English

Integrated HP NetRAID Controller Configuration Guide

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Audience Assumptions

This Configuration Guide is for the person who installs, administers, and troubleshoots LAN servers. Hewlett-Packard Company assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

English

Contents

English

English

1 Introduction

Integrated HP NetRAID Controller

The integrated HP NetRAID controller on the HP NetServer LH 3 and LH 3r provides an integral disk array storage system. The controller uses the PCI (Peripheral Component Interconnect) standard to control data transfers on one or two SCSI channels.

The integrated HP NetRAID controller supports the following network operating systems:

- Microsoft Windows NT 4.0
- Novell NetWare 3.2, 4.11, 4.11 SMP, and SFTIII 4.11

Features of the Integrated HP NetRAID Controller

The integrated HP NetRAID controller lets you link multiple hard disk drives together and write data across them as if they were one large drive. You can configure your linked drives in a RAID (redundant array of independent disks) subsystem.

Channels and Devices

The integrated HP NetRAID controller supports one or two channels as configured by the user. Each of the two integrated Symbios SCSI controllers on the HP NetServer LH 3/LH 3r can be configured as either a RAID or a SCSI channel. The factory default configuration is:

- SCSI A: integrated HP NetRAID Channel 0
- SCSI B: integrated SCSI

You have complete freedom to change these defaults and to enable both channels for use with HP NetRAID.

For each HP NetRAID channel, you can have either one internal, or one external connection.

- The HP NetServer LH 3/LH 3r hot-swap mass storage cage supports up to six Ultra2 disk drive modules.
- A second hot-swap mass storage cage can be installed in your HP NetServer LH 3/LH 3r which supports an additional six Ultra2 disk drive modules.
- External storage with the HP Storage System/6 supports a maximum of six Fast/Wide SCSI devices.
- External storage with the HP Rack Storage/8 supports a maximum of eight Fast/Wide or Ultra/Wide SCSI devices.

If the necessary cables were not supplied with your system, see HP's Order Assistant for ordering information. Order Assistant is available on the Internet at **`http://www.hp.com/go/netserver`**.

Controller Hardware

IOP: The IOP (I/O Processor) for the integrated HP NetRAID controller is the 32-bit Intel i960RD™ Intelligent I/O RISC processor running at 66 MHz. The processor directs all functions of the controller, including command processing, PCI and SCSI bus transfers, RAID processing, drive rebuilding, cache management, and error recovery.

Cache: Cache memory resides in a 16 MB 50ns EDO (extended data output) DRAM SIMM.

The integrated HP NetRAID controller supports Direct and Cached I/O and Write Through or Write Back caching, which can be selected for each logical drive. To improve performance in sequential disk accesses, the integrated HP NetRAID controller uses Adaptive Read Ahead caching by default, but it can be disabled to Normal or set to simple Read Ahead caching.

English

SCSI Firmware

The integrated HP NetRAID controller firmware handles all RAID and SCSI command processing and also supports the following functions:

- Disconnect/Reconnect feature optimizes SCSI Bus seek.
- Tagged Command Queuing allows multiple commands to be sent to the controller, thus improving random access.
- Scatter/Gather supports multiple address/count pairs.
- Multi-threading supports up to 255 simultaneous commands with elevator sorting and concatenation of requests per SCSI channel.
- Stripe size for each logical drive can be set from 4 KB to 128 KB.
- Multiple rebuilds and consistency checks have user-definable priority.

Array Spanning

The integrated HP NetRAID controller allows up to four arrays to be spanned together as one logical drive. For example, the integrated HP NetRAID controller can support a RAID 10 logical drive with up to eight physical disks. Using both channels, you can group up to 12 to 16 physical disks in a RAID 30 or RAID 50 logical drive depending on whether you use the internal hot-swap mass storage cages or an external mass storage system.

I_2O Support

The integrated HP NetRAID controller supports I_2O (Intelligent Input/Output) with some operating systems. For a complete list of operating systems for which HP NetRAID I_2O drivers are available, see the HP web site at **`http://www.hp.com/go/netserver`**.

Physical Disk Roaming

The integrated HP NetRAID controller allows physical disk roaming, in which the controller keeps track of disk modules if they are moved to different slots in the hot-swap cages.

Multiple Adapters

The integrated HP NetRAID controller can be used with up to two HP NetRAID-3Si adapters. The integrated HP NetRAID controller allows disk

modules to be moved to an HP NetRAID-3Si adapter without losing data readability.

Be sure to check your system's PCI I/O slot availability and any slot restrictions before purchasing another adapter.

Fault-Tolerance and Management Features

Fault-Tolerance features include the following:

- Automatic failed-drive detection with Autorebuild (automatic rebuild with a hot spare or when a drive is replaced)
- Manual hot-swap replacement

Management features include the following:

- Monitoring of HP NetRAID configuration, data parity consistency, and SNMP error messages
- Rapid online configuration change and capacity expansion without the need to first back up all data, reconfigure the array, and reload the data

Changing Capacity and RAID Levels

The integrated HP NetRAID controller can expand capacity and change RAID levels of logical drives without powering down the server.

- **Online Capacity Expansion:** You can add a physical drive to a RAID 0, 3, or 5 logical drive. This can be an online operation if you are running Microsoft Windows NT or Novell NetWare. (Preparations for capacity expansion must be made, as described in Chapter 6, "Preparing for Online Capacity Expansion.")
- **Online Capacity Reduction:** You can remove a physical drive from a RAID 1, 3, or 5 logical drive as part of an online operation.
- **Online Changes to RAID Levels:** You can convert a RAID 1, 3, or 5 logical drive to RAID 0.

NOTE	You cannot perform online conversions of logical drives that span arrays (RAID level 10, 30, or 50).

English

About This Guide

This *Integrated HP NetRAID Controller Configuration Guide* helps you plan and configure your HP NetRAID system. It guides you through power-up, launching the HP NetServer Navigator software, configuring the HP NetRAID system, and installing a NOS-specific configuration utility. It contains a glossary, and an appendix contains worksheets to use in planning the configuration of physical and logical drives.

Fill in the worksheets in Appendix B as you read this guide and make your configuration decisions. The worksheets contain the information you need to enter into the HP NetRAID Assistant configuration utility launched by the *HP NetServer Navigator CD-ROM*. The pencil icon in the margin is a reminder to log your configuration choices on the worksheets.

The *Integrated HP NetRAID Controller Configuration Guide* is intended to be used in conjunction with your HP NetServer documentation. Refer to your system documentation for details such as cable product numbers and I/O slot boot order.

If you are setting up your HP NetServer for the first time, begin with the *HP NetServer Installation Road Map* that came with your system. Return to this guide when the roadmap instructs you to configure the mass storage subsystem.

Other Information Sources

Disk array administration and management are beyond the scope of this document. Refer to the *HP NetRAID Series User Guide* in Information Assistant on the *HP NetServer Online Documentation CD-ROM*. Access it, and other material in Information Assistant, either by booting your system from the *HP NetServer Online Documentation CD-ROM*, or by installing Information Assistant onto any Microsoft Windows-based PC.

You should also consult the following HP NetServer documentation:

- Readme file for your HP NetServer on the *HP NetServer Navigator CD-ROM*
- Your *HP NetServer Installation Road Map*
- Your *HP NetServer System User Guide*
- Technical Reference Cards or labels on the HP NetServer system chassis (for cables and SCSI ID switch settings)
- Internet site: **`http://www.hp.com/go/netserver`**

2 RAID Overview

This chapter summarizes concepts and terminology used to describe RAID systems. It describes the different RAID levels available with the integrated HP NetRAID controller. For definitions of terms not introduced here, see the Glossary.

RAID Overview

The integrated HP NetRAID controller lets you link multiple hard disk drives together and write data across them as if they were one large drive. With the integrated HP NetRAID controller, you can configure your linked drives into a RAID (Redundant Array of Independent Disks) subsystem.

Physical Drives

The term "physical drive" refers to a single hard disk module.

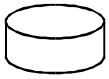


Figure 2-1. Physical Drive

Arrays

The integrated HP NetRAID controller can combine up to eight physical drives into one array. It is recommended that all drives in an array have the same capacity. If you use drives with different capacities in an array, all the drives in the array are treated as though they have the capacity of the smallest drive.

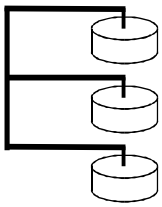


Figure 2-2. Array of Physical Drives

Arrays can combine disk drives that are all on one channel, or they can combine disk drives from one or two different channels.

Hot Spares

A hot spare is a powered-on, stand-by disk drive that is ready for use should another disk drive fail. When a disk fails, the HP NetRAID firmware can automatically rebuild the data from the failed disk onto the hot spare. The system administrator can then replace the failed disk and designate the replacement as the new hot spare disk. Until a rebuild occurs, a hot spare does *not* contain user data.

There are two types of hot spares:

- A global hot spare is used if a disk in any array fails.
- A dedicated hot spare is reserved for use by a single array.

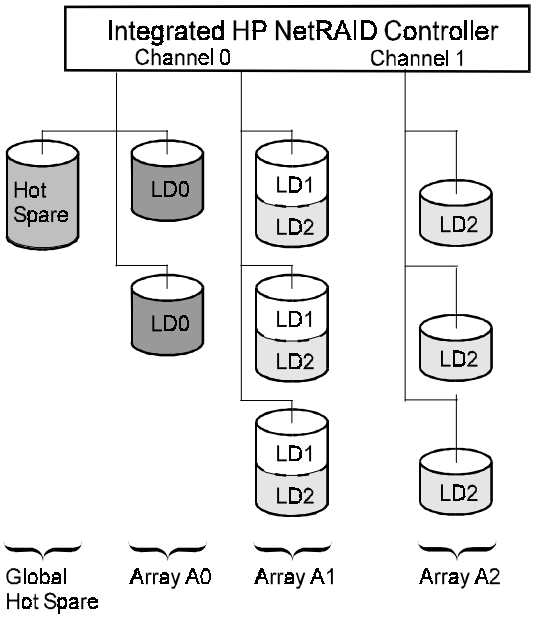
Logical Drives

The term "logical drive" refers to a virtual drive which is assigned some portion of the total capacity of an array. For example, if you have an array of disk drives with a total capacity of 80 GB, you can create a logical drive with a total capacity of 20 GB within that array.

Logical drives can take three forms:

- A logical drive can use all of the storage capacity of one array. In Figure 2-3, Logical Drive LD0 uses all storage capacity in Array A0.
- A logical drive can use less than the available storage capacity of one array. In Figure 2-3, Logical Drive LD1 occupies only a part of Array A1.
- A logical drive can span arrays by spreading across two, three, or four different arrays. In Figure 2-3, Logical Drive LD2 spans Arrays A1 and A2.

English



The nine physical drives are in three arrays (A0, A1, and A2) with one global hot spare.

Figure 2-3. Sample Configuration with Three Arrays and Three Logical Drives

Understanding RAID Levels

During installation, you configure your logical drives by running a disk array configuration utility. Each of the logical drives you define must have an assigned RAID level. Each RAID level has different advantages in terms of performance, redundancy, and capacity. The integrated HP NetRAID controller supports both non-spanned array and spanned array configurations.

- Non-spanned arrays have logical drives that are contained entirely within the array. Non-spanned array configurations use RAID levels 0, 1, 3, or 5.
- Spanned arrays have logical drives that are spread across multiple arrays. This permits the physical drives on two, three, or four arrays to function as one large logical drive. Spanned array configurations use RAID levels 10, 30, and 50.

Arrays with No Redundancy: RAID Level 0

RAID 0: Striping

In RAID 0 configurations, data is distributed among hard disks in the array via an algorithm called *striping*. Data written to a logical drive is divided into pieces called *blocks*. *RAID 0 provides no data redundancy*. If one hard disk fails, the data is lost from the entire logical drive and must be retrieved from a backup copy. If you have five physical drives configured as one RAID 0 logical drive, data blocks are written as follows:

	Disk 1	**Disk 2**	**Disk 3**	**Disk 4**	**Disk 5**
Stripe 1	Block 1	Block 2	Block 3	Block 4	Block 5
Stripe 2	Block 6	Block 7	Block 8	Block 9	Block 10

The RAID 0 algorithm allows data to be accessed on multiple disks simultaneously. Read and write performance on a multidisk RAID 0 system is significantly faster than on a single drive system.

RAID 0 Advantages

Provides maximum data capacity, because all disk space is used for data.

Costs are low, because no disk space is allocated for redundancy.

Access time is fast for both reads and writes.

RAID 0 Disadvantages

RAID 0 provides no redundancy so if a hard drive fails, data must be restored from backup.

Hot spares cannot be used with RAID 0 configurations.

RAID 0 Summary

Choose RAID 0 if redundancy is not required, and you need fast performance and low costs.

English

Non-spanned Arrays with Redundancy: RAID Levels 1, 3, and 5

RAID 1: Mirroring

In RAID 1 configurations, data on one disk is completely duplicated on another disk. This is called *mirroring*. RAID 1 must be configured on a two-disk array. (The array cannot contain more than two disk drives.) With this algorithm, if either of the two disks fail, data is available from the duplicate disk. Data is written as follows:

	Disk 1	**Disk 2**
Stripe 1	Block 1	Block 1
Stripe 2	Block 2	Block 2
Stripe 3	Block 3	Block 3

RAID 1 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, the other is available.

Read performance is fast, because data is available from either disk.

RAID 1 Disadvantages

Costs are high, because 50% of all disk space is allocated for data protection.

Actual data capacity is only 50% of physical capacity.

RAID 1 Summary

Choose RAID 1 if high availability and performance are important, but cost is not a major concern.

RAID 3: Striping with Dedicated Parity

In RAID 3 configurations, each data stripe generates one *parity* block to provide redundancy and data protection. The parity block is encoded information that can be used to reconstruct the data on that stripe if one of the disks fails. RAID 3 configurations dedicate one disk in the array to store all parity blocks. If you have five physical drives configured as one RAID 3 logical drive, data blocks are written as follows:

	Disk 1	Disk 2	Disk 3	Disk 4	Disk 5
Stripe 1	Block 1	Block 2	Block 3	Block 4	**Parity 1-4**
Stripe 2	Block 5	Block 6	Block 7	Block 8	**Parity 5-8**
Stripe 3	Block 9	Block 10	Block 11	Block 12	**Parity 9-12**

With RAID 3, data reads are faster than writes, because parity must be calculated for writes. RAID 3 performs better for long writes than for short ones, because writes of less than one full stripe involve a parity calculation. RAID 3 works well for long data transfers, such as CAD files and data logging.

RAID 3 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, data can be rebuilt.

Only one disk in the RAID 3 logical drive is reserved to provide redundancy.

HP NetRAID firmware optimizes RAID 3 data flow for long, serial data transfers such as video or imaging applications.

RAID 3 Disadvantages

Performance is slower than RAID 0 or RAID 1.

RAID 3 Summary

Choose RAID 3 if cost, availability, and performance are equally important. RAID 3 performs best when long, serial transfers account for most of the reads and writes.

English

RAID 5: Striping with Distributed Parity

RAID 5 is the most common configuration because it provides good overall performance and data protection with a minimum loss of storage capacity. RAID 5 distributes the parity blocks equally among all disk drives to achieve better overall performance than if a dedicated parity disk is used (RAID 3). If you have five physical drives configured as one RAID 5 logical drive, data blocks are written as follows:

	Disk 1	Disk 2	Disk 3	Disk 4	Disk 5
Stripe 1	Block 1	Block 2	Block 3	Block 4	**Parity 1-4**
Stripe 2	Block 5	Block 6	Block 7	**Parity 5-8**	Block 8
Stripe 3	Block 9	Block 10	**Parity 9-12**	Block 11	Block 12

RAID 5 outperforms RAID 1 for read operations. The write performance, however, may be slower than RAID 1, especially if most writes are small and random. For example, to change Block 1 in the diagram above, the integrated HP NetRAID controller must first read Blocks 2, 3, and 4 before it can calculate Parity Block 1-4. Once it has calculated the new Parity Block 1-4, it must write Block 1 and Parity Block 1-4.

RAID 5 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, data can be rebuilt.

Capacity equivalent to only one disk in the RAID 5 logical drive is reserved to store redundant data.

RAID 5 outperforms RAID 1 for read operations.

RAID 5 gives good performance if you have a high volume of small, random transfers.

RAID 5 Disadvantages

Write performance is slower than RAID 0 or RAID 1.

RAID 5 Summary

Choose RAID 5 if cost, availability, and performance are equally important. RAID 5 performs best if you have I/O-intensive, high read/write ratio applications such as transaction processing.

Spanned Arrays: RAID Levels 10, 30, and 50

Array spanning allows the capacity of two, three, or four arrays to be combined into a single storage space. A spanned array configuration must have the same number of disk drives in each array: each array can have two disks, three disks, four disks, and so on.

RAID 10: Spanning with Mirrored Arrays

A RAID 10 configuration uses two, three, or four pairs of mirrored disks, spanning two, three, or four arrays, respectively. (RAID 10 is a RAID 1 configuration with array spanning.) If your RAID 10 logical drive spans two arrays with two physical drives each, data blocks are written as follows:

	Array 1		Array 2	
	Disk 1	**Disk 2**	**Disk 3**	**Disk 4**
Stripe 1	Block 1	Block 1	Block 2	Block 2
Stripe 2	Block 3	Block 3	Block 4	Block 4
Stripe 3	Block 5	Block 5	Block 6	Block 6

RAID 10 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, its mirror image is available.

Read performance is fast, because data is available from either disk in each pair.

RAID 10 lets you create large logical drives. You can span up to four arrays containing a maximum of eight physical drives.

RAID 10 Disadvantages

Costs are high, because 50% of all disk space is allocated for redundancy.

Capacity expansion is an offline operation only.

RAID 10 Summary

RAID 10 provides the best performance for most applications where redundancy and large logical drive size are required, and cost is not a factor.

English

RAID 30: Spanning with Dedicated Parity Drives

In RAID 30 configurations, parity blocks provide redundancy to a logical drive that spans two, three, or four arrays. (RAID 30 is a RAID 3 configuration with array spanning.) If your RAID 30 logical drive has two arrays with four physical drives each, data blocks are written as follows:

	Array 1				Array 2			
	Disk 1	**Disk 2**	**Disk 3**	**Disk 4**	**Disk 5**	**Disk 6**	**Disk 7**	**Disk 8**
Stripe 1	Block 1	Block 2	Block 3	**Parity 1-3**	Block 4	Block 5	Block 6	**Parity 4-6**
Stripe 2	Block 7	Block 8	Block 9	**Parity 7-9**	Block 10	Block 11	Block 12	**Parity 10-12**
Stripe 3	Block 13	Block 14	Block 15	**Parity 13-15**	Block 16	Block 17	Block 18	**Parity 16-18**

RAID 30 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, data can be rebuilt.

Only one disk in each array of a RAID 30 logical drive is required to provide redundancy.

HP NetRAID firmware optimizes RAID 30 data flow for long, serial data transfers such as video or imaging applications.

RAID 30 lets you create large logical drives. You can span up to four arrays containing a maximum of 12 to 16 physical drives.

RAID 30 Disadvantages

Capacity expansion is an offline operation only.

Performance is slower than RAID 0 or RAID 10.

RAID 30 Summary

Choose RAID 30 if you need a large logical drive size, and cost, availability, and performance are equally important. RAID 30 performs best when long, serial transfers account for most of the reads and writes.

RAID 50: Spanning with Distributed Parity

In RAID 50 configurations, parity blocks are distributed throughout the logical drive that spans two, three, or four arrays. (RAID 50 is a RAID 5 configuration with array spanning.) If your RAID 50 logical drive has two arrays with four physical drives each, data blocks are written as follows:

	Array 1				Array 2			
	Disk 1	**Disk 2**	**Disk 3**	**Disk 4**	**Disk 5**	**Disk 6**	**Disk 7**	**Disk 8**
Stripe 1	Block 1	Block 2	Block 3	**Parity 1-3**	Block 4	Block 5	Block 6	**Parity 4-6**
Stripe 2	Block 7	Block 8	**Parity 7-9**	Block 9	Block 10	Block 11	**Parity 10-12**	Block 12
Stripe 3	Block 13	**Parity 13-15**	Block 14	Block 15	Block 16	**Parity 16-18**	Block 17	Block 18

RAID 50 Advantages

There is no data loss or system interruption due to disk failure, because if one disk fails, data can be rebuilt.

Capacity equivalent to only one disk in each array of the RAID 50 logical drive is required to provide redundancy.

RAID 50 lets you create large logical drives. You can span up to four arrays containing a maximum of 12 to 16 physical drives.

RAID 50 gives good performance if you have a high volume of small, random transfers.

RAID 50 Disadvantages

Capacity expansion is an offline operation only.

Performance is slower than RAID 0 or RAID 10.

RAID 50 Summary

Choose RAID 50 if you need a large logical drive size, and cost, availability, and performance are equally important. RAID 50 performs best for I/O-intensive, high read/write ratio applications such as transaction processing.

English

Table 2-1. RAID Level Summary for RAID Levels 0 to 5

RAID Level	RAID 0	RAID 1	RAID 3	RAID 5
Also Known As	striping	mirroring	striping with dedicated parity	striping with distributed parity
Fault Tolerance	no	yes	yes	yes
Redundancy Type	none	duplicate	parity	parity
Hot Spare Option	no	yes	yes	yes
Disks Required	one or more	two	three or more	three or more
Usable Capacity	greatest	least	intermediate	intermediate
Capacity Reduction	none	50%	capacity of one disk	capacity of one disk
Read Performance	fast (depends on number of disks)	intermediate	fast	fast
Random Write Performance	fastest	intermediate	slowest	slow
Sequential Write Performance	fastest	intermediate	slow	slowest
Typical Usage	Rapid reads and writes with no need for fault tolerance	Mostly small random writes with fault tolerance	Mostly large, serial transfers with fault tolerance	Mostly small, random transfers with fault tolerance

Table 2-2. RAID Level Summary for Spanned Arrays

RAID Level	RAID 10	RAID 30	RAID 50
Also Known As	striping with mirrored arrays	striping with dedicated parity drives	striping with distributed parity
Fault Tolerance	yes	yes	yes
Redundancy Type	duplicate	parity	parity
Hot Spare Option	yes	yes	yes
Disks Required:			
spans 2 arrays	4	6, 8, 10, 12, 14, or 16*	6, 8, 10, 12, 14, or 16*
spans 3 arrays	6	9, 12, or 15*	9, 12, or 15*
spans 4 arrays	8*	12 or 16*	12 or 16*
Usable Capacity	least	intermediate	intermediate
Capacity Reduction	50%	capacity of one disk for each array spanned	capacity of one disk for each array spanned
Read Performance	intermediate	fast	fast
Random Write Performance	intermediate	slowest	slow
Sequential Write Performance	intermediate	slow	slowest
Typical Usage	Mostly small random writes with fault tolerance and enhanced speed	Mostly large serial transfers with fault tolerance and enhanced speed	Mostly small, random transfers with fault tolerance and enhanced speed

*The maximum number of devices depends on the number of channels and types of enclosures being used.

