name and password

Unless otherwise specified, when more than one component is required, the additional component(s) must be identical in manufacture and configuration.

Hardware

The following hardware components are required for HP NetServer LH Pro cluster installations.

Quantity System A	Hardware Component	Quantity System B
1	HP NetServer LH Pro	1
1	Display	1
1	HP 64MB, 60ns RAM	1
1	System Disk (not part of shared storage)	1
1	Generic PCI Ethernet LAN adapter	1
1	HP J3171A 10/100TX PCI Ethernet LAN Adapter (for cluster LAN)	1
1	HP D4943A HP NetRAID Adapter	1
1	HP D5957A NetRAID Cluster Adapter	1
1	HP D4921A Power Supply (redundant)	1
Shared Storage		
	1-2 HP Storage System/6	
	2-12 Hot Swap Disk Drive (shared storage)	

Dual Processor Requirement

Uni-processor HP NetServers LH Pros are not supported by the Microsoft Server Cluster. To upgrade an HP NetServer's processing capability to allow cluster operations, see HP Order Assistant (below) for the required hardware, and refer to the appropriate instructions in HP Information Assistant (below).

Required Tools

When installing an HP NetServer LH Pro using an HP NetServer Storage System/6, you will need the following tools to disassemble and re-assemble the hardware:

- 1/4" flat-blade screwdriver
- Torx™ driver (#T15)
- Paper clip, or similar pointed instrument (used to toggle small dip switches)
- Flashlight (optional)
- Portable Field Service Grounding Kit (3M part number 8505, or equivalent)

Software

To set up an HP NetServer LH Pro running Microsoft Cluster Server, use the Microsoft Windows NT Server (Enterprise Edition), version 4.0, which includes the following:

- Windows NT, version 4.0
- Windows NT Service Pack 3
- Microsoft Cluster Server installation software

The following HP software products are also required:

- *HP NetServer Navigator CD-ROM*, version G.00.85 or later
- HP NetRAID Utilities

About HP NetRAID Utilities

Before you begin your HP NetServer cluster installation, you need to obtain copies of HP NetRAID utilities that are essential to the cluster setup. These are included in a self-extracting executable file, **nr_clust.exe** that includes HP NetRAID firmware, drivers and NetRAID Assistant.

To get a copy of the HP NetRAID utilities, you must first download, extract, and then copy the HP NetRAID firmware, driver, and NetRAID Assistant that you will need to setup your cluster. Refer to Appendix A for further instructions.

HP Online and Information Services

HP offers an online service to help you determine what hardware and software you need for your particular cluster configuration. Once you have the resources you need you have extensive support information available through HP Information Assistant.

HP Order Assistant

HP Order Assistant provides a list of HP NetServers and peripheral components including HP accessories, cables, and connectors. HP Order Assistant is available on the Internet at <http://www.hp.com/go/netserver>.

HP Information Assistant

The *HP NetServer Navigator CD-ROM* includes HP Information Assistant, an online document viewer that contains all your system documentation. Although you can access the HP Information Assistant from the NetServer Navigator Main menu, HP recommends that you install HP Information Assistant on an available Windows client connected to a printer. For more information about installing HP Information Assistant, refer to the system documentation.

The following reference materials may be useful when setting up the Microsoft Cluster Server. They are available by choosing "Install" or "Reference Books" on the HP Information Assistant's Main menu:

- *HP NetRAID User Guide*
- *HP Storage System/6 User Guide*
- *Processor Upgrade Instructions*
- *HP NetServer LH Pro Microsoft Windows NT 4.0 Installation Guide*

Setup Procedure

You begin a cluster installation by setting up the hardware at both HP NetServer LH Pros, referred to here as System A and System B. The installation is complete when you have setup and tested the Microsoft Cluster Server software on both systems.

A Microsoft Cluster Server based on HP NetServers is assembled in six major parts:

- Part 1. Install Additional Hardware components
- Part 2. Setup the Storage System/6
- Part 3. Configure the NetRAID adapters
- Part 4. Install Windows NT 4.0 and configure LAN adapters
- Part 5. Install NetRAID software and configure disk arrays
- Part 6. Install and test MS Cluster Server software

As you proceed through these instructions, pay close attention to the order in which components are installed and systems are brought up. Be sure to configure the systems in the sequence outlined above. Departing from the procedures presented here may cause unnecessary work and unpredictable results. To begin the cluster installation, continue to "Part 1: Installing Additional Hardware Components."

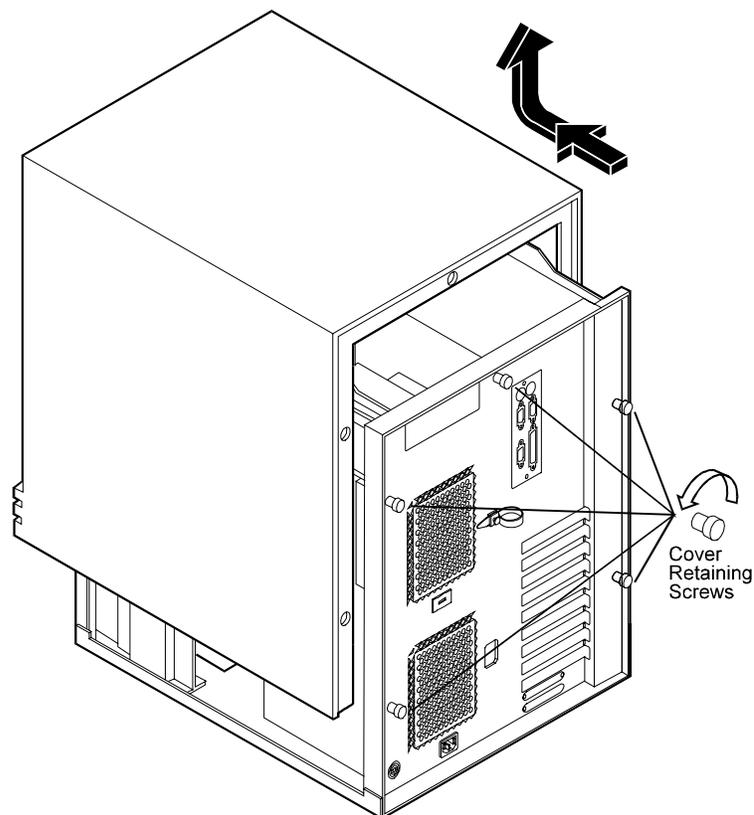
Part 1: Installing Additional Hardware Components

When HP NetServer LH Pros are shipped from the factory, they are configured for stand-alone operation. The first step in creating a cluster is to reconfigure the two HP NetServers for use in a cluster. Because these steps involve opening the HP NetServers, HP recommends you use a Portable Field Service Grounding Kit (3M part number 8505, or equivalent). The kit contains a wrist strap, anti-static mat, and cable. Using this kit prevents damage to the system from static electricity.

NOTE The steps outlined below are duplicated on both HP NetServer LH Pro systems (System A and System B). You may proceed through all the steps on System A, and then repeat on System B, or you may choose to perform each step on both systems before moving to the next step.

To install additional hardware components at Systems A and B:

1. Assemble the required hardware components listed in the requirements for the HP NetServer LH Pro cluster, except the HP Storage System/6 unit(s). Separate the components into two systems designated **System A** and **System B**.
2. Remove the cover from the HP NetServer LH Pro as shown here.



Removing the Cover from the HP NetServer LH Pro

Installing Peripheral Components

In this step, you will install peripheral components that are necessary for the servers to operate in a cluster configuration.

NOTE The standard HP NetServer LH Pro is equipped with 32 to 64 MB of memory. Cluster operations require a minimum of 128 MB of memory. If you have a standard system, you will need to add additional memory to each of your HP NetServer LH Pros to bring them up to the minimum requirement for cluster operations.

To install peripheral components at Systems A and B:

1. If necessary, install additional main memory according to the instructions that come with the memory. (See Note above.)
2. Install the system disk.
HP recommends use of a hot swap drive. Install it in the upper center slot of the HP NetServer LH Pro card cage (SCSI address 0).
3. Install two LAN cards (HP part number HP J3171A) in each System as follows.

Use PCI slot 7 for the Cluster (heartbeat) LAN

Use PCI slot 6 for the Client LAN

Installing the cards in other slots may cause IRQ conflicts.

4. Remove the fan and install the redundant power supply.
Follow the instructions included with the power supply. Pay close attention to the lower left corner of the power supply to ensure it doesn't pinch, snag, or otherwise interfere with the SCSI cables coming from the main system board.

NOTE If you are using array model LH Pros for your cluster, proceed to the section below, "Recabling the Array Model LH Pro". If you are using non-array model LH Pros for your cluster, skip the next section and proceed with the "Installing the HP NetRAID Adapter" section.

Recabling the Array Model LH Pro

The array model LH Pro is cabled internally so that the NetRAID card uses the drives in the internal hot swap cages. To use an array model LH pro in a cluster, it must be recabled as a non-array model, so the internal hot swap cages are connected to the embedded SCSI A and B controllers, and the NetRAID card may be connected to the external shared storage.

To recable an array model LH Pro to a non-array model, refer to the reference label on the right side of the computer and perform these steps:

1. Remove the C14 cable that connects the lower hot swap cage to the upper cage. Set this cable aside.
2. Remove the adapter that connects the C22 cable from SCSI A to the C11 cable that goes to the CD-ROM drive. Set the adapter aside.
3. Connect the free end of the C22 cable that comes from SCSI A to the 68 pin input connector on the top hot swap cage. The input connector is on the right when the cage is viewed from the back.

4. Connect the free end of the C11 cable from the CD-ROM drive to the 50-pin output connector on the top hot swap cage. The output connector is on the left when the cage is viewed from the back.
5. Remove the C23 cable from the SCSI B controller connector and coil the cable up out of the way.
6. Remove the C22 cable from channel 0 of the NetRAID card and connect it to SCSI B.
7. Set the DIP switches on the back of the hot swap cages as shown below. Note the DIP switches are off when they are set to the left.

Top Cage Switch		Bottom Cage Switch	
Number	Position	Number	Position
1	off	1	off
2	off	2	off
3	off	3	off
4	on	4	off
5	on	5	on
6	off	6	on

8. Replace the LH Pro cover and bezel.

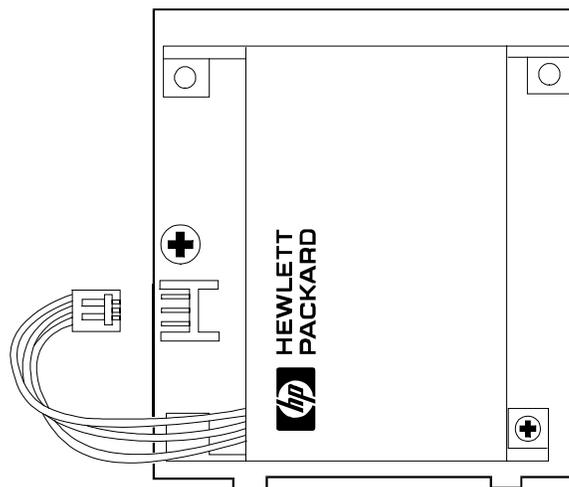
You have now completed hardware installation on the LH Pros and are ready to proceed to Part 2: "Setting up the HP Storage System/6".

