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Configuration Guide for IBM® AIX® Host Attachment

Hitachi Virtual Storage Platform
Hitachi Universal Storage Platform V/VM

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MK-96RD636-05

Contents

Preface

This document describes and provides instructions for installing and configuring the devices on the Hitachi RAID storage systems for operations in an IBM® AIX® environment. The Hitachi RAID storage system models include the Hitachi Virtual Storage Platform (VSP) and the Hitachi Universal Storage Platform V and Hitachi Universal Storage Platform VM (USP V/VM).

Please read this document carefully to understand how to use this product, and maintain a copy for reference purposes.

This preface includes the following information:

Intended Audience

This document is intended for system administrators, Hitachi Data Systems representatives, and authorized service providers who are involved in installing, configuring, and operating the Hitachi RAID storage systems.

Readers of this document should meet the following requirements:

- You should have a background in data processing and understand RAID storage systems and their basic functions.
- You should be familiar with the Hitachi RAID storage system(s), and you should have read the *User and Reference Guide* for the storage system.
- You should be familiar with the Storage Navigator software for the Hitachi RAID storage system(s), and you should have read the *Storage Navigator User's Guide*.
- You should be familiar with the AIX operating system and the hardware hosting the AIX system.
- You should be familiar with the hardware used to attach the Hitachi RAID storage system to the AIX host, including fibre-channel cabling, host bus adapters (HBAs), switches, and hubs.

Product Version

This document revision applies to the following microcode levels:

- Hitachi Virtual Storage Platform microcode 70-01-0x or later.
- Hitachi Universal Storage Platform V/VM microcode 60-05-0*x* or later.

Document Revision Level

Revision	Date	Description
MK-96RD636-P	February 2007	Preliminary Release
MK-96RD636-00	May 2007	Initial Release, supersedes and replaces MK-96RD636-P
MK-96RD636-01	September 2007	Revision 1, supersedes and replaces MK-96RD636-00
MK-96RD636-02	November 2009	Revision 2, supersedes and replaces MK-96RD636-01
MK-96RD636-03	January 2010	Revision 3, supersedes and replaces MK-96RD636-02
MK-96RD636-04	October 2010	Revision 4, supersedes and replaces MK-96RD636-03
MK-96RD636-05	April 2011	Revision 5, supersedes and replaces MK-96RD636-04

Source Documents for this Revision

- Not applicable.

Changes in this Revision

- Corrected the procedure for changing the device parameters from the AIX command line (step (2) in Changing Device Parameters from the AIX Command Line).
- Added information about the system option modes (SOMs) and instructions for setting the SOMs (new section Setting the System Option Modes).

Referenced Documents

Hitachi Virtual Storage Platform documentation:

- *Provisioning Guide for Open Systems*, MK-90RD7022
- *Storage Navigator User Guide*, MK-90RD7027
- *Storage Navigator Messages*, MK-90RD7028
- *User and Reference Guide*, MK-90RD7042

Hitachi Universal Storage Platform V/VM documentation:

- *Storage Navigator Messages*, MK-96RD613
- *LUN Manager User's Guide*, MK-96RD615
- *LUN Expansion (LUSE) User's Guide*, MK-96RD616
- *Storage Navigator User's Guide*, MK-96RD621
- *Virtual LVI/LUN and Volume Shredder User's Guide*, MK-96RD630
- *User and Reference Guide*, MK-96RD635
- *Cross-OS File Exchange User's Guide*, MK-96RD647
- *Hitachi Dynamic Link Manager Software User's Guide for IBM AIX Systems* MK-92DLM111

IBM AIX documentation

Document Organization

The following table provides an overview of the contents and organization of this document. Click the chapter title in the left column to go to that chapter. The first page of each chapter provides links to the sections in that chapter.

Chapter	Description
Chapter 1, Introduction	Provides a brief overview of the Hitachi RAID storage systems, supported device types, and an installation roadmap.
Chapter 2, Installing the Storage System	Provides instructions for installing and connecting the Hitachi RAID storage system to an IBM AIX host.
Chapter 3, Configuring the New Disk Devices	Provides instructions for configuring the new devices for use.
Chapter 4, Using AIX with Object Data Manager (ODM)	Provides information about the AIX Object Data Manager (ODM) and how the Hitachi RAID storage system interacts with it.
Chapter 5, Failover and SNMP Configuration	Describes how to configure the Hitachi RAID storage system for failover and SNMP.
Chapter 6, Troubleshooting	Provides information for identifying and resolving problems.
Appendix A, SCSI TID Maps for Fibre-Channel Adapters	Describes SCSI TID Maps for fibre-channel adapters.
Appendix B, Online Device Installation	Provides instructions for online installation of new devices.
Appendix C, Online LUSE	Describes the LU Expansion.
Appendix D, Note on Using Veritas Cluster Server	Provides information about adding reserve keys for LUs to increase disk capacity.

Document Conventions

The terms “Virtual Storage Platform” and “VSP” refer to all models of the Hitachi Virtual Storage Platform storage system, unless otherwise noted.

The terms “Universal Storage Platform V” and “Universal Storage Platform VM” refer to all models of the Universal Storage Platform V/VM, unless otherwise noted.

This document uses the following typographic conventions:

Convention	Description
Bold	Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click **OK**.
Italic	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy *source-file target-file* ***Note:*** Angled brackets (< >) are also used to indicate variables.
screen/code	Indicates text that is displayed on screen or entered by the user. Example: `# pairdisplay -g oradb`
< > angled brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: `# pairdisplay -g <group>` ***Note:*** Italic font is also used to indicate variables.
[ ] square brackets	Indicates optional values. Example: [a | b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a | b } indicates that you must choose either a or b.
| vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a | b] indicates that you can choose a, b, or nothing. { a | b } indicates that you must choose either a or b.
underline	Indicates the default value. Example: [a | b]

This document uses the following icons to draw attention to information:

Icon	Meaning	Description
	Note	Calls attention to important and/or additional information.
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Caution	Warns the user of adverse conditions and/or consequences (e.g., disruptive operations).
	WARNING	Warns the user of severe conditions and/or consequences (e.g., destructive operations).

Convention for Storage Capacity Values

Physical storage capacity values (e.g., disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 KB	1,000 (10^3) bytes
1 MB	1,000 KB or $1,000^2$ bytes
1 GB	1,000 MB or $1,000^3$ bytes
1 TB	1,000 GB or $1,000^4$ bytes
1 PB	1,000 TB or $1,000^5$ bytes
1 EB	1,000 PB or $1,000^6$ bytes

Logical storage capacity values (e.g., logical device capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 KB	1,024 (2^{10}) bytes
1 MB	1,024 KB or $1,024^2$ bytes
1 GB	1,024 MB or $1,024^3$ bytes
1 TB	1,024 GB or $1,024^4$ bytes
1 PB	1,024 TB or $1,024^5$ bytes
1 EB	1,024 PB or $1,024^6$ bytes

Accessing Product Documentation

The user documentation for the Hitachi RAID storage systems is available on the Hitachi Data Systems Portal: https://hdssupport.hds.com. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting Help

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: https://hdssupport.hds.com

Comments

Please send us your comments on this document: doc.comments@hds.com Include the document title, number, and revision, and refer to specific section(s) and paragraph(s) whenever possible.

Thank you! (All comments become the property of Hitachi Data Systems.)

1

Introduction

This chapter provides an overview of the Hitachi RAID storage systems and host attachment:

- ☐ About the Hitachi RAID Storage Systems
- ☐ Device Types
- ☐ Installation and Configuration Roadmap

About the Hitachi RAID Storage Systems

The Hitachi RAID storage systems offer a wide range of storage and data services, including thin provisioning with Hitachi Dynamic Provisioning™ software, application-centric storage management and logical partitioning, and simplified and unified data replication across heterogeneous storage systems. These storage systems are an integral part of the Services Oriented Storage Solutions architecture from Hitachi Data Systems, providing the foundation for matching application requirements to different classes of storage and delivering critical services such as:

- Business continuity services
- Content management services (search, indexing)
- Non-disruptive data migration
- Volume management across heterogeneous storage arrays
- Thin provisioning
- Security services (immutability, logging, auditing, data shredding)
- Data de-duplication
- I/O load balancing
- Data classification
- File management services

The Hitachi RAID storage systems provide heterogeneous connectivity to support multiple concurrent attachment to a variety of host operating systems, including AIX and other UNIX platforms as well as Windows, Linux, VMware, and mainframe servers, enabling massive consolidation and storage aggregation across disparate platforms. The storage systems can operate with multi-host applications and host clusters, and are designed to handle very large databases as well as data warehousing and data mining applications that store and retrieve terabytes of data.

The Hitachi RAID storage systems are configured with OPEN-V logical units (LUs) and are compatible with most fibre-channel (FC) host bus adapters (HBAs). Users can perform additional LU configuration activities using the LUN Manager, Virtual LVI/LUN (VLL), and LUN Expansion (LUSE) features provided by the Storage Navigator software, which is the primary user interface for the storage systems.

For further information on storage solutions and the Hitachi RAID storage systems, please contact your Hitachi Data Systems account team.

Device Types

Table 1-1 describes the types of logical devices (volumes) that can be installed and configured for operation with the Hitachi RAID storage systems on a Solaris operating system. Table 1-2 lists the specifications for devices supported by the Hitachi RAID storage systems. Logical devices are defined to the host as SCSI disk devices, even though the interface is fibre channel. For information about configuring devices other than OPEN-V, contact your Hitachi Data Systems representative.

The sector size for the devices is 512 bytes.

Table 1-1 Logical Devices Supported by the Hitachi RAID Storage Systems

Device Type	Description
OPEN-V Devices	OPEN-V logical units (LUs) are disk devices (VLL-based volumes) that do not have a predefined size.
OPEN-x Devices	OPEN-*x* logical units (LUs) (e.g., OPEN-3, OPEN-9) are disk devices of predefined sizes. The Hitachi RAID storage systems support OPEN-3, OPEN-8, OPEN-9, OPEN-E, and OPEN-L, devices. For the latest information on usage of these device types, contact your Hitachi Data Systems account team.
LUSE Devices (OPEN-x*n)	LUSE devices are combined LUs that can be from 2 to 36 times larger than standard OPEN-x LUs. Using LUN Expansion (LUSE) remote console software, you can configure these custom-size devices. LUSE devices are designated as OPEN-x*n, where x is the LU type (e.g., OPEN-9*n) and 2< n < 36). For example, a LUSE device created from 10 OPEN-3 LUs is designated as an OPEN-3*10 disk device. This lets the host combine logical devices and access the data stored on the Hitachi RAID storage system using fewer LU numbers.
VLL Devices (OPEN-x VLL)	VLL devices are custom-size LUs that are smaller than standard OPEN-*x* LUs. Using Virtual LVI/LUN remote console software, you can configure VLL devices by “slicing” a single LU into several smaller LUs that best fit your application needs to improve host access to frequently used files. The product name for the OPEN-*x* VLL devices is OPEN-*x*-CVS (CVS stands for custom volume size). The OPEN-L LU type does not support Virtual LVI/LUN.
VLL LUSE Devices (OPEN-x*n VLL)	VLL LUSE devices combine Virtual LVI/LUN devices (instead of standard OPEN-*x* LUs) into LUSE devices. Use the Virtual LVI/LUN feature to create custom-size devices, then use the LUSE feature to combine the VLL devices. You can combine from 2 to 36 VLL devices into one VLL LUSE device. For example, an OPEN-3 LUSE volume created from a0 OPEN-3 VLL volumes is designated as an OPEN-3*10 VLL device (product name OPEN-3*10-CVS).
FX Devices (3390-3A/B/C, OPEN-x-FXoto)	The Hitachi Cross-OS File Exchange (FX) software allows you to share data across mainframe, UNIX, and PC server platforms using special multiplatform volumes. The VLL feature can be applied to FX devices for maximum flexibility in volume size. For more information about FX, see the *Cross-OS File Exchange User’s Guide*, or contact your Hitachi Data Systems account team. FX devices are not SCSI disk devices, and must be installed and accessed as raw devices. UNIX/PC server hosts must use FX to access the FX devices as raw devices (no file system, no mount operation). The 3390-3B devices are write-protected from UNIX/PC server access. The Hitachi RAID storage system rejects all UNIX/PC server write operations (including fibre-channel adapters) for 3390-3B devices. Multiplatform devices are not write-protected for UNIX/PC server access. Do not execute any write operation by the fibre-channel adapters on these devices. Do not create a partition or file system on these devices. This will overwrite any data on the FX device and prevent the FX software from accessing the device.