English

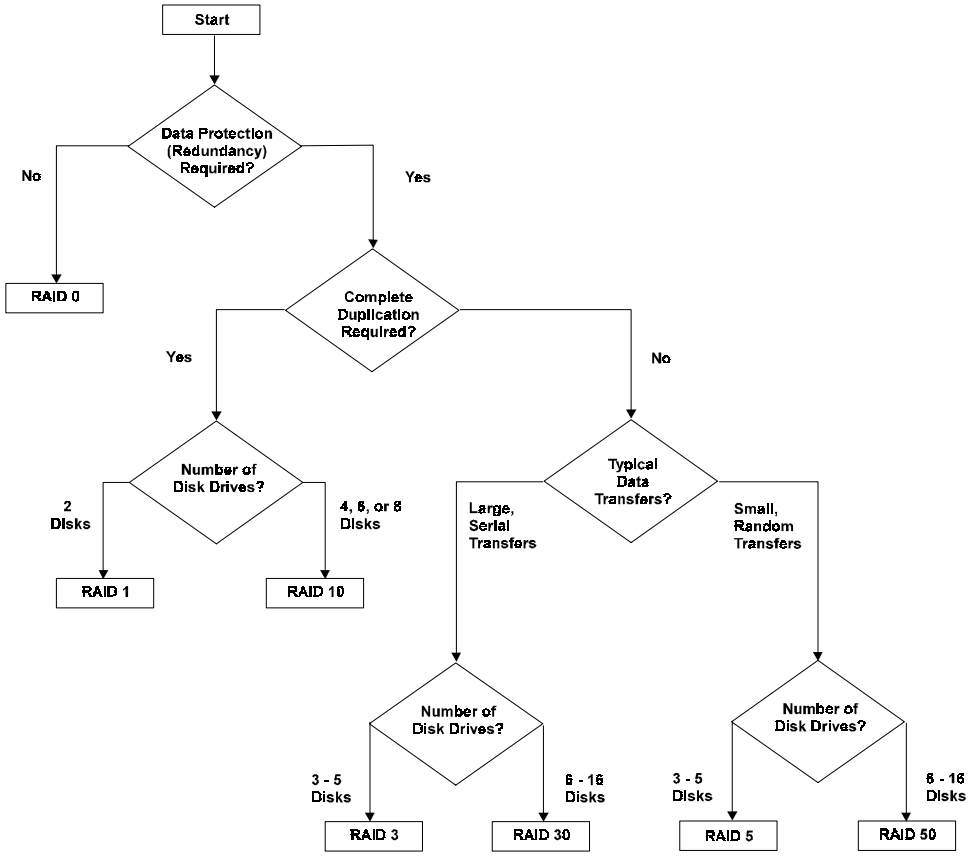


Figure 2-4. Decision Tree for Choosing a RAID Level

3 Configuration Overview

To configure your integrated HP NetRAID controller, you need to perform the following steps. Steps A through M are described in Chapters 4 through 7 of this guide.

Step A. Plan Your Hardware (Chapter 4 and Worksheet A)

Step B. Plan Arrays and Logical Drives (Chapter 4 and Worksheets A and B)

Step C. Verify Hardware Setup (Chapter 5)

Step D. Enable Integrated HP NetRAID Controller (Chapter 5)

Step E. Boot HP NetServer Navigator to Launch HP NetRAID Assistant (Chapter 5)

Step F. Configure Arrays and Logical Drives (Chapter 5)

Step G. Save Configuration and Initialize (Chapter 5)

Step H. Decide Which HP NetRAID Driver You Need (Chapter 6)

Step I. Use HP NetServer Navigator CD-ROM to Prepare Disks (Chapter 6)

Step J. Install NOS and HP NetRAID Drivers (Chapter 6)

Step K. Install NOS-specific Configuration Utility (Chapter 6)

Step L. Run HP NetRAID Express Tools (Chapter 6)

Step M. (Optional) Prepare for Online Capacity Expansion (Chapter 7)

Once you have configured your HP NetRAID system, refer to Chapter 8, "Managing Servers Over the Network," and the *HP NetRAID Series User Guide* for information on managing your controller from a remote location.

If you have configured and are operating a one-channel HP NetRAID system, and later you want to configure a second channel, follow the steps in Chapter 9, "Configuring a Second Integrated HP NetRAID Channel."

Chapter 10, "Understanding HP NetRAID Utilities," provides menu maps for the three utilities that are available to manage your HP NetRAID system.

4 Planning

Overview

Before attempting to configure your disk array subsystem, you should invest some time in planning the configuration that best suits your computing environment. The options you choose depend on factors such as the host operating system used and your requirements for data protection, performance, and capacity.

This chapter guides you through the planning process.

- Step A, Plan Your Hardware, is the first step.
- Step B, Plan Arrays and Logical Drives, is the second step.

Worksheets are provided in Appendix B. You should make one copy of Worksheet A and Worksheet B on which to write your choices for your integrated HP NetRAID controller.

Step A. Plan Your Hardware

In Step A, Plan Your Hardware, you will begin to fill out Worksheet A. But first, you must gather information about your HP NetServer and your user requirements.

Gather Information

You need to know the following information about your system and its use to create the best HP NetRAID configuration:

- Your host operating system and its block size
- Any special needs that certain work groups or users have for security, data protection, or performance that vary from the requirements of other groups or users
- Redundancy requirements to protect data
- Performance requirements
- Storage capacity requirements
- Whether you want hot spare capability

Sample Worksheet A

Figure 4-1 shows a sample Configuration Worksheet A. (See Appendix B for a complete explanation of this example.)

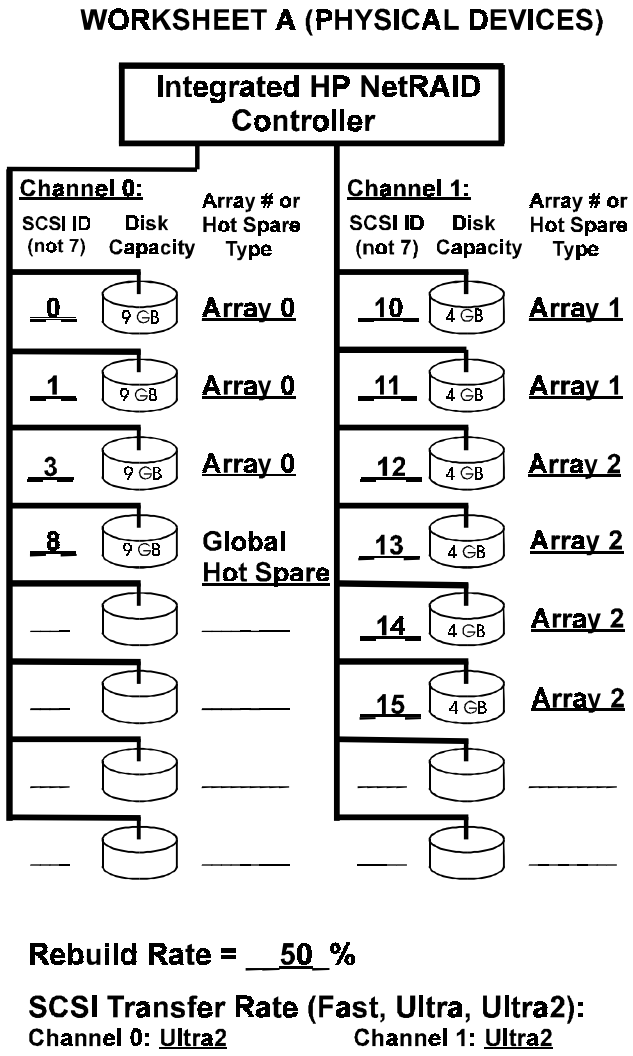


Figure 4-1. Sample Worksheet A for Integrated HP NetRAID Controller

English

Channels

In this section you determine which physical devices will connect to each SCSI channel. As explained in Chapter 1, "Introduction," for each channel, you have either one internal or one external connection. The integrated HP NetRAID controller supports both internal and external connectors for Channels 0 and 1.

SCSI Channels on the HP NetServer LH 3 and LH 3r

The HP NetServers LH 3 and LH 3r have two SCSI channels: A and B.

SCSI A has these characteristics:

- By default, SCSI channel A is connected to the hot-swap mass storage cage that was shipped with your HP NetServer. (For the HP NetServer LH 3, SCSI A is connected to the right drive cage; for the HP NetServer LH 3r, SCSI A is connected to the lower drive cage.)
- By default, the integrated HP NetRAID subsystem is enabled for SCSI A.

SCSI B has these characteristics:

- By default, SCSI channel B is connected to the non-hot-swap devices. If you install a second hot-swap mass storage cage, you can connect it to SCSI B. There are two SCSI B connectors: one SCSI B connector is designed for the single-ended (SE), non-hot-swap devices; the other SCSI B connector supports Ultra2 (LVD) drives. The two connectors are on the same SCSI bus, but are separated electrically by an LVD to SE converter. The slow devices on SE are not affected by LVD operation. However, *SE devices and LVD devices cannot share the same SCSI ID*. To resolve a conflict, change the SCSI address of the non-hot-swap device by resetting its SCSI address switches.
- By default, the integrated HP NetRAID subsystem is disabled for SCSI B. However, you may enable the integrated HP NetRAID subsystem on SCSI B as described in Step D in Chapter 5 of this guide.
- If you enable HP NetRAID for SCSI B, all non-hot-swap SCSI devices and all hot-swap drives in the second hot-swap mass storage cage become part of the HP NetRAID subsystem.
- If you enable HP NetRAID for SCSI B, you cannot use devices with multiple LUNs (logical units) in the non-hot-swap shelves. An example of a device with multiple LUNs that you cannot use is an autoloader tape device. If you want to use a device with multiple LUNs, and you want to

enable HP NetRAID for SCSI B, you must connect the device to a SCSI controller accessory board.

HP NetRAID Channels

The integrated HP NetRAID controller refers to channels as 0 and 1. If only one HP NetRAID channel is enabled, it becomes Channel 0. If both HP NetRAID channels are enabled, then SCSI A is Channel 0 and SCSI B is Channel 1.

NOTE It is recommended that if you enable HP NetRAID on only one channel, that you use the default configuration and enable HP NetRAID on SCSI A.

If you enable HP NetRAID on only one channel, and later want to enable a second channel, you must follow the instructions in Chapter 9, "Configuring a Second Integrated HP NetRAID Channel," in this guide.

Record the SCSI ID number and physical capacity of each hot-swap drive in the correct channel on Worksheet A. Physical drives on different channels can be assigned to the same array.

NOTE If you plan to enable HP NetRAID on SCSI B, and if you have installed non-hot-swap SCSI devices, make certain the non-hot-swap and the hot-swap devices do not share the same SCSI ID. Resolve conflicts by resetting the SCSI address switch of the non-hot-swap device.

How to Handle Non-Hot-Swap Devices

When you enable integrated HP NetRAID for SCSI B, the non-hot-swap SCSI devices automatically appear as part of the HP NetRAID channel and must be configured along with the hot-swap drives in the mass storage cage. For example, SCSI tape devices will appear as part of the HP NetRAID channel.

NOTE To avoid having the non-hot-swap drives be part of the HP NetRAID subsystem, you can connect the non-hot-swap devices to a SCSI controller accessory board.

If you plan to enable integrated HP NetRAID on SCSI B, list the non-hot-swap SCSI devices on Worksheet A that will be part of the RAID subsystem.

English

SCSI Transfer Rate

On Worksheet A, record the SCSI transfer rate for each channel. The default SCSI transfer rate is Ultra2, because the internal hot-swap mass storage cage supports Ultra2 disk drive modules. However, you can change the SCSI transfer rate to Fast or Ultra if the channel is connected to an external mass storage enclosure. Refer to your system or external mass storage system documentation to determine whether your disk enclosure supports Fast, Ultra, or Ultra2 SCSI drives.

NOTE	If you have connected a second hot-swap mass storage cage to SCSI B, your SCSI transfer rate for this channel should also be Ultra2. Any non-hot-swap SCSI devices have a separate SCSI connector that isolates the Ultra2 drives from the non-hot-swap, single-ended devices.

Step B. Plan Arrays and Logical Drives

There are two ways to set up arrays and logical drives.

- Automatic configuration is explained for those users who do not want to customize their arrays and logical drives.
- Custom configurations permit you to create exactly the configuration that best suits your needs.

Automatic Configuration

Automatic mode defines the arrays and logical drives for you, and sets their parameters. It makes configuration easy.

Automatic mode uses the following rules to define arrays:

- *If integrated HP NetRAID is enabled for SCSI B, Automatic mode does not distinguish non-hot-swap devices from hot-swap disk drives in the mass storage cage or other enclosure.* Both the hot-swap and non-hot-swap devices are incorporated into the RAID subsystem.
- It scans the physical drives, starting at SCSI ID 0 on Channel 0, and it groups the physical drives by capacity, with up to five drives in an array.
- Each array is defined as a single logical drive, and array spanning is not used.

- For each array, the system looks to see if you have asked to implement redundancy (checked the Redundancy box). If you are not using redundancy, all logical drives are assigned RAID level 0.
- If an array contains two drives, and you checked Redundancy, the logical drive is assigned RAID level 1.
- If a group contains three to five drives, and you checked Redundancy, the logical drive is assigned RAID level 5.
- If an array contains only one drive, the logical drive is assigned RAID level 0. (No redundancy is possible on a logical drive containing just one physical drive.)
- Automatic configuration does not create hot spares. You must create your hot spares before you begin automatic configuration.

CAUTION	For performance reasons, non-hot-swap devices should *not* be combined in arrays with hot-swap disk drives. If your non-hot-swap devices have the same capacity as your hot-swap disk drives, do *not* use Automatic mode. See "Custom Configuration," next in this guide, for recommendations on making best use of your non-hot-swap devices.

If Automatic configuration will suit your needs, you can proceed to Chapter 5, "Configuration." However, you are encouraged to read the entire planning section to determine whether or not a custom configuration would better meet your needs.

Custom Configuration

To plan a custom configuration, you will do the following:

- Plan your non-hot-swap devices (only if integrated HP NetRAID is enabled for SCSI B)
- Plan your arrays
- Plan hot spares
- Decide the rebuild rate
- Plan logical drives

English

Plan Your Non-Hot-Swap Devices

If you plan to enable integrated HP NetRAID on SCSI B, you need to decide how to use the non-hot-swap SCSI devices. For each non-hot-swap device log its array number in Worksheet A.

- Non-hot-swap drives can be used alone, as the only disk in the array.
- Non-hot-swap drives can be used in an array with other non-hot-swap drives of the same capacity.

For performance reasons, do not use non-hot-swap drives in arrays with hot-swap drives. Do not use non-hot-swap drives as hot spares.

Plan Your Arrays

In this section you specify which hot-swap drives are assigned to which arrays. For each hot-swap drive that is assigned to an array, log its array number in Worksheet A.

When creating your arrays, please consider the following:

- Group together hot-swap drives that have the same capacity. (If you use drives with different capacities in an array, all the drives in the array are treated as though they have the capacity of the smallest drive.)
- Arrays are numbered sequentially beginning with Array 0.
- Arrays can have between one and eight hot-swap drives per array.
- The more drives you group together in an array, the better the performance.
- The hot-swap drives in an array can be all on the same channel, or they can be on separate channels.
- You might plan to reserve one or more hot-swap drives for use as a hot spare. See "Plan Hot Spares (Optional)" later in this chapter for more information.

When you create your arrays, you should look ahead toward the logical drives that you will configure later. (Logical drives are discussed in "Plan Logical Drives" later in this chapter.) Here are some considerations about logical drives that might impact how you set up your arrays:

- Consider what RAID levels you will need.
  - ◊ Different RAID levels require different minimum numbers of physical drives. For example, RAID 1 requires exactly two physical drives, RAID levels 3 and 5 require at least three physical drives, and arrays with only one physical drive must be assigned RAID 0.
  - ◊ Different RAID levels reserve different amounts of capacity to provide redundancy.
- A single array can be divided into a maximum of eight logical drives.
- The integrated HP NetRAID controller can support a maximum of eight logical drives.
- If you want to use the online capacity expansion feature later on, logical drives cannot span arrays and there must be only one logical drive per array.
- If you want one logical drive to span two or more arrays:
  - ◊ Spanned arrays must be numbered consecutively.
  - ◊ Spanned arrays must contain the same number of physical drives per array.
  - ◊ Although each physical drive in an array must have the same capacity, one logical drive can span two or more arrays of different capacities. For example, one array might contain three drives of 1 GB each, and the second array might contain three drives of 5 GB each. One logical drive can span both of these arrays.

As you plan your arrays, it might help to sketch your configuration. See Figures 4-2 and 4-3 for examples.

In Figure 4-2, Logical Drive 1 (labeled "LD1") spans arrays A0 and A1, occupying space in both. Each array of physical drives is on a separate channel.

English

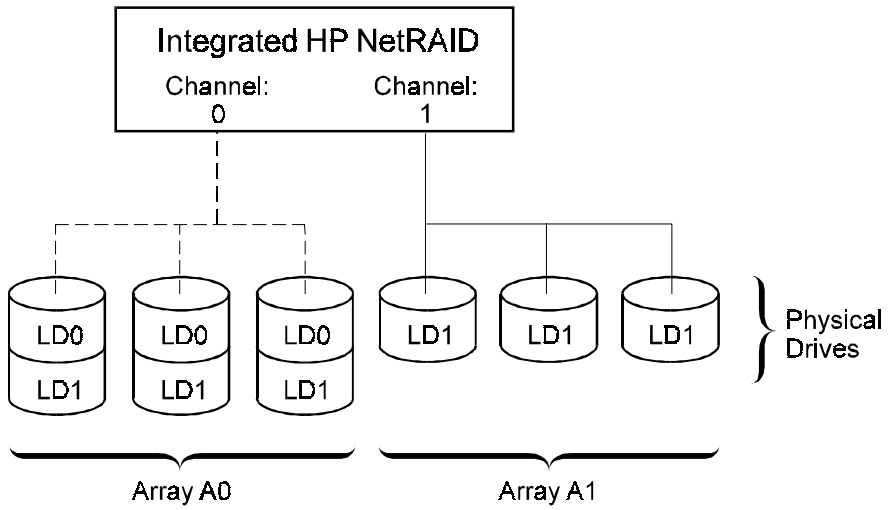


Figure 4-2. Two Logical Drives Where Whole Arrays Appear on Different Channels

Figure 4-3 shows the same configuration, except Array A0 contains physical drives from both Channel 0 and Channel 1.

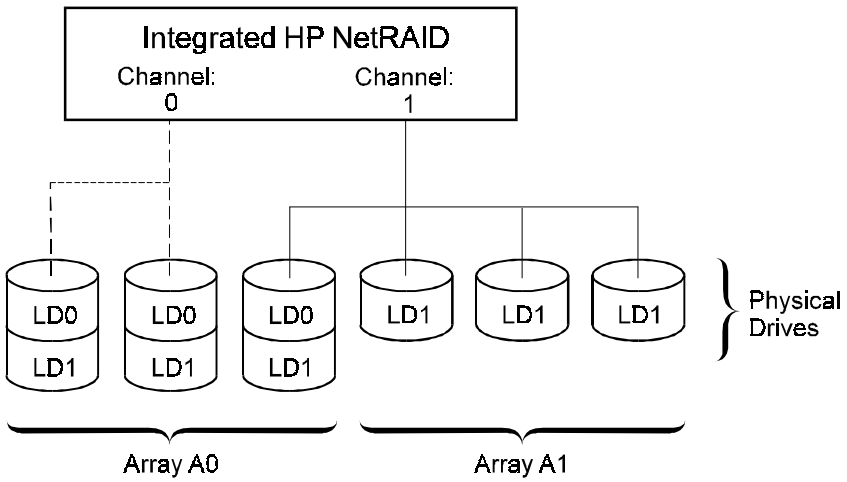


Figure 4-3. Two Logical Drives Where Array A0 Contains Drives on More than One Channel

Plan Hot Spares (Optional)

On Worksheet A, log any hot spare disk modules and indicate whether each is global or dedicated to a particular array.

A hot spare is a powered-on, stand-by disk that is ready for use should another disk fail. When a disk fails, the HP NetRAID firmware can automatically rebuild the data from the failed disk onto the hot spare. Unless a rebuild occurs, a hot spare does not contain user data. When planning hot spares, keep these considerations in mind:

- Hot spares are useful only for logical drives with RAID levels of 1, 3, 5, 10, 30, or 50.
- Hot spares *cannot* rebuild logical drives of RAID 0, because this RAID level does not provide a means of recovering data.
- A dedicated hot spare is assigned to a specific array. Only one hot spare can be dedicated to each individual array.
- Global hot spares stand ready to rebuild any physical drive for any array with redundancy.
- A hot spare does not count toward the usable capacity of any array.
- A hot spare must have capacity equal to or greater than the capacity of the physical drive it would replace.

Decide the Rebuild Rate

During a rebuild, the contents of a complete physical drive is rewritten. Normal operations can go on during a rebuild, but performance may be degraded. The Rebuild Rate controls the rate at which a rebuild is done by specifying what percentage of IOP resources will be dedicated to rebuilding the data on a failed physical drive.

A high Rebuild Rate (over 50%) speeds up the rebuild, but slows system performance. A low Rebuild Rate (under 50%) slows the rebuild process, but speeds up system performance. The default is 50%.

RAID 0 data cannot be rebuilt because it has no redundancy.

Log the Rebuild Rate on Worksheet A.