Installing the HP NetRAID Adapter

You are now ready to connect the HP NetRAID Adapter to the battery backup module, and then to install the HP NetRAID Adapter (model number D4943A). The battery backup module is a mezzanine card already in place on the HP NetRAID Adapter.

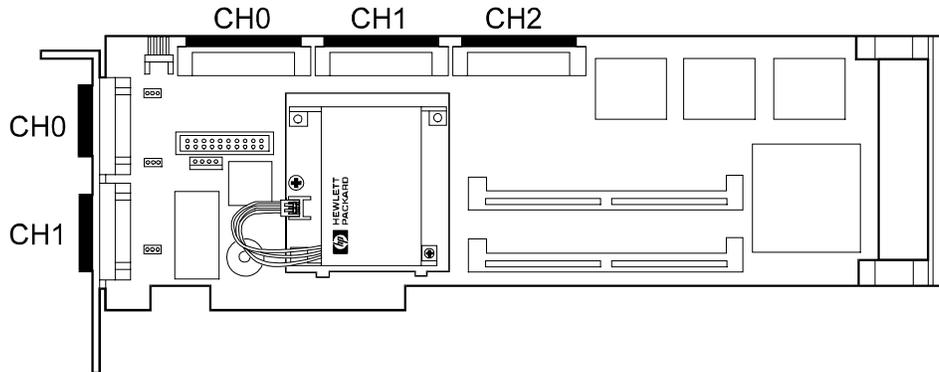
To install the HP NetRAID Adapter at Systems A and B:

1. Plug the connector on the wire leading from the lower left corner of the battery backup module into the connector as shown below.



Battery Backup Module with Disconnected Battery Pack

The connector is keyed to insure correct connection. When connected, the battery backup module protects the HP NetRAID Adapter's cache memory.



HP NetRAID Adapter with Connected Battery Pack

NOTE To assemble a certified Microsoft Cluster Server, use only an HP NetRAID Adapter (model number D4943A).

2. Using a Torx™ driver, remove the PCI card holddown plate.
3. With the battery backup module connected, install the HP NetRAID Adapter in PCI slot 9.
4. Replace the hold-down plate.
5. Replace the HP NetServer LH Pro cover and bezel.
You have now completed hardware installation on the HP NetServer LH Pros, and are ready to proceed to "Part 2: Setting Up the HP Storage System/6."

Part 2: Setting Up the HP Storage System/6

In this section, you prepare the HP Storage System/6 for cluster operations by:

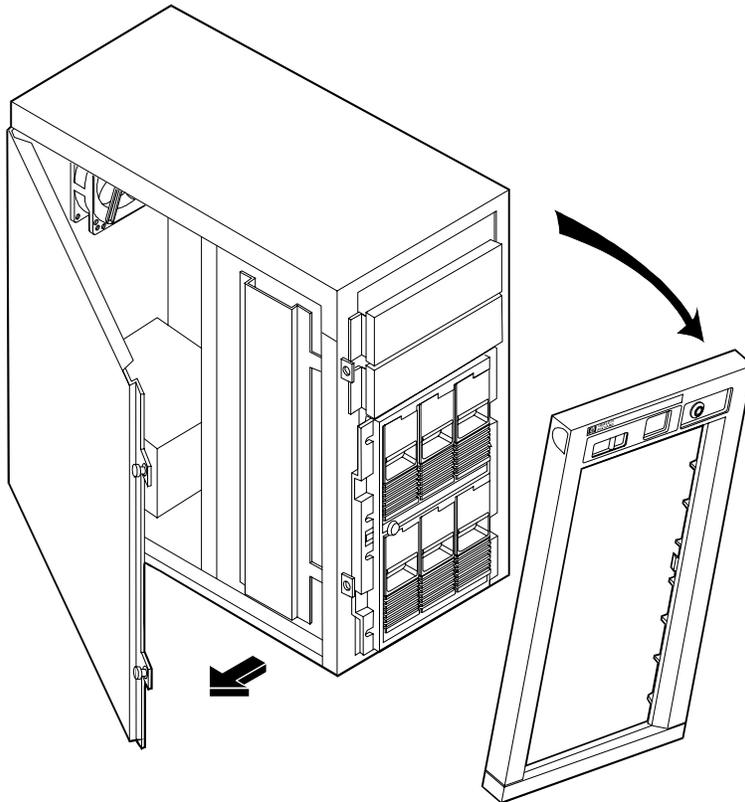
- Configuring the internal cabling on the HP Storage System/6
- Assigning SCSI IDs (via dip switches) for the disks in the HP Storage System/6

Verifying SS6 Internal Cabling

Before connecting the disks housed in the HP Storage System/6, you need to setup the Storage System/6's internal cables to support the cluster. To gain access to internal cables and dip switches, you must open the storage system's side door.

To remove the door from the HP Storage System/6:

1. Unlock the bezel from the chassis.
2. Pull the top of the bezel forward, swinging it down to clear the retaining clips at the bottom of the chassis. Lift the bezel away from the chassis, as shown in the following illustration.



HP Storage System/6 Cabinet with Bezel and Side Cover Removed

3. Loosen the door-mounting screws using a flat-blade screwdriver. (The screws remain attached to the door.)

4. Swing the door open, as shown in Step 2.
5. Lift the door off the chassis.

Repeat Steps 1-5 for each Storage System/6 to be included in the cluster.

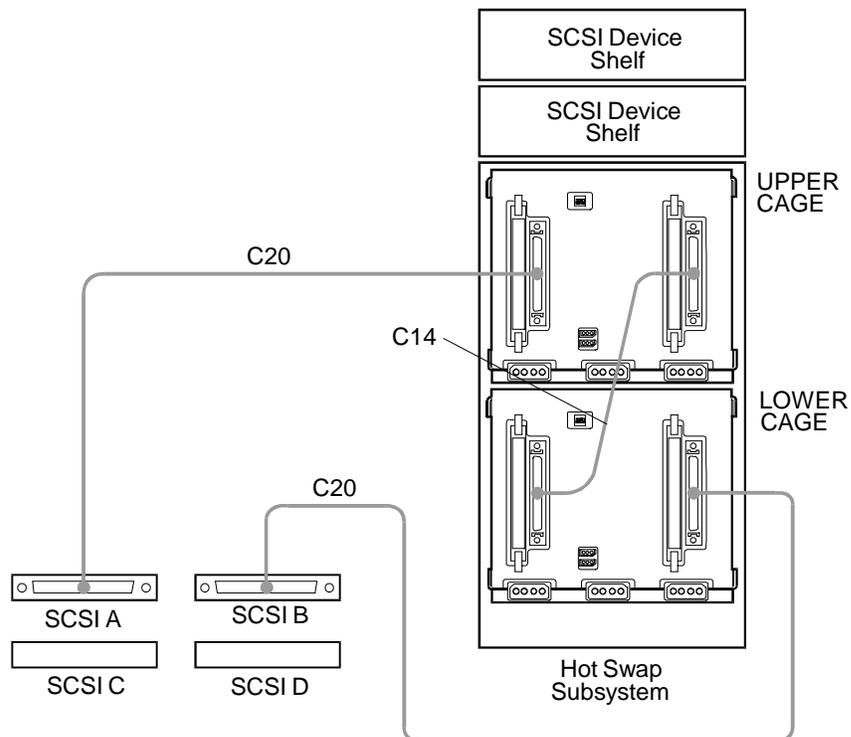
HP Storage System/6 Internal Cabling

Using the schematic view of the HP Storage System/6's internal cabling shown below, you need to check and, if necessary re-route, the three cables located inside the storage unit. These are:

- C14: A short cable connecting lower cage to upper cage
- C20: A cable connecting the external port and routed to the "in" side of the lower disk cage
- C20: A cable connecting the other external port to the top cage

Cabling Diagram Legend

Cable Label	Description	Part Number
C14	Fast-Wide SCSI (68 pin) cable	5182-6747
C20	Fast-Wide SCSI (68 pin) cable with external connector	5182-9326

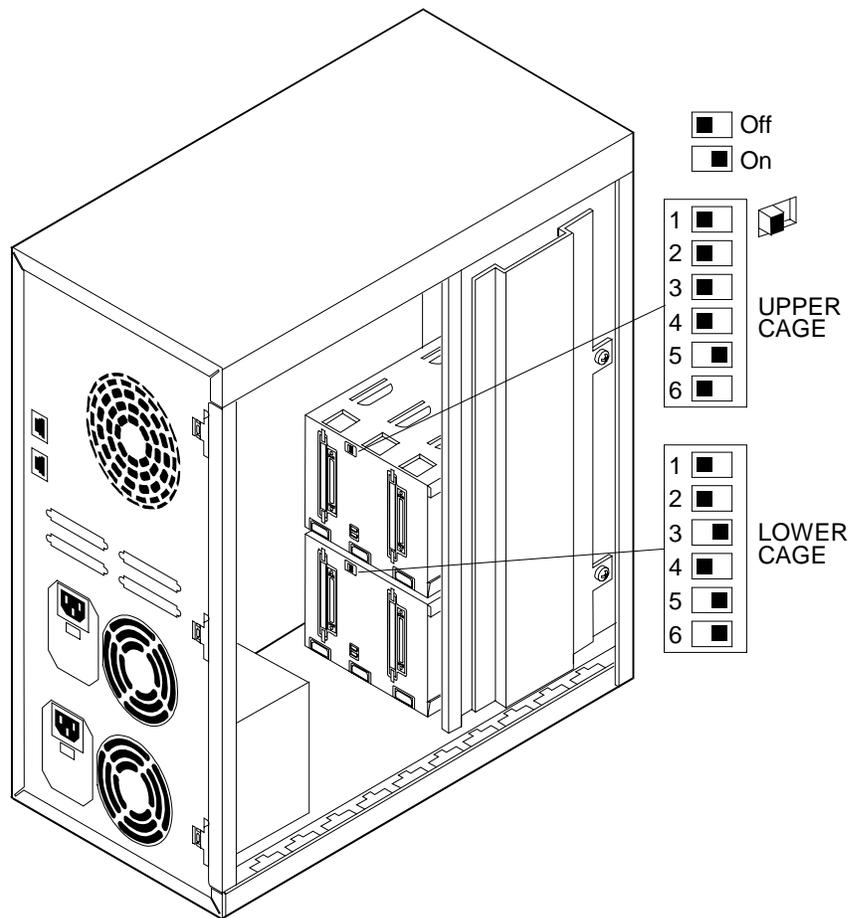


Schematic View of Storage System/6 Cabinet Internal Cabling

Assigning SCSI IDs

To configure the shared disks, you need to change the SCSI ID assignments for each of the HP Storage System/6 units you are including in the cluster:

1. Check, and if necessary re-assign, SCSI ID's for both the upper and lower cages. Configure the DIP switches as indicated in the figure below. Note that the upper cage settings are shown in their default positions.