Table 1-2 Device Specifications

Device Type	Category (Note 1)	Product Name (Note 2)	# of Blocks (512 B/blk)	# of Cylinders	# of Heads	# of Sectors per Track	Capacity (MB) (Note 3)
OPEN-3	SCSI disk	OPEN-3	4806720	3338	15	96	2347
OPEN-8	SCSI disk	OPEN-8	14351040	9966	15	96	7007
OPEN-9	SCSI disk	OPEN-9	14423040	10016	15	96	7042
OPEN-E	SCSI disk	OPEN-E	28452960	19759	15	96	13893
OPEN-L	SCSI disk	OPEN-L	71192160	49439	15	96	34761
OPEN-V	SCSI disk	OPEN-V	125827200 max ***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3*n	SCSI disk	OPEN-3*n	4806720*n	3338*n	15	96	2347*n
OPEN-8*n	SCSI disk	OPEN-8*n	14351040*n	9966*n	15	96	7007*n
OPEN-9*n	SCSI disk	OPEN-9*n	14423040*n	10016*n	15	96	7042*n
OPEN-E*n	SCSI disk	OPEN-E*n	28452960*n	19759*n	15	96	13893*n
OPEN-L*n	SCSI disk	OPEN-L*n	71192160*n	49439*n	15	96	34761*n
OPEN-V*n	SCSI disk	OPEN-L*n	***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3 VLL	SCSI disk	OPEN-3-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-8 VLL	SCSI disk	OPEN-8-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-9 VLL	SCSI disk	OPEN-9-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-E VLL	SCSI disk	OPEN-E-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-V VLL	SCSI disk	OPEN-V	***Note 4***	***Note 5***	15	128	***Note 6***
OPEN-3*n VLL	SCSI disk	OPEN-3*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-8*n VLL	SCSI disk	OPEN-8*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-9*n VLL	SCSI disk	OPEN-9*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-E*n VLL	SCSI disk	OPEN-E*n-CVS	***Note 4***	***Note 5***	15	96	***Note 6***
OPEN-V*n VLL	SCSI disk	OPEN-V*n	***Note 4***	***Note 5***	15	128	***Note 6***
3390-3A	FX otm/mto	3390-3A	5820300	3345	15	116	2844
3390-3B	FXmto	3390-3B	5816820	3343	15	116	2844
3390-3C	FXotm	OP-C-3390-3C	5820300	3345	15	116	2844
FX OPEN-3	FXoto	OPEN-3	4806720	3338	15	96	2347
3390-3A VLL	FX otm/mto	3390-3A-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
3390-3B VLL	FXmto	3390-3B-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
3390-3C VLL	FXotm	OP-C-3390-3C-CVS	***Note 4***	***Note 5***	15	116	***Note 6***
FX OPEN-3 VLL	FXoto	OPEN-3-CVS	***Note 4***	***Note 5***	15	96	***Note 6***

Note 1: The category of a device (SCSI disk or FX) determines its volume usage. Table 1-3 shows the volume usage for SCSI disk devices and FX devices. The SCSI disk devices (OPEN-*x*, VLL, LUSE, and VLL LUSE) are usually formatted with file systems for IBM AIX operations. The FX devices (3390-3A/B/C, and OPEN-*x*-FXoto) must be installed as raw devices and can only be accessed using the FX software. Do not partition or create a file system on any device used for FX operations.

Table 1-3 Volume Usage for Device Categories

Category	Device Type	Volume Usage
SCSI Disk	OPEN-*x*, OPEN-*x* VLL, OPEN-*x**n LUSE, OPEN-*x**n VLL LUSE	File System or Raw Device (e.g., some applications use raw devices)
FX	3390-3A/B/C 3390-3A/B/C VLL OPEN-*x* for FXoto, OPEN-*x* VLL for FXoto	Raw Device

Note 2: The command device (used for Command Control Interface (CCI) operations) is distinguished by **–CM** on the product name (e.g., OPEN-3-CM, OPEN-3-CVS-CM). The product name for VLL devices is OPEN-*x*-CVS, where CVS = custom volume size.

Note 3: This capacity is the maximum size which can be entered using the **lvcreate** command. The device capacity can sometimes be changed by the BIOS or host bus adapter. Also, different capacities may be due to variations such as 1 MB = 1000^2 or 1024^2 bytes.

Note 4: The number of blocks for a VLL volume is calculated as follows:

# of blocks = (# of data cylinders) × (# of heads) × (# of sectors per track)

The number of sectors per track is 128 for OPEN-V and 96 for the other emulation types.

Example: For an OPEN-3 VLL volume with capacity = 37 MB:

# of blocks = (53 cylinders – see Note 2) × (15 heads) × (96 sectors per track) = 76320

Note 5: The number of data cylinders for a Virtual LVI/LUN volume is calculated as follows (↑**...**↑ means that the value should be rounded up to the next integer):

- Number of data cylinders for OPEN-*x* VLL volume (except for OPEN-V) =
  # of cylinders = ↑ (capacity (MB) × 1024/720 ↑

  Example: For OPEN-3 VLL volume with capacity = 37 MB:

  # of cylinders = ↑37 × 1024/720↑ = ↑52.62↑
  = 53 cylinders

- Number of data cylinders for an OPEN-V VLL volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑

  Example: For OPEN-V VLL volume with capacity = 50 MB:

  # of cylinders = ↑50 × 16/15↑ = ↑53.33↑ = 54 cylinders

- Number of data cylinders for a VLL LUSE volume (except for OPEN-V) =
  # of cylinders = ↑ (capacity (MB) × 1024/720 ↑ × n

  Example: For OPEN-3 VLL LUSE volume with capacity = 37 MB and n = 4:

  # of cylinders = ↑37 × 1024/720↑ × 4 = ↑52.62↑ × 4 = 53 × 4 = 212

- Number of data cylinders for an OPEN-V VLL LUSE volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑ × n

  Example: For OPEN-V VLL LUSE volume with capacity = 50 MB and n = 4:

  # of cylinders = ↑50 × 16/15↑ × 4 = ↑53.33↑× 4 = 54 × 4 = 216

- Number of data cylinders for a 3390-3A/C =
  # of cylinders = (number of cylinders) + 9

- Number of data cylinders for a 3390-3B VLL volume =
  # of cylinders = (number of cylinders) + 7

S1 = maximum **lvcreate** size value for VLL, LUSE, and VLL LUSE devices. Calculate the maximum size value (in MB) as follows: S1 = (PE Size) × (Free PE). ***Note:*** Do not exceed the maximum **lvcreate** size value of 128 GB.

Note 6: The size of an OPEN-*x* VLL volume is specified by capacity in MB, not number of cylinders. The size of an OPEN-V VLL volume can be specified by capacity in MB or number of cylinders. The user specifies the volume size using the Virtual LVI/LUN software.

Installation and Configuration Roadmap

The steps in Table 1-4 outline the general process you follow to install and configure the Hitachi RAID storage system on an IBM AIX operating system.

Table 1-4 Installation and Configuration Roadmap

	Task
1.	Verify that the system on which you are installing the Hitachi RAID storage system meets the minimum requirements for this release.
2.	Prepare the Hitachi RAID storage system for the installation.
3.	Prepare the fibre-channel HBAs for the installation.
4.	Connect the Hitachi RAID storage system to the IBM AIX host.
5.	Verify recognition of the new devices.
6.	Change the read/write time-out, queue type, and queue depth parameters for the new devices.
7.	Assign the new devices to volume groups and set the partition size.
8.	Create, mount, and verify the file system.

2

Installing the Storage System

This chapter describes how to install the Hitachi RAID storage system on an IBM AIX operating system:

- ☐ Requirements
- ☐ Preparing for the Storage System Installation
- ☐ Configuring the Host Fibre-Channel HBA(s)
- ☐ Connecting the Storage System to the IBM AIX Host
- ☐ Verifying New Device Recognition

Requirements

Table 2-1 lists and describes the requirements for installing the Hitachi RAID storage system on the AIX operating system.

Table 2-1 Requirements

Item	Requirements
Hitachi RAID storage system	The availability of features and devices depends on the level of microcode installed on the Hitachi RAID storage system. Use the LUN Manager software on Storage Navigator to configure the fibre-channel ports.
IBM AIX system hardware	Please refer to the Hitachi Data Systems interoperability site for specific support information for the AIX server: http://www.hds.com/products/interoperability
Latest HDS ODM updates	Consult your Hitachi Data Systems representative.
IBM AIX operating system	Please refer to the Hitachi Data Systems interoperability site for specific support information for the AIX operating system: http://www.hds.com/products/interoperability Root login access to the AIX system is required.
Fibre-channel HBAs	The Hitachi RAID storage system supports fibre-channel HBAs equipped as follows: ▪ 8-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 4-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 2-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors. ▪ 1-Gbps fibre-channel interface, including shortwave non-OFC optical interface and multimode optical cables with SC connectors. If a switch or HBA with a 1-Gbps transfer rate is used, configure the device to use a fixed 1-Gbps setting instead of Auto Negotiation. Otherwise, it may prevent a connection from being established. However, the transfer speed of CHF port cannot be set as 1 Gbps when the CHF is 8US/8UFC/16UFC. Therefore 1 Gbps HBA and switch cannot be connected. Do not connect OFC-type fibre-channel interfaces to the Hitachi RAID storage system. For information about supported fibre-channel HBAs, optical cables, hubs, and fabric switches, contact your Hitachi Data Systems account team. For information about supported HBAs, drivers, hubs, and switches, see the Hitachi Data Systems interoperability site: http://www.hds.com/products/interoperability
Fibre-channel utilities and tools	Refer to the documentation for your fibre-channel HBA for information about installing the utilities and tools for your adapter.
Fibre-channel drivers	Do not install/load the driver(s) yet. When instructed in this guide to install the drives for your fibre-channel HBA, refer to the documentation for your adapter.

Preparing for the Storage System Installation

The following sections describe preinstallation considerations to follow before installing the Hitachi RAID storage system.

Hardware Installation Considerations

The Hitachi Data Systems representative performs the hardware installation by following the precautions and procedures in the Maintenance Manual for the storage system.

Hardware installation activities include:

- Assembling all hardware and cabling
- Installing and formatting the logical devices (LDEVs). Be sure to obtain the desired LDEV configuration information from the user, including the desired number of OPEN-x, LUSE, VLL, VLL LUSE, and multiplatform (FX) devices.
- Installing the fibre-channel HBAs and cabling. The total fibre cable length attached to each fibre-channel adapter must not exceed 500 meters (1,640 feet).
  - Do not connect any OFC-type connectors to the storage system.
  - Do not connect/disconnect fibre-channel cabling that is being actively used for I/O. This can cause the IBM AIX system to hang.
  - Always confirm that the devices on the fibre cable are offline before connecting/disconnecting the fibre cable.
- Configuring the fibre port topology. The fibre topology parameters for each fibre-channel port depend on the type of device to which the port is connected, and the type of port. Determine the topology parameters supported by the device, and set your topology accordingly (see Configuring the Fibre-Channel Ports).

Before starting the installation, check all specifications to ensure proper installation and configuration.

Setting the System Option Modes

To provide greater flexibility, the Hitachi RAID storage systems have additional operational parameters called *system option modes* (SOMs) that allow you to tailor the storage system to your unique operating requirements. The SOMs are set on the service processor (SVP) by your Hitachi Data Systems representative.

To set and manage the SOMs

1. Review the SOMs for your operational environment. The SOMs are described in detail in the *User and Reference Guide* for your storage system model:
   - *Hitachi VSP User and Reference Guide*, MK-90RD7042
   - *Hitachi USP V/VM User and Reference Guide*, MK-96RD635
2. Work with your Hitachi Data Systems team to make sure the appropriate SOMs are set on your storage system.
3. Check each new revision of the *User and Reference Guide* to see if there are any SOM changes that may apply to your operational environment. If so, contact your Hitachi Data Systems team.

LUN Manager Software Installation

The LUN Manager software on Storage Navigator is used to configure the fibre-channel ports. The user or Hitachi Data Systems representative installs the LUN Manager software. For instructions, see the *Storage Navigator User's Guide*.

Setting the Host Mode

The Hitachi RAID storage system has host modes that the storage administrator must set for all new installations (newly connected ports) to AIX hosts. The required host mode for IBM AIX is **0F**. Do not select a host mode other than **0F** for IBM AIX.

Use LUN Manager to set the host mode for each newly connected port. For instructions, see the *LUN Manager User's Guide* for the USP V/VM storage system or the *Provisioning Guide for Open Systems* for the VSP storage system.

Caution: Changing host modes on a Hitachi RAID storage system that is already installed and configured is disruptive and requires the server to be rebooted.

Setting the Host Mode Options

When each new host group is added, the storage administrator must be sure that all host mode options (HMOs) are set for all host groups connected to AIX hosts. Use LUN Manager to set the HMOs. For instructions, see the *LUN Manager User's Guide* for the USP V/VM storage system or the *Provisioning Guide for Open Systems* for the VSP storage system.

Table 2-2 lists the host mode options for AIX and specifies the conditions for setting the mode. Host mode option 13 is common to all platforms.

Caution: Changing host mode options on a Hitachi RAID storage system that is already installed and configured may be disruptive and may require the server to be rebooted.

Table 2-2 Host Mode Options for IBM AIX

HMO	Function	Description	Notes
2	Veritas Database Edition™/ Advanced Cluster	Select HMO 2 if you are using either: ▪ Veritas Database Edition™/Advanced Cluster for Real Application Clusters, **or** ▪ Veritas Cluster Server™ 4.0 or later (I/O fencing function).	Mandatory. Do not apply this option to Sun™ Cluster.
13	SIM report at link failure	Select HMO 13 to enable SIM notification when the number of link failures detected between ports exceeds the threshold.	Optional This mode is common to all host platforms.
15	For HACMP	Select HMO 15 when HACMP is used. ▪ HACMP 5.1 Version 5.1.0.4 or later ▪ HACMP 4.5 Version 4.5.0.13 or later ▪ HACMP 5.2 or later	Mandatory
22	For Veritas Cluster Server	When a reserved volume receives a Mode Sense command from a node that is not reserving this volume, the host will receive the following responses from the storage system: ON: Normal response OFF (default): Reservation Conflict ***Note:*** 1. When HMO 22 is ON, the volume status (reserved/non-reserved) will be checked more frequently (several tens of msec per LU). 2. When HMO 22 is ON, the host OS will not receive warning messages when a Mode Select command is issued to a reserved volume. 3. There is no impact on the Veritas Cluster Server software when HMO 22 is OFF. Set HMO 22 to ON when the software is experiencing numerous reservation conflicts. 4. Set HMO 22 to ON when Veritas Cluster Server is connected.	***Note:*** ▪ Before setting HMO 22 ask your Hitachi Data Systems representative for assistance. ▪ HMO 22 can be changed while the host is online. However I/O activity may be affected when it is being changed. It is recommended to stop the host IO on the port where you want to change the HMO 22 setting.