English

Plan Logical Drives

Logical drives are virtual drives configured within an array or across arrays. Logical drives can take three forms:

- A logical drive can use all of the storage capacity of one array.
- A logical drive can use less than the available storage capacity of one array. The remaining capacity can be used by one or more logical drives.
- A logical drive can span arrays by using capacity in two, three, or four different arrays. Spanned logical drives can use all of the storage capacity of the arrays they span, or they can use less than all the available capacity.

General Considerations

Consider the differing needs of work groups or users for security, data protection, and performance as you decide how to configure the logical drives in each array.

Here are some considerations about logical drives that might impact how you set them up:

- You must configure at least one logical drive per array.
- A single array can be divided into a maximum of eight logical drives. However, if you want to use the online capacity expansion feature later on, plan to create just one logical drive per array.
- Consider what RAID levels you need. Review the information in Chapter 2 and look at Tables 2-1 and 2-2 that compare the RAID levels.
- Look at the arrays you have defined so far. Ensure that the arrays contain the minimum number of physical drives required for the RAID levels you want to create.
- Make sure the redundancy requirements of the RAID levels you want leave you with enough capacity for your data.
- If you want a logical drive to span two or more arrays, consider the following:
  - ◊ You cannot use the online capacity expansion feature with logical drives that span arrays.
  - ◊ Spanned arrays must contain the same number of disk drives per array.

- ◊ Although each drive in an array must have the same capacity, one logical drive can span two or more arrays with different capacities. For example, one array might contain three drives of 4 MB each, and the second array might contain three drives of 12 MB each. One logical drive can span both of these arrays.
- ◊ Spanned arrays must be numbered consecutively.
- ◊ When you use an HP NetRAID utility to configure your system, and you specify that a logical drive will span arrays, the system will span *all* eligible arrays that are numbered consecutively and that contain the same number of disk drives, up to a maximum of four arrays.

Sample Worksheet B

A sample Worksheet B is shown in Figure 4-4.

WORKSHEET B (LOGICAL DEVICES)

Logical Drive #	Array #	Span	RAID Level	Logical Drive Size	Stripe Size	Write Policy	Read Policy	Cache Policy
LD0	0	No	5	18 GB	64 KB	W. Thru.	Adapt.	Cached
LD1	1	No	1	4 GB	16 KB	W. Thru.	Adapt.	Cached
LD2	2	No	5	12 GB	64 KB	W. Thru.	Adapt.	Cached
LD3								
LD4								
LD5								
LD6								
LD7								
Use up to eight logical drives, starting with LD0.	Start with Array 0, and number consecutively.	Span this LD over the next 1-3 consecutive arrays?	RAID Level 0, 1, 3, 5, 10, 30, or 50	Optional. You can let the HP NetRAID Assistant Wizard calculate the size.	4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB (128 KB requires 8 MB of memory)	Write Back or Write Thru	Normal, Read Ahead, or Adaptive Read Ahead	Cached I/O or Direct I/O

Figure 4-4. Sample Worksheet B

English

Logical Drives, RAID Levels, and Array Spanning

On Worksheet B, logical drives are numbered LD0 through LD7. For each logical drive you plan to create, record the following information:

- Array number to which the logical drive is assigned
- Whether the logical drive spans up to four sequentially-numbered arrays
- RAID level

For each logical drive, you also need to define the logical drive size (capacity), stripe size, write policy, read policy, and cache policy as defined in the sections that follow.

Logical Drive Size

You can calculate the usable capacity to assign to each logical drive, or you can let the HP NetRAID Assistant Wizard specify it during configuration. If you calculate logical drive capacity, record it in Worksheet B.

If you want a logical drive to occupy less space than is available on one array, you must enter the logical drive size.

Stripe Size (Stripe Depth)

Stripe size is the amount of data contiguously written to each disk in an array. It is sometimes called "stripe depth." You can specify stripe sizes of 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, and 128 KB for each logical drive. Consider the following when setting your stripe size:

- The default stripe size is 64 KB.
- For best performance, choose a stripe size equal to or smaller than the block size used by your operating system.
- A large stripe size produces better performance if the system does mostly sequential reads.
- Choose a small stripe size if your system performs mostly random reads.
- Online conversions of RAID 3 logical drives can be done only if the stripe size is 64 KB.

For each logical drive, log the stripe size in Worksheet B.

NOTE	Consider the stripe size carefully, because once the logical drive is configured, you cannot change its stripe size.

Write Policy

When the IOP writes to disk, the data is first written to the cache on the assumption that the IOP will read it again soon. The two Write policies are:

- **Write-Through**: In a write-through cache, data is written to disk at the same time it is cached. This setting provides better security because entries are always copied to disk. This is the default setting.
- **Write Back**: In a write-back cache, data is written to disk only when it is forced out of the cache. Write-back is efficient, because an entry may be written many times in the cache without a disk access. While this setting increases performance, it is not recommended unless your system is equipped with a UPS (uninterruptible power supply).

NOTE	Write Back is not certified for any logical drive used as a Novell NetWare volume.

For each logical drive, record the write policy in Worksheet B.

Read Policy

The three Read policies for HP NetRAID are:

- **Read-Ahead**: This is a memory caching feature that tells the controller to read sequentially ahead of requested data and cache the additional data in memory, anticipating that the additional data will be requested. Read-Ahead supplies sequential data faster, but it is not as efficient when accessing random data.
- **Normal**: This policy does not use the read-ahead memory caching feature. This policy is efficient when most of the data reads are random.
- **Adaptive**: Adaptive policy causes the read-ahead feature to be used if the last two disk accesses were in sequential sectors. This is the default setting.

For each logical drive, record the read policy in Worksheet B.

English

Cache Policy

HP NetRAID lets you choose one of two cache policies:

- **Cached I/O**: Reads are always cached regardless of randomness. The selected Read policy (Read-Ahead, Normal, or Adaptive) and Write policy (Write-Through and Write-Back) always applies. This is the default setting.
- **Direct I/O**: First reads to a new location always come directly from the disk. If a location is read repeatedly, then the Read policy as selected will apply and the read data will be cached. Read data is cached only if accessed repeatedly. With 100% randomness, nothing is cached.

For each logical drive, record the cache policy in Worksheet B.

5 Configuration

Overview

This chapter covers Steps C, D, E, F, and G of the installation procedure. You should already have completed Step A, "Plan Your Hardware," and Step B, "Plan Arrays and Logical Drives" in Chapter 4.

Step C. Verify Hardware Setup

Verify that your hardware setup matches the plans you sketched in Worksheet A. Make sure that:

- Disk drive modules are inserted in the hot-swap mass storage cage
- You have installed a second mass storage cage, or you have connected an external mass storage enclosure, if you are planning to use two channels
- SCSI IDs are set

NOTE	Make sure the SCSI IDs of the non-hot-swap devices do not conflict with the SCSI IDs of the hot-swap disk drive modules connected to SCSI B.

Step D. Enable Integrated HP NetRAID Controller

The HP NetServer LH 3 and LH 3r factory default setting enables the integrated HP NetRAID controller for the SCSI A port only. Use the Setup utility to verify this setting, or to enable the integrated HP NetRAID controller for the SCSI B port as well.

CAUTION	*If you ever use the Setup (F2) utility to reset to system defaults, your HP NetRAID configuration will also be reset to its default value.* The default HP NetRAID configuration enables integrated HP NetRAID and includes SCSI A only. If you have changed the HP NetRAID configuration in the Setup utility, and then you reset to system defaults, you must re-enable the correct HP NetRAID channels before you exit the Setup utility.

1. Turn on the power to the HP NetServer and display monitor.
2. Press the **F2** function key when you see this message:

   ```
   Press <F2> to enter SETUP
   ```

3. If a password has been set, provide it when prompted.
4. When the Setup Utility menu is displayed, the settings for the integrated HP NetRAID controller are:

   - `Integrated HP NetRAID [Enable/Disable]`

     This setting enables or disables the integrated HP NetRAID controller for both SCSI ports. To use the HP NetRAID controller, this setting must be set to **Enable**.

   - `Included SCSI_A Channel [Yes/No]`

     If the integrated HP NetRAID controller is enabled, this setting selectively includes or excludes SCSI port A from the HP NetRAID subsystem.

   - `Included SCSI_B Channel [Yes/No]`

     If the integrated HP NetRAID controller is enabled, this setting selectively includes or excludes SCSI port B from the HP NetRAID system.

NOTE	If you enable HP NetRAID for just one SCSI channel, that becomes the integrated HP NetRAID Channel 0. If you enable both SCSI channels, SCSI A becomes Channel 0, and SCSI B becomes Channel 1.

English

5. If necessary, you can use the Setup utility to change settings such as IRQs or MP specification settings.
6. Press the **F10** function key to save and exit.
7. In the Setup Configuration dialog box, press the Enter key to answer "Yes" to the question "Save configuration and exit now?" The HP NetServer reboots.

Step E. Boot HP NetServer Navigator to Launch HP NetRAID Assistant

Boot HP NetServer Navigator CD-ROM

To launch the HP NetRAID Assistant, you must boot from the *HP NetServer Navigator CD-ROM*. Ensure that all the SCSI devices power up before or at the same time as the host computer.

Boot Messages

If you receive an HP NetRAID error message during the boot process, refer to Chapter 11, "Troubleshooting," or to the online help in Information Assistant for more information. Some power-up (boot) messages are routine.

Select Configure Disk Array

If HP Navigator asks you to set the date, time, and so on, do so. The HP Navigator Main Menu then appears.

1. When the HP Navigator Main Menu is displayed, choose **NetServer Utilities**.
2. Choose **Disk Array Utility** from the NetServer Utilities screen. This launches the HP NetRAID Assistant utility.

Step F. Configure Arrays and Logical Drives

In this step, you will use Worksheets A and B to:

- Configure the arrays of physical drives
- Configure the logical drives

HP NetRAID Assistant

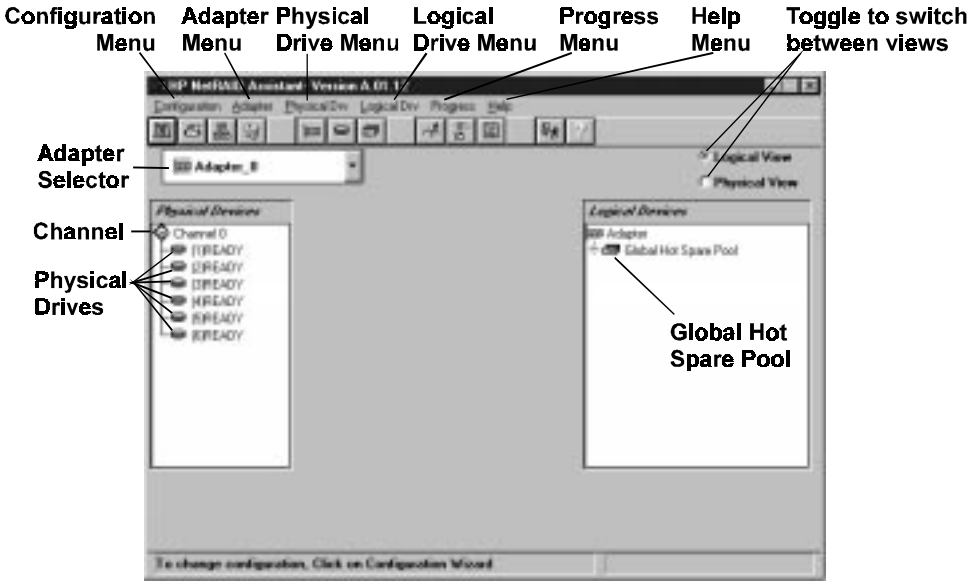


Figure 5-1. HP NetRAID Assistant

Figure 5-1 shows a typical configuration where SCSI A is included in the HP NetRAID subsystem and SCSI B is excluded. If you include both SCSI A and SCSI B, you see two channel columns of physical devices.

The HP NetRAID Assistant, shown in Figure 5-1, is an object-oriented graphical user interface (GUI) with conventions similar to those in Microsoft Windows. Click on an object with the left mouse button to select or deselect it. Chapter 10 lists all the menus that are available by clicking on menu bar items.

Steps F and G describe the features of the HP NetRAID Assistant needed to configure the adapter initially. Refer to the *HP NetRAID Series User Guide* in Information Assistant for more information about HP NetRAID Assistant.

The HP NetRAID Assistant window contains the following features from top to bottom:

- **Menu bar**: The menu bar activates pull-down menus for Configuration, Adapter, Physical Drives, Logical Drives, Progress, and Help.

English

- **Toolbar**: The toolbar icons are separated into four categories of functions: Configuration, Properties, Miscellaneous, and Other. They provide shortcuts to access the menu options.

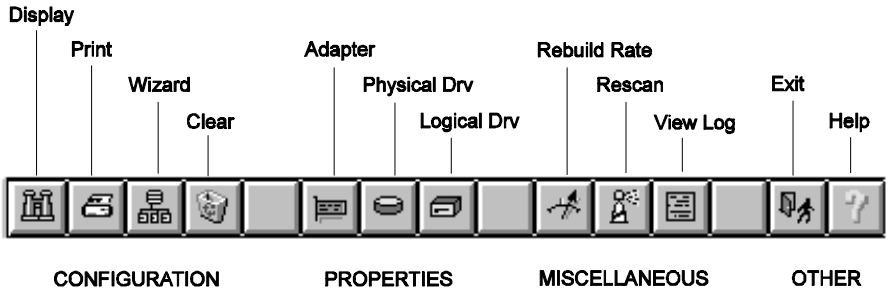


Figure 5-2. HP NetRAID Assistant Main Menu Toolbar Options

- **Adapter box**: The Adapter box shows the number of the current adapter that is being configured. If you installed one or more HP NetRAID-3Si adapters in your HP NetServer, you can switch between the integrated HP NetRAID controller and other HP NetRAID-3Si adapters by using the Adapter box pull-down list. The integrated HP NetRAID controller is always Adapter 0.
- **Physical Devices box**: The Physical Devices box contains one or two channel columns, which show the physical drives on the SCSI channels of the integrated HP NetRAID controller (or the currently selected adapter). The number in parentheses to the right of each physical drive icon is its SCSI ID (Target) on the channel.

  The state of each physical drive appears to the right of the SCSI ID or array designation. The possible states of a physical drive are as follows:

  - ◊ **Online:** The physical drive is online, functioning normally, and part of a configured logical drive.
  - ◊ **Ready:** The physical drive is functioning normally, but is not part of a configured logical drive, nor configured as a hot spare.
  - ◊ **Spare:** The physical drive is configured as a hot spare, and is powered up and ready for use as a spare in case an online drive fails.
  - ◊ **Failed:** The physical drive failed and is out of service.

- ◊ **Rebuilding:** The physical drive is involved in a rebuild process to recover data that was on a failed drive.

- **Logical Devices box**: When arrays, logical drives, and hot spares have been defined, they are displayed here. Clicking on Logical View or Physical View switches between showing logical drives and physical drives. Clicking on the + sign in the yellow diamond expands the view if it is collapsed (physical or logical drives or hot spares are hidden).
- **Status line**: The status line at the bottom of the window shows the progress of the scan required to build the displays on the HP NetRAID Assistant window. It also suggests possible actions.

Select Adapter to Configure

If you installed one or more HP NetRAID-3Si adapters, look in the Adapter box to see if the integrated HP NetRAID controller is displayed. The integrated HP NetRAID controller is always defined as Adapter 0. If not, select it from the pull-down list.

Clear Configuration

You should clear the configuration to prepare it for the new configuration.

To clear the existing configuration:

1. Select the **Configuration** menu.
2. Choose **Clear Configuration**.
3. Click **OK**.

Check Rebuild Rate

During a rebuild, the content of a complete physical drive is rewritten. Normal operations can go on during a rebuild, but performance may be degraded. The Rebuild Rate controls the rate at which a rebuild is performed. A high Rebuild Rate (over 50%) speeds up the rebuild, but slows system performance. A low Rebuild Rate (under 50%) slows the rebuild process, but speeds up system performance. The default setting for the Rebuild Rate is 50%.

To check the Rebuild Rate from the HP NetRAID Assistant window:

1. Choose **Rebuild Rate** from the Adapter menu.
2. Reset the rate by dragging the slider with the mouse.
3. Click **OK**.

English

NOTE	Clearing the configuration does *not* affect the rebuild rate.

Assign Global Hot Spares

NOTE	Refer to Worksheet A when assigning hot spares.

To assign any physical drives to the global hot spare pool:

1. Click on a Ready physical drive in the Physical Devices box. This drive must have capacity that is at least as great as any drive it will replace.

   You can select more than one Ready drive if you want to create more than one global hot spare. Clicking on a Ready drive either selects it or deselects it.

2. Drag the selected drives into the global hot spare pool.

NOTE	To check the capacity of a physical drive, double-click on it to display its properties.

Select Wizard

NOTE	If any physical drives have been moved, added, removed, changed, or changed in state since HP NetRAID Assistant was started, rescan the drives by choosing the **Adapter** menu and then selecting the **Rescan** option.

To launch the HP NetRAID Assistant Wizard:

1. Select the **Configuration** menu.
2. Choose the **Wizard**. The Wizard starting window is displayed, as shown in Figure 5-3, with a choice of Custom and Automatic configuration modes.

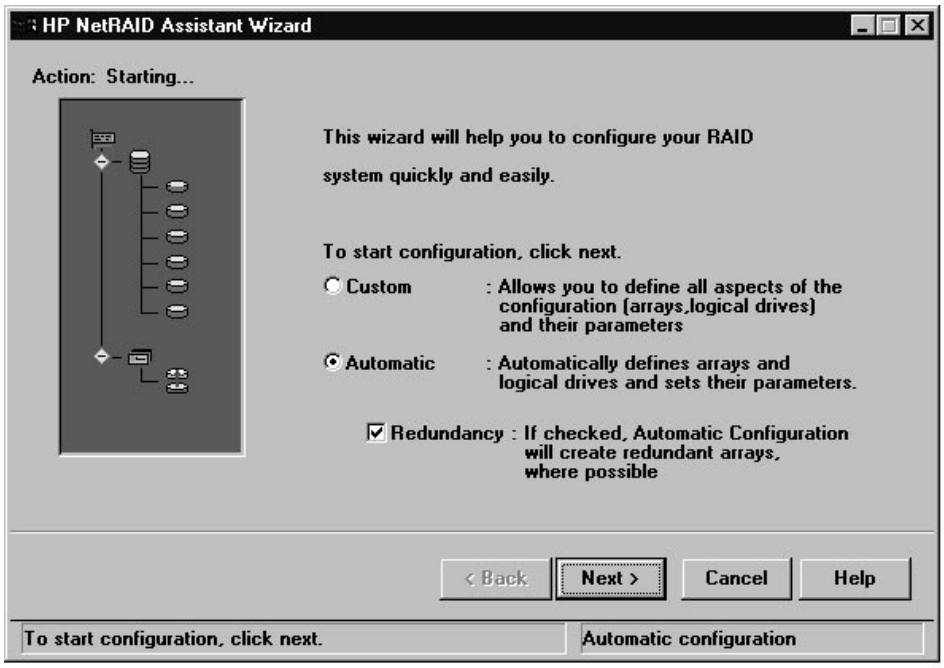


Figure 5-3. HP NetRAID Assistant Wizard Starting Window

3. Click one of the following configuration modes:

   ◊ Select **Custom** if you want to define the arrays and logical drives and set their parameters.

   ◊ Select **Automatic** if you want the HP NetRAID Assistant Wizard to define the arrays and logical drives (and set their parameters) for you automatically.

   When you select Automatic mode, you can toggle the Redundancy check mark at the bottom of the window. If the Redundancy box contains a check, the arrays are automatically configured with redundant logical drives if possible. They will be assigned RAID levels of 1 or 5, depending on the number and capacities of the physical drives. If the Redundancy box is empty, all logical drives are configured as RAID 0, which is not redundant. See "Automatic Configuration" in Chapter 4 for a complete list of the rules used in Automatic configuration.

English

4. Click the **Next** button.
5. If you chose Automatic mode, skip to "Preview Configuration" later in this chapter.

Define Physical Arrays and Dedicated Hot Spares

NOTE	Refer to Worksheet A when defining arrays.

The HP NetRAID Assistant Wizard Array Definition window appears, displaying the Physical Devices and Logical Devices configured on your system. It will be similar to the display shown in Figure 5-4 depending on your configuration. The "new array" in the Logical Devices box shows where a new array can be defined.

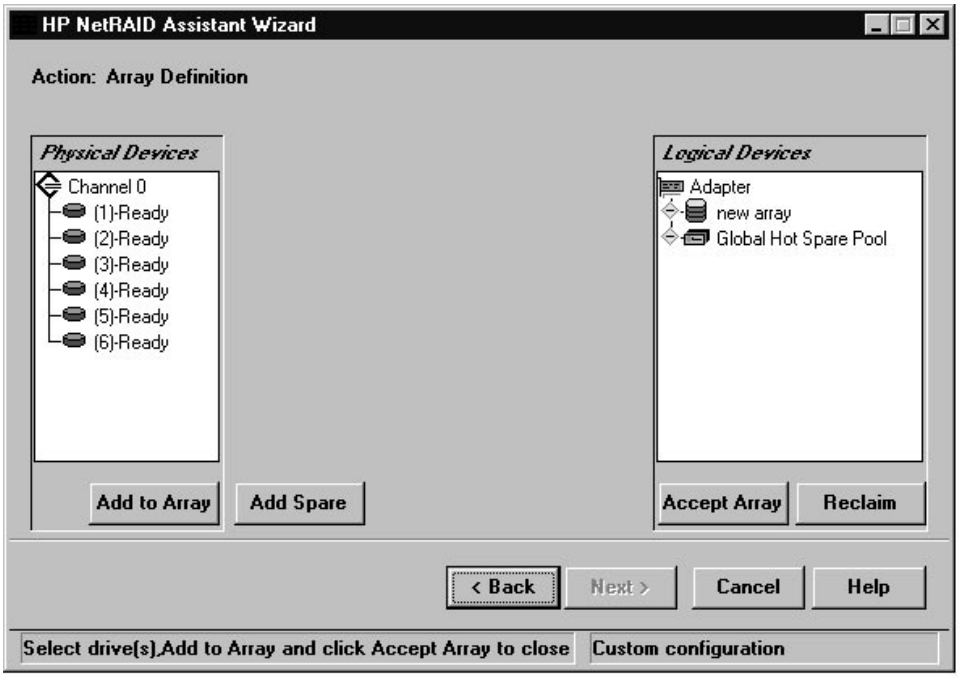


Figure 5-4. HP NetRAID Assistant Wizard Array Definition Window

To assign physical drives to the first array:

1. Select all the Ready physical drives that you want to put into the first array. Clicking on a drive either selects or deselects it.
2. Click the **Add to Array** button.