HP Storage System/6 DIP Switch and Cluster Assignments

2. Reattach and close the HP Storage System/6 door. Replace the front bezel. Leave the power off. The HP Storage System/6 must be operated with the door closed to ensure proper airflow and to prevent radio frequency interference. Repeat Steps 1-2 for each HP Storage System/6 to be included in the cluster.

When you have finished, the hardware configuration of the Storage System/6 is complete. You are now ready to proceed to "Part 3: Configuring the HP NetRAID Adapter."

WARNING Do not cable the shared storage units to System A and B at this time. You must configure the HP NetRAID Adapter (Part 3), and install Microsoft Windows NT Server, Enterprise Edition (Part 4) before attaching the HP Storage System/6.

Part 3: Configuring the HP NetRAID Adapter

In Parts 1 and 2, you installed additional hardware in your HP NetServers to support cluster operations, and configured both the HP NetServers and the shared storage units for use in the cluster. In Part 3, you will be configuring the HP NetRAID Adapters you installed in Systems A and B using the HP NetRAID Express Tool.

To configure the HP NetRAID Adapter, at both Systems A and B:

1. Ensure that Systems A and B are **not** cabled to the shared storage cabinets. Premature cabling of the external storage units to the HP NetServers will confuse later configuration steps.
2. Power up Systems A and B.
During server boot-up, the firmware displays the HP NetRAID version after initialization and a quick channel scan. The HP NetRAID firmware version number should read **firmware version A.03.10** or later.

NOTE The NetRAID boot banner first displays a BIOS version and then a firmware version. Both versions must be A.03.10 or later.

If the NetRAID firmware version is not A.03.10 or later, it must be updated using the procedure in Appendix B, "Updating the NetRAID Firmware."

3. Use the HP NetRAID Express Tools to configure the adapter. When the following prompt appears:
Option: Experienced users may press <Ctrl> <M>
for HP NetRAID Express Tools now.

Press CTRL+M.

When system scanning is complete, HP NetRAID Express Tools Management menu appears.

NOTE HP NetRAID Express Tools are management and diagnostic utilities that contain functions not available in HP NetRAID Assistant.

4. From the Management menu, choose Disable BIOS, then choose Yes.
HP NetRAID Express Tools displays the message, "BIOS Is Currently Disabled".
5. From the Management menu, choose Objects | SCSI Channel.
Select and then disable the Ultra SCSI option for all three channels.
6. From the Management menu, choose Objects | Adapter | Cluster Mode.
Choose Enable and then Yes. The display confirms "Cluster Mode Enabled."
7. Optional: You may want to disable Alarms at this point.
From the Management menu, choose Objects | Adapter | Alarm Control | Disable Alarm.
8. From the Management menu, choose Objects | Adapter | Initiator ID.
Set the Initiator ID as follows:
On **System A**, set the Initiator ID to **7**.
On **System B**, set the Initiator ID to **6**.

9. If the previous step did not force a reboot, continue pressing Escape to exit the NetRAID Express Tools utility. When prompted to exit, press Yes.
The utility re-boots to enable the changes you have made.

When the HP NetRAID Adapters on both systems are configured, proceed to "Part 4: Installing Microsoft Windows NT, and configuring the LAN Adapters."

Part 4: Installing Microsoft Windows NT and Configuring the LAN Adapters

After you have configured the HP NetRAID Adapter, you are ready to install Microsoft Windows NT Server, Enterprise Edition. Prior to Windows NT installation, use the HP EISA Configuration Utility to configure the hardware for use with the network operating system.

NOTE Ensure that your *HP NetServer Navigator CD-ROM* is designated "version G.00.85", or later before continuing with the HP EISA Configuration Utility. If your *Navigator CD-ROM* is out-of-date, you must upgrade it before proceeding.

Configuring Your Systems for Windows NT Installation

To configure the hardware using the HP EISA Configuration Utility, at both Systems A and B:

1. Insert the *HP NetServer Navigator CD-ROM* in the CD-ROM and restart the HP NetServer. The HP NetServer boots from the *Navigator CD-ROM*. If Navigator does not come up in its main menu, choose Back to get to the main menu.
2. From the Navigator Main menu, choose NetServer Utilities, then EISA Configuration Utility.
3. In the EISA Configuration Utility, disable the Embedded IDE Hard Disk Controller. (The embedded IDE controller is not used on HP NetServer systems.)
4. Save and exit the EISA Configuration Utility. The Utility saves your configuration data, restarts the HP NetServer and reloads the *HP Navigator CD-ROM*.
5. Go back to the HP Navigator Main menu, then choose Configuration Assistant, then select Custom, then Microsoft. Select MS Windows NT 4.0 as your NOS.
6. After viewing the configuration advisories, continue and Choose Install/Update Utility Partition. Configuration Assistant creates the Utility Partition, and copies over the appropriate files. Leave the *Navigator CD* in the drive. When finished, the system re-boots. After re-booting, the system displays the Custom Configuration menu.
7. Go back to the Navigator Main menu, then choose NetServer Utilities, then Diagnostic Assistant. Navigator displays the Diagnostic Assistant Main menu.
8. From the Diagnostic Assistant Main menu, choose Quick Tests. Diagnostic Assistant runs a sequence of tests to determine if hardware is performing properly.

NOTE Because your HP NetServers are not yet joined to the cluster, this is a good time to run all the tests including the SCSI Device Tests. Disregard any cautionary notes that discourage testing at this point.

After you have configured both Systems A and B you are ready to proceed to "Installing Microsoft Windows NT."

Installing Microsoft Windows NT

In addition to installing Microsoft Windows NT, in this section you also configure the operating system for cluster operations.

To install Microsoft Windows NT for Microsoft Cluster Server operations, at both Systems A and B:

1. Insert the Base CD of the Microsoft Windows NT Server, Enterprise Edition and reboot the system. Microsoft Windows NT begins installation.
2. As you proceed through the installation, select these options when prompted.
 - Accept the AIC-78XX controller driver selection.
 - Install Windows NT on unpartitioned space, not on the EISA utilities partition.
 - Enable networking. At the network Adapters screen install the network adapter for the intra-cluster (heartbeat) interconnect:
 1. Click "Select from list".
 2. Select the HP 10/100TX PCI Ethernet Adapter and click OK.
 3. When prompted to use DHCP, select No.
 4. Enter an IP address and subnet mask for the intra-cluster network card. See the "Microsoft Cluster Server Administrator's Guide" for guidance on selecting an IP address and subnet mask for the intra-cluster network card.
 - Finish the installation of Windows NT, Enterprise Edition by installing Service Pack 3.

NOTE Do NOT install the Microsoft Cluster Server (MSCS) software at this time.

3. After Windows NT is installed, you may change the video driver. Windows NT installs a generic video driver that does not permit you to use the full resolution of the video chip.

From the Start menu, choose Settings | Control Panel | Display | Settings | Display Type | Change. Select the Trident 9000 video driver and click OK. You will be prompted to supply the driver; it is located on the Base Windows NT CD. After rebooting you may use the full video resolution of the video chip.

4. Install the client network adapter. From the Start menu, choose Settings | Control Panel | Network | Adapters | Add. Select the network adapter you are using to connect to the client network and click OK. When prompted, supply the TCP/IP properties for this network connection.

After installing Windows NT on both systems, proceed to Part 5: Installing the HP NetRAID Software and Configuring Disk Arrays.

Part 5: Installing HP NetRAID Software and Configuring the Disk Arrays

After Windows NT has been installed and configured for cluster operations and you have upgraded the operating system with Service Pack 3, you need perform the following tasks to prepare Systems A and B for the Microsoft Cluster Server software:

- Install the NT NetRAID driver
- Install NetRAID Assistant software
- Connect the shared storage
- Configure the disk arrays.

Installing the NT NetRAID Driver

To install the driver for the HP NetRAID adapter:

1. From the Start menu select Settings | Control Panel | SCSI Adapters | Drivers | Add | Have Disk. Insert the disk you created earlier labeled "NetRAID Firmware and Driver" in the floppy drive and click OK. After the driver is installed, remove the disk and restart the computer to load the driver.

Installing NetRAID Assistant

To install the NetRAID Assistant software that will manage the cluster's disk arrays:

1. Using the HP NetRAID Utility diskettes you have already created, insert the disk labeled "NetRAID Assistant 1" in the floppy drive and run A:\SETUP.EXE.
2. During NetRAID Assistant Setup, you will see two options:
 1. **Manage NetRAID adapters**
 2. **Manage NetRAID adapters in NT and Netware Servers**

Choose option one. Do *not* choose the option that includes Netware servers.

After you have installed the NetRAID software on both systems, you are ready to proceed to "Connecting the Cluster's Shared Storage."

Connecting the Cluster's Shared Storage

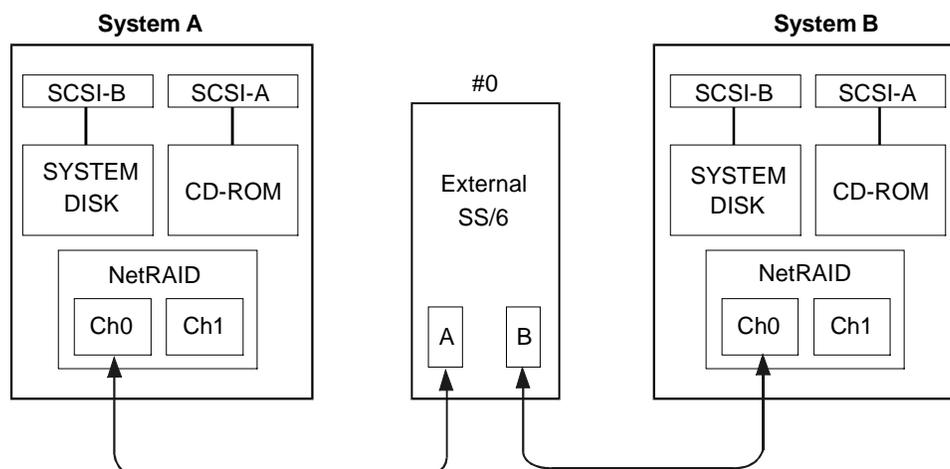
Refer to one of the following schematics as you connect the HP Storage System/6 cabinet(s) to the cluster's NetServers. Use only D5957A NetRAID Cluster Adapters to connect the HP Storage System/6 to the servers.