Configuring the Fibre-Channel Ports

Use the LUN Manager software on Storage Navigator to configure the fibre-channel ports with the appropriate fibre parameters. Select the appropriate settings for each port based on the device to which the port is connected. Determine the topology parameters supported by the device, and set your topology accordingly.

Table 2-3 explains the settings for defining port parameters. For instructions, see the *LUN Manager User's Guide* for the USP V/VM or the *Provisioning Guide for Open Systems* for the VSP.

Table 2-3 Fibre Parameter Settings

Fabric	Connection	Provides
Enable	FC-AL	FL-port (fabric port)
Enable	Point-to-Point	F-port (fabric port)
Disable	FC-AL	NL-port (private arbitrated loop)
Disable	Point-to-Point	*Not supported*

Note:

- The Hitachi RAID storage system supports up to 2048 LUs per port.
- If you plan to connect different types of servers to the Hitachi RAID storage system via the same fabric switch, use the zoning function of the fabric switch.
- Contact Hitachi Data Systems for information about port topology configurations supported by HBA/switch combinations. Not all switches support F-port connection.

Port Address Considerations for Fabric Environments

In fabric environments, port addresses are assigned automatically by fabric switch port number and are not controlled by the storage system port settings. In arbitrated loop environments, the port addresses are set by entering an AL-PA (arbitrated-loop physical address, or loop ID).

Table 2-4 shows the available AL-PA values ranging from **01** to **EF**. Fibre-channel protocol uses the AL-PAs to communicate on the fibre-channel link, but the software driver of the platform host adapter translates the AL-PA value assigned to the port to a SCSI TID. See Appendix A for a description of the AL-PA-to-TID translation.

Table 2-4 Available AL-PA Values

EF	CD	B2	98	72	55	3A	25
E8	CC	B1	97	71	54	39	23
E4	CB	AE	90	6E	53	36	1F
E2	CA	AD	8F	6D	52	35	1E
E1	C9	AC	88	6C	51	34	1D
E0	C7	AB	84	6B	4E	33	1B
DC	C6	AA	82	6A	4D	32	18
DA	C5	A9	81	69	4C	31	17
D9	C3	A7	80	67	4B	2E	10
D6	BC	A6	7C	66	4A	2D	0F
D5	BA	A5	7A	65	49	2C	08
D4	B9	A3	79	63	47	2B	04
D3	B6	9F	76	5C	46	2A	02
D2	B5	9E	75	5A	45	29	01
D1	B4	9D	74	59	43	27	
CE	B3	9B	73	56	3C	26	

Loop ID Conflicts

The IBM AIX operating system assigns port addresses from lowest (**01**) to highest (**EF**). To avoid loop ID conflict, assign the port addresses from highest to lowest (i.e., starting at **EF**). The AL-PAs should be unique for each device on the loop to avoid conflicts. Do not use more than one port address with the same TID in same loop (e.g., addresses **EF** and **CD** both have TID 0, see Appendix A for the TID-to-AL-PA mapping).

Configuring the Host Fibre-Channel HBA(s)

Configure the fibre-channel HBA(s) connected to the Hitachi RAID storage system. The HBAs have many configuration options. For more information, refer to the documentation for your fibre-channel HBA(s).

Connecting the Storage System to the IBM AIX Host

After you prepare the Hitachi RAID storage system hardware and software and fibre-channel HBA(s), connect the storage system to the IBM AIX system.

Table 2-5 summarizes the steps for connecting the Hitachi RAID storage system to the AIX host. Some steps are performed by the Hitachi Data Systems representative, while others are performed by the user.

Table 2-5 Steps for Connecting the Storage System to an AIX Host

	Activity	Performed by	Description
1.	Verify Hitachi RAID storage system installation	Hitachi Data Systems representative	Confirm that the status of the fibre-channel HBA(s) and LDEVs is NORMAL.
2.	Shut down the AIX system	User	Power off the AIX system before connecting the Hitachi RAID storage system. ▪ Shut down the AIX system. ▪ When shutdown is complete, power off the IBM AIX display. ▪ Power off all peripheral devices except for the Hitachi RAID storage system. ▪ Power off the host system. You are now ready to connect the storage system.
3.	Connect the Hitachi RAID storage system	Hitachi Data Systems representative	Install fibre-channel cables between the Hitachi RAID storage system and the AIX system. Follow all precautions and procedures in the Maintenance Manual. Check all specifications to ensure proper installation and configuration.
4.	Power on the AIX system	User	Power on the AIX system after connecting the Hitachi RAID storage system: ▪ Power on the IBM AIX system display. ▪ Power on all peripheral devices. The Hitachi RAID storage system should be on, the fibre-channel ports should be configured, and the driver configuration file and system configuration file should be edited. If the fibre ports are configured or configuration files edited after the AIX system is powered on, restart the system to have the new devices recognized. ▪ Confirm the ready status of all peripheral devices, including the storage system. ▪ Power on the AIX system.

Verifying New Device Recognition

The final step before configuring the new disk devices is to verify that the host system recognizes the new devices. The host system automatically creates a device file for each new device recognized.

Hitachi Data Systems recommends that the devices should be installed and formatted with the fibre ports configured before the host system is powered on. Enter the **cfgmgr** command to force the system to check the buses for new devices.

To verify new device recognition:

1. Log in to the host system as **root**.
2. Display the system device data by entering the following command (see Figure 2-1):

   lsdev -C -c disk
3. Verify that the system recognizes all new disk devices, including OPEN-x, LUSE, VLL, VLL LUSE, and FX devices. The devices are listed by device file name.
4. Make a blank table (see Table 2-6 for a sample) to record the device data. The table must include the device file name, bus number, TID, LUN, and device type for each new device.
5. Record the device information for all new devices in your device data table (see Table 2-6). You need this information in order to change the device parameters.

```
# lsdev -C -c disk                                          ← Display device data.
hdisk0  Available 10-68-00-0,0 16 Bit SCSI Disk Drive
hdisk1  Available 00-01-00-2,0  Hitachi Disk Array (Fibre)  ← New device.
hdisk2  Available 00-01-00-2,1  Hitachi Disk Array (Fibre)  ← New device.
   ↖ Device file name = hdiskx.
 :
#
```

Figure 2-1 Verifying New Device Recognition

This example shows the following information:

- The device hdisk1 is TID=2, LUN=0 on bus 1.
- The device hdisk2 is TID=2, LUN=1 on bus 1.

Note: When you create the FX volume definition file (`datasetmount.dat`), provide the device file names for the FX devices. For example, if hdisk3 is a 3390-3B FX device, the entry for this volume in the FX volume definition file is: `\\.\PHYSICALDRIVE3 XXXXXX 3390-3B` (where `XXXXXX` is the VOLSER)

Table 2-6 Device Data Table

Device File Name	Bus No.	TID	LUN	Device Type	Alternate Path(s)	
hdisk1					TID:____ LUN:____	TID:____ LUN:____
hdisk2					TID:____ LUN:____	TID:____ LUN:____
hdisk3					TID:____ LUN:____	TID:____ LUN:____
hdisk4					TID:____ LUN:____	TID:____ LUN:____
hdisk5					TID:____ LUN:____	TID:____ LUN:____
hdisk6					TID:____ LUN:____	TID:____ LUN:____
hdisk7					TID:____ LUN:____	TID:____ LUN:____
hdisk8					TID:____ LUN:____	TID:____ LUN:____
hdisk9					TID:____ LUN:____	TID:____ LUN:____
and so on...						

3

Configuring the New Disk Devices

This chapter describes how to configure the new disk devices on the AIX host:

- ☐ Changing Default Device Parameters
- ☐ Assigning New Devices to Volume Groups and Setting Partition Sizes
- ☐ Creating, Mounting, and Verifying File Systems

Changing Default Device Parameters

After the Hitachi RAID storage system is installed and connected, and device files are created, the AIX system sets device parameters to system default values. Using the System Management Information Tool (SMIT) or the AIX command line, you can change the read/write time-out, queue type, and queue depth parameters for each new device. Both methods are described in the following sections.

Note: When you set parameters for the FX devices and SCSI disk devices, use the same settings and device parameters for all storage system devices.

Note: If you installed the ODM update, skip this section and proceed to Assigning New Devices to Volume Groups and Setting Partition Sizes.

Table 3-1 lists the read/write time-out and queue type requirements for the devices. Table 3-2 lists the queue depth requirements for the devices.

Table 3-1 Read/Write Time-Out and Queue Type Requirements

Parameter Name	Default Value	Requirement
Read/write time-out	30	60
Queue type	none	simple

Table 3-2 Queue Depth Requirements

Parameter	Requirement
Queue depth per LU	≤ 32
Queue depth per port (MAXTAGS)	≤ 2048 per port

Note: To optimize the I/O performance of the devices, you can adjust the queue depth for the devices within the specified range later as needed.

Changing Device Parameters using SMIT

To change the device parameters using SMIT:

1. At the AIX command line prompt, type the following command to start SMIT and open the System Management panel: **smit**
2. On the SMIT System Management panel, select **Devices** to bring up the Devices panel.
3. Select **Fixed Disk** to bring up the Fixed Disk panel.
4. Select **Change / Show Characteristics of a Disk** to open the Disk panel (see Figure 3-1).
5. Select the desired device from the **Disk** menu to open the Change/Show Characteristics of a Disk panel.
6. Enter the desired queue depth (see Table 3-2), queue type (simple), and read/write time-out value (60). Press Enter to complete the parameter changes.
7. Repeat steps 5 and 6 for each new device.
8. Type the following command to verify that the parameters for all devices were changed:

   lsattr -E -1 hdiskx

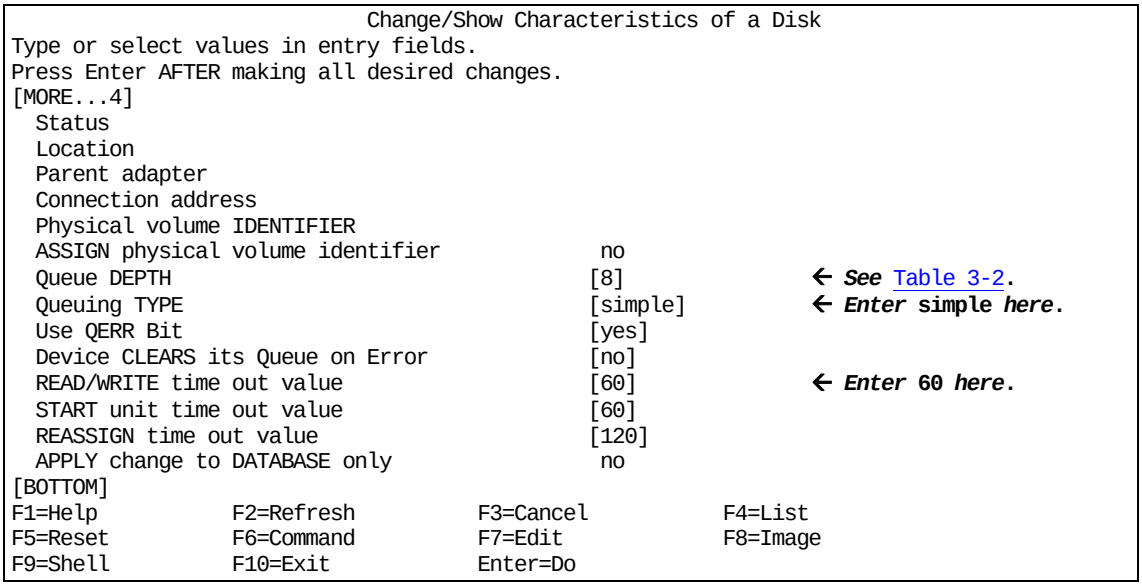


Figure 3-1 Changing the Device Parameters Using SMIT

Changing Device Parameters from the AIX Command Line

To change the device parameters from the AIX command line:

1. Type the following command at the AIX command line prompt to display the parameters for the specified device:

   ```
   lsattr -E -l hdiskx
   ```

   Note: **'hdiskx'** is the device file name, e.g., hdisk2. You can also use the **`lscfg -vl hdiskx`** command (see Figure 3-3).

2. Type the following commands to change the device parameters:

   ```
   cfgmr
   rmdev -l hdisk$i
   chdev -l hdisk$i -a reserve_policy=no_reserve -a queue_depth=8 -a algorithm=round_robin
   mkdev -l hdisk$i
   ```

   Note: *x* is used to indicate the desired queue depth within the limits specified in Table 3-2.