   Physical drives show "A:new" to indicate the drive has been added to a new array, but has not been accepted yet.
3. If you want to remove a physical drive from a new array, select the drive in the new array and click the **Reclaim** button.
4. When the array is complete, click the **Accept Array** button.

   All physical drives assigned to arrays display their array numbers to the right of the SCSI ID. The numbering is zero-based. For example, A0 designates a physical drive assigned to Array 0.
5. The next new array appears. Assign physical drives to it as described above. Be sure to click the **Accept Array** button to close the array.

To assign physical drives to an existing (not new) array:

1. Click one or more Ready physical drives to select (or deselect) them.
2. Drag the drives into the existing array. All selected Ready drives will be added to the array.

Drives cannot be removed selectively from an existing array, but the entire array can be undone. An array cannot be reclaimed if it has any logical drives defined.

To remove an entire array:

1. Select the array. (Make sure that nothing else is selected.)
2. Click the **Reclaim** button.
3. Click **OK**.

Hot Spares

Hot spares can be assigned to the global hot spare pool, or they can be dedicated to a specific array. Only one hot spare can be dedicated to a given array.

To assign a dedicated hot spare:

1. Select a Ready physical drive. Be sure nothing else is selected.
2. Click the **Add Spare** button. The Hot Spare Target window appears.

English

3. Click the **Dedicated to** button, and then click on the down arrow to display a list of valid arrays.
4. Click the array to which you want to dedicate the hot spare.
5. Click **OK**.
6. Continue defining arrays and hot spares.

To reclaim (undo) one or more hot spares:

1. Select one or more hot spares in the Logical Devices box.
2. Click the **Reclaim** button to convert the hot spares to Ready physical drives.

When you are finished defining arrays and hot spares:

- Click the **Next** button.

Define Logical Drives

NOTE	Refer to Worksheet B when defining logical drives.

After you finish defining arrays and hot spares, and click **Next**, the HP NetRAID Assistant Wizard Logical Drive Definition window appears. A sample window is shown in Figure 5-5. The window is ready for you to define Logical Drive 0.

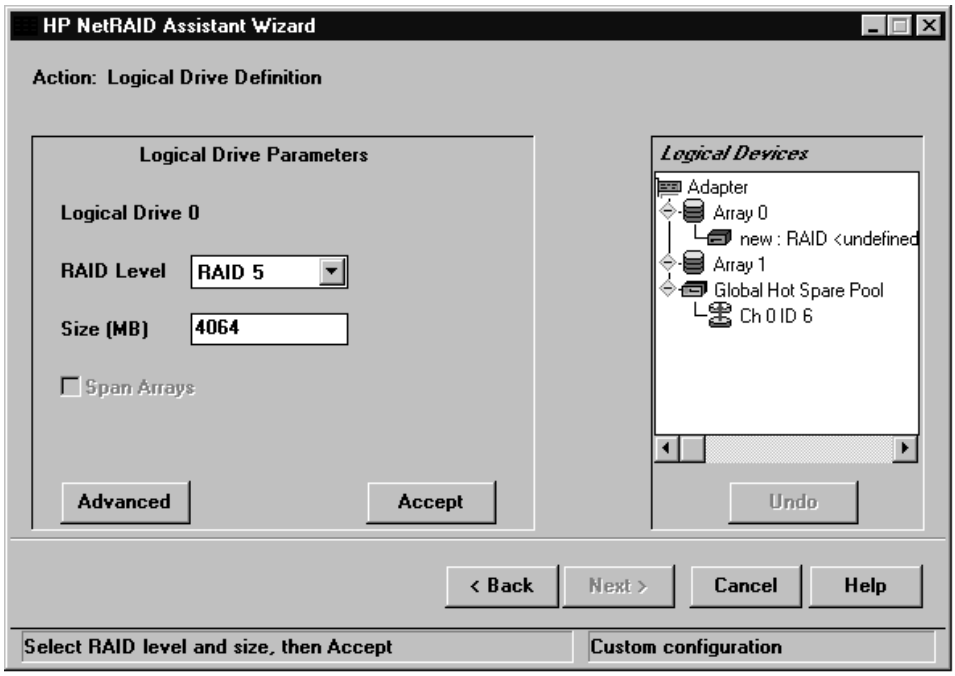


Figure 5-5. HP NetRAID Assistant Wizard Logical Drive Definition Window

- The **Logical Drive Parameters box** shows the number of the logical drive being defined and has boxes to set its RAID level and size.
- The **Span Arrays check box** turns array spanning on or off.
- The **Advanced button** leads to more parameters, which are preset but can be changed.
- The **Logical Devices box** depicts the arrays, the logical drives on each array, and the global hot spare pool. Logical drives are labeled as new and as LD0 through LD7. Click on the + sign in the yellow diamond if the view is collapsed (logical drives are hidden).

The HP NetRAID Assistant Wizard is ready for you to set the parameters of the new logical drive.

English

To define a logical drive that does *not* span arrays:

1. Make sure that the Span Arrays box does not have a check mark in it; if it does, click on it to remove the check.
2. Set the RAID level by clicking the arrow and selecting the RAID level from the pull-down menu.
3. Set the logical drive size by either accepting the default in the box or by clicking in the Size box and typing a smaller size. Setting a smaller size leaves space for another logical drive on the same array.
4. Set the stripe size, read policy, write policy, or cache policy, by clicking the **Advanced** button to display the Advanced Parameter window. Click the arrows to view the choices, and select the ones you want. Disregard the Virtual Sizing check box, because you can change this parameter only in the HP NetRAID Express Tools utility. Click **OK** to return to the Logical Drive Definition window.
5. When the logical drive parameters are set, click the **Accept** button.

   The next logical drive to be defined is displayed. If there is still space in the current array, the new logical drive is on it.
6. Define any other logical drives on the current array that will not span to the next array. HP NetRAID Assistant Wizard keeps creating logical drives on the same array until its capacity is used fully, or until there are eight logical drives defined.

To create a logical drive that spans two or more arrays:

NOTE The arrays to be spanned must have sequential array numbers and each array must contain the same number of physical drives.

HP NetRAID Assistant will attempt to span up to four arrays. Array spanning will stop when:

- It has created a logical drive of the size you specify in Step 2 below.
- The next sequentially numbered array has a different number of drives. (Spanned arrays must contain the same number of drives in each array.)

1. Click the **Span Arrays** box to mark it with a check. An array labeled with a hyphenated number, such as A0-1 or A0-3, appears in the Logical Devices box.
2. If you know the exact size of the logical drive you want, enter it in the Size (MB) box.

   If you do not specify the size of the logical drive, the default size reflects the maximum number of arrays that can be spanned.
3. Define the logical drive as described above.

To remove the last logical drive that was added:

1. Click the **Undo** button.
2. You can continue undoing logical drives by clicking Undo.

When you are done defining logical drives:

- When all the logical drives are defined and you have clicked the Accept button for the last one, click the **Next** button.

  The Next button does not operate until one of the following conditions has been satisfied:

  ◊ All capacity has been assigned to logical drives.

  ◊ Eight logical drives have been defined.

Preview Configuration

NOTE	Refer to Worksheets A and B when checking the configuration.

The HP NetRAID Assistant Wizard Configuration Preview window, shown in Figure 5-6, displays the configuration proposed for the physical and logical drives.

English

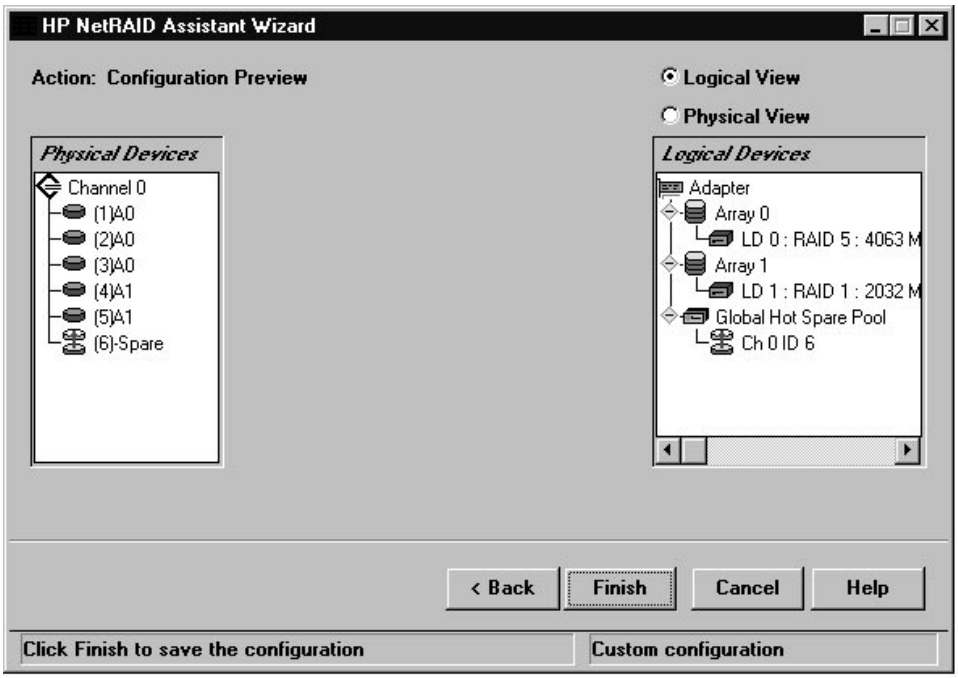


Figure 5-6. HP NetRAID Assistant Wizard Configuration Preview Window

NOTE	The RAID level of a logical drive that spans arrays lacks the terminal zero. Mentally add it to make RAID 1 into RAID 10, RAID 3 into RAID 30, and RAID 5 into RAID 50.

To switch between showing logical drives and physical drives:

- Click **Logical View** or **Physical View**.

To expand a view that has been collapsed (physical or logical drives, or hot spares are hidden):

- Click the + sign in the yellow diamond.

To display the properties of a logical drive:

- Double-click the logical drive in the Logical Devices box.

To display the properties of a physical drive:

- Double-click the physical drive in the Physical Devices box.

To change a logical drive:

1. Click the **Back** button to back up to the previous screen.
2. Delete the last logical drive defined (accepted) by clicking the **Undo** button. Keep clicking **Undo** until you have removed the logical drive you want to change.
3. Configure the logical drives again or click **Back** to back up and change array definitions.

To correct the assignment of physical drives:

1. Undo any logical drives that are defined on the array by clicking **Back**, then clicking **Undo** as necessary to delete the last logical drive.
2. Click the **Back** button to go to the Array Definition screen.
3. Select the array to be reclaimed, and click the **Reclaim** button.
4. Configure the physical drives and logical drives again.

To start the configuration over again:

- Click the **Cancel** button.

To accept the final configuration:

- Click the **Finish** button on the Configuration Preview screen.

To save your configuration and initialize logical drives:

1. Click **OK** at the message asking if you want to save the configuration.

   A Writing Configuration message appears briefly, indicating that the configuration information is being written to the controller's NVRAM and to the physical drives. This is *not* a binary file that can be loaded to restore the configuration.

   HP NetRAID Assistant asks if you want to initialize your logical drives now. Logical drives must be initialized before they can be used.

2. Click the **OK** button to initialize logical drives now or click the **Cancel** button to defer initialization of the logical drives until later.

English

Step G. Save Configuration and Initialize

In this step, you will do the following:

- Save the configuration to a binary file
- Print a copy of the configuration
- Initialize the logical drives if you have not done so already

Save to Binary File

To save the configuration to a binary file:

1. Choose **Save** from the Configuration menu. The Save Configuration dialog box appears.
2. Type the file name and directories to be used to save the configuration. The file type should be `*.cfg`.
3. Click **Save** to save the configuration to the designated file.

Print Configuration

To print a copy of the configuration:

1. Choose **Print** from the Configuration menu.
2. Keep a copy of configuration Worksheets A and B together with the printed copy of your configuration file. They help you understand your configuration, or communicate with HP Customer Support.

Initialize Logical Drives

If you have not done so already, you must initialize your logical drives.

CAUTION	Initializing a logical drive destroys all data currently on the disk modules.

To initialize the logical drives you defined for the adapter in the HP NetRAID Assistant Wizard:

1. If you installed one or more HP NetRAID-3Si adapters, click the **Adapter** pull-down list and select the adapter.
2. Select the logical drives to be initialized.
3. Choose **Initialize** from the Logical Drive menu and click **OK**.

   The Initialize screen appears with separate windows for each logical drive. The bar graph for each logical drive shows the progress of the initialization.
4. Click the **Abort** button if you need to stop the initialization of that logical drive.
5. To rearrange individual windows, click the **Arrange** menu and make a selection.
6. Repeat the initialization process for other logical drives as necessary.

Exit HP NetRAID Assistant

To exit HP NetRAID Assistant, choose **Exit** from the Configuration menu.

You have now completed the configuration of the HP NetRAID system hardware. The next chapter discusses HP NetRAID software.

6 HP NetRAID Software

Overview

In this chapter you will complete the next five steps of the configuration:

- In Step H, you choose whether you want to use I_2O or non-I_2O HP NetRAID drivers
- In Step I, you use the *HP NetServer Navigator CD-ROM* to prepare the diskettes needed to install the NOS, HP NetRAID drivers, and the HP NetRAID NOS-specific utilities
- In Step J, you install the network operating system (NOS) if necessary and the appropriate HP NetRAID drivers
- In Step K, you install the NOS-specific configuration utility you need to manage your HP NetRAID system
- In Step L, you run HP NetRAID Express Tools (optional)

Step H. Decide Which HP NetRAID Drivers You Need

Before you begin to install your software, you must decide which set of drivers you need. Non-I_2O drivers are provided for all network operating systems supported by the integrated HP NetRAID controller. In addition, I_2O drivers are available for selected network operating systems.

The data stored using I_2O drivers is fully compatible with data stored using non-I_2O drivers.

This chapter contains complete instructions on installing non-I_2O drivers. If you are installing non-I_2O drivers, see Step I next in this chapter.

Information about I_2O drivers are not included in this guide. For complete information on which operating systems are supported with I_2O and instructions on installing I_2O drivers, see the HP web site at **`www.hp.com/go/netserver`**.

Step I. Use the HP NetServer Navigator CD-ROM to Prepare Disks

In this step, you will use the *HP NetServer Navigator CD-ROM* to create the diskettes you need to install the non-I_2O HP NetRAID drivers and the HP NetRAID configuration utility specific to your NOS. You need to:

- Verify that you have the most recent version of *the HP NetServer Navigator CD-ROM*
- Create the diskette(s) containing the non-I_2O drivers and instructions
- Create the diskette(s) containing the NOS-specific configuration utility

Check Latest Versions

To ensure that you have the latest versions of the software, obtain the current Status Report for your *HP NetServer Navigator CD-ROM*. This report describes any software updates since the CD-ROM was created, and indicates whether you need any updates and how to obtain them.

Each version of the CD-ROM has a four-digit Document Number printed on the disk. Obtain the Status Report for your CD-ROM in one of these ways:

- **FAX:** Call HP's FAX system at 1-800-333-1917 (or 1-208-344-4809 from your FAX machine). Request the FAX using the Document Number.
- **Internet:** Access URL **`http://www.hp.com/netserver/servsup`**. Click on the line that corresponds to your document number.
- **Internet FTP:** Address: **`ftp://ftp.hp.com/pub/servers`**
- **BBS:** Call 1-208-344-1691; download `<document-number>.txt` from the NSNAVCD library.
- **CompuServe:** GO HPPC; download `<document-number>.txt` from the HP NetServer library.

Create Drivers Diskette and Instructions

You must use the *HP NetServer Navigator CD-ROM* to create the diskette containing the drivers for your NOS and the instructions for installing them.

English

1. Turn on the HP NetServer and monitor, and insert the *HP NetServer Navigator CD-ROM* into the drive. Turn off the HP NetServer power, wait 10 seconds, and turn it back on again.
2. From the HP Navigator Main Menu, choose **Configuration and Installation Assistant.**
3. From the Configuration Assistant menu, choose **Custom**.
4. From the Gather Information window, choose your NOS. If necessary, also select your version of the NOS.
5. When you see the message, "Would you like to use HP's automated mode of NOS installation?" click **No**.
6. From the Custom Configuration menu, choose **Create Driver Diskette(s)**.
7. From the Create Driver Diskette(s) window, choose **Create Driver Diskette(s)**. Select the diskette to create, click **Execute**, and follow the onscreen instructions.
8. When the driver diskette is complete, click **Back** to return to the Custom Configuration menu.
9. From the Custom Configuration menu, choose **Show NOS Installation Instructions**.
10. On the Show NOS Installation Instructions window, click **Save to Disk**. Later in these procedures, you will print the *Network Operating System Installation Instructions*.
11. Click **Back** to return to Configuration Assistant, and click **Back** again to return to the Main Menu. Do not exit the HP NetServer Navigator system, because in the next step, you will create the NOS-specific configuration diskette.

Make NOS-specific Configuration Utility Diskette

You must make another diskette containing the NOS-specific configuration utility. To create the diskette needed to install the NOS-specific utility for Windows NT or Novell NetWare:

1. From the HP Navigator Main Menu, choose **NetServer Utilities**.
2. Select **More NetServer Utilities**, then choose **Diskette Library**.
3. From the Diskette Library, do the following:

- ◊ For Windows NT, create the utility diskette by selecting **NetRAID Assistant for WindowsNT and Windows95** in the diskette library.
- ◊ For NetWare, select **NetRAID Utilities for NetWare** in the diskette library.

4. Follow the onscreen instructions to create the NOS-specific diskette.
5. Remove the *HP NetServer Navigator CD-ROM* and click **Exit** to reboot the HP NetServer.

Print the Network Operating System Instructions

Print the *Network Operating System Installation Instructions* you saved previously onto the drivers disk. In Step J, you will follow these instructions to load the drivers from the driver diskette.

Step J. Install NOS and HP NetRAID Drivers

Install Network Operating System (if necessary)

If the NOS is not already installed on the HP NetServer, install it according to the instructions you printed in Step I after you created the HP NetRAID drivers diskette. If you are using Novell Netware, also see the *Novell NetWare Installation* book. For the HP NetServer LH 3 or LH 3r, the NOS can be installed on a non-hot-swap drive or on a logical drive in the RAID subsystem.

Install HP NetRAID Series Driver

Load the appropriate driver as instructed in the *Network Operating System Installation Instructions* that you just printed in Step I earlier in this chapter. The driver names are listed in the table that follows.

Network Operating System	HP NetRAID Drivers
Microsoft Windows NT 4.0	mraidnt.sys
NetWare 3.2x	Mega3_1x.dsk
NetWare 4.1x	Mega4_xx.ham Mega4_xx.ddi

English

Step K. Install NOS-specific Configuration Utility

In this step, you install the configuration utility specific to Windows NT or Novell NetWare.

- If you are using Microsoft Windows NT, you install the HP NetRAID Assistant utility. This is the Windows NT version of the utility you used to configure your system in Chapter 5.
- If you are using Novell NetWare, you install the HP NetRAID Config utility for NetWare.

Chapter 10, "Understanding HP NetRAID Utilities," has menu maps of both of these utilities. For complete information about these utilities, see the *HP NetRAID Series User Guide* in Information Assistant.

Install the utility as described for the NOS version below.

Microsoft Windows NT 4.0

1. Select **Start** from the taskbar.
2. Choose **Run** from the Start menu.
3. Insert diskette #1, "NetRAID Assistant for WindowsNT and Windows95."
4. Type **`<d>:\setup`** at the Open: prompt, where `<d>` is the drive letter of the diskette drive you are using.
5. Follow the on-screen instructions.

Novell NetWare 4.11, 4.11 SMP, SFTIII 4.11

1. Exit to the DOS prompt.
2. Insert the diskette called "NetRAID Utilities for NetWare."
3. Type **`Copy <d1>:\NetRAID\*.* <d2>:\nwserver`**, where `<d1>` is the drive letter for the diskette drive and `<d2>` is the hard disk where NetWare is installed. Press Enter.
4. To load the HP NetRAID Config utility, type **`load <d2>:\nwserver\megamgr.nlm`** and press Enter at the NetWare command prompt.

Novell NetWare 3.2

1. Exit to the DOS prompt.
2. Insert the diskette called "NetRAID Utilities for NetWare."
3. Type **`Copy <d1>:\NetRAID\*.* <d2>:\server.312`**, where `<d1>` is the drive letter for the diskette drive and `<d2>` is the hard disk where NetWare is installed. Press Enter.
4. To load the HP NetRAID Config utility, type **`load <d2>:\nwserver\megamgr.nlm`** and press Enter at the NetWare command prompt.

Step L. Run HP NetRAID Express Tools (optional)

After you have installed your software, you might need to run the HP NetRAID Express Tools utility. Run HP NetRAID Express Tools if you need to do either of the following:

- Set the SCSI transfer rate if you are using either Fast/Wide or Ultra/Wide devices with an external connection. The default SCSI transfer rate is Ultra2, so you do *not* need to set the SCSI transfer rate if you are using internal hot-swap mass storage only.
- Disable the HP NetRAID BIOS to prevent booting from the HP NetRAID subsystem.

HP NetRAID Express Tools is a configuration and management utility that resides in a chip on the HP NetServer I/O board along with the HP NetRAID BIOS and firmware. For more information about HP NetRAID Express Tools and its functions, refer to the *HP NetRAID Series User Guide* in Information Assistant.

To start HP NetRAID Express Tools:

1. Boot the host HP NetServer and watch for the flashing message:

   ```
   Option: Experienced users may press <Ctrl> <m> for
   HP NetRAID Express Tools now.
   Firmware Initializing
   ```

2. While this message is flashing, press <Ctrl> <M> or <Ctrl> <m>. When the system stops scanning, HP NetRAID Express Tools starts and displays the Tools Management menu.