To connect the HP Storage System/6 unit(s) to the HP NetServers:

1. Power down all cluster hardware including both HP NetServers and the HP Storage System/6 cabinet(s)
2. Install the hot swap disks in the HP Storage System/6 cabinet(s).

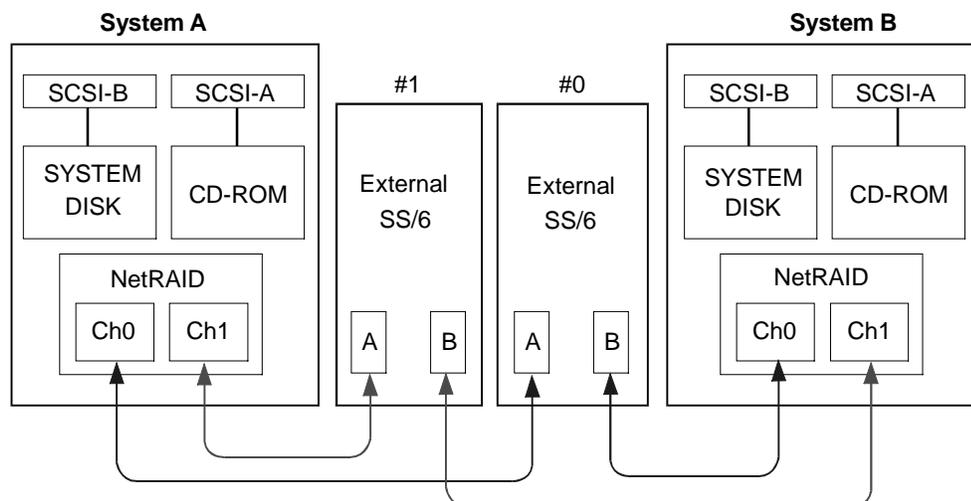
NOTE If you are using two HP Storage System/6 cabinets, proceed to steps 5 and 6 where you add cluster adapters for channel 1. Otherwise, proceed to "Connecting the LAN Adapters."

3. Connect System A's NetRAID channel 0 to the SCSI A port located on the back of HP Storage System/6 #0.
4. Connect System B's NetRAID channel 0 to the SCSI B port located on the back of HP Storage System/6 #0.



HP NetServer LH Pro Cluster with One HP Storage System/6

5. Connect System A's NetRAID channel 1 to the SCSI A port located on the back of HP Storage System/6 #1.
6. Connect System B's NetRAID channel 1 to the SCSI B port located on the back of HP Storage System/6 #1.



HP NetServer LH Pro Cluster with Two HP Storage System/6 Units

NOTE NetRAID channels must not cross. Connect HP NetRAID channel 0 leading from both HP NetServers to the same external storage cabinet. Likewise, cable both HP NetRAID channel 1 to the other storage cabinet. It is a good idea to color code the cable ends with the ports they connect. In this way, when a cluster component is removed for maintenance or repair, it can easily be reconnected without danger of crossing channels.

Connecting the LAN Adapters

To finish cabling the cluster you need to connect the two LANs that allow the cluster to communicate node to node as well as outside the cluster. Keep in mind the intra-cluster LAN (that provides the cluster heartbeat) uses the slot 7 LAN adapters whereas the extra-cluster (client) PCI adapters are installed in slot 6.

To connect the cluster's LAN adapters:

1. Using a crossover cable, connect System A PCI slot 7 to System B PCI slot 7.
2. Connect a standard Ethernet cable connector to each of the cluster's PCI slot 7 adapters.

Your cluster's major hardware components are now cabled and cluster ready. After powering up your external storage, you are ready to begin the process of software installation and configuration.

Powering Up the HP Storage System/6

With external cabling of the cluster complete, you are ready to configure the shared disks for cluster use. Begin by powering on the HP Storage System/6 unit(s). Be sure to connect both power cords (each on a separate circuit) to supply redundant power to the shared disk drives.

CAUTION At this point and until Microsoft Cluster Server is fully installed, only one HP NetServer system should be running NT 4.0 at a time. The other system must be either powered off or held at the NT loader prompt.

The front panel of the storage system includes two-digit, seven-segment LEDs. Because the LEDs are powered by the internal power supply, if the power supply is not functioning you will not see a display. When operations are normal, the display shows "HP" or the unit identification number.

Typical error messages related to power-up problems include:

- **Fan Fault** Display show "FF" alternately with "HP" Do not continue to operate the storage system without a functional fan as the disk drives will quickly overheat.
- **Power Supply Fault** Display shows "PF" blinking alternately with "HP" (The voltage switch may not be set correctly or a power supply is not working. Check to see find if the line power voltage matches the voltage switch setting (for example, 115 volts in the U.S. and 230 volts in Europe).
- **Line Power Fault** Display shows "LF" blinking alternately with "HP". Check to be certain that line power is properly connected to each power supply and to viable power sources.

CAUTION Do not run the storage system if the fan is not operational.

For more information on HP Storage System/6 error messages and operating conditions, consult the *HP Storage System/6 User Guide*.

Configuring the Arrays: System A

You configure the cluster's arrays using HP NetRAID Assistant. Unlike most other cluster setup procedures, you configure the arrays only once, on System A. Later, you will confirm you have matching arrays on System B.

Before beginning array configuration, you need to partially boot System B so the HP NetRAID adapters in System A and B can communicate array configuration information to one another.

To partially boot Windows NT you need to halt the system when it reaches the NT Loader prompt:

1. Reboot System B.
During bootstrap, you will be prompted to select the operating system you want to start.
2. Press the Esc key to hold the boot at the loader prompt.
Pressing Esc puts the partially completed boot process on hold until you select the operating system and press Enter.

Now start NetRAID Assistant on System A:

3. With System B holding at the NT loader prompt, boot System A to NT.

Defining RAID Arrays

With System B on hold, you can now use HP NetRAID Assistant (on System A) to create and initialize the shared logical disks. You use proprietary HP NetRAID software to organize the cluster's disk storage into RAID disk arrays, either RAID level 1 or RAID level 5.

- Each level 1 RAID array is composed of two hard (hot swap) drives located in the external shared storage cabinets.
- Each level 5 RAID array is composed of three hard (hot swap) drives located in the external shared storage cabinets

To set up your RAID arrays:

1. Review the examples and procedures included in Appendix C before using HP NetRAID Assistant.
2. Follow the procedures outlined in Appendix C for the RAID level appropriate to your installation. Refer to the *HP NetRAID User Guide* in HP Information Assistant for detailed information about HP NetRAID configuration.

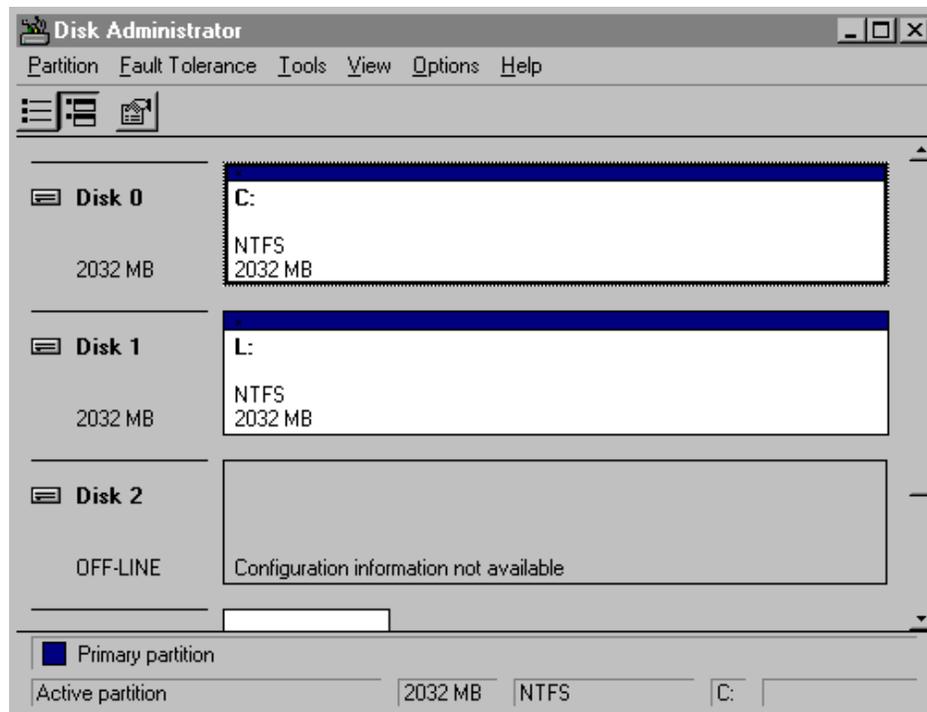
After you have finished defining and configuring the cluster's arrays using HP NetRAID Assistant, you need to finish configuration using the Windows NT Disk Administrator utility.

Configuring the Array Using Windows NT Disk Administrator

The next configuration steps use the Windows NT utility, Disk Administrator. After you have created and initialized the logical arrays, you need to format the logical disks and then assign them "sticky" drive letters.

To run Windows NT Disk Administrator:

1. Reboot System A so that Windows NT can recognize the logical disks you just created. The system boots and loads Windows NT on System A. To get accurate information about your shared disks, you must reboot the System **before** you run Disk Administrator.
2. From the Start menu, choose Programs | Administrative Tools | Disk Administrator. Disk Administrator loads, scans the disks and displays a list of the logical disks you created when you initialized the arrays using HP NetRAID Assistant.



Disk Administrator, Partitioning Logical Drives

Disk Administrator lists disks in order, beginning with local (non-shared) disks first. If you have three local disks, Disk Administrator will designate them Disk 0, Disk 1, and Disk 2. The shared arrays (logical disks) will be identified as Disk 3, Disk 4, and so on. Next, using Disk Administrator, you will create a single partition on each of the logical disks you just configured.

To create a partition for each array:

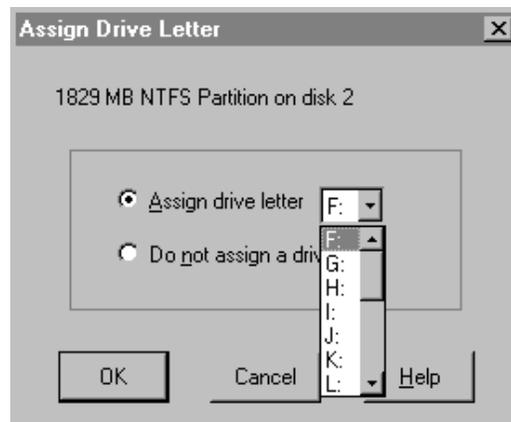
1. Click on a disk box to select a disk.
Disk Administrator highlights the selected disk.
2. From Disk Administrator's Partition menu, choose Create.
A dialog box appears indicating the maximum size of a single partition.
3. Click OK to include the full disk in the partition (the default).
Although NT allows you to partition a disk into separate drives, Microsoft Cluster Server will only manage **one partition per disk**.
4. Repeat steps 1 through 3 for each disk to be shared by the cluster.
5. From Disk Administrator's Partition menu, choose "Commit changes now".
All configurations are enabled by the network operating system.