3. Repeat steps 1 and 2 for each new device.

4. Type the following command to verify that the parameters for all devices were changed (see Figure 3-2):

   ```
   lsattr -E -1 hdiskx
   ```

```
#lsattr -E -1 hdisk1
scsi_id       0xef                                SCSI ID
lun_id        0x0                                 LUN ID
location                                          Location Label
ww_name       0x500490e802757500                  FC World Wide Name for this LUN
pvid          000432871c6bbceb0000000000000000    Physical volume identifier
queue_depth   8                                   Queue DEPTH
q_type        simple                              Queuing TYPE
q_err         yes                                 Use QERR bit
clr_q         no                                  Device CLEARS its Queue on error
rw_timeout    60                                  READ/WRITE time out value
start_timeout 60                                  START unit time out value
reassign_to   120                                 REASSIGN time out value
```

Figure 3-2 Verifying the Device Parameters Using the lsattr -E -1 hdiskx Command

```
#lscfg -vl hdisk1
DEVICE            LOCATION          DESCRIPTION
hdisk1            20-58-01          Other FC SCSI Disk Drive
Manufacturer.....HITACHI
Machine Type and Model......OPEN-3              Type of device emulation
ROS Level and ID.....30313130
Serial Number.....04007575      Type of System and serial number (hex)
Device Specific.(Z0).....000002026300003A
Device Specific.(Z1).....0200 1A                LCU (02) LDEV (00) and port (1A)
Device Specific.(Z2).....
```

Figure 3-3 Verifying the Device Parameters Using the lscfg -vl hdisk1 Command

Assigning New Devices to Volume Groups and Setting Partition Sizes

After you change the device parameters, assign the new SCSI disk devices to new or existing volume groups and set the partition size using SMIT. If SMIT is not installed, refer to the IBM AIX user guide for instructions on assigning new devices to volume groups using AIX commands.

- Table 3-3 specifies the partition sizes for standard LUs.
- Table 3-4 specifies the partition sizes for VLL LUSE devices.
- Table 3-5 specifies the partition sizes for LUSE devices (OPEN-x*n).

Note: **Do not assign the FX devices (e.g., 3390-3A/B/C) to volume groups.** If you are configuring storage devices for databases that use a "raw" partition, do not assign those devices to volume groups.

To assign the SCSI disk devices to volume groups and set the partition size:

1. At the AIX command line prompt, type the following command to start SMIT and open the System Management panel: **`smit`**
2. Select **System Storage Management (Physical & Logical Storage)** to open the System Storage Management panel.
3. Select **Logical Volume Manager** to open the Logical Volume Manager panel.
4. Select **Volume Groups** to open the Volume Group panel.
5. Select **Add a Volume Group** to open the Add a Volume Group panel.
6. Using the Add a Volume Group panel (see Figure 3-4), you can assign one or more devices (physical volumes) to a new volume group and set the physical partition size:
   a. Place the cursor in the **VOLUME GROUP name** entry field. Enter the name of the new volume group (e.g., USPvg0). A volume group can contain multiple hdisk devices, depending on the application.
   b. Place the cursor in the **Physical partition SIZE in megabytes** field, and press the **F4** key. When the size menu appears, select the correct partition size for the device(s).
   c. Place the cursor in the **PHYSICAL VOLUME names** entry field. Enter the device file name(s) for the desired device(s) (e.g., hdisk1), or press **F4** and select the device file name(s) from the list.
   d. Place the cursor in the **Activate volume group AUTOMATICALLY** entry field.
   e. Type **yes** to activate the volume group automatically at system restart (or type **no** if you are using a High Availability Multi-Cluster Processing [HACMP] product.

7. Press the **Enter** key.
8. When the confirmation panel opens, select **Yes** to assign the specified device(s) to the specified volume group with the specified partition size.
9. When the Command Status panel opens, wait for OK to appear on the Command Status line (this response ensures that the devices have been assigned to a volume group).
10. To continue creating volume groups, press F3 until the Add a Volume Group panel opens.
11. Repeat steps 2 through 9 until all new disk devices are assigned to a volume group.

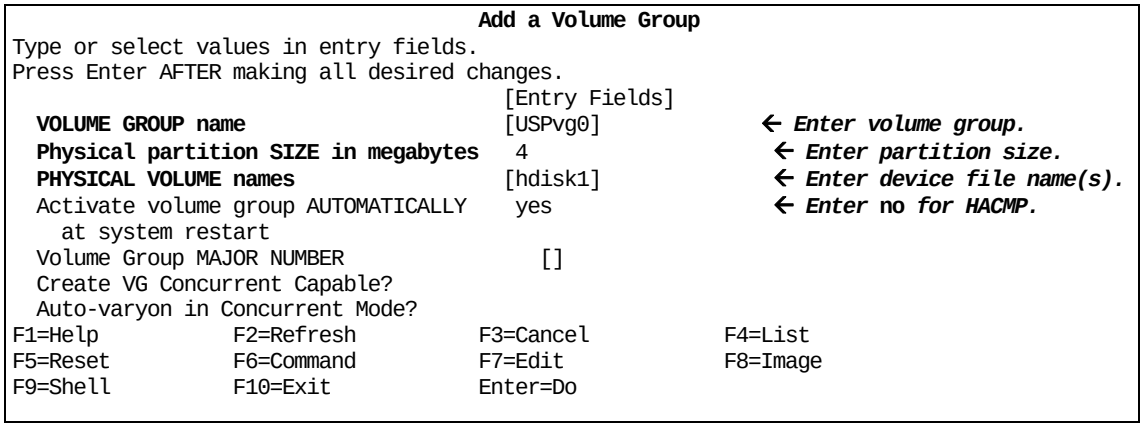


Figure 3-4 Assigning Devices to Volume Groups and Setting the Partition Size

Table 3-3 Partition Sizes for Standard LUs

Device Type	Partition Size
OPEN-3	4
OPEN-8	8
OPEN-9	8
OPEN-E	16
OPEN-L	64
OPEN-V	256 (default size)

Table 3-4 Partition Sizes for VLL LUSE Devices

Device Type	LU Size (MB)	Partition Size (MB)
OPEN-*x**n VLL	35-1800	2
	1801-2300	4
	2301-7000	8
	7001-16200	16
	13201-32400	32
	32401-64800	64
	64801-126000	128
	126001–259200	256
	259201–518400	512
	518401 and higher	1024

Table 3-5 Partition Sizes for LUSE Devices

Device Type	LUSE Configuration	Partition Size (MB)
OPEN-3	OPEN-3	4
	OPEN-3*2-OPEN-3*3	8
	OPEN-3*4-OPEN-3*6	16
	OPEN-3*7-OPEN-3*13	32
	OPEN-3*14-OPEN-3*27	64
	OPEN-3*28-OPEN-3*36	128
OPEN-8	OPEN-8	8
	OPEN-8*2	16
	OPEN-8*3-OPEN-8*4	32
	OPEN-8*5-OPEN-8*9	64
	OPEN-8*10-OPEN-8*18	128
	OPEN-8*19-OPEN-8*36	256
OPEN-9	OPEN-9	8
	OPEN-9*2	16
	OPEN-9*3-OPEN-9*4	32
	OPEN-9*5-OPEN-9*9	64
	OPEN-9*10-OPEN-9*18	128
	OPEN-9*19-OPEN-9*36	256
OPEN-E	OPEN-E	16
	OPEN-E*2	32
	OPEN-E*3,OPEN-E*4	64
	OPEN-E*5-OPEN-E*9	128
	OPEN-E*10-OPEN-E*18	256
OPEN-L	OPEN-L	64
	OPEN-L*2-OPEN-L*3	128
	OPEN-L*4-OPEN-L*7	256
OPEN-V	OPEN-V is a VLL-based volume	

Creating, Mounting, and Verifying File Systems

After you assign SCSI disk devices to volume groups and set the partition sizes, create the file systems. Table 3-6 summarizes the steps for creating, mounting, and verifying the file systems for new SCSI disk devices.

Table 3-6 Steps for Creating, Mounting, and Verifying the File Systems

	Task
1.	Create the file systems
2.	Mount and verify the mount directories

Note: Do not create file systems or mount directories for the FX devices (e.g., 3390-3A). These devices are accessed as raw devices and do not require any further configuration after being partitioned and labeled.

Creating the File Systems

To create the file systems for the newly installed SCSI disk devices:

1. At the AIX command line prompt, type the following command to start SMIT and open the System Management panel: **`Smit`**

Note: If SMIT is not installed, refer to the IBM AIX user guide for instructions on creating file systems using AIX commands.

2. Select **System Storage Management (Physical & Logical Storage).** The System Storage panel opens.
3. Select **File Systems**. The File Systems panel opens.
4. Select **Add/Change/Show/Delete File Systems**. The Add/Change panel opens.
5. Select **Journaled File Systems**. The Journaled File System panel opens.
6. Select **Add a Standard Journaled File System**. The Volume Group Name panel opens.
7. Move the cursor to the selected volume group, then press **Enter**.
8. Select the desired value, then press **Enter** (see Figure 3-5).
9. In the **SIZE of file system** field, enter the desired file system size (see Table 3-7).
10. In the **Mount Point** field, enter the desired mount point name (e.g., **/USP_VG00**). Record the mount point name and file system size for use later in the configuration process.

11. In the **Mount AUTOMATICALLY** field, type **yes** to auto-mount the file systems.

Note: If you are using a HACMP product, do not set the file systems to auto-mount.

12. In the **Number of bytes per inode** field, enter the correct value for the selected device (see Table 3-8, Table 3-9, and Table 3-10).
13. Be sure that the file system size, mount point name, auto-mount options, and number of bytes per inode are correct. Press **Enter** to create the Journaled File System.
14. The Command Status panel appears. To be sure the Journaled File System has been created, wait for **OK** to appear on the Command Status line (see Figure 3-6).
15. Repeat steps 2 through 14 for each Journaled File System that you want to create. To continue creating Journaled File Systems press the **F3** key until you return to the Add a Journaled File System panel.
16. To exit SMIT, press **F10**.

```
                                Add a Journaled File System
Type or select values in entry fields.
Press Enter AFTER making all desired changes.
                                                  [Entry Fields]
  Volume group name                                USPvg0
  SIZE of file system (in 512-byte blocks)        [4792320]      ← See Table 3-7.
  MOUNT POINT                                     [/USPVG00]     ← Enter mount point name.
  Mount AUTOMATICALLY at system restart?           yes           ← Enter no for HACMP.
  PERMISSIONS                                      read/write
  Mount OPTIONS                                    []
  Start Disk Accounting?                           no
  Fragment Size (bytes)                           4096
  Number of bytes per inode                       4096           ← See Table 3-8-Table 3-10
  Compression algorithm                            no
  Allocation Group Size (Mbytes)
F1=Help          F2=Refresh          F3=Cancel            F4=List
F5=Reset         F6=Command          F7=Edit              F8=Image
F9=Shell         F10=Exit            Enter=Do
```

Figure 3-5 Adding a Journaled File System Using SMIT

```
                                    COMMAND STATUS
Command : OK          stdout : yes          stderr : no

    Before command completion, additional instructions may appear below.

Based on the parameters chosen, the new /USP_VG00 JFS file system
is limited to a maximum size of 134217728 (512 byte blocks)
New Filesystems size is 4792320                    ← 4792320 is displayed for OPEN-3.

F1=Help          F2=Refresh          F3=Cancel          F6=Command
F8=Image         F9=Shell            F10=Exit           /=Find
n=Find Next
```

Figure 3-6 Verifying Creation of Journaled File System

Table 3-7 Journaled File System Size

Device Type	LU Product Name	Capacity (in 512-Byte Blocks)	Maximum File System Size *(see Note 1)* (in 512-Byte Blocks)
Standard LU	OPEN-3	4806720	4792320
	OPEN-8	14351040	14319616
	OPEN-9	14423040	14401536
	OPEN-E	28452960	28409856
	OPEN-L	71192160	71041024
	OPEN-V	Max.125827200	*Max.125566976*
	OPEN-*x**n	See Table 1-2.	(see ***Note 2***)
LUSE Device	OPEN-*x**n VLL	See Table 1-2.	(see ***Note 2***)
VLL LUSE Device	OPEN-*x**n VLL	See Table 1-2.	(see ***Note 2***)

Note 1: When determining SIZE of file system at **Add a Journaled File System**, AIX already uses an unspecified amount of disk space. You must determine the remaining space available for physical partitions.