English

To change the SCSI transfer rate:

1. If you have installed one or more HP NetRAID-3Si adapters, select the integrated controller or adapter controlling the SCSI channel on which Fast/Wide or Ultra SCSI support is to be enabled:
   - ◊ Choose **Select Adapter** from the Tools Management menu.
   - ◊ Select the adapter controlling the SCSI channel of interest.
2. Choose **Objects** from the Tools Management menu.
3. Choose **SCSI Channel** from the Objects menu.
4. Select the channel on which the SCSI transfer rate is to be changed.
5. To change the SCSI transfer rate:
   - ◊ Choose **SCSI Transfer Rate** from the SCSI Channel menu. A submenu appears.
   - ◊ Use the arrow keys to highlight your selection: **Fast**, **Ultra**, or **Ultra2**. Press Enter.
   - ◊ Choose **Yes** to confirm your selection.
6. Press Esc to return to the Tools Management menu.

Disable the HP NetRAID BIOS

If you want to prevent the system from booting from the integrated HP NetRAID controller, you can disable the HP NetRAID BIOS.

To disable the HP NetRAID BIOS:

1. If you have installed one or more HP NetRAID-3Si adapters, select the integrated controller or adapter on which you want to disable the BIOS.
   - ◊ Choose **Select Adapter** from the Tools Management menu.
   - ◊ Select the adapter for which you want to disable the BIOS.
2. Choose **Disable BIOS** from the Tools Management menu.

Exit HP NetRAID Express Tools

To exit HP NetRAID Express Tools, press Esc repeatedly until the Exit? prompt is displayed. Choose **Yes**. Then press any key to reboot. The new parameters become effective after you reboot.

7 Preparing for Online Capacity Expansion

Step M. Prepare for Online Capacity Expansion

The HP NetRAID Online Capacity Expansion feature allows you to add new storage capacity to drives controlled by an integrated HP NetRAID controller without rebooting the server.

Online Capacity Expansion has these restrictions:

- You can use Online Capacity Expansion with any logical drive of RAID level 0, 3, or 5. Capacity expansion is an offline operation only for logical drives of RAID levels 10, 30, or 50.
- You cannot use Online Capacity Expansion with an array that contains more than one logical drive. The logical drive must be the only logical drive in the array.
- Online Capacity Expansion is supported only for the Novell NetWare and Microsoft Windows NT operating systems.

This chapter explains how to prepare logical drives for future online expansion. The *HP NetRAID Series User Guide* in Information Assistant describes how to actually expand capacity.

NOTE	If you are using I_2O drivers, some special precautions exist. See the I_2O information on the following web site: **www.hp.com/go/netserver**

This chapter is divided into two sections:

- See "Capacity Expansion Under Novell NetWare" if you are using Novell NetWare.
- See "Capacity Expansion Under Windows NT" if you are using Microsoft Windows NT.

Online Capacity Expansion Under Novell NetWare

Theory of Operation

Normally, to add capacity you must shut down the server to reconfigure and then restore data, or you must add the new storage space as a new volume. The Online Capacity Expansion feature allows you to expand an *existing* logical drive without shutting down the server.

Capacity expansion is enabled separately on each logical drive. When enabled, the controller presents to the operating system a logical drive of 144 GB. However, only a part of the 144-gigabyte logical drive exists as actual physical storage. You configure volumes to use only the actual physical space while the virtual space allows room for online expansion.

For example, assume you have one RAID-5 logical drive built from four physical hard disk drives of 9 GB each. The result is 27 GB of actual storage space. If you enable Virtual Sizing for this logical drive, then the operating system will see a logical drive of 144 GB. Only the first 27 GB are real, 9 GB are used for parity, and the last 108 GB are virtual**.** Under NetWare, you create an 144-GB *partition*, but within that partition you only create a logical drive totaling 27 GB or less. Since there is unused partition space, the physical storage of 27 GB can be expanded online by adding another hard disk drive, but the partition remains at 144 GB.

Precautions

When using the Online Capacity Expansion feature, it is very important that you do *not* create volumes that exceed the actual physical capacity. You must add up the capacities of all volumes that may be using the physical storage space, such as a DOS volume, SYS volume, Hot Fix Area, and any user volumes. This is most important if NetWare will be installed on the disk array (rather than a SCSI disk outside of the HP NetRAID system). During installation, if the total physical capacity is exceeded during volume creation, a NetWare abend and loss of the

installation occurs. As long as the physical capacity is not exceeded, the installation will be successful.

Although undesirable, NetWare allows you to create volumes into the virtual space. (This is because during volume creation, NetWare only looks at the beginning of the volume and if there is real storage space there, the volume will be created.) However, when writing to this volume, you cannot write beyond the physical limit and write errors will be generated when the physical space is filled. You need to be careful when creating volumes in a partition containing virtual space. Use the HP NetRAID Config module to check the actual physical capacity available, and be sure the total size of NetWare volumes do not exceed this value.

One other useful measure is to set the capacity alarms under NetWare so that warnings will be generated when you approach the limit of a volume.

The Online Capacity Expansion feature cannot be used if a logical drive spans multiple arrays. Each array can contain only one logical drive. Reconstruction (for the purposes of adding a drive to an array) can be done only on an array having a single logical drive. It is also important to plan future storage expansion into your installation. This ensures that you can easily expand capacity without the need for backup/restore operations or reconfiguration.

NOTE **SFT-3 and mirroring users:** Novell's operating system, which provides system level fault tolerance by mirroring two systems, is not compatible with the Online Capacity Expansion feature. SFT-3 mirrors disk storage on a partition basis rather than a volume basis. Because of the virtual space created within the partition, SFT-3 cannot successfully mirror the partitions. This limitation also applies to regular mirroring (without SFT-3) of volumes. SFT-3 users may add storage capacity online without bringing the two systems down if enough drives are added to create a new array and logical drive on an integrated HP NetRAID controller. Under the Install module, NetWare can then scan for new devices and detect the new logical drive.

Preparing for Online Capacity Expansion

This section describes how to enable Virtual Sizing and set up your partitions to permit easy capacity expansion.

For NetWare installations, plan ahead and consider your storage use. Since NetWare permits only one NetWare partition per logical drive, make the NetWare partition the size of the virtual logical drive in advance so that you can expand that volume. Under NetWare, you cannot grow a partition, but you can add additional segments within an existing partition. The added segments can be "joined" to be part of the same volume, or they can be made into separate volumes.

NOTE If NetWare must be installed on the disk array, create a single logical drive with Virtual Sizing enabled. Create a DOS partition of 500 MB or less for booting. NetWare volumes can then be added after the DOS partition on the same logical drive. The unused space on the partition can be used later for capacity expansion. Be sure to follow the precautions above.

In most installations, the operating system is installed on a SCSI drive connected outside of the HP NetRAID system. The following steps are necessary to prepare your array for capacity expansion.

Setting Up Your Array for Capacity Expansion

This section makes the following assumptions:

- You have already configured your HP NetRAID system as discussed in Chapter 5. You should have created only one logical drive per array.

  For example, you might have four physical drives of 4 GB each. You might have configured these four drives as a single RAID 5 logical drive. This will produce a logical drive with 12 GB of real storage capacity, with 4 GB used for parity.

- You have initialized your logical drives.

English

NOTE It is important to initialize your logical drives. If the drives have been previously configured under an operating system, there can sometimes be residual partition/format information which subsequently causes misrepresentation of logical drives under NetWare's Install module.

- You already installed NetWare as discussed in Chapter 6.

1. Enable Virtual Sizing.

1. Restart the host HP NetServer, and watch for the message:

   ```
   Option: Experienced users may press <Ctrl> <M> for
   HP NetRAID Express Tools now.
   Firmware Initializing
   ```

2. When the message is displayed, press <Ctrl> <M> or <Ctrl> <m>. When the system stops scanning, HP NetRAID Express Tools starts and displays the Tools Management menu.
3. If you have installed one or more HP NetRAID-3Si adapters, do the following to select the integrated controller or adapter controlling a logical drive you want to prepare for expansion:
   a. Choose **Adapter** from the Tools Management menu.
   b. Choose the adapter controlling the logical drive.
4. Choose **Objects** from the Tools Management menu.
5. Choose **Logical Drive** from the Objects menu.
6. From the Logical Drive menu, choose the logical drive you want to prepare for expansion.
7. From the Logical Drive menu for the drive you want to prepare, choose **Properties**.
8. Choose **Virtual Sizing**.
9. On the Virtual Size menu, choose **Enable**, and confirm your choice.
10. Press Esc twice to return to the Logical Drive menu.

    If you need to enable Virtual Sizing on another logical drive, choose the logical drive and repeat steps 6 through 10.

11. If you have installed one or more HP NetRAID-3Si adapters, press Esc to return to the Objects menu. Enable Virtual Sizing on the logical drives of all adapters as necessary.
12. To exit, press Esc until you see the Exit? box, then choose **Yes**.

NOTE	Clearing a previous configuration does not reset the Virtual Sizing setting for a logical drive. Use the Reset to Factory Defaults option in Express Tools to disable Virtual Sizing for all logical drives, or manually change the setting.

2. Create the NetWare Partition.

1. Start NetWare and load the Install module.
2. Select **Disk Options.**
3. Select **Modify Disk Partitions**.
4. Create a NetWare partition on the logical drive (which has Virtual Sizing enabled). The partition size will be 144 GB.
5. Save the partition.

3. Create NetWare Volume.

How you create the NetWare volume depends on where you installed NetWare.

- For drives that do not contain the NetWare operating system, see "Create Volumes on Drives that do *not* Contain NetWare" below.
- If NetWare was installed on a disk array, see "Create Volumes on Drives That Contain NetWare" below.

Create Volumes on Drives that do *not* Contain NetWare

1. Select **Volume Options** from the Install module.
2. Add a segment up to the actual physical capacity available.

   In this example, you would add 12 GB. (If this was a NetWare sys volume, you would want to use a 2-GB size, or a size appropriate for your system, and use the balance for a user volume.)
3. Save and mount the volume.

At this point, the logical drive has a NetWare partition of 144 GB with a 12-GB segment set as a volume. The 12-GB volume is mounted and ready for use. Be sure not to exceed the actual physical capacity when creating the 12-GB volume and include other uses such as a Hot Fix area.

The new volume is now ready for use. Assume for this example, the volume is called VOL1. Leave the remaining virtual storage space (144 GB minus 12 GB) as unused. You can write data up to 12 GB on the drive.

Create Volumes on Drives that Contain NetWare

Sometimes it is desirable to have the network operating system reside on a disk array. The advantage is that the NOS resides on a redundant drive.

Virtual Sizing can be used with a disk array that is used as the boot device and also contains user data. If NetWare must be installed on the disk array, follow these steps:

1. Create a DOS partition of 500 MB or less for booting.
2. Create additional NetWare volumes after the DOS partition on the same logical drive for data.
3. The remaining virtual capacity must be left unpartitioned, and will be available for future partitions as you add disk drives to the array.

NOTE Be sure *not* to create volumes that exceed the actual physical capacity. You must add up the capacities of all volumes that may be using the physical storage space such as a DOS volume, SYS volume, Hot Fix Area, and any user volumes.

Online Capacity Expansion Under Windows NT

Theory of Operation

Normally, adding capacity requires shutting down the server to reconfigure/restore an existing volume or to add the new storage space as a new volume. Using the Online Capacity Expansion feature allows you to expand an *existing* logical drive without shutting down the server.

NOTE The additional capacity will have a different drive letter than the original logical drive. If the expanded capacity and the original capacity must share the same drive letter, you cannot expand capacity online and you must reboot NT. For more information about drive letters, see "Capacity Expansion" in the *HP NetRAID Series User Guide* in Information Assistant.

Capacity Expansion is enabled separately on each logical drive. When enabled, the controller presents to the operating system a logical drive of 500 GB. However, only a part of the 500-GB logical drive exists as actual physical storage. You configure logical drives to use only the actual physical space while the virtual space allows room for online expansion.

For example, assume you have one logical RAID-5 drive built from four physical hard disk drives of 9 GB each; the result is 27 GB of actual storage space. If you enable Virtual Sizing for this logical drive, then the operating system will see a logical drive of 500 GB. The first 27 GB are real, 9 GB is used for parity, and the last 464 GB are virtual. Since there is unused logical drive space, the physical storage of 27 GB can be expanded online, but the total logical drive remains at 500 GB.

Precautions

When using the Online Capacity Expansion feature, it is important that you do *not* create volumes that exceed the actual physical capacity. If you attempt to do this under NT, the format operation will fail. If you extend an existing partition into virtual space, this will be detected upon rebooting. In either case, be sure to use no more than the actual available physical capacity. Capacity of the logical drive can be checked with the NetRAID Assistant under Windows NT.

The Online Capacity Expansion feature cannot be used if a logical drive spans multiple arrays. Each array can contain only one logical drive. Reconstruction (for the purposes of adding a drive to an existing array) can only be done on an array having a single logical drive. It is also important to plan future storage expansion into your installation. This will ensure that you can easily expand capacity without backup/restore operations or reconfiguration.

English

Setting Up Your Array for Capacity Expansion

This section makes the following assumptions:

- You have already configured your HP NetRAID system as discussed in Chapter 5. You should have created only one logical drive per array.

  For example, you might have four physical drives of 4 GB. You might have configured these four drives as a single RAID 5 logical drive. This produces a logical drive with 12 GB of real storage capacity, with 4 GB used for parity.

- You have initialized your logical drives.

NOTE	It is important to initialize your logical drives because, if the drives have been previously configured under an operating system, there may be residual partition/format information that can subsequently cause misrepresentation of logical drives under the Windows NT Disk Administrator.

- You have already installed Windows NT as discussed in Chapter 6.

1. Enable Virtual Sizing.

1. Restart the host HP NetServer, and watch for the message:

   ```
   Option: Experienced users may press <Ctrl> <M> for
   HP NetRAID Express Tools now.
   Firmware Initializing
   ```

2. When the message is displayed, press <Ctrl> <M>. When the system stops scanning, HP NetRAID Express Tools starts and displays the Tools Management menu.

3. If you have installed one or more HP NetRAID-3Si adapters, do the following to select the integrated controller or adapter controlling a logical drive you want to prepare for expansion:

   a. Choose **Adapter** from the Tools Management menu.

   b. Choose the adapter controlling the logical drive.

4. Choose **Objects** from the Tools Management menu.

5. Choose **Logical Drive** from the Objects menu.

6. From the Logical Drive menu, choose the logical drive you want to prepare for expansion.
7. From the Logical Drive menu for the drive you want to prepare, choose **Properties**.
8. Choose **Virtual Sizing**.
9. On the Virtual Size menu, choose **Enable**, and confirm your choice.
10. Press Esc twice to return to the Logical Drive menu.

    If you need to enable Virtual Sizing on another logical drive, choose the logical drive and repeat steps 6 through 10.
11. If you have installed one or more HP NetRAID-3Si adapters, press Esc to return to the Objects menu. Enable Virtual Sizing on the logical drives of all adapters as necessary.
12. To exit, press Esc until you see the Exit? box, and choose **Yes**.

NOTE	Clearing a previous configuration does not reset the Virtual Sizing setting for a logical drive. Use the Reset to Factory Defaults option in HP NetRAID Express Tools to disable Virtual Sizing for all logical drives, or manually change the setting.

2. Start NT and Enter the Disk Administrator.

Start NT and enter the Disk Administrator. Here you see the new logical drive shown as a single unpartitioned/unformatted drive of 500 GB. Although there might be only 12 GB of real storage space on the logical drive, the Online Capacity Expansion feature creates a virtual drive of 500 GB.

3. Partition and Format the Drive.

How you partition and format a drive depends on where you installed Windows NT.

- For drives that do not contain the Windows NT operating system, see "Partition and Format Drives that do *not* Contain Windows NT" below.
- If Windows NT was installed on a disk array, see "Partition and Format a Drive that Contains Windows NT" below.

English

Partition and Format Drives that do *not* Contain Windows NT

Follow these instructions for drives that do not contain Windows NT.

1. Create a partition equal to (or less than) the real storage capacity.

   In our ongoing example, you would create a 12 GB partition.

> **NOTE** If you try to create a partition that is larger than the real storage capacity, the format operation will generate this message: `Warning: NT was unable to complete the format.`

2. Format the partition.

The formatted drive is now ready for use. Assume for this example that the drive is now E: and was partitioned as a primary partition. The remaining virtual storage space (500 GB minus 12 GB) must be left unpartitioned. You can write data up to 12 GB on the drive. Windows NT will not allow you to write beyond 12 GB and lose any data.

Partition and Format a Drive that Contains Windows NT

Sometimes it is desirable to have the network operating system reside on a disk array. The advantage is that the NOS resides on a redundant drive.

Virtual Sizing can be used with a disk array that is used as the boot device and also contains user data. The key limitation is that Windows NT only allows a FAT boot partition size of 4 GB or less.

If the NOS and data need to be on a single array (and single logical drive), and you want to allow for capacity expansion, you must create multiple partitions.

1. Create a FAT boot partition of 4 GB or less for the NOS, which becomes the C: volume.
2. Create a second partition for the data, which becomes, for example, the D: volume.
3. The remaining virtual capacity must be left unpartitioned, and is available for future partitions as you add disk drives to the array.

8 Managing Servers Over the Network

This chapter describes the installation and use of software to manage the integrated HP NetRAID controller and other HP NetRAID Series adapters over a network. It lists features of the software, identifies the operating systems it supports, details installation instructions, and shows how to get started. It contains instructions for servers running Microsoft Windows NT and Novell NetWare.

Adapter Management

Features

In a networked environment, it is desirable to access and manage servers from clients or other servers. The HP NetRAID management software allows clients or servers to manage integrated HP NetRAID controllers and HP NetRAID Series adapters installed in servers on the network. Its key features include the following:

- HP NetRAID Assistant GUI management utility
- Support for servers running Microsoft Windows NT 4.0 or Novell NetWare 3.2, 4.11, 4.11 SMP, and SFTIII 4.11
- Support for clients running Microsoft Windows NT or Windows 95
- Full access or view only modes
- Password authentication

NOS Requirements

The sections that follow identify the NOS requirements for different clients and servers on the network.

Requirements for Clients that Manage HP NetRAID Over the Network

- Microsoft Windows NT or Windows 95 must be installed.
- If the client will manage NetWare servers, you must install "Client Service for NetWare," which is part of Windows NT and Windows 95. You can find this in the Control Panel, Network Icon. Refer to Windows documentation for more information.
- Optionally, the client can be your HP NetRAID Registration Server as described later in this chapter.

Requirements for Servers that Manage HP NetRAID Over the Network

- Microsoft Windows NT must be installed.
- If the server will manage NetWare servers, you must install "GateWay Service for NetWare," which is part of Windows NT and Windows 95. You can find this in the Control Panel, Network Icon. Refer to Windows documentation for more information.
- Optionally, this server can be your HP NetRAID Registration Server as described later in this chapter.

Requirements for Servers on the Network that do *Not* Manage HP NetRAID

- Either Microsoft Windows NT or Novell NetWare.
- A server running either Microsoft Windows NT or Novell NetWare can be your HP NetRAID Registration Server.

Other Requirements

Before installing the software for HP NetRAID management, ensure that the network is operating and that all of the following have been done:

- Integrated HP NetRAID controllers (and HP NetRAID Series adapters) are configured in all servers to be managed. (See Chapter 5 of this guide for instructions.)

English

- NOS-specific drivers are installed in all servers. (See Chapter 6 of this guide for instructions.)
- TCP/IP is configured and operational on all clients and servers.
- You must know the server names and their IP addresses.

Understanding HP NetRAID Network Utilities

The software that lets you manage integrated HP NetRAID controllers (and HP NetRAID Series adapters) over a network is built on remote procedure calls (RPC) using TCP/IP protocol. The HP NetRAID network utilities include the following:

- **HP NetRAID Assistant** is the GUI utility that provides a user interface to the adapters in the servers on the network. This utility can run on either clients or servers on the network.
- **HP NetRAID Access Service** is installed on all servers with integrated HP NetRAID controllers (or HP NetRAID Series adapters) that will be managed over the network. This utility makes the server and its integrated HP NetRAID controller accessible to a client or another server running HP NetRAID Assistant.
- **HP NetRAID Registration Server** is installed on one server or client, and it maintains the list of servers that can be accessed over the network. When the servers start, they check in with the Registration Server, which keeps track of the servers available for access by HP NetRAID Assistant. When HP NetRAID Assistant is started, it obtains the list of available servers from the Registration Server. Each network requires one Registration Server in order to support the HP NetRAID network utilities.

Determine Where to Install HP NetRAID Assistant

HP NetRAID Assistant can be installed on any client running Microsoft Windows NT or Windows 95.

HP NetRAID Assistant can be installed on any server running Microsoft Windows NT.

Identify the Registration Server/Client

Only one server or client on the network can be identified as the Registration Server. The Registration Server does *not* have to be the same server or client that is running HP NetRAID Assistant.

The HP NetRAID Registration Server utility can be installed on only one server running Microsoft Windows NT or Novell NetWare.

The HP NetRAID Registration Server utility can be installed on only one client running Microsoft Windows NT or Windows 95.

HP NetRAID Network Utilities to Install

For each client or server, refer to Table 8-1 to determine which HP NetRAID Utilities to install on it, as indicated by an X:

English

Table 8-1. NetRAID Network Utilities Installation

HP NetRAID Management Functions	HP NetRAID Registration Server	HP NetRAID Access Service	HP NetRAID Assistant
Server: - is the Registration Server - has no HP NetRAID controller - cannot run HP NetRAID Assistant	X		
Server: - is *not* a Registration Server - has HP NetRAID controller - cannot run HP NetRAID Assistant - can be accessed over the network		X	
Server: - is *not* a Registration Server - has HP NetRAID controller - can run HP NetRAID Assistant - can be accessed over the network		X	X
Server: - is the Registration Server - has HP NetRAID controller - can run HP NetRAID Assistant - can be accessed over the network	X	X	X
Client: - is the Registration Server - can run HP NetRAID Assistant	X		X
Client: - is not the Registration Server - can run HP NetRAID Assistant			X
Standalone Server: - is *not* a Registration Server - cannot be accessed over network - can run HP NetRAID Assistant			X

Make the Installation Disk if Necessary

The files needed to install the HP NetRAID Network utilities can be found on the following utilities diskette(s) created by the *HP NetServer Navigator CD-ROM*:

- For Microsoft Windows NT and Windows 95, there are two diskettes titled "NetRAID Assistant for Windows NT and Windows 95."
- For Novell NetWare, there is one diskette titled "NetRAID Utilities for NetWare."

If you do not have these diskettes, you can generate them using the *HP NetServer Navigator CD-ROM*.