NOTE The order of these steps is important. Be sure to "commit" changes in Disk Administrator *before* attempting to assign drive letters. You must assign drive letters to all shared disks before installing Microsoft Cluster Server software.

After you have created a single partition for each array, you need to assign a permanent (sticky) drive letter to each drive you want to make available to both Systems A and B.

To assign a permanent drive letter to the arrays that will be shared by the cluster:

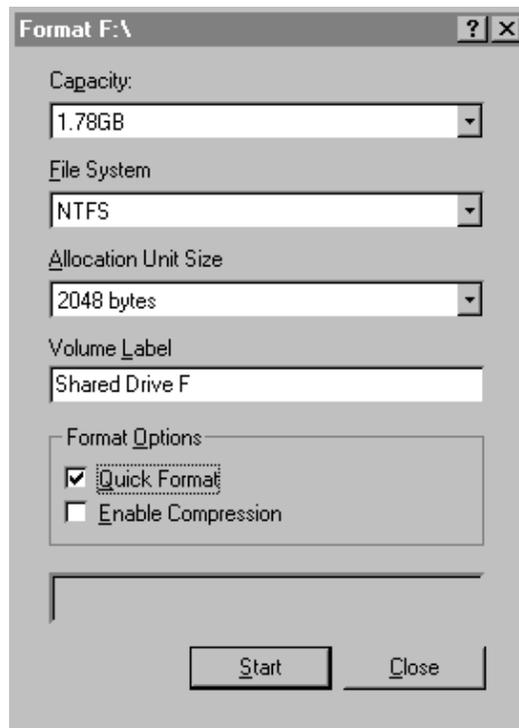
1. Click to select one of the disks you just partitioned.
Disk Administrator highlights the selected disk.
2. From the NT Disk Administrator's Tools menu, choose Assign Drive-Letter.
Disk Administrator displays the Assign Drive Letter dialog box.



Disk Administrator, Assigning Drive Letters

3. In the Assign Drive Letter dialog box, select a drive letter.
To avoid confusion later on choose sequential drive letters.
4. From the NT Disk Administrator's Tools menu, choose Format and, in the space provided, provide a Volume Label for the drive.

Choosing a descriptive label such as "Shared Drive F" will be helpful later when you need to match drive letter assignments at System B.



Disk Administrator, Formatting a Disk

5. Repeat steps 1 through 4 for each disk to be shared in the cluster.

At this point, you have completed disk configuration. Before continuing, you need to check System B to be sure that its array configuration matches System A's. To do this, you need to shut down System A (but leave it powered on):

To shut down System A:

1. From the Windows NT Start Menu, click Shut Down.
Windows displays its Shut Down dialog box.
2. From the Windows Shut Down dialog box, choose Shut Down the Computer.
Windows displays the Shutdown Computer prompt (with the option to Restart).
3. Leave the prompt displayed and the computer powered on at this point.
The computer is powered on but idle. Proceed to "Confirming the Arrays on System B."

Confirming the Arrays on System B

To confirm the cluster's disk configuration, you need to check System B to be sure it recognizes all the drives you created to System A.

1. Boot System B.

You may, while booting System B, get the message "Configuration of NVRAM and drives mismatch" in the NetRAID boot banner. This usually happens if you had System B powered down, rather than holding at the NT loader prompt, while you were configuring the drives on System A.

If you get this message, enter the NetRAID Express Tools. From the Management Menu, choose Configure | View/Add/Delete Configuration | View Disk Configuration and then press Esc and save the configuration. Exit the NetRAID Express Tools and reboot System B.

2. Start NetRAID Assistant to check the arrays you defined on System A have transferred to System B. From the start menu choose Programs | NetRAID | NetRAID Assistant.
3. Examine the composition of the arrays as shown in the Physical Devices and Logical Devices panes in the NetRAID Assistant main window. If they differ from the arrays you configured in System A, use the same procedure you used for system A to configure the arrays to match. However, **DO NOT INITIALIZE** the arrays.

Once the arrays match those defined in System A, exit NetRAID Assistant.

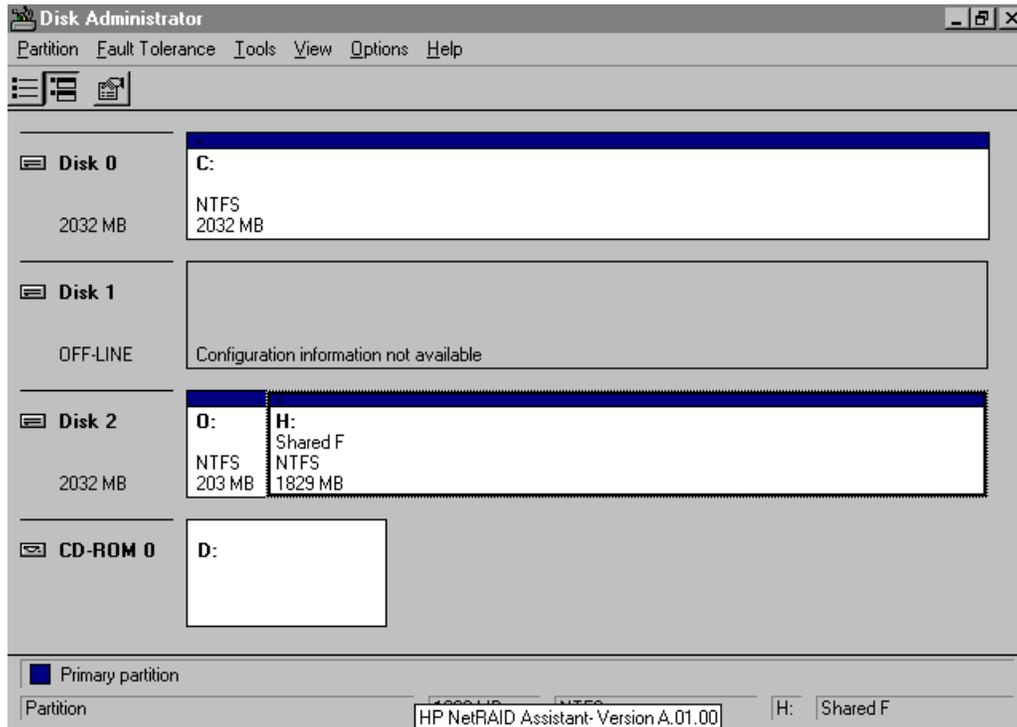
Assigning Drive Letters: System B

After you have confirmed System B has correctly recognized the cluster's arrays, you need to assign matching drive letters to the disks as seen by System B. You'll find that the volume labels you assigned the disks will help you sort out the disks from the vantage point of System B.

To assign drive letters at System B that match those at System A:

1. From the Windows NT Start menu, choose Programs | Administrative Tools | Disk Administrator. Windows NT runs Disk Administrator and displays the shared disks you formatted using System A. Notice that the disks are identified with provisional drive letters. Typically, the drive letters Disk Administrator assigned to the disks do not match System A's as indicated by the Volume Labels and drive letters you assigned the logical disks at System A.

Even if the drive letters all match, perform the steps below to make the assignments permanent, so NT does not change the assignments at the next reboot.



Disk Administrator, Mismatched Drive Letters

2. Click on a disk box to select one of the disks that includes an array to be shared by the cluster. Disk Administrator highlights the selected disk.
3. Select Tools from the pull-down menu, and choose Assign Drive Letter.
4. Based on the Volume Labels you assigned the arrays ("Shared F" in the above example), assign a drive letter that matches the System A drive letter assignment. Disk Administrator updates the disk driver letter assignment.
5. Repeat steps 2 through 5 to make permanent drive letter assignments for each array initialized from System A.
Be sure that the drive letters for all arrays (logical drives) recognized by System B match System A's "sticky" assignments.
6. Close Disk Administrator.
The arrays are now fully configured for use by the cluster.

The HP NetServer systems and the shared disks are ready for you to proceed to "Part 6: Installing and Testing Microsoft Cluster Server Software."

Part 6: Installing and Testing Microsoft Cluster Server Software

During installation at System B, you will create a Microsoft Cluster Server. Initially, it is a cluster with only one server, System B. Later, you will join System A to the cluster and thus create a standard two-server cluster. If you need more information about the installation process outlined here, see the *Microsoft® Windows NT™ Cluster Server Administrator's Guide*.

Setup at System B

Microsoft Cluster Server installation includes slightly different software setups for System A and System B. Since you just finished configuring disks on System B, continue Microsoft Cluster Server Setup where you left off with Disk Administrator.

If you have not already done so, you should create an account for System B in a Microsoft Domain now. During the installation of Microsoft Cluster Server you will need to supply a domain account for Microsoft Cluster Server to run in.

