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# Configuration Guide for Solaris™ Host Attachment

## Hitachi Virtual Storage Platform
## Hitachi Universal Storage Platform V/VM

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Hitachi Data Systems

MK-96RD632-05

# Contents

# Preface

This document describes and provides instructions for installing and configuring the devices on the Hitachi RAID storage systems for operations in a Solaris 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 Solaris operating system and the hardware hosting the Solaris system.
- You should be familiar with the hardware used to attach the Hitachi RAID storage system to the Solaris 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 60-03-2*x* or later.

## Document Revision Level

| Revision | Date | Description |
|---|---|---|
| MK-96RD632-P | February 2007 | Preliminary Release |
| MK-96RD632-00 | May 2007 | Initial Release, supersedes and replaces MK-96RD632-P |
| MK-96RD632-01 | September 2007 | Supersedes and replaces MK-96RD632-00 |
| MK-96RD632-02 | June 2009 | Revision 2, supersedes and replaces MK-96RD632-01 |
| MK-96RD632-03 | November 2009 | Revision 3, supersedes and replaces MK-96RD632-02 |
| MK-96RD632-04 | January 2010 | Revision 4, supersedes and replaces MK-96RD632-03 |
| MK-96RD632-05 | October 2010 | Revision 5, supersedes and replaces MK-96RD632-04 |

## Source Documents for this Revision

- MK-96RD632-05a-1_RSDreview

## Changes in this Revision

- Added the Hitachi Virtual Storage Platform storage system.
- Added information about the 8-Gbps fibre-channel interface (Table 2-1).
- Added a link to the Hitachi Data Systems interoperability site for specific information about supported OS versions, HBAs, drivers, hubs, and switches (Table 2-1).

## Referenced Documents

Hitachi Virtual Storage Platform documentation:

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

Hitachi Universal Storage Platform V/VM documentation:

- *Hitachi LUN Manager User's Guide*, MK-96RD615
- *Hitachi LUN Expansion (LUSE) User's Guide*, MK-96RD616
- *Hitachi Storage Navigator User's Guide*, MK-96RD621
- *Hitachi Virtual LVI/LUN and Volume Shredder User's Guide*, MK-96RD630
- *User and Reference Guide*, MK-96RD635
- *Hitachi Cross-OS File Exchange User's Guide*, MK-96RD647
- *Hitachi Dynamic Link Manager for Solaris User's Guide*, MK-92DLM114

Solaris user 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 a Solaris host. |
| Chapter 3, Configuring the New Disk Devices | Provides instructions for configuring the new devices on the Hitachi RAID storage system for use. |
| Chapter 4, Failover and SNMP Operations | Describes how to configure the Hitachi RAID storage system for failover and SNMP. |
| Chapter 5, Troubleshooting | Provides information for identifying and resolving problems. |
| Appendix A, Fibre Port Addressing | Provides information about fibre port addressing. |
| Appendix B, Online Device Installation | Provides instructions for online installation of new devices. |
| Appendix C, Using MPxIO (Sun Path Failover Software) | Describes how to use Solaris Operating Environment Multi−path I/O with the Hitachi RAID storage system. |
| 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 Hitachi Universal Storage Platform V and VM storage systems, 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*<br>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>`<br>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:<br>[ a \| b ] indicates that you can choose a, b, or nothing.<br>{ a \| b } indicates that you must choose either a or b. |
| underline | Indicates the default value. Example: [ a \| b ] |
| # | A **pound sign** at the beginning of a line indicates an operating system command line prompt. |