1. Turn on the HP NetServer and monitor, and insert the *HP NetServer Navigator CD-ROM* into the drive. Turn off the HP NetServer power, wait 10 seconds, and turn it back on again.
2. Go to the HP Navigator Main Menu, and choose **NetServer Utilities**.
3. Select **More NetServer Utilities**.
4. From the NetServer Utilities menu, select **Diskette Library.**
5. From the Diskette Library, do the following
   - ◊ For Windows NT, select **NetRAID Assistant for Windows NT and Windows95**.
   - ◊ For NetWare, select **NetRAID Utilities for NetWare**.
6. Follow the onscreen instructions to create the diskette.
7. When the diskette is complete, remove the *HP NetServer Navigator CD-ROM* and click **Exit** to reboot the HP NetServer.

Microsoft Windows NT Client or Server Installation Instructions

For each client or server operating under Microsoft Windows NT, or for each client running under Windows 95, run Setup and then follow the on-screen instructions to install the appropriate utilities.

English

Run Setup

To run the Setup program, follow the steps listed below for either Microsoft Windows NT 4.0 or Windows 95:

1. Select **Start** from the taskbar. Then choose **Run** from the Start menu.
2. Insert Diskette 1 of "NetRAID Assistant for Windows NT and Windows 95."
3. Type **<d>:\setup** at the Open prompt, where <d> is the drive letter of the diskette drive you are using.
4. On the User Information screen, type the user name and the company.
5. For Windows 95, go to Step 6.

   For Windows NT, on the Select Installation Options window, select one of the following options:

   ◊ Manage NetRAID adapter(s) in this server only. (If you choose this option, skip Step 6 and go on to Step 7.)

   ◊ Manage NetRAID adapter(s) in this server and in other NT and NetWare servers on the network. (If you choose this option, go on to Step 6.)
6. For clients running Windows 95, select one or both of the following utilities:

   ◊ NetRAID Registration Server manages a list of HP NetRAID adapters.

   ◊ NetRAID Assistant is the management utility.

   For clients or servers running Windows NT, select one or more of the following utilities to install:

   ◊ NetRAID Registration Server manages a list of HP NetRAID adapters.

   ◊ NetRAID Access Service allows server management over the network.

   ◊ NetRAID Assistant is the management utility.
7. For the Destination Directory, type the path of the directory in which to install the utilities on this client or server.
8. For Select Folder, accept the default or type the name of the folder in which to install the utilities on this client or server.

9. When Setup asks for the next diskette, remove Diskette 1 and insert Diskette 2 of "NetRAID Assistant for Windows NT and Windows 95." Setup copies various files.
10. In the Setting Password window, type the password that must be given for Full Access mode to manage this server. *Passwords are case-sensitive.*

NOTE	The Setting Password Screen appears only if you installed HP NetRAID Access Service in Step 6.

11. Choose to restart Windows now or defer this until later. The Setup program is now complete.

Edit the `regserv.dat` and `hosts` Files

12. Edit the `regserv.dat` file to replace `localhost` with the name of the Registration Server for this network.
    - ◊ In Windows NT systems you will find `regserv.dat` under this pathname where <winnt path> is the path to the Windows files:

      `<winnt path>\system32\drivers\etc\regserv.dat`

    - ◊ In Windows 95 systems you will find `regserv.dat` under this pathname where <win95 path> is the path to the Windows files:

      `<win95 path>\system\regserv.dat`

13. Add to the `hosts` file the names and IP addresses of servers with adapters to be managed over the network.
    - ◊ In Windows NT systems you will find the `hosts` file under this pathname where <winnt path> is the path to the Windows files:

      `<winnt path>\system32\drivers\etc\hosts`

    - ◊ In Windows 95 systems you will find the `hosts` file under this pathname where <win95 path> is the path to the Windows files:

      `<win95 path>\system\hosts`

English

NOTE HP recommends that all servers and clients that manage integrated HP NetRAID controllers (or HP NetRAID Series adapters) over the network have the same `hosts` file content. This prevents problems in resolving server names and addresses.

Finishing Up

14. Read the Release Notes.
15. Restart Windows NT or Windows 95 if you did not do so in Step 11.

Novell NetWare Server Installation Instructions

For each server operating under Novell NetWare and containing HP NetRAID Series adapters to be managed over the network, install the HP NetRAID Network Utilities as described below:

1. For NetWare 4.11 only, the file `rpcbstub.nlm` is a read-only file. This file attribute must be changed to read/write before installing the HP NetRAID Network Utilities on a client connected to NetWare through the network. Exit to the DOS prompt and change the file attribute to r/w with the `attrib` command. The file is located in the `\system\` directory of NetWare on the `SYS` volume.
2. Start the NetWare server and insert the "NetRAID Utilities for NetWare" diskette.
3. At the NetWare console prompt, type `load a:\raidinst.nlm`
4. Choose **Install Package**.
5. To the question “Install registration server?” select yes or no.
   - ◊ Select **yes** if you want this server to be the Registration Server.
   - ◊ Select **no** if this server will *not* be the Registration Server. Enter the name of the Registration Server when prompted.
6. Files are copied.
7. Enter and retype the password that will be required for access to this server. *Passwords are case-sensitive*.

8. Edit the `regserv.dat` file located at `sys:\etc\regserv.dat` Replace `localhost` with the name of the server that will be the Registration Server for this network.
9. Edit the `hosts` file located at `sys:\etc\hosts`. It should contain the IP address and name of each server with integrated HP NetRAID controllers (or HP NetRAID Series adapters) to be managed over the network.
10. Restart NetWare.

NOTE	If the NetWare server is a Registration Server, the `reg_serv.nlm` will be put in `autoexec.ncf` to automatically start it. However, if the software was installed previously, but not as a Registration Server, edit the `autoexec.ncf` file to add the statement `load reg_serv.nlm` so that the Registration Server will automatically start under NetWare.

Using HP NetRAID Assistant to Manage Servers

Before Starting HP NetRAID Assistant

The Registration Server must be running before any other servers are started.

- If the Registration Server is a NetWare server, it must be running `reg_serv.nlm`.
- If the Registration Server is an NT server, it must be running the NetRAID Registration Server icon (under the NetRAID program group).

To access an HP NetRAID Series adapter in a server from the network, the three services listed below must be running. Start them in the order listed. You may set them for automatic start, if desired.

1. **NobleNet Portmapper**: It should have been installed by the HP NetRAID software and set for automatic start in Windows NT. In NetWare, load `rpcstart.nlm`.
2. **HP NetRAID Registration Server**: Start it before the others by double-clicking on its Windows icon or by loading NetWare module `reg_serv.nlm`.

English

3. **HP NetRAID Access Service**: Start it by double-clicking on its Windows icon or by loading NetWare module `raidserv.nlm`.

NOTE

To change the password for a server using Windows NT, run `setpass.exe` under `\netraid\dll\`.

To change the password for a server using NetWare, reinstall the HP NetRAID management software, as described in this chapter, with the new password.

Start HP NetRAID Assistant

Run HP NetRAID Assistant from a client or server in which the HP NetRAID Assistant utility was installed by clicking on the NetRAID Assistant icon in the NetRAID program group (or group you specified).

If HP NetRAID Assistant is started on a standalone server, the main window is displayed immediately.

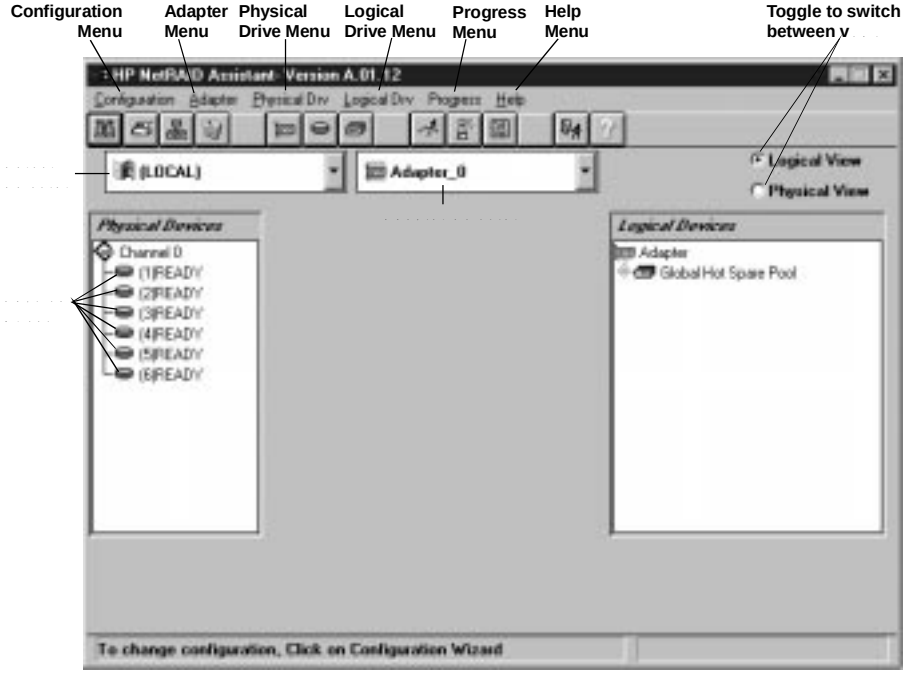


Figure 8-1. HP NetRAID Assistant Window

If HP NetRAID Assistant is started on a client or server that can access integrated HP NetRAID controllers (or HP NetRAID Series adapters) over the network, you must select the server you want to access. The HP NetRAID Assistant Main window has a Server pull-down list next to the Adapter pull-down list.

When you select a server from the server selector box on HP NetRAID Assistant, a window appears with the choice of access modes: Full Access and View Only. Select one.

- **Full Access** mode requires that authorized users enter a password. *The password is case-sensitive.* The password must be given before full access can be established to a server, and each server can require a unique password. Full Access mode activates features that let you change the HP NetRAID configuration and the states of physical and logical drives. For example, in Full Access mode, you can initiate recovery from a disk failure, or make a new hot spare.
- **View Only** mode does not require a password, and does not permit users to change the configuration. All menu selections that would change the configuration are inactive. Examples of operations that you can perform in View Only mode are displaying the properties of physical and logical drives and viewing the configuration.

NOTE You cannot enter Full Access mode on a server if it is already being managed by HP NetRAID Assistant in Full Access mode, or by another HP NetRAID utility. However, View Only mode can always be entered.

The only distinction the Main Screen shows between the Full Access and View Only modes is that in View Only mode various actions are inoperative and the related menu options are grayed out.

To change to another adapter within the server, use the Adapter pull-down list.

Select Another Server-Adapter Pair

Use these pull-down lists on the HP NetRAID Assistant Main Screen to select the next server-adapter pair to be viewed or modified.

English

NOTE You cannot leave the current server-adapter pair if any operations--such as Performance Monitor or the rebuilding or reconstruction of a drive--are running in Full Access mode.

You cannot change from View Only mode to Full Access mode. Instead, exit HP NetRAID Assistant and restart. Choose the server and Full Access mode. Then enter the password.

When selecting a new server in Full Access mode, a dialog box appears. Enter the new server's password, which is case-sensitive. The new server cannot be accessed if it is already being managed by a system in Full Access mode, or if either of the following utilities are running on the new server:

- HP NetRAID Assistant
- HP NetRAID Config

Exit HP NetRAID Assistant

Exit HP NetRAID Assistant by choosing **Exit** from the Configuration menu, or by clicking the **Exit** button in the toolbar, or by double-clicking the upper-left corner of the main window.

9 Configuring a Second Integrated HP NetRAID Channel

If you have already configured, and are operating, a one-channel integrated HP NetRAID system, you can add a second HP NetRAID channel at any time. This chapter provides instructions on adding a second HP NetRAID channel after one channel has been operating for a time. (There are no special instructions if you enable two HP NetRAID channels when you first configure your system.)

WARNING	*Be sure to follow these instructions exactly*. If you don't follow all of the steps, you may jeopardize the integrity of your existing data. *Be sure to back up your data*--both RAID and non-RAID--before you configure a second integrated HP NetRAID channel. It is essential that you back up before you reconfigure your system.

When you enable a second channel, you will have both Channel 0 and Channel 1.

- If you initially included SCSI A on HP NetRAID, and now plan to include SCSI B, then the drives on SCSI A stay associated with HP NetRAID Channel 0, and the drives on SCSI B are now associated with HP NetRAID Channel 1.
- If you initially included SCSI B on HP NetRAID, and now plan to include SCSI A, then the drives on SCSI B become HP NetRAID Channel 1, and the drives on SCSI A are now associated with HP NetRAID Channel 0.

Options for Adding a Second Channel

How you enable a second HP NetRAID channel depends on where you installed your network operating system (NOS).

Option A. Your NOS is installed on an HP NetRAID logical drive. In this case, you will not have to reinstall your NOS.

or

Option B. Your NOS is installed on a non-RAID hard disk drive module controlled by the embedded SCSI controller. When you enable HP NetRAID for two channels, the hard disk containing your NOS becomes part of the RAID subsystem. You can no longer boot the existing NOS, so you need to reinstall the NOS and restore your existing data.

These two options are discussed separately.

Option A: Your NOS is Installed on a RAID Logical Drive

There are two sets of instructions for enabling a second integrated HP NetRAID channel when your NOS is installed on a RAID logical drive:

- **See Option A-1 if you started with SCSI A enabled for HP NetRAID** (the default mode), and now you want to enable SCSI B.

  or

- **See Option A-2 if you started with SCSI B enabled for HP NetRAID**, and now you want to enable SCSI A.

Option A-1: To Enable SCSI B as Your Second HP NetRAID Channel

To configure SCSI B as a second HP NetRAID channel when your NOS is installed on a RAID logical drive:

1. *Back up all your drives, both RAID and non-RAID.* You should not need to restore your data, but backups are essential any time you change your configuration.

CAUTION	Do not proceed until you back up all your drives, both RAID and non-RAID.

2. Log off all users, close all applications, and shut down the HP NetServer.

English

3. Plan the configuration of your second channel as described in Chapter 4 of this guide.

   Be sure to note that all non-hot-swap devices on SCSI B will become part of your HP NetRAID channel. For performance reasons, non-hot-swap devices and hot-swap disk drives should not be combined in the same array.

4. Verify that your hardware is set up correctly for your second channel. The second channel may use hot-swap disk drive modules in a second hot-swap mass storage cage or in an external mass storage enclosure. Make sure that the SCSI IDs of the non-hot-swap devices do not conflict with the SCSI IDs of the hot-swap disk drive modules connected to SCSI B.

5. Enable HP NetRAID on SCSI B using the Setup (F2) utility. See "Step D. Enable Integrated HP NetRAID Controller" in this guide for complete instructions.

   ◊ `Integrated HP NetRAID` should be set to `Enable`.

   ◊ `Included SCSI_A Channel` should be set to `Yes`.

   ◊ `Included SCSI_B Channel` should be set to `Yes`.

6. Boot the *HP NetServer Navigator CD-ROM*. You will see the following message during power up:

   ```
   New drives found. Configuration updated.
   ```

7. Launch HP NetRAID Assistant, following the instructions in "Step E" in Chapter 5.

8. From the HP NetRAID Assistant main window, verify that your existing hard disk drive information is correct. The drives with your existing data are still on Channel 0 and their status should be "Online." The new drives are now on Channel 1 and their status should be "Ready."

9. Select the **Configuration** menu, and then choose **Wizard**.

CAUTION	Do not clear your configuration! You don't need to change the configuration of your existing HP NetRAID channel.

10. Choose either **Custom** or **Automatic** mode and define arrays, hot spares, and logical drives on your second channel. Automatic mode will *not* affect your existing configuration. For complete instructions on configuring arrays and logical drives, see "Step F" in Chapter 5 of this guide.

11. Save your configuration and initialize your new logical drives on Channel 1 as described in "Step G" in Chapter 5 of this guide. Exit HP NetRAID Assistant.

CAUTION	Do not initialize the existing logical drives on Channel 0! If you initialize your existing drives, you will lose all of your data.

12. Set your SCSI Transfer Rate if necessary, as described in "Step L" in Chapter 6 of this guide.
13. Prepare your new logical drives for online capacity expansion if desired, as described in Chapter 7 of this guide.

Your configuration for a two-channel HP NetRAID system is now complete.

Option A-2: To Enable SCSI A as Your Second HP NetRAID Channel

To configure SCSI A as a second HP NetRAID channel when your NOS is installed on a RAID logical drive:

1. *Back up all your drives, both RAID and non-RAID.* You should not need to restore your data, but backups are essential any time you change your configuration.

CAUTION	Do not proceed until you back up all your drives, both RAID and non-RAID.

2. Log off all users, close all applications, and shut down the HP NetServer.
3. Plan the configuration of your second channel as described in Chapter 4 of this guide.
4. Verify that your hardware is set up correctly for your second channel. The second channel may use hot-swap disk drive modules in a second hot-swap mass storage cage or in an external mass storage enclosure.
5. ***Remove all hot-swap drives connected to the non-RAID channel (SCSI A).*** *You must perform this step to ensure that the drive roaming feature works correctly.*

CAUTION	Do not proceed until you have removed all hot-swap drives connected to SCSI A.

English

6. Enable HP NetRAID on SCSI A using the Setup (F2) utility. See "Step D. Enable Integrated HP NetRAID Controller" in this guide for complete instructions.
   - ◊ `Integrated HP NetRAID` should be set to `Enable`.
   - ◊ `Included SCSI_A Channel` should be set to `Yes`.
   - ◊ `Included SCSI_B Channel` should be set to `Yes`.
7. Boot the *HP NetServer Navigator CD-ROM*. You will see the following message indicating that the drive roaming feature has moved your existing physical drives from Channel 0 to Channel 1:

   ```
   Drive roaming done.
   ```
8. When the NetServer Navigator Main Menu appears, exit and turn off the power to the HP NetServer.
9. Insert the drives that you removed in Step 5. These drives are connected to SCSI A which has just been enabled for HP NetRAID.
10. Boot the *HP NetServer Navigator CD-ROM* again. You will see the following message:

    ```
    New drives found. Configuration updated.
    ```
11. Launch HP NetRAID Assistant, following the instructions in "Step E" in Chapter 5.
12. From the HP NetRAID Assistant main window, verify that your existing hard disk drive information is correct. The drives with your existing data have now moved to Channel 1 and their status should be "Online." The new drives are now on Channel 0 and their status should be "Ready."
13. Select the **Configuration** menu, and then choose **Wizard**.

CAUTION	Do not clear your configuration! You don't need to change the configuration of your existing HP NetRAID channel.

14. Choose either **Custom** or **Automatic** mode and define arrays, hot spares, and logical drives on your second channel. Automatic mode will *not* affect your existing configuration. For complete instructions on configuring arrays and logical drives, see "Step F" in Chapter 5 of this guide.
15. Save your configuration and initialize your new logical drives as described in "Step G" in Chapter 5 of this guide. Exit HP NetRAID Assistant.

CAUTION	Do not initialize the existing logical drives on Channel 1! If you initialize your existing drives, you will lose all of your data.

16. Set your SCSI Transfer Rate if necessary, as described in "Step L" in Chapter 6 of this guide.
17. Prepare your new logical drives for online capacity expansion if desired, as described in Chapter 7 of this guide.

Your configuration for a two-channel HP NetRAID system is now complete.

Option B: Your NOS is Installed on a Non-RAID Hard Disk Module

To configure a second HP NetRAID channel when your NOS is installed on a non-RAID hard disk module:

1. ***Back up all your drives, both RAID and non-RAID.*** You *must* perform this step, because later on you will restore your RAID data.

CAUTION	Do not proceed until you back up all your drives, both RAID and non-RAID.

2. Make two photocopies of Worksheets A and B, found in Appendix B of this guide.
3. Use the first copy of Worksheets A and B to write down your existing configuration. This is an essential step, because later you will need to recreate your existing configuration. The information you write down on Worksheets A and B is extremely important.
4. Use the second copy of Worksheets A and B to plan the configuration of your second channel. For more information on planning a new configuration, see Chapter 4 of this guide.

   If you adding SCSI B to HP NetRAID, be sure to note that all non-hot-swap devices on SCSI B will become part of your HP NetRAID channel. For performance reasons, non-hot-swap devices and hot-swap drives should not be combined in the same array.
5. Log off all users, close all applications, and shut down the HP NetServer.
6. Boot the *HP NetServer Navigator CD-ROM* and follow the instructions in "Step E" in Chapter 5 to launch HP NetRAID Assistant.

English

7. Select the **Configuration** menu, and choose **Clear Configuration**.
8. Exit HP NetRAID Assistant and reboot the HP NetServer.
9. Enable HP NetRAID on the second SCSI channel using the Setup (F2) utility. See "Step D. Enable Integrated HP NetRAID Controller" in this guide for complete instructions.
   - `Integrated HP NetRAID` should be set to `Enable`.
   - `Included SCSI_A Channel` should be set to `Yes`.
   - `Included SCSI_B Channel` should be set to `Yes`.
10. Verify that your hardware is set up correctly for your second channel. The second channel may use hot-swap disk drive modules in a second hot-swap mass storage cage or in an external mass storage enclosure. Make sure that the SCSI IDs of the non-hot-swap devices do not conflict with the SCSI IDs of the hot-swap disk drive modules connected to SCSI B.
11. Boot the *HP NetServer Navigator CD-ROM* and launch HP NetRAID Assistant as described in "Step E" in Chapter 5 of this guide.
12. Select the **Configuration** menu, and then choose **Wizard**.
13. Choose **Custom** mode and define arrays, hot spares, and logical drives on both of your channels. Configure your system exactly as defined in the two sets of worksheets you prepared in Steps 3 and 4.

    For complete instructions on configuring arrays and logical drives, see "Step F" in Chapter 5 of this guide.
14. Save your configuration and initialize your logical drives as described in "Step G" in Chapter 5 of this guide. Exit HP NetRAID Assistant.
15. Reinstall your NOS, HP NetRAID drivers, and HP NetRAID utilities as described in Chapter 6 of this guide. These files are installed on Logical Drive 0.
16. Set your SCSI Transfer Rate if necessary, as described in "Step L" in Chapter 6 of this guide.
17. Prepare your new logical drives for online capacity expansion if desired, as described in Chapter 7 of this guide.
18. Restore your data onto your new logical drives.

Your configuration for a two-channel HP NetRAID system is now complete.