Note 2: Calculate the file system size for these devices as follows:

1. Display the number of free physical partitions (FREE PPs) and physical partition size (PP SIZE) by entering the following command (see Figure 3-7): **lsvg**
2. Calculate the maximum size of the file system as follows:
   (FREE PPs – 1) × (PP SIZE) × 2048

Figure 3-7 shows an example for OPEN-3*20 LUSE:

Maximum file system size = (733 – 1) × (64) × 2048 = 95944704

```
# lsvg USPvg0
VOLUMEGROUP:   USPvg0              VG IDENTIFIER:   0083665612e98521
VG STATE:      active               PP SIZE:         64 megabyte(s)
VG PERMISSION: read/write           TOTAL PPs:       733 (46912 megabytes)
MAX LVs:       256                  FREE PPs:        733 (46912 megabytes)
LVs:           0                    USED PPS:        0 (0 megabytes)
OPEN LVs:      0                    QUORUM:          2
TOTAL PVs:     1                    VG DESCRIPTORS:  2
STALE PVs;     0                    STALE PPs        0
ACTIVE PVs     1                    AUTO ON:         yes
Concurrent:    Non-Capable          Auto-Concurrent: Disabled
VG Mode:       Non-Concurrent
```

Figure 3-7 Determining the Maximum File System Size

Table 3-8 Number of Bytes per Inode for LUSE Devices

Device Type	LU Product Name	Number of Bytes per Inode
OPEN-3	OPEN-3, OPEN-3*2-OPEN-3*28	4096
	OPEN-3*29-OPEN-3*36	8192
OPEN-8	OPEN-8, OPEN-8*2-OPEN-8*9	4096
	OPEN-8*10-OPEN-8*18	8192
	OPEN-8*19-OPEN-8*36	16384
OPEN-9	OPEN-9, OPEN-9*2-OPEN-9*9	4096
	OPEN-9*10-OPEN-9*18	8192
	OPEN-9*19-OPEN-9*36	16384
OPEN-E	OPEN-E, OPEN-E*2-OPEN-E*4	4096
	OPEN-E*5-OPEN-E*9	8192
	OPEN-E*10-OPEN-E*18	16384
OPEN-L	OPEN-L	4096
	OPEN-L*2-OPEN-L*3	8192
	OPEN-L*4-OPEN-L*7	16384
OPEN-V	See Table 3-10	

Table 3-9 Number of Bytes per Inode for VLL

Device Type	LU Product Name	Number of Bytes per Inode
OPEN-*x* VLL	OPEN-3 VLL, OPEN-8 VLL, OPEN-9 VLL, OPEN-E VLL, OPEN-V VLL	4096

Table 3-10 Number of Bytes per Inode for VLL LUSE

Device Type	LU size in Megabytes	Number of Bytes per Inode
OPEN-*x**n VLL	35-64800	4096
	64801-126000	8192
	126001 and higher	16384

Mounting and Verifying File Systems

After you create the Journaled File Systems, mount the file systems and verify that the file systems were created correctly and are functioning properly.

To mount and verify the file systems:

1. At the AIX command line prompt, type the following command:

   mount <*mount_point_name*> (e.g., mount/USP_VG00)

2. Repeat step 1 for each new file system.
3. Use the **df** command to verify the size of the file systems you created.

Note: The file system capacity is listed in 512-byte blocks by default. To list capacity in 1024-byte blocks, use the **df -k** command.

4. Verify that the new devices and file systems are fully operational by performing some basic operations (e.g., file creation, copying, deletion) on each device (see Figure 3-8).
5. Restart the system and verify that the file systems have successfully auto-mounted by using the **mount** or **df** command to display all mounted file systems (see Figure 3-9). Any file systems that were not auto-mounted can be set to auto-mount using SMIT.

Note: If you are using a HACMP™ product, do not set the file systems to auto-mount.

```
# cd /USPVG00      ← Go to mount point.
# cp /smit.log /USPVG00/smit.log.back1                          ← Copy file.
# ls -l USPVG00                                                 ← Verify file copy.
-rw-rw-rw-   1   root  system      375982 Nov 30 17:25 smit.log.back1
# cp smit.log.back1 smit.log.back2                              ← Copy file again.
# ls -l                                                         ← Verify copy again.
-rw-rw-rw-   1   root  system      375982 Nov 30 17:25 smit.log.back1
-rw-rw-rw-   1   root  system      375982 Nov 30 17:28 smit.log.back2
# rm smit.log.back1                                             ← Remove test file.
# rm smit.log.back2                                             ← Remove test file.
```

Figure 3-8 Verifying the Auto-Mounted File Systems

```
# df                                                            ← List mounted file systems.
File system  512-blocks      free  %Used  Iused  %Iused  Mounted on
/dev/hd4           8192      3176   61%    652     31%  /
/dev/hd2        1024000    551448   46%   6997      5%  /usr
/dev/hd9var        8192      5512   32%     66      6%  /var
/dev/hd3          24576     11608   52%     38      0%  /tmp
/dev/hd1           8192      7840    4%     17      1%  /home
/dev/lv00       4792320   4602128    4%     16      1%  /USPVG00      ← OPEN-3 device.
/dev/lv01       4792320   4602128    4%     16      1%  /USPVG01      ← OPEN-3 device.
/dev/lv02      14401536  13949392    4%     16      1%  /USPVG02      ← OPEN-9 device.
```

Figure 3-9 Final File System Verification

4

Using AIX with Object Data Manager (ODM)

This chapter describes the AIX Object Data Manager (ODM) and its relationship with the Hitachi RAID storage system:

Overview of ODM

The ODM is a repository of system information, which includes the basic components of object classes and characteristics. Information is stored and maintained as objects with associated characteristics.

System data managed by ODM includes:

- Device configuration information
- Display information for SMIT (menus, selectors, and dialogs)
- Vital product data for installation and update procedures
- Communications configuration information
- System resource information

IBM provides a predefined set of devices (PdDv) and attributes (PdAt). Hitachi Data Systems has added its own device definitions to the ODM, based on classes defined as objects with associated characteristics. This allows you to add devices that are recognized when the system boots or when the configuration manager command (**`cfgmgr`**) is executed. These devices have their own set of predefined attributes, which allows you to customize device definitions easily and automatically, thereby minimizing the amount of work required to define a device.

IBM provides a set of commands to manipulate the ODM and procedures to package ODM updates. For more information, see the references at the end of this chapter.

Installing the ODM 5.0.0.1 Fibre Update Package

The ODM update filesets include the ODM parameters for all Hitachi disks. The current file contains two install images:

- 5.0.0.1 AIX Support for Hitachi Disk Arrays
- 5.0.0.0 HACMP Support for Hitachi Disk Arrays

Both of these filesets are required when using concurrent resources with High Availability Multi-Cluster Processing (HACMP). HACMP must be installed prior to installing the HACMP support fileset.

Note: ODM updates can be found on the Product Documentation Library (PDL) CDs that ship with the hardware.

The ODM update for Hitachi Data Systems LUN definitions is only for releases of Hitachi Dynamic Link Manager (HDLM) and Dynamic Link Manager (DLM) versions 2.0.3 and later. Do not install the ODM update on earlier versions, because it will not recognize Hitachi-defined LUNs and will not build vpaths.

Previous versions of the ODM must be uninstalled before installing version 5.0.0.1 because this is a base level fileset. You can install the 5.0.0.4 update on either the 5.0.0.0 or 5.0.0.1 base. Installing to the 5.0.0.4 level includes all changes in previous ODM levels.

To install the Hitachi Data Systems ODM Fibre updates for AIX:

1. Type the following command to copy the fileset to an AIX directory (/usr/sys/inst.images)

   `# cp HDS_FC_ODM2.bff /usr/sys/inst.images`

2. Type the following commands to create a new .toc file:

   `#cd /usr/sys/inst.images`
   `#inutoc`

3. Use the command **`installp`** to install the AIX support fileset:

   `#smitty install`

4. Select **5.0.0.1 AIX Support for Hitachi Disk Arrays**.
5. Select **Install and Update Software**.
6. Select **Install and Update from LATEST Available Software**.
7. When prompted for an input device, enter the directory where the fileset was copied.
8. Press F4 to list the available installation packages.
9. Press F7 to select **5.0.0.1 AIX Support for Hitachi Disk Arrays**, then select **Enter**.
10. Press Enter to start the installation process.

11. If necessary, remove any Hitachi Data Systems devices already defined as **Other FC SCSI**.
    - To remove one device, type the command:
      #rmdev –dl hdisk(n)
    - To remove all devices on a path, type the command:
      #rmdev –dl fscsi(n) –R
9. Reboot AIX.
10. Confirm that the parameters have the following values:

```
#lsattr  -E  -l  hdisk(n)
pvid      •••
queue_depth       8
q_type    simple
q_err     yes
clr_q     no
rw_timeout 60
start_timeout     60
reassign_timeout  120
```

Uninstalling the ODM Fibre Update Package

To uninstall the Hitachi Data Systems ODM Fibre updates for AIX:

1. Use the **rmdev** command to remove all Hitachi LUNs from the system:
   - To remove a single hdisk, type the command:
     rmdev –dl hdisk(n)
   - To remove all hdisks on a path, type the command:
     rmdev –dl fscsi(n) –R
2. From the command line, type:
   smitty install
3. Select **Software Maintenance and Utilities**.
4. Select **Remove Installed Software.**
5. Select **F4** for **SOFTWARE name** to list all installed software.
6. Search (/) for **Hitachi**.
7. Select the package to remove pressing **F7** and then **Enter**.
8. Use either the **Tab** key or **F4** to change **PREVIEW only** to **No**.
9. Select **Enter** to remove the package.
10. Select **Enter** to confirm the warning message.
11. Reboot AIX.

Installing the ODM Fibre Update Package for 5.0.0.4

The following procedure described how to install the ODM Fibre Update Package for 5.0.0.4. You can only install the update for 5.0.0.4 if the base fileset is either version 5.0.0.0 or 5.0.0.1.

1. Type the following command to copy the fileset to an AIX directory (/usr/sys/inst.images):

   # cp HDS_FC_ODMUPD.bff /usr/sys/inst.images

2. Type the following commands to create a new .toc file:

   #cd /usr/sys/inst.images
   #inutoc

3. Use **installp** to install the AIX support fileset:

   #smitty install

4. Select **5.0.0.4 AIX Support for Hitachi Disk Arrays**.
5. Select **Install and Update Software**.
6. Select **Install and Update from LATEST Available Software**.
7. When prompted for an input device, enter the directory where the fileset was copied.
8. Press **F4** to list the available installation packages.
9. Press **F7** to select **5.0.0.1 AIX Support for Hitachi Disk Arrays**, and then select **Enter**.
10. Press **Enter** to start the installation process.
11. Reboot AIX.

Using ODM

Discovering New Devices

When the system boots and a new device is discovered, the system checks the ODM for a device definition that matches the new device. For a disk device, this is based on the SCSI inquiry command. If a match is found, then a customized definition (**CuDv** and **CuAt**) is built for that device using the default attributes for that device definition. The new device then has the description based in the ODM for that device (e.g., 2105 or LVD SCSI disk drive). This customized definition is persistent and will remain until the device is removed from the system. An active device will have an “available” status and is ready for use. A device that was available, but has been physically removed from the system will have a “defined” status and cannot be used.

Deleting Devices

A device’s definition remains until it is removed using the **rmdev** command. Some device attributes (such as physical volume identifier, SCSI ID, or Target ID) are unique to a device and remain until the device is removed using the **rmdev** command. A device definition remains in the ODM when an attribute (e.g., the WWN) changes. The definitions in the ODM are persistent and remain until a system administrator removes them.

Default Device Definitions for “Other FC SCSI Disk Drive”

Devices that are predefined in the ODM will be uniquely identified and have a predefined set of default attributes. Disk devices that do not have a predefined definition will be considered generic devices by AIX and will be defined as “Other FC SCSI Disk Drive”.

The predefined attributes for “Other FC SCSI Disk Drive” devices at AIX 4.3.3 and later are:

- attribute = "scsi_id"
- attribute = "lun_id"
- attribute = "location"
- attribute = "ww_name"
- attribute = "model_name"
- attribute = "pv"
- attribute = "pvid"
- attribute = "mode_data"
- attribute = "mode_default"
- attribute = "recovery_limit"
- attribute = "safe_relocate"
- attribute = "reset_delay"
- attribute = "queue_depth"
  (default=**1**)
- attribute = "q_type"
  (default=**simple**)
- attribute = "q_err"
- attribute = "clr_q"
- attribute = "ses_attach"
- attribute = "rw_timeout"
  (default=**30**)
- attribute = "start_timeout"
- attribute = "reassign_to"
- attribute = "pm_dev_itime"
- attribute = "pm_dev_stime"
- attribute = "pm_devid"

Queue Depth and Read/Write Timeout Values

The default IBM read/write timeout and queue depth values are different from the recommended and required values for Hitachi disk devices. For Hitachi disk devices:

- The required value for read/write timeout is 60.
- The default value for queue depth is 2.

If AIX defines a device as “Other FC SCSI Disk Drive”, the queue depth setting for that device is ignored, which can have a negative impact on performance. The disk devices on the Hitachi RAID storage system should be defined as **Hitachi Disk Array (Fibre)** and the queue depth should be at least 2. If the queue depth is changed, all devices on a storage port MUST have the same queue depth and must not exceed a total queue of 2048 per port. Contact your Hitachi Data Systems representative for more information about the recommended queue depth.

ODM Advantages and Cautions

Advantages

The Hitachi Data Systems ODM updates lets AIX recognize Hitachi disk devices and set the proper attributes. If the attributes for queue type, queue depth, and read/write timeout for all Hitachi disk devices are not the same, disk errors can be logged on both the disk storage system and in the AIX error log.

If the Hitachi ODM update is installed and a device is discovered, a match will be found in the ODM and the attributes will be set to the defaults recommended by the manufacturer. For Hitachi disk devices, the default queue depth will be set to 2 (with a range of 1-32) and the read/write timeout value will be set to 60. If the Hitachi ODM update is not installed, a system administrator will be required to run a **chdev** (change device) command for every device on the system to change the default attributes.

Cautions

Since the Hitachi ODM update changes attributes, it is possible that you may experience problems if you share ports on the Hitachi RAID storage system with multiple AIX servers at different ODM update levels (e.g., one AIX host at 5.0.0.0 and one AIX host at 5.0.0.2). Contact your Hitachi Data Systems representative for more information on restrictions when sharing ports.