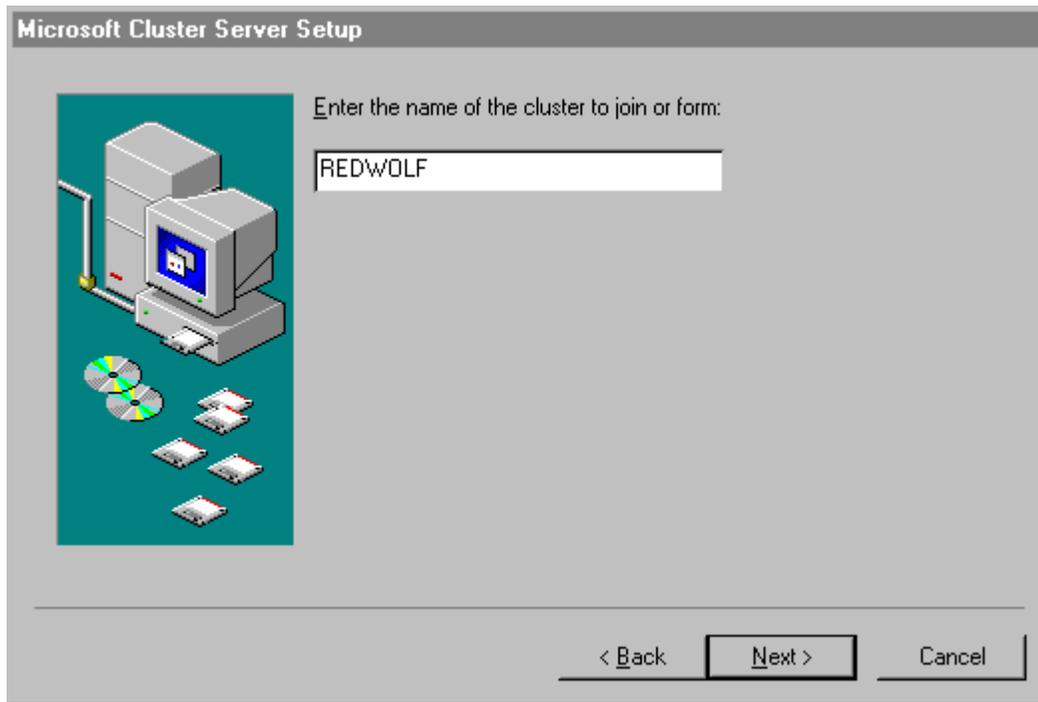
To install Microsoft Cluster Server at System B:

1. Insert the Component CD of Microsoft Windows NT Server, Enterprise Edition in System B's CD-ROM drive.
2. Run the Microsoft Cluster Server setup program.
Setup.exe is located in the following folder:

```
\mcs\cluster\i386
```

Setup examines your system and displays a dialog box that lists the following install options:

- Form a new cluster
 - Join an existing cluster
 - Install Cluster Administrator
3. Choose Form a New Cluster and click Next.
Setup prompts you to identify the cluster by name.



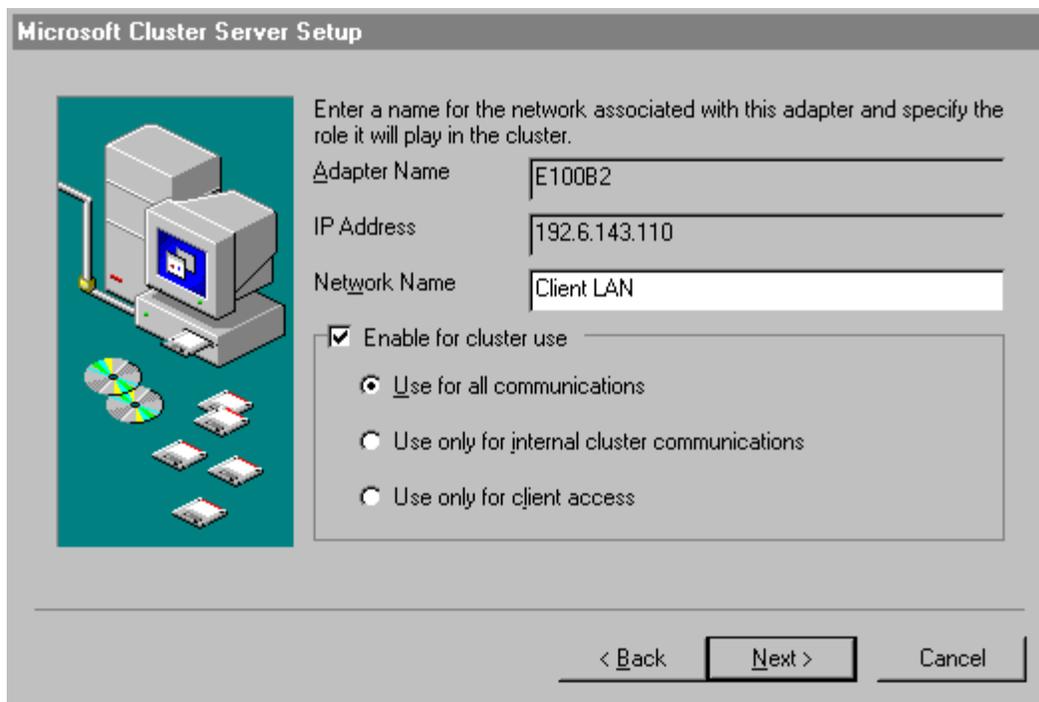
Microsoft Cluster Administrator, Assigning a Cluster Name

4. Enter a name for the cluster.
Make note of the name you enter here. You will need to provide the identical name during Microsoft Cluster Server software setup at System A.
Click Next.
5. Setup allows you to specify a directory in which to install the cluster files. Select a directory and click Next.
6. Setup requires a domain account to run MSCS in. Specify an appropriate account and click Next.
7. You are presented with a list of disks to be shared in the cluster and provided the option to remove those you do not want to share. Remove only disks that you want to reserve for the exclusive use of System B. Normally you would share all disks listed. Click Next.
8. Setup prompts you to select a disk on which to store permanent cluster files. Cluster Administrator uses the disk you select to synchronize the cluster nodes and store a cluster log file. The disk must always be available to the cluster. Select the disk that you will commit to keep online.
Click Next.
9. Setup now scans the System's network resources (i.e. LAN adapters) so they can be configured for cluster use. The scan starts with Slot 9 and finishing with Slot 1. Each identified network resource is presented for configuration. Note that intra-cluster (heartbeat) network adapter is presented and configured before the client-network adapter.

10. Configure your network resources (LAN adapters).

Setup presents a dialog box for each LAN adapter installed in your HP NetServer. The intra-cluster LAN is shown first with the Adapter Name and IP address already filled in (setup supplies the IP address that you specified during NT installation). Enter a network name for the resource and check Enable for Cluster Use. Identify the resource according to use (e.g. cluster LAN 1). When you enable cluster use, Setup presents you with three additional options:

- Use for all communications (for client LAN)
Choose this option if you are configuring a client LAN adapter, and System A and B reside on the same IP subnet.
- Use only for internal cluster communications (for cluster LAN)
Choose this option if you are configuring an intra-cluster LAN adapter.
- Use only for client access (alternate for client LAN)
Choose this option if you are configuring a client LAN adapter, and System A and B reside on different IP subnets.



Microsoft Cluster Administrator, Assigning a Network Name

11. Repeat step 10 for each network resource (LAN adapter). After you have configured all LAN adapters, click Next.
12. Setup lists your network Adapters and asks you to prioritize them with reference to the cluster's internal LAN.
Follow the on screen instructions to order the adapters so that the Cluster LAN adapter is identified first (at the top of the list). After you have ordered the adapters, click Next.

NOTE If you previously defined Systems A and B as residing on different subnets, the client LAN will be unable to assume responsibility for intra-cluster (heartbeat) communication.

13. Setup prompts you for the Cluster IP address.
Input the proper IP address and subnet mask *for the CLUSTER*. Note that what is required here is an IP address for the cluster. Do not enter either of the IP addresses assigned to System A or System B.
14. Click Finish to complete installation of the Microsoft Cluster Server software.
Setup activates your configuration specifications and starts the cluster service.

Microsoft Cluster Server is now fully installed on System B. To finish installation, leave System B running and proceed to "Setup at System A."

Setup at System A

While you have been configuring System B, System A has been idling at the NT loader prompt.

To install Microsoft Cluster Server at System A:

1. Bring up System A to Windows NT.
2. Insert the Microsoft Windows NT Server (Enterprise Edition) Component CD in System B's CD-ROM drive.
3. Run Setup, the Microsoft Cluster Server setup program
Setup.exe is located in the following folder:

`\mcs\cluster\i386`
4. Setup examines your system and displays a dialog box that lists install options. Choose Join an existing cluster and click Next.
5. Setup prompts you to identify the cluster to join. Enter the name of the cluster you used when you created the cluster on System B. Click Next.
6. Setup allows you to specify a directory in which to install the cluster files. Select a directory and click Next.
7. Setup requires a domain account to run MSCS in. It uses the account you specified for System B. Fill in the password for the account and click Next.
8. Click Finish.
You have now installed and configured all necessary software and hardware components to create a Microsoft Cluster Server.

At this point, your cluster is operational. You are now ready to proceed to "Testing the Cluster Installation" to ensure that your cluster is fully operational.

Testing the Cluster Installation

The installation of an HP NetServer cluster is checked by running two tests. The Microsoft Cluster Administrator Sanity test is run, then the HP Cluster Installation Test is run.

The Microsoft Cluster Administrator Sanity test is run on a node of the cluster and uses the cluster administrator to perform some basic cluster tests.

The HP Cluster Installation Test is run by a certified installer on a cluster client. The test guides him through the process of registering a cluster and testing it to insure it is installed correctly. It provides information, tests failover, and prints a certificate required for HP customer support.

Running the Microsoft cluster administrator sanity test

1. On either System A or System B, insert the Microsoft Windows NT, Enterprise Edition Component CD in the drive. In a DOS window, go to the \mscs\support directory on the CD and execute:

```
Setuptst.bat C:\castest.
```

Setuptst.bat will create the directory castest on c: and copy the test files from the CD to drive c:.

CAUTION Once the test is started DO NOT press any keyboard keys or move the mouse until the test is completed. If you do, the test will fail.

2. At the C:\castest prompt, type castest.bat <cluster name> and press Enter to start the test.
3. The Cluster Administrator Sanity test creates a test result file (cluadms.log) in the C:\castest directory.
4. When the test finishes, view the cluadms.log file using Notepad (Start | Programs | Accessories | Notepad). Look at the test report, towards the end of the log file, and check that all tests and variations passed and there were no errors.
5. Delete the C:\castest directory.

For more information see \Mscs\support\casread.txt on the component CD.

Running the HP Cluster Installation Test

To run the HP Cluster Installation Test you will need:

- A client system to run the test. The client must be able to connect to the cluster to be tested, must have access to a printer, and must be able to download the Cluster Installation Test.
- Two free static IP addresses to use for file shares on the cluster during the test.
- Two shared disks on the cluster.
- The Microsoft Windows NT, Enterprise Edition component CD.
- to enable the local drives of each cluster node for sharing.
- to set up two file shares on the cluster

Enable the Local Drives for Sharing

On each cluster node enable the local disk for sharing. In Windows NT Explorer, right click the local drive, then select Properties | Sharing | Share As | OK.

Setting up Two File Shares (use the example below).

NOTE When setting up file shares, names must be assigned to resources. The example below uses default names and names that are typically assigned when running this test. You are free to use names that are commonly used in your organization.

For each of two disk groups of the cluster you will:

- Set up an:
 - IP address resource
 - Network Name resource
 - File Share Resource
- Bring the group on line:
- Associate each group with one node of the cluster

Start the Cluster Administrator (Start | Programs | Administrative Tools | Cluster Administrator) and connect to the cluster.

NOTE When the cluster was set up, at least two disk groups must have been created. We will use Disk Group 1 and Disk Group 2 for this test. Perform the instructions below for both disk groups.