10 Understanding HP NetRAID Utilities

After you have configured your arrays and logical drives, there are three utilities that help you manage HP NetRAID systems. Two of these utilities are available to specific network operating systems. The three utilities are:

- HP NetRAID Assistant (used with Windows NT)
- HP NetRAID Config (used with Novell NetWare)
- HP NetRAID Express Tools (used with all network operating systems)

HP NetRAID Assistant

All users configure their systems for the first time using HP NetRAID Assistant. This utility has an object-oriented GUI.

You can start this utility in two ways:

- If your NOS is Microsoft Windows NT, click the HP NetRAID icon in the Windows Program Manager.
- If your NOS is Novell NetWare, you can start HP NetRAID Assistant from the *HP NetServer Navigator CD-ROM* as you did during initial installation. To use HP NetRAID Assistant from the *HP NetServer Navigator CD-ROM*, you must reboot your HP NetServer.

For a list of functions performed by HP NetRAID Assistant, see the menu chart that follows.

For complete instructions on using HP NetRAID Assistant, see the *HP NetRAID Series User Guide*.

HP NetRAID Assistant Menus

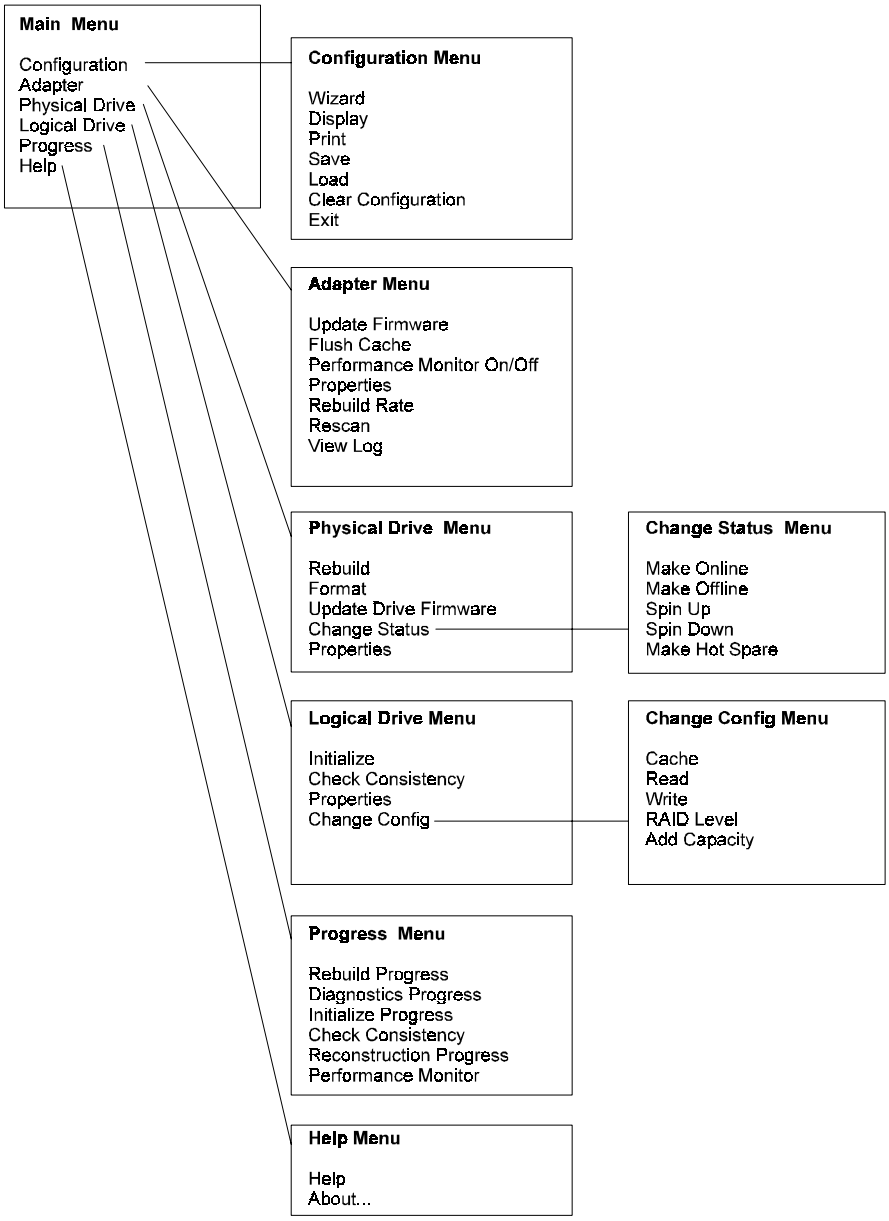


Figure 10-1. HP NetRAID Assistant Menu Chart

English

HP NetRAID Config

HP NetRAID Config performs the same functions as HP NetRAID Assistant, but it runs under Novell NetWare. HP NetRAID Config allows you to reconfigure and manage your RAID system and monitor its status.

You do not need to reboot your HP NetServer to use HP NetRAID Config.

To start HP NetRAID Config utility if you have Novell NetWare, type

```
load megamgr
```

For a list of functions performed by HP NetRAID Config, see the menu chart that follows.

For complete instructions on using HP NetRAID Config, see the *HP NetRAID Series User Guide*.

HP NetRAID Config Menus

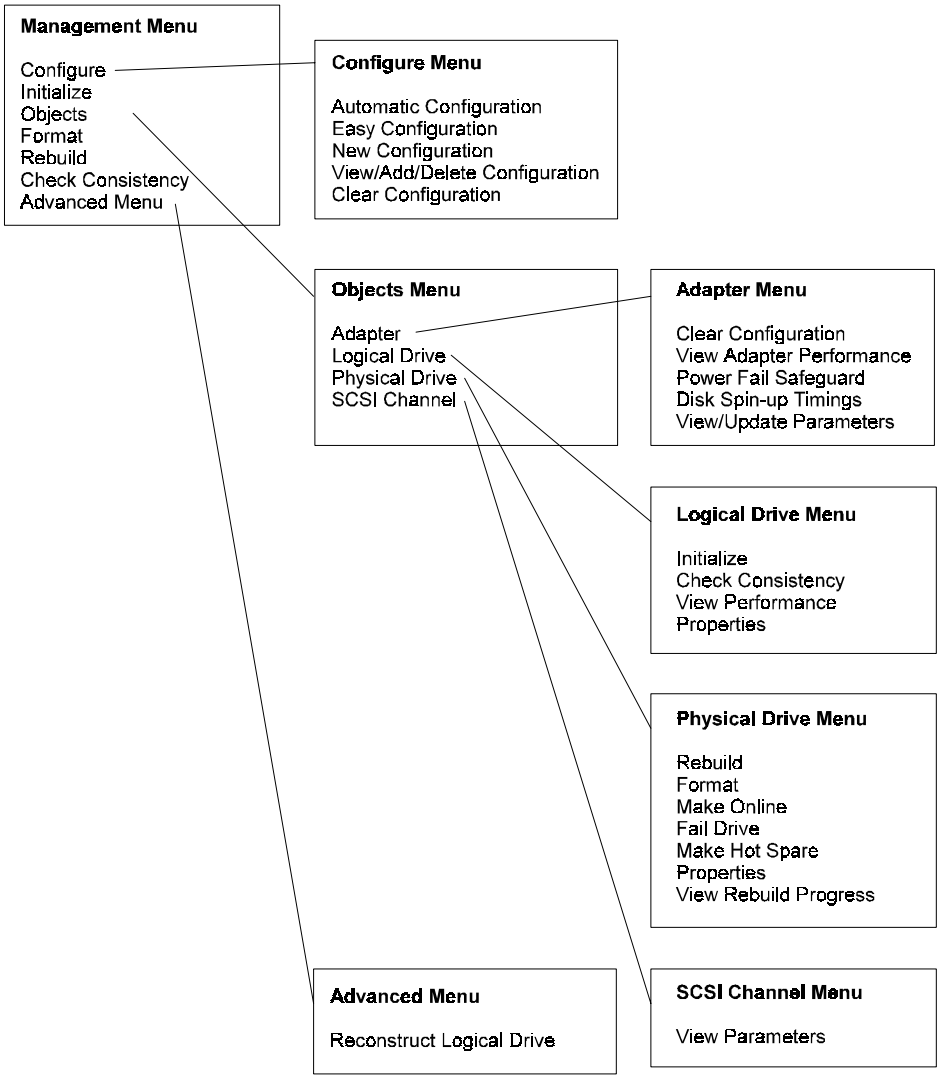


Figure 10-2. HP NetRAID Configuration Menu Chart

English

HP NetRAID Express Tools

HP NetRAID Express Tools is a text-based configuration utility that is contained in the controller firmware and available to all network operating systems. HP NetRAID Express Tools contains some advanced management and diagnostic features that are not available with HP NetRAID Assistant or HP NetRAID Config.

To start HP NetRAID Express Tools:

1. Log off all users, close all applications, and power down the HP NetServer.
2. Reboot the HP NetServer.
3. When the following prompt appears, press <Ctrl> <M>.

```
Option: Experienced users may press <Ctrl> <M> for
HP NetRAID Express Tools now.
Firmware Initializing
```

For a list of functions performed by HP NetRAID Express Tools, see the menu chart that follows.

For complete instructions on using HP NetRAID Express Tools, see the *HP NetRAID Series User Guide.*

HP NetRAID Express Tools Menus

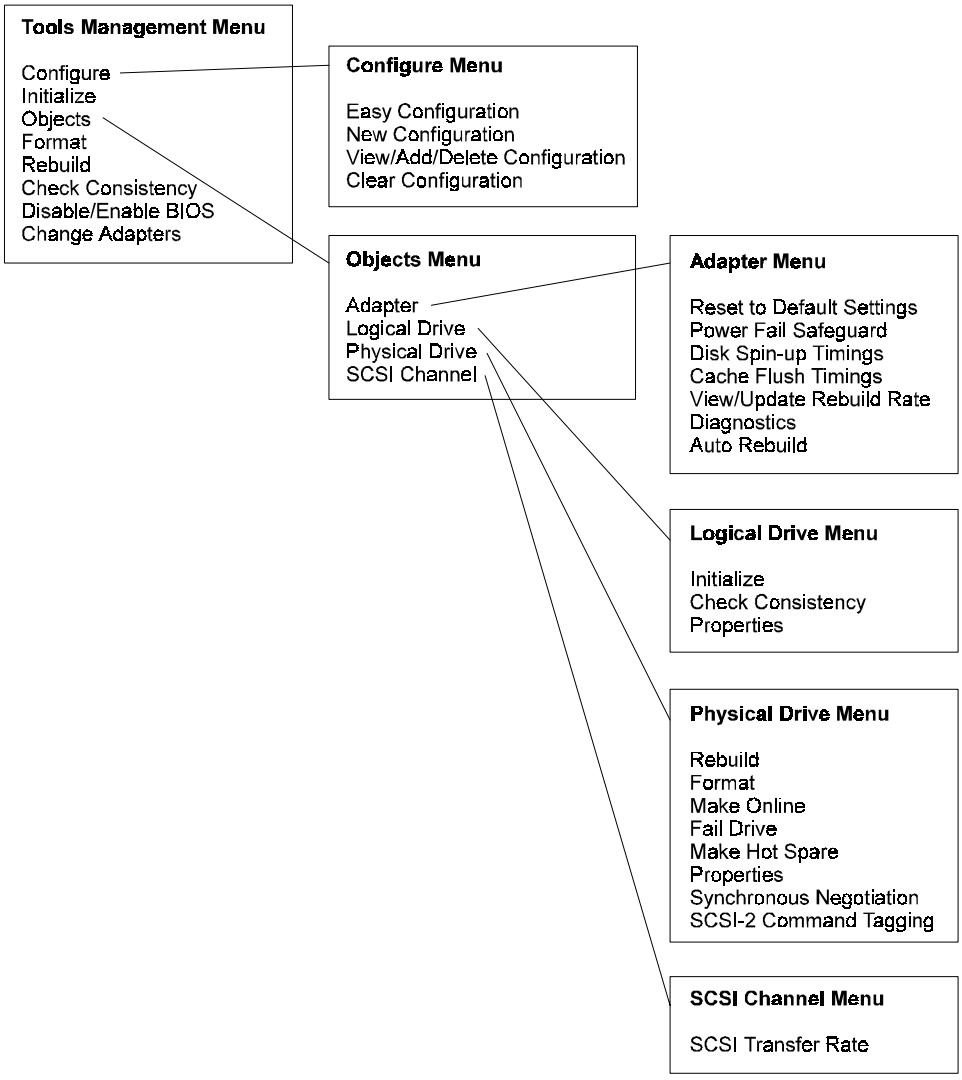


Figure 10-3. HP NetRAID Express Tools Menu Chart

11 Troubleshooting

Power-up (Boot) Error Messages

Adapter BIOS Disabled. No Logical Drives Handled by BIOS

Problem: The HP NetRAID BIOS is disabled. (This is not a problem if the BIOS is intentionally disabled to prevent booting from the adapter.)

Suggested solution: Enable the BIOS by using HP NetRAID Express Tools, as described in "Step L, Run HP NetRAID Express Tools" in Chapter 6.

Channel disabled. Press <F2> to run SETUP and re-enable channel, or press CTRL-M for NetRAID utility

Problem: An HP NetRAID channel was configured, but then disabled. A channel might have been disabled unintentionally if you used the Setup (F2) utility and reset to system defaults. Resetting to system defaults also resets the HP NetRAID channel configuration to its default value (one channel HP NetRAID on SCSI A).

Suggested solutions:

- If you disabled a channel unintentionally, do the following to re-enable it:
  1. Press the **F2** function key.
  2. Verify that the settings for integrated HP NetRAID and SCSI channels A and B are set correctly. Make changes as necessary.
  3. Press the **F10** function key to save and exit.
- If you disabled a channel intentionally, press <Ctrl> <M> to run HP NetRAID Express Tools and clear your configuration and reconfigure.

Host Adapter at Baseport *xxxxh* not Responding

Problem: The HP NetRAID BIOS cannot communicate with the firmware on the adapter.

Suggested solutions: Remove any HP NetRAID adapters from the PCI slots. If the error message persists, see the Service and Support chapter of the *HP NetServer LH 3/LH 3r User Guide*.

No HP NetRAID Adapter

Problem: The HP NetRAID BIOS cannot communicate with the firmware on the adapter.

Suggested solutions: Remove any HP NetRAID adapters from the PCI slots. If the error message persists, see the Service and Support chapter of the *HP NetServer LH 3/LH 3r User Guide*.

Configuration of NVRAM and drives mismatch
Run View/Add Configuration option of Configuration Utility.
Press any key to enter the Configuration Utility.

Problem: The configuration stored in NVRAM does not match the configuration stored in the drives. All drives contain one set of configuration information, and NVRAM contains a different set.

Suggested solution: Do the following to pick the correct configuration from either NVRAM or from the disks.

1. Press any key to enter HP NetRAID Express Tools.
2. From the Configure menu, choose the View/Add Configuration option. View/Add Configuration asks which configuration you want to view: NVRAM or disk.
3. Use View/Add Configuration to examine both configurations.
4. Resolve the configuration mismatch by selecting and saving one of the two configurations.

Configuration of NVRAM and drives mismatch for Host Adapter - x
Run View/Add Configuration option of Configuration Utility.
Press any key to enter the Configuration Utility.

Problem: You have installed one or more HP NetRAID-3Si adapters, and the configuration stored in the NVRAM of adapter x does not match the configuration stored in the drives. All drives on that adapter contain one set of configuration information, and NVRAM contains a different set.

Suggested solution: Do the following to pick the correct configuration from either NVRAM or from the disks.

1. Press any key to enter HP NetRAID Express Tools.
2. From the Configure menu, choose the View/Add Configuration option. View/Add Configuration asks which configuration you want to view: NVRAM or disk.

3. Use View/Add Configuration to examine both configurations.
4. Resolve the configuration mismatch by selecting and saving one of the two configurations.

Unresolved configuration mismatch between disk(s) and NVRAM on the adapter

Problem: The configuration stored in NVRAM does not match the configuration stored on the drives, and configuration information on some drives conflict with configuration information on other drives.

Suggested solution: Do the following to reconfigure your drives and restore your data.

1. Press <Ctrl> <M> to start HP NetRAID Express Tools, as described in Step L in Chapter 6.
2. From the Configuration menu, choose the View/Add Configuration option.
3. Use View/Add Configuration to examine the configuration stored in NVRAM. Write down all configuration information, including the SCSI IDs of the physical drives in each array, the array and logical drive numbers, stripe size, logical drive size, and the adapter settings.
4. Clear your configuration and reconfigure all of your drives using one of the HP NetRAID utilities (HP NetRAID Assistant, HP NetRAID Config, or HP NetRAID Express Tools). See the *HP NetRAID User's Guide* for more information.
5. Restore your data from a backup copy.

1 Logical Drive Failed

Problem: One logical drive failed to sign on.

Suggested solution:

1. Verify that all physical drives are connected and powered on.
2. Use a utility, such as HP NetRAID Assistant or HP NetRAID Config, to determine which physical drives are not responding and thereby make the logical drive unavailable.
3. Correct the problem with the physical drive by reconnecting, replacing, or rebuilding it.

x Logical Drives Degraded

Problem: x number of logical drives signed on in the degraded (critical) state.

Suggested solution:

1. Use a utility, such as HP NetRAID Assistant or HP NetRAID Config, to determine which physical drive(s) is not responding and thereby makes the logical drives degraded.
2. Correct the problem with the physical drive(s) by reconnecting, replacing, or rebuilding the physical drive(s).

1 Logical Drive Degraded

Problem: One logical drive signed on in the degraded (critical) state.

Suggested solution:

1. Use a utility, such as HP NetRAID Assistant or HP NetRAID Config, to determine which physical drive is not responding and thereby makes the logical drive degraded.
2. Correct the problem with the physical drive by reconnecting, replacing, or rebuilding it.

Insufficient Memory to Run. Press any Key to Continue ...

Problem: There is insufficient memory in the HP NetServer to run the HP NetRAID BIOS.

Suggested solution: Check the HP NetServer to be sure that the memory is properly installed.

Insufficient Memory

Problem: There is insufficient memory for the current configuration.

Suggested solution: Check to be sure that the memory is properly installed.

Following SCSI ID's are not Responding Channel-x:a.b.c

Problem: On the channel listed (x), the physical drives with the SCSI IDs listed (a, b, c, and so on) are not responding.

Suggested solution: Verify that the physical drives are connected and powered on.

English

Other BIOS Error Messages

Error: Following SCSI Disk not found and No Empty Slot Available for mapping it

Problem: The physical disk roaming feature failed to find the physical drive with the listed SCSI ID, and no slot is available in which to map the physical drive. The controller cannot resolve the physical drives into a current configuration.

Suggested solution: Reconfigure the array because the adapter cannot resolve the physical drives into the current configuration.

Following SCSI ID's have the same data <v.z> Channel-x:a.b.c

Problem: The physical disk roaming feature found the same data on two or more physical drives on channel (x) with the listed SCSI IDs (a, b, c, and so on). The adapter cannot determine which drive with duplicate information to use.

Suggested solution: Remove the drive or drives that should not be used.

Other Troubleshooting

NOS Does Not Load (Boot)

Problem: Operating system does not load at start up time.

Suggested solutions:

- Use the Setup utility to define the boot order. (Press the F2 function key during startup.)
- Use HP NetRAID Express Tools to enable/disable the HP NetRAID BIOS as required.

Hard Drive Fails Often

Problem: One of the hard drives in the array fails often.

Suggested solutions:

- Check the drive error counts using HP NetRAID Assistant Physical Drive Properties. Be aware that the drive error counter clears if the drive is moved or powered off while the adapter remains powered on.
- Format the drive.
- Rebuild the drive.
- If the drive continues to fail, replace the drive with another drive with the same capacity, and rebuild.

System Hangs When Scanning Devices for New Configuration

Problem: Ran HP NetRAID Express Tools or HP NetRAID Config and tried to make a new configuration. The system hangs when scanning devices.

Suggested solutions:

- Check the drives' SCSI IDs on each channel to make sure each device has a different ID. Hot-swap devices cannot share the same SCSI ID as non-hot-swap devices on the same channel.
- Check the cables for bent pins.

Management Menu Not Displayed

Problem: Running HP NetRAID Express Tools or HP NetRAID Config does not display the Management Menu.

Suggested solution: Use a color monitor.

Cannot Flash or Update the EEPROM

Problem: Cannot flash or update the EEPROM.

Suggested solution: Make sure the jumper labeled J12 (Enable I_2O Flash Writes) is present on the HP NetServer LH 3/LH 3r I/O board near the HP NetRAID SIMM.

English

HP NetRAID BIOS Banner Not Displayed

Problem: The HP NetRAID BIOS and firmware banner does not appear.

Suggested solution: Use the Setup utility to ensure that integrated HP NetRAID has been enabled for the appropriate channels. See Step D in Chapter 5 for information.

Firmware Continues to Initialize

Problem: "Firmware Initializing..." appears and remains on the screen.

Suggested solution: Be sure that the memory modules are rated as 50 ns.

Troubleshooting Management Over the Network

Without NetRAID Assistant, the client(s) and server(s) connect normally, but the NetRAID Assistant cannot connect to any servers

For NetRAID Assistant to connect to a server, it must resolve the server via TCP/IP. Ping the server by name from the client or server that will run HP NetRAID Assistant. If this is unsuccessful, then the client or server that will run HP NetRAID Assistant cannot resolve the server using TCP/IP. Confirm the following conditions:

- The IP addresses are unique.
- The subnet mask is not causing a group resolution problem.
- The **hosts** file contains correct names and IP addresses for all servers with HP NetRAID Series adapters to be managed.

No response when connecting to a server; may get Server Not Responding message after several minutes

The server is likely to be down and the connection attempt/timeout may take two minutes before a message is generated. Be sure the selected server is up.

NOTE	If the server is still not up when the timeout message is displayed, HP NetRAID Assistant will exit.

Can't unload raidserv.nlm

If an integrated HP NetRAID controller (or HP NetRAID Series adapter) in a NetWare server is being accessed by a configuration utility (HP NetRAID Assistant in Full Access mode or HP NetRAID Config), the **raidserv.nlm** module cannot be unloaded until the controller or adapter is no longer being accessed. This prevents a critical operation in the controller or adapter, such as a disk rebuild, from being interrupted.