ODM References

For more information about the configuration database and ODM, refer to the following references:

Device Configuration Database

http://www16.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/kernextc/device_config_db_over.htm

Device Configuration System

http://www16.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/kernextc/device_config_subsys.htm#a4d56110chri

List of ODM commands and subroutines:

- http://publib.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/genprogc/odm_cmds_subrs.htm
- http://publib.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/genprogc/odm.htm (Chapter 17. Object Data Manager)
- http://publib16.boulder.ibm.com/doc_link/en_US/a_doc_lib/aixprggd/genprogc/pkging_sw4_install.htm (Chapter 20. Packaging Software for Installation)

IBM Redbook:

- *Certification Study Guide*-pSeries®- AIX System Support
  http://www.redbooks.ibm.com/redbooks/pdfs/sg246199.pdf

5

Failover and SNMP Configuration

The Hitachi RAID storage systems support industry-standard products and functions that provide host and/or application failover, I/O path failover, and logical volume management (LVM). The Hitachi RAID storage systems also support the industry-standard simple network management protocol (SNMP) for remote storage system management from the UNIX/PC server host. SNMP is used to transport management information between the storage system and the SNMP manager on the host. The SNMP agent sends status information to the host(s) when requested by the host or when a significant event occurs.

This chapter describes how failover and SNMP operations are supported on the Hitachi RAID storage system. The topics covered in this chapter are:

- ☐ Host Failover
- ☐ Path Failover
- ☐ SNMP Remote System Management

Note: The user is responsible for configuring the failover and SNMP management software on the UNIX/PC server host. For assistance with failover and/or SNMP configuration on the host, refer to the user documentation, or contact the vendor's technical support.

Host Failover

The Hitachi RAID storage systems support High Availability Multi-Cluster Processing (HACMP) and Veritas Cluster Server host failover products for the IBM AIX operating system. The HACMP products are supported by Availant™ Incorporated.

The user must be sure to configure the HACMP software and any other middleware products (e.g., Tuxedo®) to recognize and operate with the newly attached devices.

For assistance with HACMP operations, refer to the HACMP user documentation or contact Availant technical support. For assistance with Veritas Cluster Server operations, refer to the Veritas user documentation, see Note on Using Veritas Cluster Server, or contact Symantec technical support. For assistance with specific configuration issues related to the Hitachi RAID storage system, contact the Hitachi Data Systems Support Center.

Note: HACMP products do not provide a complete disaster recovery or backup solution, and, as such, is not a replacement for standard disaster recovery planning and backup/recovery.

Path Failover

The Hitachi RAID storage systems support the Hitachi HiCommand Dynamic Link Manager (HDLM) and Veritas Volume Manager path failover products for the IBM AIX operating system. The user must be sure to configure the path failover software and any other products as needed to recognize and operate with the newly attached devices.

For further information, see the *Hitachi Dynamic Link Manager™ User's Guide for IBM® AIX® Systems* or contact your Hitachi Data Systems representative. For assistance with Veritas Volume Manager operations, refer to the Veritas user documentation, or contact Veritas technical support.

SNMP Remote System Management

SNMP is a part of the TCP/IP protocol suite that supports maintenance functions for storage and communication devices. The Hitachi RAID storage systems use SNMP to transfer status and management commands to the SNMP Manager on the UNIX/PC server host (see Figure 5-1). When the SNMP manager requests status information or when a service information message (SIM) occurs, the SNMP agent on the storage system notifies the SNMP manager on the UNIX/PC server. Notification of error conditions is made in real time, providing the UNIX/PC server user with the same level of monitoring and support available to the mainframe user. The SIM reporting via SNMP enables the user to monitor the storage system from the UNIX/PC server host.

When a SIM occurs, the SNMP agent initiates trap operations, which alert the SNMP manager of the SIM condition. The SNMP manager receives the SIM traps from the SNMP agent, and can request information from the SNMP agent at any time.

Note: The user is responsible for configuring the SNMP manager on the IBM AIX server host. For assistance with SNMP manager configuration on the IBM AIX server host, refer to the user documentation, or contact the vendor's technical support.

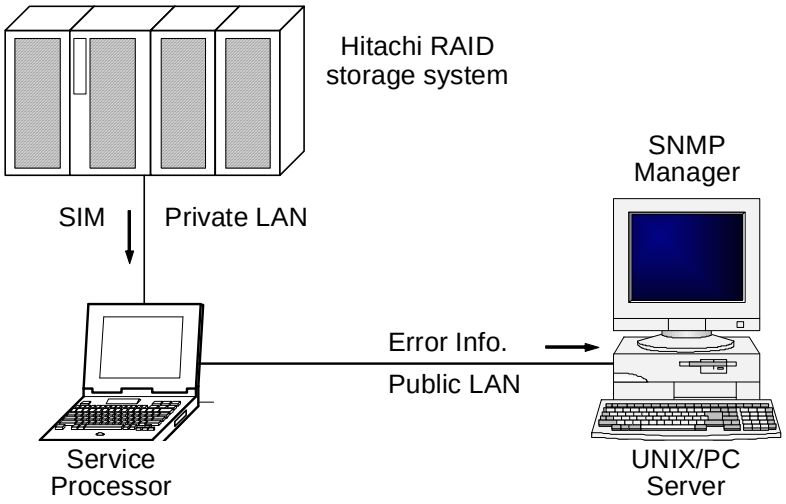


Figure 5-1 SNMP Environment

6

Troubleshooting

This chapter provides troubleshooting information for AIX host attachment and instructions for calling technical support.

- ☐ General Troubleshooting
- ☐ Calling the Hitachi Data Systems Support Center

General Troubleshooting

Table 6-1 lists potential error conditions that may occur during storage system installation and provides instructions for resolving each condition. If you cannot resolve an error condition, please contact your Hitachi Data Systems representative for help, or call the Hitachi Data Systems Support Center for assistance.

For troubleshooting information on the Hitachi RAID storage system, see the User and Reference Guide for the storage system (e.g., *Hitachi Virtual Storage Platform User and Reference Guide*).

For troubleshooting information on Hitachi Storage Navigator, see the Storage Navigator User's Guide for the storage system (e.g., *Hitachi Virtual Storage Platform Storage Navigator User Guide*).

For information on errors messages displayed by Storage Navigator, see the Storage Navigator Messages document for the storage system (e.g., *Hitachi Virtual Storage Platform Storage Navigator Messages*).

Table 6-1 Troubleshooting

Error Condition	Recommended Action
The logical devices are not recognized by the system.	Be sure the READY indicator lights on the storage system are ON. Run `cfgmgr` to recheck the fibre channel for new devices. Be sure LUSE devices are not intermixed with normal LUs or with FX devices on the same fibre-channel port. Verify that LUNs are configured properly for each TID.
The file system is not mounted after rebooting.	Be sure the system was restarted properly. Verify that the values listed under Journaled File System are correct.

Calling the Hitachi Data Systems Support Center

If you need to call the Hitachi Data Systems Support Center, provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure.
- The exact content of any error messages displayed on the host system(s).
- The exact content of any error messages displayed by Storage Navigator.
- The Storage Navigator configuration information (use the FD Dump Tool).
- The service information messages (SIMs), including reference codes and severity levels, displayed by Storage Navigator.

The Hitachi Data Systems customer support staff is available 24 hours a day, seven days a week. If you need technical support, log on to the Hitachi Data Systems Portal for contact information: https://hdssupport.hds.com

SCSI TID Maps for Fibre-Channel Adapters

When an arbitrated loop (AL) is established or re-established, the port addresses are assigned automatically to prevent duplicate target IDs (TID). When using the SCSI over fibre-channel protocol (FCP), TIDs are no longer needed. SCSI is a bus-oriented protocol requiring each device to have a unique address since all commands go to all devices.

For fibre channel, the AL-PA is used instead of the TID to direct packets to the desired destination. Unlike traditional SCSI, once control of the loop is acquired, a point-to-point connection is established from the initiator to the target. To enable transparent use of FCP, the AIX operating system "maps" a TID to each AL-PA.

Table A-1 and Table A-2 identify the fixed mappings between the bus/TID/LUN addresses assigned by AIX and the fibre-channel native addresses (AL_PA/SEL_ID) for fibre-channel adapters. There are two potential mappings depending on the value of the ScanDown registry parameter:

- For ScanDown = 0 (default) see Table A-1.
- For ScanDown = 1 see Table A-2.

Note: When Hitachi RAID storage system devices and other types of devices are connected in the same arbitrated loop, the mappings defined in Table A-1 and Table A-2 cannot be guaranteed.

Table A-1 SCSI TID Map (ScanDown=0)

Bus #	TID	LUN	AL_PA	SEL_ID
0	0-31	0-7	NONE	NONE
1	0	0-7	0x01	0x7D
	1	0-7	0x02	0x7C
	2	0-7	0x04	0x7B
	3	0-7	0x08	0x7A
	4	0-7	0x0F	0x79
	5	0-7	0x10	0x78
	6	0-7	0x17	0x77
	7	0-7	0x18	0x76
	8	0-7	0x1B	0x75
	9	0-7	0x1D	0x74
	10	0-7	0x1E	0x73
	11	0-7	0x1F	0x72
	12	0-7	0x23	0x71
	13	0-7	0x25	0x70
	14	0-7	0x26	0x6F
	15	0-7	0x27	0x6E
	16	0-7	0x29	0x6D
	17	0-7	0x2A	0x6C
	18	0-7	0x2B	0x6B
	19	0-7	0x2C	0x6A
	20	0-7	0x2D	0x69
	21	0-7	0x2E	0x68
	22	0-7	0x31	0x67
	23	0-7	0x32	0x66
	24	0-7	0x33	0x65
	25	0-7	0x34	0x64
	26	0-7	0x35	0x63
	27	0-7	0x36	0x62
	28	0-7	0x39	0x61
	29	0-7	0x3A	0x60
	30	0-7	0x3C	0x5F
	31	0-7	NONE	NONE

Table A-1 SCSI TID Map (ScanDown=0) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
2	0	0-7	0x43	0x5E
	1	0-7	0x45	0x5D
	2	0-7	0x46	0x5C
	3	0-7	0x47	0x5B
	4	0-7	0x49	0x5A
	5	0-7	0x4A	0x59
	6	0-7	0x4B	0x58
	7	0-7	0x4C	0x57
	8	0-7	0x4D	0x56
	9	0-7	0x4E	0x55
	10	0-7	0x51	0x54
	11	0-7	0x52	0x53
	12	0-7	0x53	0x52
	13	0-7	0x54	0x51
	14	0-7	0x55	0x50
	15	0-7	0x56	0x4F
	16	0-7	0x59	0x4E
	17	0-7	0x5A	0x4D
	18	0-7	0x5C	0x4C
	19	0-7	0x63	0x4B
	20	0-7	0x65	0x4A
	21	0-7	0x66	0x49
	22	0-7	0x67	0x48
	23	0-7	0x69	0x47
	24	0-7	0x6A	0x46
	25	0-7	0x6B	0x45
	26	0-7	0x6C	0x44
	27	0-7	0x6D	0x43
	28	0-7	0x6E	0x42
	29	0-7	0x71	0x41
	30	0-7	0x72	0x40
	31	0-7	NONE	NONE

Table A-1 SCSI TID Map (ScanDown=0) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
3	0	0-7	0x73	0x3F
	1	0-7	0x74	0x3E
	2	0-7	0x75	0x3D
	3	0-7	0x76	0x3C
	4	0-7	0x79	0x3B
	5	0-7	0x7A	0x3A
	6	0-7	0x7C	0x39
	7	0-7	0x80	0x38
	8	0-7	0x81	0x37
	9	0-7	0x82	0x36
	10	0-7	0x84	0x35
	11	0-7	0x88	0x34
	12	0-7	0x8F	0x33
	13	0-7	0x90	0x32
	14	0-7	0x97	0x31
	15	0-7	0x98	0x30
	16	0-7	0x9B	0x2F
	17	0-7	0x9D	0x2E
	18	0-7	0x9E	0x2D
	19	0-7	0x9F	0x2C
	20	0-7	0xA3	0x2B
	21	0-7	0xA5	0x2A
	22	0-7	0xA6	0x29
	23	0-7	0xA7	0x28
	24	0-7	0xA9	0x27
	25	0-7	0xAA	0x26
	26	0-7	0xAB	0x25
	27	0-7	0xAC	0x24
	28	0-7	0xAD	0x23
	29	0-7	0xAE	0x22
	30	0-7	0xB1	0x21
	31	0-7	NONE	NONE

Table A-1 SCSI TID Map (ScanDown=0) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
4	0	0-7	0xB2	0x20
	1	0-7	0xB3	0x1F
	2	0-7	0xB4	0x1E
	3	0-7	0xB5	0x1D
	4	0-7	0xB6	0x1C
	5	0-7	0xB9	0x1B
	6	0-7	0xBA	0x1A
	7	0-7	0xBC	0x19
	8	0-7	0xC3	0x18
	9	0-7	0xC5	0x17
	10	0-7	0xC6	0x16
	11	0-7	0xC7	0x15
	12	0-7	0xC9	0x14
	13	0-7	0xCA	0x13
	14	0-7	0xCB	0x12
	15	0-7	0xCC	0x11
	16	0-7	0xCD	0x10
	17	0-7	0xCE	0x0F
	18	0-7	0xD1	0x0E
	19	0-7	0xD2	0x0D
	20	0-7	0xD3	0x0C
	21	0-7	0xD4	0x0B
	22	0-7	0xD5	0x0A
	23	0-7	0xD6	0x09
	24	0-7	0xD9	0x08
	25	0-7	0xDA	0x07
	26	0-7	0xDC	0x06
	27	0-7	0xE0	0x05
	28	0-7	0xE1	0x04
	29	0-7	0xE2	0x03
	30	0-7	0xE4	0x02
	31	0-7	NONE	NONE