Setting Up an IP Address Resource

1. Click the Disk Group (i.e., Disk Group 1 or 2). You will see that a physical drive resource was created for this group and a drive letter was assigned.
2. Right click the Disk Group and select New | Resource.
3. On the New Resources dialog complete the following fields, then click Next. Note that this dialog allows you to set up different types of resources such as the physical drive that already appears.
 - Resource Type. Select "IP Address" from the popdown list.
 - Resource name. Name it something like "IP for Virtual U" where U is simply the designation you assigned for the physical disk already created.
 - Resource Description. Nothing needs to be entered here.
 - Group. Select the appropriate Disk Group from the popdown list.
4. On the Possible Owners dialog check to see that both cluster nodes are in the Possible Owners pane. If not, add them, then click Next.
5. On the Dependencies dialog click Next. (There are none for an IP address.)

6. On the TCP/IP Address Parameters dialog enter the following, then click Next. :
 - Address. Use the IP address you have allocated for this file share.
 - Subnet Mask. Type in the associated subnet mask for this IP address, then click Finish.

Setting Up a Network Name Resource

1. Right click the Disk Group and select New | Resource. On the New Resources dialog complete the following fields, then click Next:
 - Resource Type. Select "Network Name" from the popdown list.
 - Resource Name. Name it something like "Virtual U" where U is simply the designation you assigned to the physical disk already created.
 - Resource Description. Nothing needs to be entered here.
 - Group. Select the appropriate Disk Group from the popdown list.
2. On the Possible Owners dialog check to see that both cluster nodes are in the Possible Owners pane. If not, add them, then click Next.
3. On the Dependencies dialog add the IP address just created for this group, then click Next.
4. On the Network Name Parameters dialog enter the IP address you just created for this group, then click Next.
5. On the Network Name Parameters dialog type the desired name (e.g. "CLUSTER_U"), then click Finish.

Setting Up a File Share Resource

1. Right click the Disk Group and select New | Resource. On the New Resources dialog complete the following fields, then click Next:
 - Resource Type. Select "File Share" from the popdown list.
 - Resource Name. Type the desired name (e.g., "Share on U").
 - Resource Description. Nothing needs to be entered here.
 - Group. Select the appropriate Disk Group from the popdown list.
2. On the Possible Owners dialog check to see that both cluster nodes are in the Possible Owners pane. If not, add them, then click Next.
3. On the Dependencies dialog perform the following, then click Next.
 - Add the Network Name just created for this group.
 - Add the Physical Disk in this group (e.g., Drive U).

4. On the Disk Parameters dialog complete the following, then click Finish:
 - Name. Type the desired name (e.g., "Disk_U").
 - Path. Type "C:\\"
 - Comment. Nothing needs to be entered here.
 - User Limit. Check Maximum Allowed.

Bring Resources Online

The file share for this disk group is now complete. To bring the disk share online, right click the Disk Group and select Bring Online. Repeat the above procedure from "Setting up an IP Address" to create a disk share for the remaining Disk Group (i.e., 1 or 2).

Distributing Groups on the Cluster

1. Move one of the Disk Groups to the other node by right clicking on one of the groups and selecting Move Group.
2. Verify each node of the cluster owns one of the disk groups by selecting each of the disk groups in turn and checking each is owned by a different node.

Run the Cluster Installation Test on the Client System:

1. Download the self-extracting archive to the cluster client that will run the test.
2. Execute the archive to unpack it.
3. Run setup.exe to install the test.
4. Map the cluster nodes' local disks to drive letters on the client system. In Windows NT Explorer, pick Tools | Map Network Drive. The paths to the two cluster nodes' local disks will be \\<node name>\C\$.
5. Map the cluster file shares to drive letters on the client system. In Windows NT Explorer, pick Tools | Map Network Drive. The paths to the two cluster file shares will be the network name followed by the file share name, e.g., \\cluster_u\disk_u.
6. Copy the file MSVBVM50.dll from the %windir%\System32 directory on the client to %windir%\system32 on each cluster node.
7. Execute CIT.exe on the client to run the test.
8. After the Cluster Installation Test completes, clean up the cluster and client:
 - Remove the Cluster Installation Test files from the client.
 - Remove the MSVBVM50.dll from %windir%\System32 on the client.
 - Remove the MSVBVM50.dll from %windir%\System32 on each cluster node.
 - Remove the \Test directory from the local drives on each cluster node.
 - Delete the three resources you added to each of the two disk groups on the cluster.

APPENDIX A Obtaining HP NetRAID Utilities

To get updated versions of the HP NetRAID utilities that contain firmware, driver and the HP NetRAID Assistant program, you must download, extract, and then copy of **nr_clust.exe**, a special version of the HP NetRAID utilities for cluster installations.

To obtain NetRAID firmware, you need to download **nr_clust.exe** from the HP's FTP site.

[Enter FTP site address here]

Once you have downloaded **nr_clust.exe**, you need to extract and copy the HP NetRAID files and utilities to floppy diskettes.

To extract and copy the HP NetRAID utilities:

1. From Windows NT Explorer, run **nr_clust.exe** by double-clicking the file. **nr_clust.exe** is self-extracting and when executed creates the three subdirectories shown in the following table.

File Sub-Directory	Contents Description	Disk Label
Fw_dvr	NetRAID firmware update and NetRAID Driver for Windows NT	NetRAID Firmware & Driver
Nrast_1	HP NetRAID Assistant program Setup.	HP NetRAID Assistant 1
Nrast_2	HP NetRAID Assistant program files.	HP NetRAID Assistant 2

2. Label three blank formatted diskettes as indicated in the above table.
3. Copy the contents of each of the subdirectories to an appropriately labeled floppy disk.

You will also need a DOS bootable diskette, since the NetRAID firmware update utility runs under DOS.

APPENDIX B Updating HP NetRAID Firmware

After you created your NetRAID utilities diskettes (see Appendix A), use the flash utility diskette labeled **NetRAID Firmware & Driver** to upgrade the adapter firmware on both systems.

To flash the NetRAID adapter firmware:

1. Shut down the system and boot to DOS,
2. Insert the flash utility diskette, **NR Firmware & Driver**, in the system's floppy drive.
3. At the A: prompt, run the firmware update program mflash.exe by typing:

```
a:\mflash [Return]
```

The mflash utility begins updating the firmware and provides feedback in the form of three animated bars that gauge the utility's progress.

APPENDIX C RAID Array Configuration

The following two examples illustrate the RAID array configuration process for HP NetServer Clusters:

- Setting up RAID 1 arrays on an HP NetServer cluster
- Setting up RAID 5 arrays on an HP NetServer cluster

After you have finished defining and configuring the cluster's arrays using HP NetRAID Assistant, you will need to return to Part 5 and finish array configuration using the Windows NT Disk Administrator utility.

Setting Up RAID 1 Arrays on an HP NetServer Cluster

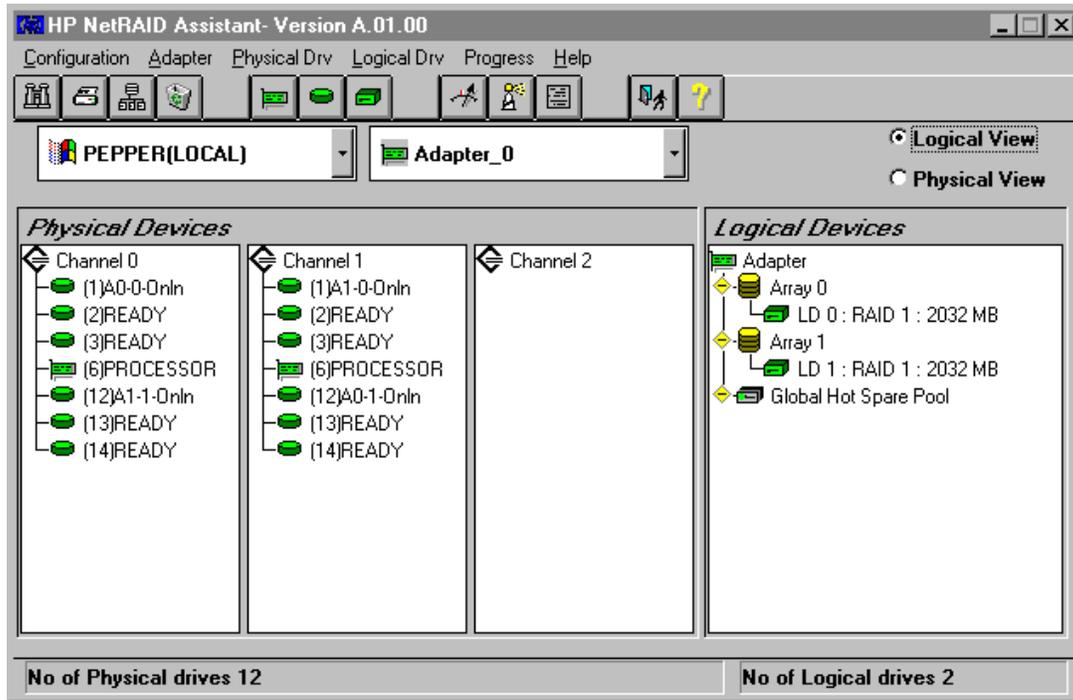
The HP NetRAID adapter and proprietary HP NetRAID software can be used to organize the cluster's disk storage into RAID level 1 disk arrays. Each level 1 RAID array is composed of two hard (hot swap) drives located in external shared storage cabinets.

RAID level 1 (mirroring) provides storage redundancy with maximum performance. A RAID 1 array consists of two drives that contain exactly the same data. That is, all of the data on one drive is replicated (mirrored) on the other.

Raid Level 1 Data Distribution		
Stripe	Drive 1	Drive 2
1	Block 1	Block 1
2	Block 2	Block 2
3	Block 3	Block 3

The preceding table shows how data is distributed for RAID 1. Since each drive contains a complete copy of all data, all data is still available after the failure of one drive. To rebuild the RAID array after a failure, the failed drive is replaced and the data simply copied from the good drive to the new drive.

From the Windows NT System A Start menu, click Programs | NetRAID | NetRAID Assistant.
 The HP NetRAID Assistant program loads and displays its main window.



HP NetRAID Assistant Screen

As you can see on the NetRAID Assistant screen, HP NetRAID Assistant lists the Physical Devices (actual physical drives) and Logical Devices (RAID arrays). The Physical Devices pane lists the drives in columns by channel. Normally, a cluster will not use channel 2 and so no devices will be listed there. Likewise, some clusters will use only one channel and so both Channel 1 and 2 will be devoid of entries.