HP NetRAID Assistant does not list any servers when started (other than "local")

When HP NetRAID Assistant starts, the Main Screen only lists "<clientname>(Local)" in the pull-down list of servers. The Registration Server may be down, or no servers may have checked in with it.

Be sure that the Registration Server is working and that it started before the other servers. Servers can only log into the Registration Server when the access server (NT) or raidserv.nlm (NetWare) executes.

12 Warranty and Support

Hardware Warranty

Refer to the warranty statement provided with your original HP NetServer system documentation for the warranty limitations, customer responsibilities, and other terms and conditions.

Obtaining HP Repair and Telephone Support

Please follow the installation instructions in this guide before calling for service.

- U.S. and Canada: 1-970-635-1000
- Europe: +31-20-581-3330

Hewlett-Packard has offices in over 100 countries. If you are located outside these areas, check your local telephone directory for a Hewlett-Packard sales and service office, or authorized service representative.

A Product Specifications

Integrated HP NetRAID Controller Specifications

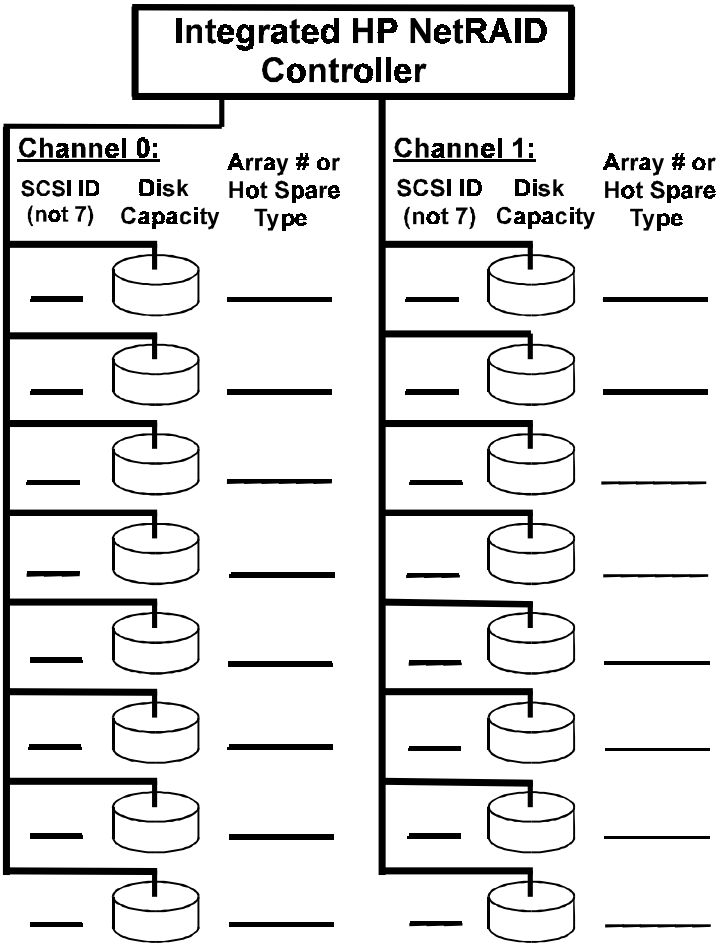
Parameter	Specification
Processor	Intel i960RD™ @ 66 MHz
Bus Type	PCI 2.1
Bus Data Transfer Rate	Up to 132 MB
BIOS	HP NetRAID BIOS
Cache Configuration	16 MB using 50 ns EDO DRAM
Firmware	1 MB flash ROM
Nonvolatile RAM	32 KB of NVRAM for disk configuration space
SCSI Controllers	Symbios Logic 53C895 on each channel
SCSI Data Transfer Rate	Up to 80 MB/sec with Ultra2 drives
SCSI Bus	Low voltage differential or single-ended SCSI
SCSI Termination	Active
Devices per SCSI Channel	6 to 8, depending on SCSI mode and storage cabinet
SCSI Device Types Supported	Low voltage differential drives in the mass storage cage or non-hot-swap, single-ended SCSI disk drives
SCSI Channels	One or two
RAID Levels Supported	0, 1, 3, 5,10, 30, and 50
SCSI Connectors	68-pin, high-density internal connectors 68-pin, ultra-high-density external connectors
HP NetRAID-3Si adapters	Up to two HP NetRAID-3Si adapters per system

B Worksheets

Configuration Worksheets

Figures B-1 and B-2 are worksheets for you to record your configuration choices for the hardware and logical drives. We recommend that you log your configuration selections on photocopies of these worksheets.

WORKSHEET A (PHYSICAL DEVICES)



Rebuild Rate = _____%

SCSI Transfer Rate (Fast, Ultra, Ultra2):

Channel 0: _____ Channel 1: _____

Figure B-1. Worksheet A

English

Adapter # ___ WORKSHEET B (LOGICAL DEVICES)

Logical Drive #	Array #	Span	RAID Level	Logical Drive Size	Stripe Size	Write Policy	Read Policy	Cache Policy
LD0								
LD1								
LD2								
LD3								
LD4								
LD5								
LD6								
LD7	Start with Array 0, and number consecutively.	Span this LD over the next 1-3 consecutive arrays?	RAID Level 0, 1, 3, or 5	Optional. You can let the HP NetRAID Assistant Wizard calculate the size.	4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB (128 KB requires 8 MB of memory)	Write Back or Write Thru	Normal, Read Ahead, or Adaptive Read Ahead	Cached I/O or Direct I/O

Use one to eight logical drives, starting with LD0.

Figure B-2. Worksheet B

Sample Configuration Worksheet

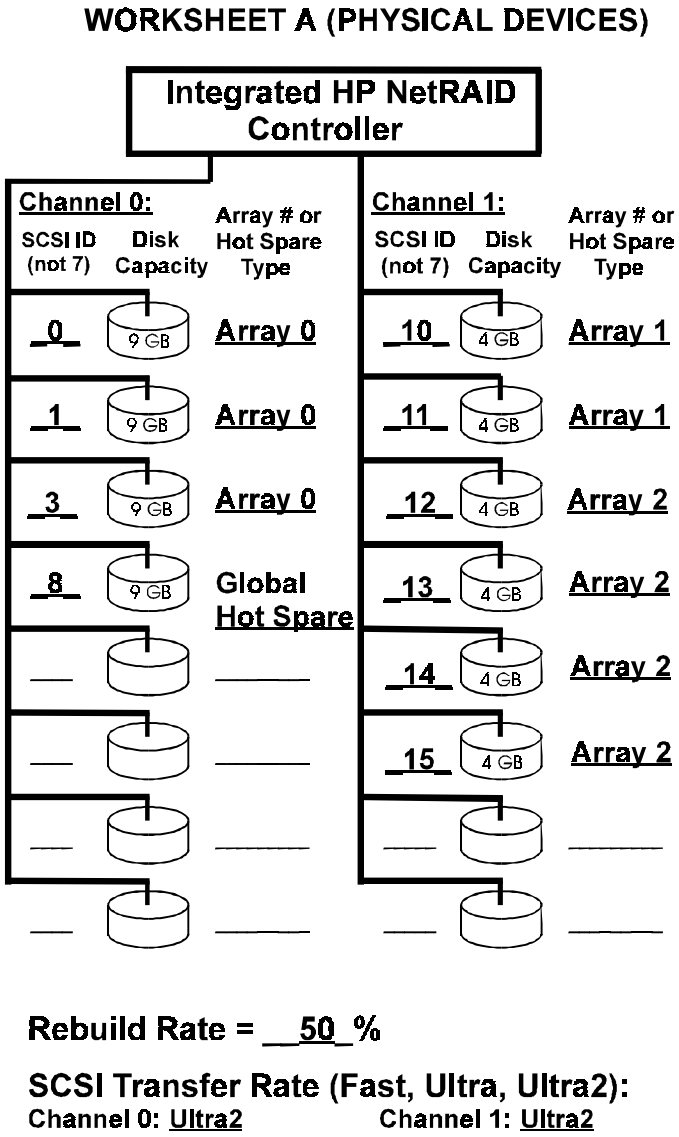


Figure B-3. Sample Worksheet A

English

WORKSHEET B (LOGICAL DEVICES)								
Logical Drive #	**Array #**	**Span**	**RAID Level**	**Logical Drive Size**	**Stripe Size**	**Write Policy**	**Read Policy**	**Cache Policy**
LD0	0	No	5	18 GB	64 KB	W. Thru.	Adapt.	Cached
LD1	1	No	1	4 GB	16 KB	W. Thru.	Adapt.	Cached
LD2	2	No	5	12 GB	64 KB	W. Thru.	Adapt.	Cached
LD3								
LD4								
LD5								
LD6								
LD7								
Use up to eight logical drives, starting with LD0.	Start with Array 0, and number consecutively.	Span this LD over the next 1-3 consecutive arrays?	RAID Level 0, 1, 3, 5, 10, 30, or 50	Optional. You can let the HP NetRAID Assistant Wizard calculate the size.	4 KB, 8 KB, 16 KB, 32 KB, 64 KB, or 128 KB (128 KB requires 8 MB of memory)	Write Back or Write Thru	Normal, Read Ahead, or Adaptive Read Ahead	Cached I/O or Direct I/O

Figure B-4. Sample Worksheet B

Figures B-3 and B-4 are samples of Worksheets A and B for an HP NetRAID adapter with ten physical drives, three arrays, and three logical drives. It has a 50% rebuild rate.

Physical Arrays and Hot Spares

- **Array 0** on Channel 0 contains three 9-GB physical drives (SCSI ID # 0, 1, 3).
- **Array 1** on Channel 1 contains two 4-GB physical drives (SCSI ID # 10 and 11).
- **Array 2** on Channel 2 contains four 4-GB physical drives (SCSI ID # 12, 13, 14, and 15).
- A **global hot spare** is available in case a drive fails in any array. The physical drive has SCSI ID #8 on Channel 0. The 9-GB capacity of the global hot spare is greater than or equal to the physical capacity of the individual physical drives in all three arrays.

Logical Drives

- **Logical Drive 0** is on Array 0 and does not span another array. It uses RAID level 5 with a capacity of 18 GB. (The capacity of one physical drive is used for parity.) Logical Drive 0 has a stripe size of 64 KB. Its write policy is Write Through, its read policy is Adaptive Read Ahead, and its cache policy is Cached.
- **Logical Drive 1** is on Array 1 and does not span another array. It uses RAID level 1 with a capacity of 4 GB. (Mirroring uses up half the physical capacity.) Logical Drive 0 has a stripe size of 16 KB. Its write policy is Write Through, its read policy is Adaptive Read Ahead, and its cache policy is Cached.
- **Logical Drive 2** is on Array 2 and does not span another array. It uses RAID level 5 with a capacity of 12 MB. (The capacity of one physical drive is used for parity.) Logical Drive 2 has a stripe size of 64 KB. Its write policy is Write Through, its read policy is Adaptive Read Ahead, and its cache policy is Cached.

Glossary

Disk Array Terms and Technologies

Array: An array of disk modules combines the storage space on the disk modules into a single segment of contiguous storage space. The integrated HP NetRAID controller can group disk modules on one or more of its SCSI channels into an array. A hot spare disk module does not participate in an array.

Array Spanning: Array spanning by a logical drive combines storage space in two, three, or four arrays of disk modules into the logical drive's single contiguous storage space.

Logical drives of the integrated HP NetRAID controller can span consecutively numbered arrays that each consist of the same number of disk modules. Array spanning promotes RAID levels 1, 3, and 5 to RAID levels 10, 30, and 50, respectively.

BIOS: (Basic Input/Output System) The part of the operating system of the computer that provides the lowest level interface to peripheral devices.

Cache Policy: HP NetRAID lets you choose one of two cache policies:

- **Cached I/O**: Reads will always be cached regardless of randomness, and the selected Read policy (Read Ahead, Normal, or Adaptive) and Write policy (Write-Through and Write-Back) applies.
- **Direct I/O**: First reads to a new location will always come directly from the disk. If a location is read repeatedly, then the Read policy (Read Ahead, Normal, or Adaptive) as selected will apply and the read data will be cached. Read data is cached only if accessed repeatedly. With 100% random reads, nothing is cached.

Capacity Expansion (or Volume Expansion): Allows you to increase the size of an existing volume while remaining online under Windows NT or Novell NetWare. The controller creates virtual space when the "virtual sizing" option is enabled in the Express Tools utility. A volume can then be expanded into the virtual space by adding a physical disk through reconstruction. Reconstruction is only permitted on a logical drive that occupies a single array and is the only logical drive in the array. You cannot use online capacity expansion on logical drives that span arrays (RAID levels 10, 30, or 50).

Channel: An electrical path for the transfer of data and control information between a disk and a disk controller.

Format: The process of writing zeros to all data fields in a physical drive (hard drive) and to map out unreadable or bad sectors. Because most hard drives are factory formatted, formatting is usually only done if a hard disk generates several media errors.

GB: A gigabyte; an abbreviation for 1,073,741,824 (2 to the 30th power) bytes used for memory or disk capacities.

Hot Spare: An idle, powered-on, stand-by disk module ready for use should another disk module fail. It does not contain any user data. Up to eight disk modules can be assigned as hot spares. A hot spare can be dedicated to a single redundant array, or it can be part of the global hot-spare pool for all the arrays. Only one hot spare can be dedicated to a given array.

When a disk fails, the controller's firmware automatically replaces and rebuilds the data from the failed disk onto the hot-spare disk. Data can only be rebuilt from logical drives with redundancy (RAID levels 1, 3, 5, 10, 30, or 50; not RAID 0), and the hot-spare disk must have sufficient capacity. The system administrator can replace the failed disk module and designate the replacement disk module as a new hot spare.

Hot Swap Disk Module: Hot swap modules allow a system administrator to replace a failed disk drive in a server without powering down the server and suspending network services. The hot swap module simply pulls out from its slot in the drive cage because all power and cable connections are integrated into the server backplane. Then the replacement hot-swap module can slide into the slot. Hot swapping only works for RAID 1, 3, 5, 10, 30, and 50 configurations.

I_2O: Intelligent Input/Output (I_2O) is an industry-standard, I/O subsystem architecture independent of the network operating system and the peripheral devices supported. I_2O uses drivers that are split into operating system services modules (OSMs) and hardware device modules (HDMs). I_2O increases overall system performance by shifting I/O computations from the system CPUs to dedicated I/O processors. It also makes driver management easier and less expensive.

Initialization: The process of writing zeros to the data fields of a logical drive and generating corresponding parity to put the logical drive in a Ready state. Initializing erases previous data, generating parity so that the logical drive will pass a Consistency Check. Arrays work without initializing, but they may fail a Consistency Check because parity fields may not have been generated.

Logical Drive: A virtual drive within an array, which may consist of more than one physical disk.

Logical drives divide up the contiguous storage space of an array of disk modules or a spanned group of arrays of disks. The storage space in a logical drive is spread across all the disks in the array or spanned arrays. An integrated HP NetRAID controller can be configured with up to eight logical drives in any combination of sizes. Configure at least one logical drive for each array.

A logical drive can be in one of five states (also see the SCSI Disk Status below):

- **Online**: all participating disk modules are online.
- **Degraded:** (Critical) a single disk module in a redundant array (not RAID 0) is not online. Data loss may result if a second disk module fails.
- **Offline**: two or more disk modules in a redundant array (not RAID 0), or one or more disk modules in a RAID 0 array are not online.
- **Reconstructing**: participating disk modules are being reconstructed.
- **Rebuilding**: participating disk modules are being rebuilt.

I/O operations can only be performed with logical drives that are online or degraded (critical).

Logical Volume: A virtual disk made up of logical disks rather than physical ones. Also called a partition.

MB: A megabyte; an abbreviation for 1,048,576 (2 to the 20th power) bytes; used for memory or disk capacities.

Mirroring: The style of redundancy in which the data on one disk completely duplicates the data on another disk. RAID levels 1 and 10 use mirroring.

Parity: Parity is an extra bit added to a byte or word to reveal errors in storage (in RAM or disk) or transmission. It is used to generate a set of redundancy data from two or more parent data sets. The redundancy data can be used to reconstruct one of the parent data sets; however, parity data do not fully duplicate the parent data sets. In RAID, this method is applied to entire drives or stripes across all disk drives in an array. Parity consists of Dedicated Parity, in which the parity of the data on two or more disks is stored on an additional disk, and Distributed Parity, in which the parity data are distributed among all the disks in the system. If a single disk fails, it can be rebuilt from the parity of the respective data on the remaining disks.

Physical Disk Roaming: The ability of a controller to keep track of a hot swap disk module that has been moved to a different slot in the hot swap cages. Both slots must be controlled by the same controller.

Power Fail Safeguard: When this setting is enabled, during a reconstruction process (not a rebuild) a copy of the data that is being restructured will always be stored on disk, so that if a power failure occurs during the reconstruction, there will be no risk of data loss.

Power-on Rights: These settings specify how a logical drive can be accessed by the controller. These settings may be used in clustering setups where more than one controller is sharing a logical drive, or to control local logical drive access. The None selection specifies that this controller will have no access rights to the logical drive. The Read setting specifies that this controller will have read only access to the logical drive. The Read+Write setting allows both read and writes to the logical drive. The All setting allows read, write, rebuild, consistency checks, and so on.

RAID: Redundant Array of Independent Disks (originally Redundant Array of Inexpensive Disks) is an array of multiple small, independent hard disk drives that yields performance exceeding that of a Single Large Expensive Disk (SLED). A RAID disk subsystem improves I/O performance using only a single drive. The RAID array appears to the host HP NetServer as a single storage unit. I/O is expedited because several disks can be accessed simultaneously.

RAID Levels: A style of redundancy applied to a particular logical drive. It may increase the fault tolerance and performance of the logical drive, and it may decrease its usable capacity. Each logical drive must have a RAID level assigned to it.

RAID levels 1, 3, and 5 are for logical drives that occupy a single array (non-spanned array). Table 2-1 in Chapter 2 describes RAID levels for logical drives that do not span arrays. Briefly,

- **RAID 0** has no redundancy. It requires one or more physical drives.
- **RAID 1** has mirrored redundancy. It requires two physical drives in an array.
- **RAID 3** has parity redundancy with a dedicated parity disk. It requires three or more physical drives in an array.
- **RAID 5** has parity redundancy distributed over all the disks in the array. It requires three or more physical drives in an array.

RAID levels 10, 30, and 50 result when logical drives span arrays. Table 2-2 in Chapter 2 describes RAID levels for logical drives that span arrays.

- **RAID 10** results when a RAID 1 logical drive spans arrays.
- **RAID 30** results when a RAID 3 logical drive spans arrays.
- **RAID 50** results when a RAID 5 logical drive spans arrays.

Read Policy: The three Read policies for HP NetRAID are:

- **Read-Ahead**: This is a memory caching ability that tells the controller to read sequentially ahead of requested data and cache the further data in memory, anticipating that the further data will be requested. Read-Ahead supplies sequential data faster, but is not as effective when accessing random data.
- **Normal**: This policy does not use the read-ahead memory caching feature. This policy is efficient when most of the data reads are random.
- **Adaptive**: Adaptive policy causes the read-ahead feature to be used if the last two disk accesses were in sequential sectors.

Ready State: A condition in which a workable hard drive is neither online nor a hot spare, and therefore is available to add to an array, or to designate as a hot spare.

Rebuild: The regeneration of all data from a failed disk in a RAID level 1, 3, 5, 10, 30, or 50 array to a replacement disk. A disk rebuild normally occurs without interruption of application access to data stored on the logical drive.

Rebuild Rate: The speed at which the rebuild operation proceeds. Each controller is assigned a rebuild rate, which specifies the percentage of IOP resources to be devoted to rebuild operations.

Reconstruct: The act of remaking a logical drive after changing RAID levels.

Redundancy: *See* RAID Levels

SCSI Channel: The integrated HP NetRAID controller controls the disk drives via SCSI-2 buses called "channels" over which the system transfers data in Fast-and-Wide, Ultra SCSI, or Ultra2 SCSI mode. An integrated HP NetRAID controller can manage one or two SCSI channels.

SCSI Disk Status: A SCSI disk module (physical drive) can be in one of five states:

- **Ready**: a powered-on and operational disk that has not been configured.

- **Online**: a powered-on and operational disk that has been configured.
- **Hot Spare**: a powered-on, stand-by disk ready for use should a disk fail.
- **Failed:** errors on the disk have caused it to fail, or you have used an HP NetRAID utility to take the drive offline.
- **Rebuilding**: a disk in the process of having data restored from one or more critical logical drives.

SCSI ID: Each SCSI device on a SCSI bus must have a different SCSI address number (Target) from 0 to 15, but not 7, which is reserved for the SCSI controller.

Stripe Size: The amount of data contiguously written to each disk. Also called "stripe depth." You can specify stripe sizes of 4 KB, 8 KB, 16 KB, 32 KB, 64 KB, and 128 KB, for each logical drive. For best performance, choose a stripe size equal to or smaller than the block size used by your host operating system. A larger stripe depth produces higher read performance, especially if most of the reads are sequential. For mostly random reads, select a smaller stripe width. You may specify a stripe size for each logical drive. A 128-KB stripe requires 8 MB of memory.

Stripe Width: The number of disk modules across which the data is striped. Equivalent to the number of disks in the array.

Striping: Segmentation of logically sequential data, such as a single file, so that segments can be written to multiple physical devices in a round-robin fashion. This technique is useful if the processor is capable of reading or writing faster than a single disk can supply or accept it. While data is being transferred from the first disk, the second disk can locate the next segment. Data striping is used in some modern databases and in certain RAID devices.

Virtual Sizing: This setting, when enabled for a logical drive, causes the controller to report the logical drive size as 82 GB even though the actual physical capacity is much less. The "virtual" space allows for online capacity expansion.

Write Policy: When the processor writes to disk, the data is first written to the cache on the assumption that the processor will probably read it again soon. The two Write policies for HP NetRAID are:

- **Write Back**: In a write-back cache, data is written to disk only when it is forced out of the cache. Write-back requires the cache to initiate a write to disk of the flushed entry, followed (for a processor read) by a main

memory read. Write-back is efficient, because an entry may be written many times in the cache without a disk access.

- **Write Through**: In a write-through cache, data is written to disk at the same time as it is cached. Write-through is simpler than write-back, because an entry that is to be replaced can be overwritten in the cache, as it will already have been copied to disk.

English

Index

English