Table A-1 SCSI TID Map (ScanDown=0) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
5	0	0-7	0xE8	0x01
	1	0-7	0xEF	0x00
	2	0-7	NONE	NONE
	3	0-7	NONE	NONE
	4	0-7	NONE	NONE
	5	0-7	NONE	NONE
	6	0-7	NONE	NONE
	7	0-7	NONE	NONE
	8	0-7	NONE	NONE
	9	0-7	NONE	NONE
	10	0-7	NONE	NONE
	11	0-7	NONE	NONE
	12	0-7	NONE	NONE
	13	0-7	NONE	NONE
	14	0-7	NONE	NONE
	15	0-7	NONE	NONE
	16	0-7	NONE	NONE
	17	0-7	NONE	NONE
	18	0-7	NONE	NONE
	19	0-7	NONE	NONE
	20	0-7	NONE	NONE
	21	0-7	NONE	NONE
	22	0-7	NONE	NONE
	23	0-7	NONE	NONE
	24	0-7	NONE	NONE
	25	0-7	NONE	NONE
	26	0-7	NONE	NONE
	27	0-7	NONE	NONE
	28	0-7	NONE	NONE
	29	0-7	NONE	NONE
	30	0-7	NONE	NONE
	31	0-7	NONE	NONE

Table A-2 SCSI TID Map (ScanDown=1)

Bus #	TID	LUN	AL_PA	SEL_ID
0	0-31	0-7	NONE	NONE
1	0	0-7	0xEF	0x00
	1	0-7	0xE8	0x01
	2	0-7	0xE4	0x02
	3	0-7	0xE2	0x03
	4	0-7	0xE1	0x04
	5	0-7	0xE0	0x05
	6	0-7	0xDC	0x06
	7	0-7	0xDA	0x07
	8	0-7	0xD9	0x08
	9	0-7	0xD6	0x09
	10	0-7	0xD5	0x0A
	11	0-7	0xD4	0x0B
	12	0-7	0xD3	0x0C
	13	0-7	0xD2	0x0D
	14	0-7	0xD1	0x0E
	15	0-7	0xCE	0x0F
	16	0-7	0xCD	0x10
	17	0-7	0xCC	0x11
	18	0-7	0xCB	0x12
	19	0-7	0xCA	0x13
	20	0-7	0xC9	0x14
	21	0-7	0xC7	0x15
	22	0-7	0xC6	0x16
	23	0-7	0xC5	0x17
	24	0-7	0xC3	0x18
	25	0-7	0xBC	0x19
	26	0-7	0xBA	0x1A
	27	0-7	0xB9	0x1B
	28	0-7	0xB6	0x1C
	29	0-7	0xB5	0x1D
	30	0-7	0xB4	0x1E
	31	0-7	NONE	NONE

Table A-2 SCSI TID Map (ScanDown=1) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
2	0	0-7	0xB3	0x1F
	1	0-7	0xB2	0x20
	2	0-7	0xB1	0x21
	3	0-7	0xAE	0x22
	4	0-7	0xAD	0x23
	5	0-7	0xAC	0x24
	6	0-7	0xAB	0x25
	7	0-7	0xAA	0x26
	8	0-7	0xA9	0x27
	9	0-7	0xA7	0x28
	10	0-7	0xA6	0x29
	11	0-7	0xA5	0x2A
	12	0-7	0xA3	0x2B
	13	0-7	0x9F	0x2C
	14	0-7	0x9E	0x2D
	15	0-7	0x9D	0x2E
	16	0-7	0x9B	0x2F
	17	0-7	0x98	0x30
	18	0-7	0x97	0x31
	19	0-7	0x90	0x32
	20	0-7	0x8F	0x33
	21	0-7	0x88	0x34
	22	0-7	0x84	0x35
	23	0-7	0x82	0x36
	24	0-7	0x81	0x37
	25	0-7	0x80	0x38
	26	0-7	0x7C	0x39
	27	0-7	0x7A	0x3A
	28	0-7	0x79	0x3B
	29	0-7	0x76	0x3C
	30	0-7	0x75	0x3D
	31	0-7	NONE	NONE

Table A-2 SCSI TID Map (ScanDown=1) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
3	0	0-7	0x74	0x3E
	1	0-7	0x73	0x3F
	2	0-7	0x72	0x40
	3	0-7	0x71	0x41
	4	0-7	0x6E	0x42
	5	0-7	0x6D	0x43
	6	0-7	0x6C	0x44
	7	0-7	0x6B	0x45
	8	0-7	0x6A	0x46
	9	0-7	0x69	0x47
	10	0-7	0x67	0x48
	11	0-7	0x66	0x49
	12	0-7	0x65	0x4A
	13	0-7	0x63	0x4B
	14	0-7	0x5C	0x4C
	15	0-7	0x5A	0x4D
	16	0-7	0x59	0x4E
	17	0-7	0x56	0x4F
	18	0-7	0x55	0x50
	19	0-7	0x54	0x51
	20	0-7	0x53	0x52
	21	0-7	0x52	0x53
	22	0-7	0x51	0x54
	23	0-7	0x4E	0x55
	24	0-7	0x4D	0x56
	25	0-7	0x4C	0x57
	26	0-7	0x4B	0x58
	27	0-7	0x4A	0x59
	28	0-7	0x49	0x5A
	29	0-7	0x47	0x5B
	30	0-7	0x46	0x5C
	31	0-7	NONE	NONE

Table A-2 SCSI TID Map (ScanDown=1) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
4	0	0-7	0x45	0x5D
	1	0-7	0x43	0x5E
	2	0-7	0x3C	0x5F
	3	0-7	0x3A	0x60
	4	0-7	0x39	0x61
	5	0-7	0x36	0x62
	6	0-7	0x35	0x63
	7	0-7	0x34	0x64
	8	0-7	0x33	0x65
	9	0-7	0x32	0x66
	10	0-7	0x31	0x67
	11	0-7	0x2E	0x68
	12	0-7	0x2D	0x69
	13	0-7	0x2C	0x6A
	14	0-7	0x2B	0x6B
	15	0-7	0x2A	0x6C
	16	0-7	0x29	0x6D
	17	0-7	0x27	0x6E
	18	0-7	0x26	0x6F
	19	0-7	0x25	0x70
	20	0-7	0x23	0x71
	21	0-7	0x1F	0x72
	22	0-7	0x1E	0x73
	23	0-7	0x1D	0x74
	24	0-7	0x1B	0x75
	25	0-7	0x18	0x76
	26	0-7	0x17	0x77
	27	0-7	0x10	0x78
	28	0-7	0x0F	0x79
	29	0-7	0x08	0x7A
	30	0-7	0x04	0x7B
	31	0-7	NONE	NONE

Table A-2 SCSI TID Map (ScanDown=1) (continued)

Bus #	TID	LUN	AL_PA	SEL_ID
5	0	0-7	0x02	0x7C
	1	0-7	0x01	0x7D
	2	0-7	NONE	NONE
	3	0-7	NONE	NONE
	4	0-7	NONE	NONE
	5	0-7	NONE	NONE
	6	0-7	NONE	NONE
	7	0-7	NONE	NONE
	8	0-7	NONE	NONE
	9	0-7	NONE	NONE
	10	0-7	NONE	NONE
	11	0-7	NONE	NONE
	12	0-7	NONE	NONE
	13	0-7	NONE	NONE
	14	0-7	NONE	NONE
	15	0-7	NONE	NONE
	16	0-7	NONE	NONE
	17	0-7	NONE	NONE
	18	0-7	NONE	NONE
	19	0-7	NONE	NONE
	20	0-7	NONE	NONE
	21	0-7	NONE	NONE
	22	0-7	NONE	NONE
	23	0-7	NONE	NONE
	24	0-7	NONE	NONE
	25	0-7	NONE	NONE
	26	0-7	NONE	NONE
	27	0-7	NONE	NONE
	28	0-7	NONE	NONE
	29	0-7	NONE	NONE
	30	0-7	NONE	NONE
	31	0-7	NONE	NONE

B

Online Device Installation

After initial installation and configuration of the Hitachi RAID storage system, additional devices can be installed or de-installed online without having to restart the AIX system. After online installation, the device parameters for new volumes must be changed to match the LUs defined under the same fibre-channel port (see Changing Default Device Parameters). This procedure should be performed by the system administrator (i.e., super-user).

- ☐ Installing or Uninstalling a Device Online

Note: For additional instructions about online installation and reinstallation of LUs, see the Maintenance Manual for the storage system.

Installing or Uninstalling a Device Online

To install or uninstall a device online without having to restart the system:

1. Log on to the AIX system as **root**.
2. At the AIX command line prompt, type the following command to start SMIT and open the System Management panel:

   ```
   smit
   ```

Note: If SMIT is not installed, refer to the IBM AIX user guide for instructions on assigning new devices to volume groups using AIX commands.

3. Select **Devices** to open the Devices panel.
4. Select **Install/Configure Devices Added After IPL** to open the Install/Configure Devices Added After IPL panel.
5. Select **INPUT device/directory** for software, then press **Enter**. The AIX system scans the buses for new devices.
6. To verify that the new device is installed, type the following command:

   ```
   lsdev -C -c disk
   ```

Note: See Verifying New Device Recognition for complete instructions. Record the device file names for the new devices.

Configure the new devices for AIX operations as described in Chapter 3 and Chapter 4.

C

Online LUSE

Online LUSE is LU Expansion that is performed after mounting (2GB => 5GB). Before you begin, verify that the size of corresponding LUN in the storage system can be expanded online. Online LUSE involves the following steps:

- ☐ Creating and Mounting the File Systems
  - – Unmounting the File System
  - – Varying off the Volume Group
  - – Expanding the size of LU from the Hitachi RAID storage system
  - – Varying on the Volume Group
  - – Changing the Volume Group
  - – Mounting the File System
- ☐ Expanding the Logical Volume (LP400)
- ☐ Expanding the File System (up to 3GB)
- ☐ Increasing the File System to 40 GB

Note:

- There is no unmount during this process.
- The only platform that is available for online LUSE is AIX 5.2.

Creating and Mounting the File Systems

1. Type the following command to unmount all file systems in the affected volume group:

   #umount /mnt/h00

2. Type the following command to vary off the volume group:

   #varyoff vg_fc00

3. Expand the size of LU from the Hitachi RAID storage system.

4. Vary on the volume group:

```
#varyonvg vg_fc00
0516-1434 varyonvg: Following physical volumes appear to be grown in size
Run chvg command to activate the new space.
hdisk1
```

5. Change the volume group:

```
#chvg  -g vg_fc00
0516-1224 chvg: WARNING, once this operation is completed, volume group vg_fc00
cannot be imported into AIX 510 or lower versions. Continue (y/n) ?

y
0516-1164 chvg: Volume group vg_fc04 changed. With given characteristics vg_fc00
can include up to 16 physical volumes with 2032 physical partitions each.
```

6. Type the following command to mount all file systems unmounted in step 1:

   #mount /mnt/h00

7. Type the **df-k** command as follows:

```
# df -k
/dev/lv00         2097152   2031276    4%       17     1% /mnt/h00
```

8. Type the **lsvg vg_fc00** command:

```
# lsvg vg_fc00
VOLUME GROUP:   vg_fc00                  VG IDENTIFIER:
0007d6dc00004c00000000f3305f5d36
VG STATE:       active                   PP SIZE:        128 megabyte(s)
VG PERMISSION:  read/write               TOTAL PPs:      543 (69504 megabytes)
MAX LVs:        256                      FREE PPs:       526 (67328 megabytes)
LVs:            2                        USED PPs:       17 (2176 megabytes)
OPEN LVs:       2                        QUORUM:         2
TOTAL PVs:      1                        VG DESCRIPTORS: 2
STALE PVs:      0                        STALE PPs:      0
ACTIVE PVs:     1                        AUTO ON:        yes
MAX PPs per PV: 1016                     MAX PVs:        32
LTG size:       128 kilobyte(s)          AUTO SYNC:      no
HOT SPARE:      no                       BB POLICY:      relocatable
```

9. Type the **`lslv lv00`** command:

```
# lslv lv00
LOGICAL VOLUME:     lv00                   VOLUME GROUP:   vg_fc00
LV IDENTIFIER:      0007d6dc00004c00000000f3305f5d36.2 PERMISSION:     read/write
VG STATE:           active/complete        LV STATE:       opened/syncd
TYPE:               jfs                    WRITE VERIFY:   off
MAX LPs:            512                    PP SIZE:        128 megabyte(s)
COPIES:             1                      SCHED POLICY:   parallel
LPs:                16                     PPs:            16
STALE PPs:          0                      BB POLICY:      relocatable
INTER-POLICY:       minimum                RELOCATABLE:    yes
INTRA-POLICY:       middle                 UPPER BOUND:    32
MOUNT POINT:        /mnt/h00               LABEL:          /mnt/h00
```

Expanding the Logical Volume (LP400)