If you want to view the properties of a physical or logical device listed by HP NetRAID Assistant, double-click on the device. The number in parentheses to the right of each physical drive icon is its SCSI ID. The state of each physical drive appears to the right of the SCSI ID. Initially the device will be described as **READY**. The possible states of a physical drive are as follows:

The state...	indicates the drive is...
Onln	online, functioning normally, and part of a configured array.
Rdy or READY	functioning normally, but not part of a configured logical drive nor configured as a hot spare
HOTSP	configured as a hot spare, powered up and ready for use (not Cluster supported).
FAILED	out of service because a fault occurred.
REBUILDING	rebuilding and salvaging data recovered from a degraded array.

Refer to the *HP NetRAID User Guide* in Information Assistant for more information about HP NetRAID Assistant.

Setting Up the Arrays

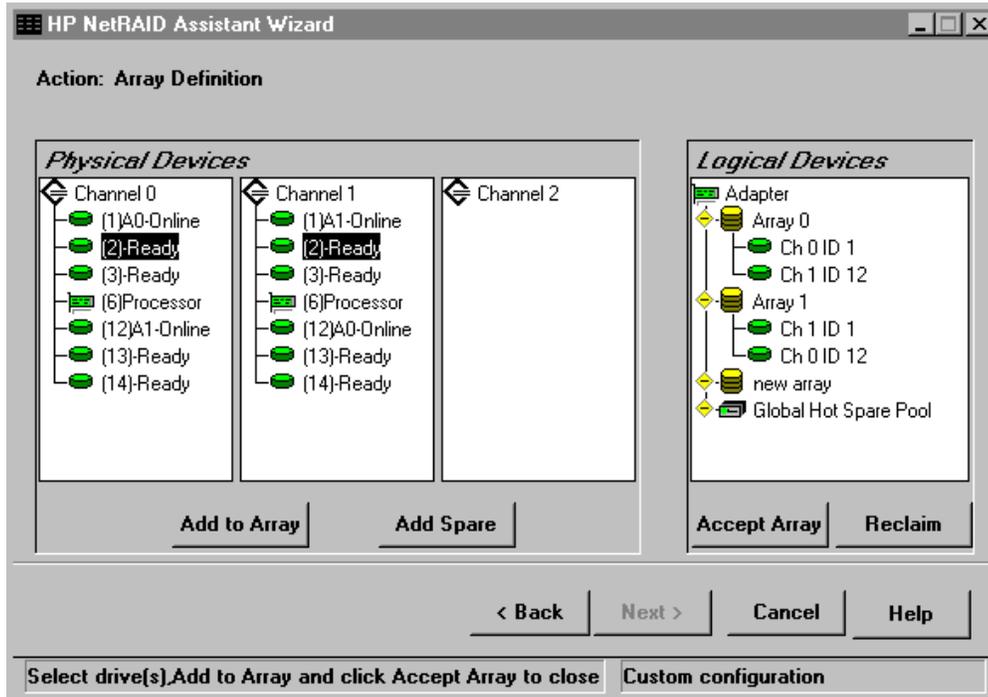
To set up an array you need to define an array, set its parameters, and then initialize the array.

Define an Array

RAID arrays are defined using the Configuration Wizard.

To define a RAID 1 array:

1. On the NetRAID Assistant's menu bar click Configuration, then Wizard.
2. Select Custom in the dialog box and click Next.
The Configuration Wizard displays its Array Definition window.



HP NetRAID Array Definition

3. In the Array Definition window define an array by selecting the two physical drives in the Physical Devices pane that will compose the array.
As you click your selections, they are highlighted in the Physical Devices pane.
4. Click Add to Array, then Accept Array.

Set Array Parameters

After the array has been defined, its parameters must be set.

1. Click Next.
The Configuration Wizard displays its Logical Drive Definition window.
2. The Logical Drive Definition window shows the array's RAID level (RAID 1) and its usable size. Notice that the size of the array is one half of the sum of the capacity of the two drives composing the array, since all data is duplicated.
3. Click Advanced and verify that Write Policy is set to "Write Thru" and then click OK.
4. Click Accept to set the array parameters.
5. If you:
 - want to define another array, click Back and repeat the steps listed above starting with step 3 in Define Array.
 - have identified all your arrays, click Next, Finish, and then OK.
NetRAID Assistant saves the array configuration and prompts that the array configuration has changed. Click OK.

Initialize the Array

After you have defined the cluster's arrays, you need to initialize the arrays you defined. HP NetRAID Assistant initializes all arrays you have defined at the same time. To initialize all the arrays:

1. At the "Would you like to Initialize?" prompt, click OK.
HP NetRAID Initialization may be time consuming. Plan on 5 to 15 minutes per array.
2. When NetRAID initialization is complete, exit NetRAID Assistant.
3. Continue configuration using Windows NT Disk Administrator.

When you have finished defining and configuring the cluster's arrays using HP NetRAID Assistant, return to Part 5 and finish array configuration using the Windows NT Disk Administrator utility.

Setting Up RAID 5 Arrays on an HP NetServer Cluster

The HP NetRAID adapter and proprietary HP NetRAID software can be used to organize the cluster's disk storage into RAID level 5 disk arrays. Each level 5 RAID array is composed of three hard (hot swap) drives located in external shared storage cabinets.

RAID level 5 (striping with distributed parity) provides storage redundancy with good overall performance and a minimum loss in storage capacity. With RAID 5 the equivalent of only one hard drive in the array is used for redundancy. Note that each array supporting RAID 5 logical disks requires at least three physical drives.

Raid Level 5 Parity Distribution			
Stripe	Disk 1	Disk 2	Disk 3
1	Block 1.1	Block 1.2	Parity 1

2	Block 2.1	Parity 2	Block 2.2
3	Parity 3	Block 3.1	Block 3.2

The preceding table shows how data is distributed for RAID 5. As you can see, each stripe has one block assigned to track parity data. Parity data can be used to reconstruct the data on that stripe if one of the disks should fail. RAID 5 distributes parity information equally among all disk drives to equalize data I/O and achieve better overall performance.

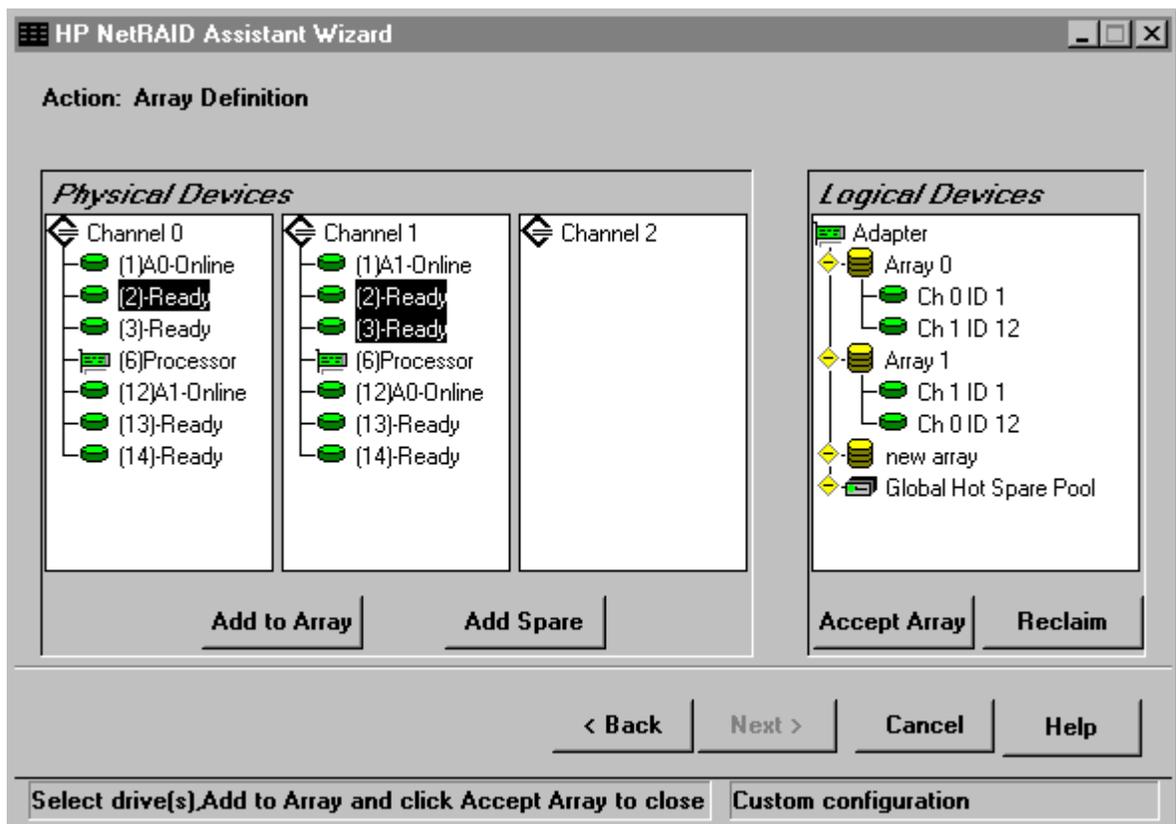
Setting Up the Arrays

To set up an array you need to define an array, set its parameters, and then initialize the array.

Define an Array

RAID arrays are defined using the Configuration Wizard. To define a RAID 5 array:

1. On the NetRAID Assistant's menu bar click Configuration, then Wizard.
2. Select Custom in the dialog box and click Next.
The Configuration Wizard displays its Array Definition window.



HP NetRAID Array Definition

3. In the Array Definition window define an array by selecting the three physical drives in the Physical Devices pane that will compose the array.
As you click your selections, they are highlighted in the Physical Devices pane.
4. Click Add to Array, then Accept Array.

Set Array Parameters

After the array has been defined, its parameters must be set.

1. Click Next.
The Configuration Wizard displays its Logical Drive Definition window.
2. The Logical Drive Definition window shows the array's RAID level (RAID 5) and its usable size.
Notice that the size of the array is two thirds of the sum of the capacity of the drives composing the array.
The other third is used to store redundant data.
3. Click Advanced. Verify that Write Policy is set to "Write Thru" then click OK.
4. Click Accept to set the array parameters.
5. If you:
 - want to define another array, click Back and repeat the steps listed above starting with step 3 in "Define an Array."
 - have identified all your arrays, click Next, Finish, and then OK.
NetRAID Assistant saves the array configuration and prompts that the array configuration has changed. Click OK.

Initialize the Array

After you have defined the cluster's arrays, you need to initialize the arrays you defined. HP NetRAID Assistant initializes all arrays you have defined at the same time.

To initialize all the arrays:

1. At the "Would you like to Initialize?" prompt click OK.
HP NetRAID Initialization may be time consuming. Plan on 5 to 15 minutes per array.
2. When NetRAID initialization is complete, exit NetRAID Assistant.
3. Continue configuration using Windows NT Disk Administrator.

When you have finished defining and configuring the cluster's arrays using HP NetRAID Assistant, return to Part 5 and finish array configuration using the Windows NT Disk Administrator utility.