1. Type the **`extendlv lv00 400`** command:

```
# extendlv lv00 400

# lsvg vg_fc00
VOLUME GROUP:   vg_fc00                  VG IDENTIFIER:
0007d6dc00004c00000000f3305f5d36
VG STATE:       active                   PP SIZE:        128 megabyte(s)
VG PERMISSION:  read/write               TOTAL PPs:      543 (69504 megabytes)
MAX LVs:        256                      FREE PPs:       126 (16128 megabytes)
LVs:            2                        USED PPs:       417 (53376 megabytes)
OPEN LVs:       2                        QUORUM:         2
TOTAL PVs:      1                        VG DESCRIPTORS: 2
STALE PVs:      0                        STALE PPs:      0
ACTIVE PVs:     1                        AUTO ON:        yes
MAX PPs per PV: 1016                     MAX PVs:        32
LTG size:       128 kilobyte(s)          AUTO SYNC:      no
HOT SPARE:      no                       BB POLICY:      relocatable
```

2. Type the **`lslv lv00`** command:

```
# lslv lv00
LOGICAL VOLUME:     lv00                    VOLUME GROUP:   vg_fc00
LV IDENTIFIER:      0007d6dc00004c00000000f3305f5d36.2 PERMISSION:     read/write
VG STATE:           active/complete         LV STATE:       opened/syncd
TYPE:               jfs                     WRITE VERIFY:   off
MAX LPs:            512                     PP SIZE:        128 megabyte(s)
COPIES:             1                       SCHED POLICY:   parallel
LPs:                416                     PPs:            416
STALE PPs:          0                       BB POLICY:      relocatable
INTER-POLICY:       minimum                 RELOCATABLE:    yes
INTRA-POLICY:       middle                  UPPER BOUND:    32
MOUNT POINT:        /mnt/h00                LABEL:          /mnt/h00
MIRROR WRITE CONSISTENCY: on/ACTIVE
EACH LP COPY ON A SEPARATE PV ?: yes
Serialize IO ?:     NO
```

Notes:

- To determine the parameters for LUSE expansion, see Table 3-4 (Partition Sizes for VLL LUSE Devices), Table 3-5 (Partition Sizes for LUSE Devices), and Table 3-8 (Number of Bytes per inode for LUSE Devices).
- To correspond to the capacity per emulation type, physical partitions such as PPs, LPs, and inodes will need to be adjusted. They cannot be set with the OS default value.
- The number of bytes per inode cannot be changed with online LUSE

Expanding the File System (up to 3GB)

1. Type the **chfs** command to change the size of the file system to 10485760:

   # chfs -a size=+3G /mnt/h00

2. Type the **df-k** command:

```
# df -k
Filesystem    1024-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4            32768     18496   44%     1474     9% /
/dev/hd2           851968     33396   97%    24029    12% /usr
/dev/hd9var         32768      4712   86%      436     6% /var
/dev/hd3            32768     31620    4%       47     1% /tmp
/dev/hd1            32768     29936    9%       97     2% /home
/proc                   -         -    -        -     -  /proc
/dev/hd10opt        32768     24108   27%      395     5% /opt
/dev/lv00         5242880   5078268    4%       17     1% /mnt/h00
```

Increasing the File System to 40 GB

1. Type the **chfs** command to change the file system size to 31457280:

   # chfs -a size=+10G /mnt/h00

2. Type the **df-k** command:

```
# df -k
Filesystem    1024-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4            32768     18496   44%     1474     9% /
/dev/hd2           851968     33396   97%    24029    12% /usr
/dev/hd9var         32768      4584   87%      436     6% /var
/dev/hd3            32768     31620    4%       47     1% /tmp
/dev/hd1            32768     29936    9%       97     2% /home
/proc                   -         -    -        -     -  /proc
/dev/hd10opt        32768     24108   27%      395     5% /opt
/dev/lv00        15728640  15234908    4%       17     1% /mnt/h00
```

3. Type the **lsvg vg_fc00** command:

```
# lsvg vg_fc00
VOLUME GROUP:   vg_fc00                  VG IDENTIFIER:
0007d6dc00004c00000000f3305f5d36
VG STATE:       active                   PP SIZE:        128 megabyte(s)
VG PERMISSION:  read/write               TOTAL PPs:      543 (69504 megabytes)
MAX LVs:        256                      FREE PPs:       126 (16128 megabytes)
LVs:            2                        USED PPs:       417 (53376 megabytes)
OPEN LVs:       2                        QUORUM:         2
TOTAL PVs:      1                        VG DESCRIPTORS: 2
STALE PVs:      0                        STALE PPs:      0
ACTIVE PVs:     1                        AUTO ON:        yes
MAX PPs per PV: 1016                     MAX PVs:        32
LTG size:       128 kilobyte(s)          AUTO SYNC:      no
HOT SPARE:      no                       BB POLICY:      relocatable
```

4. Type the **chfs** command to change the size of the file system to 94371840:

   # chfs -a size=+30G /mnt/h00

5. Type the **lsvg vg_fc00** command:

```
# lsvg vg_fc00
VOLUME GROUP:   vg_fc00                  VG IDENTIFIER:
0007d6dc00004c00000000f3305f5d36
VG STATE:       active                   PP SIZE:        128 megabyte(s)
VG PERMISSION:  read/write               TOTAL PPs:      543 (69504 megabytes)
MAX LVs:        256                      FREE PPs:       126 (16128 megabytes)
LVs:            2                        USED PPs:       417 (53376 megabytes)
OPEN LVs:       2                        QUORUM:         2
TOTAL PVs:      1                        VG DESCRIPTORS: 2
STALE PVs:      0                        STALE PPs:      0
ACTIVE PVs:     1                        AUTO ON:        yes
MAX PPs per PV: 1016                     MAX PVs:        32
LTG size:       128 kilobyte(s)          AUTO SYNC:      no
HOT SPARE:      no                       BB POLICY:      relocatable
#
```

6. Type the **lslv lv00** command:

```
# lslv lv00
LOGICAL VOLUME:     lv00                   VOLUME GROUP:   vg_fc00
LV IDENTIFIER:      0007d6dc00004c00000000f3305f5d36.2 PERMISSION:     read/write
VG STATE:           active/complete        LV STATE:       opened/syncd
TYPE:               jfs                    WRITE VERIFY:   off
MAX LPs:            512                    PP SIZE:        128 megabyte(s)
COPIES:             1                      SCHED POLICY:   parallel
LPs:                416                    PPs:            416
STALE PPs:          0                      BB POLICY:      relocatable
INTER-POLICY:       minimum                RELOCATABLE:    yes
INTRA-POLICY:       middle                 UPPER BOUND:    32
MOUNT POINT:        /mnt/h00               LABEL:          /mnt/h00
MIRROR WRITE CONSISTENCY: on/ACTIVE
EACH LP COPY ON A SEPARATE PV ?: yes
Serialize IO ?:     NO
```

7. Type the **df-k** command to increase the volume size to 47GB and fully expand the file system size:

```
# df -k
Filesystem    1024-blocks      Free %Used    Iused %Iused Mounted on
/dev/hd4            32768     18496   44%     1474     9% /
/dev/hd2           851968     33396   97%    24029    12% /usr
/dev/hd9var         32768      4584   87%      436     6% /var
/dev/hd3            32768     31620    4%       47     1% /tmp
/dev/hd1            32768     29936    9%       97     2% /home
/proc                   -         -    -        -     -  /proc
/dev/hd10opt        32768     24108   27%      395     5% /opt
/dev/lv00        47185920  45704828    4%       17     1% /mnt/h00
```

Note on Using Veritas Cluster Server

By issuing a SCSI-3 Persistent Reserve command for a Hitachi RAID storage system, the Veritas Cluster Server (VCS) provides the I/O fencing function that can prevent data corruption from occurring if the cluster communication stops. Each node of VCS registers reserve keys to the storage system, which enables these nodes to share a disk to which the reserve key is registered.

Each node of VCS registers the reserve key when importing a disk groups. One node registers the identical reserve key for all paths of all disks (LU) in the disk group. The reserve key contains a unique value for each disk group and a value to distinguish nodes.

Key format: <Node # + disk group-unique information>

Example: APGR0000, APGR0001, BPGR0000, and so on

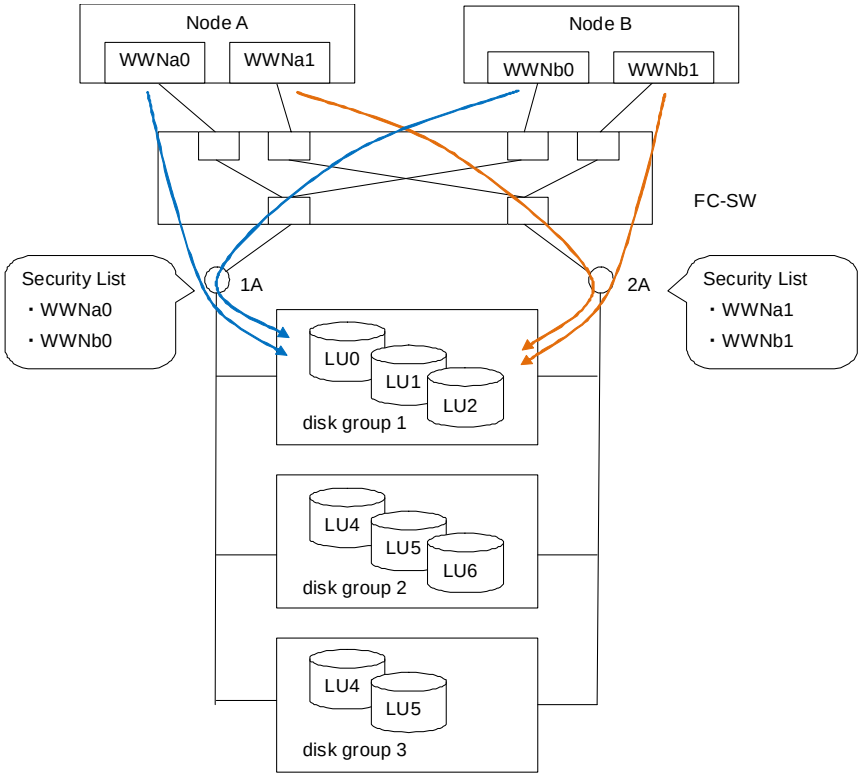
When the Hitachi RAID storage system receives a request to register the reserve key, the reserve key and Port WWN of node are recorded on a key registration table of each port of storage system where the registration request is received. The number of reserve keys that can be registered to one storage system is 128 for a port. The storage system confirms duplication of registration by a combination of the node Port WWN and reserve key. Therefore, the number of entries of the registration table does not increase even though any request for registering duplicated reserve keys is accepted.

Calculation formula for the number of used entries of key registration table:

(number of nodes) × (number of Port WWN of node) × (number of disk groups)

When the number of registered reserve keys exceeds the upper limit of 128, key registration as well as operations such as installing a LU to the disk group fails. To avoid failure of reserve key registration, the number of reserve keys needs to be kept below 128. For this, restrictions such as imposing a limit on the number of nodes or on the number of server ports using LUN security function or maintaining the number of disk groups appropriate are necessary.

Example: When adding a LU to increase disk capacity, do not add the number of disk groups, but add a LU to the current disk group.



Key registration table for Port-1A		
Entry	**Reserve Key**	**WWN**
0	APGR0001	WWNa0
1	APGR0002	WWNa0
2	APGR0003	WWNa0
3	BPGR0001	WWNb0
4	BPGR0002	WWNb0
5	BPGR0003	WWNb0
6	-	-
:	:	:
127	-	-

Key registration table for Port-2A		
Entry	**Reserve Key**	**WWN**
0	APGR0001	WWNa1
1	APGR0002	WWNa1
2	APGR0003	WWNa1
3	BPGR0001	WWNb1
4	BPGR0002	WWNb1
5	BPGR0003	WWNb1
6	-	-
:	:	:
127	-	-

Figure D-1 Adding Reserve Keys for LUs to Increase Disk Capacity

Acronyms and Abbreviations

AL	arbitrated loop
AL-PA	arbitrated loop physical address
blk	block
CVS	custom volume size
dev	device
FC	fibre-channel
FCP	fibre-channel protocol
FX	Hitachi Cross-OS File Exchange
GB	gigabyte
Gbps	gigabits per second
HACMP	High Availability Cluster Multi-Processing
HBA	host bus adapter
HDLM	Hitachi Dynamic Link Manager
HDS	Hitachi Data Systems
I/O	input/output
IPL	initial program load
JFS	Journaled File System
KB	kilobyte
LCU	logical control unit
LDEV	logical device
LU	logical unit
LUN	logical unit number
LUSE	LUN Expansion
LV	logical volume
LVI	logical volume image
LVM	Logical Volume Manager, logical volume management
MB	megabyte
mto	mainframe-to-open
ODM	Object Data Manager

OFC	open fibre control
OS	operating system
otm	open-to-mainframe
oto	open-to-open
PA	physical address
PB	petabyte
PC	personal computer
PdAt	predefined attributes
PdDv	predefined devices
PP	physical partition
PV	physical volume
RAID	redundant array of independent disks
rw	read-write
SCSI	small computer system interface
SIM	service information message
SMIT	System Management Information Tool
SNMP	simple network management protocol
SOM	system option mode
TB	terabyte
TID	target ID
USP V	Hitachi Universal Storage Platform V
USP VM	Hitachi Universal Storage Platform VM
VG	volume group
VLL	Virtual LVI/LUN
VOLSER	volume serial number
VSP	Hitachi Virtual Storage Platform
WWN	worldwide name

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