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 of adverse conditions and/or consequences (e.g., disruptive operations). |
|  | WARNING | Warns 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 Solaris 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) feature 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.<br>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).<br>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.<br>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 (Note 1) | Category (Note 2) | Product Name (Note 3) | # of Blocks (512-byte blk) | # of Cylinders | # of Heads | # of Sectors per Track | Capacity MB (Note 4) |
|---|---|---|---|---|---|---|---|
| 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-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-3 VLL | SCSI disk | OPEN-3-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-8 VLL | SCSI disk | OPEN-8-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-9 VLL | SCSI disk | OPEN-9-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-E VLL | SCSI disk | OPEN-E-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-V VLL | SCSI disk | OPEN-V | ***Note 5*** | ***Note 6*** | 15 | 128 | ***Note 7*** |
| OPEN-3*n VLL | SCSI disk | OPEN-3*n-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-8*n VLL | SCSI disk | OPEN-8*n-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-9*n VLL | SCSI disk | OPEN-9*n-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-E*n VLL | SCSI disk | OPEN-E*n-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |
| OPEN-V*n VLL | SCSI disk | OPEN-V*n | ***Note 5*** | ***Note 6*** | 15 | 128 | ***Note 7*** |
| 3390-3A | FX otm/mto | 3390-3A | 5820300 | 3345 | 15 | 116 | 2844 |
| 3390-3B | FXmto | 3390-3B | 5816820 | 3343 | 15 | 116 | 2842 |
| 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 5*** | ***Note 6*** | 15 | 116 | ***Note 7*** |
| 3390-3B VLL | FXmto | 3390-3B-CVS | ***Note 5*** | ***Note 6*** | 15 | 116 | ***Note 7*** |
| 3390-3C VLL | FXotm | OP-C-3390-3C-CVS | ***Note 5*** | ***Note 6*** | 15 | 116 | ***Note 7*** |
| FX OPEN-3 VLL | FXoto | OPEN-3-CVS | ***Note 5*** | ***Note 6*** | 15 | 96 | ***Note 7*** |

***Table Notes:***

***1:*** The availability of a specific device type depends on the level of microcode installed on the Hitachi RAID storage system.

***2:*** The category of a device (SCSI disk or raw) determines its volume usage. Table 1-3 shows the volume usage for SCSI disk devices and raw devices. The SCSI disk devices (OPEN-*x*, VLL, LUSE, VLL LUSE) require partitions and file systems for Solaris operations. The multiplatform devices (e.g., 3390-3A/B/C) must be installed as raw devices and can only be accessed using FX. Do not create a partition or 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<br>3390-3A/B/C VLL<br>OPEN-x for FXoto, OPEN-x VLL for FXoto | Raw Device |

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

***4:*** The device capacity can sometimes be changed by the BIOS or HBA. Different capacities may be due to variations such as 1 MB = $1000^2$ or $1024^2$ bytes.

***5:*** The number of blocks for a VLL volume is calculated as follows:

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

**Example 1***:* For an OPEN-3 VLL volume with capacity = 37 MB:

**# of blocks = (53 cylinders – see Note 6) × (15 heads) × (96 sectors per track) = 76320**

**Example 2:** For an OPEN-V VLL volume with capacity = 49 MB:

**# of blocks = (53 cylinders – see Note 6) × (15 heads) × (128 sectors per track) = 101760**

***6:*** The number of data cylinders for a VLL volume is calculated as follows (↑**…**↑ means the value should be rounded up to the next integer):

- **N**umber of data cylinders for OPEN-x VLL volume (except for OPEN-V) =
  **# of cylinders = ↑ (capacity (MB) specified by user) × 1024/720 ↑**

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

  **# of cylinders = ↑37 × 1024/720↑ = ↑52.62↑ (rounded up to next integer) = 53 cylinders**

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

  ***Example:*** For an OPEN-V VLL volume with capacity = 49 MB:

  **# of cylinders = ↑49 × 16/15↑ = ↑52.26↑ (rounded up to next integer) = 53 cylinders**

- Number of data cylinders for an OPEN-3/8/9/E VLL LUSE volume =
  **# of cylinders = ↑ (capacity (MB) specified by user) × 1024/720 ↑ × n**

  ***Example:*** For an 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 an OPEN-V VLL LUSE volume with capacity = 49 MB and n = 4:

  **# of cylinders = ↑49 × 16/15↑ × 4 = ↑52.26↑× 4 = 53 × 4 = 212**

- Number of data cylinders for a 3390-3A/C VLL volume =
  **# of cylinders = (number of cylinders specified by user) + 9**

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

***7:*** The size of an OPEN-x 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 a Solaris 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 a Solaris host. |
| 5. | Set and recognize the LUs. |
| 6. | Verify recognition of the new devices. |
| 7. | Partition disk devices and label the new devices. |
| 8. | Create mount directories, mount and verify the file system, and set and verify auto-mount parameters. |

2

# Installing the Storage System

This chapter describes how to install the Hitachi RAID storage system on a Solaris operating system:

- ☐ Requirements
- ☐ Preparing for Storage System Installation
- ☐ Configuring the Host Fibre-Channel HBAs
- ☐ Connecting the Storage System to the Solaris Host

# Requirements

Table 2-1 lists and describes the requirements for installing the Hitachi RAID storage system on the Solaris 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.<br>Use the LUN Manager software on Storage Navigator to configure the fibre-channel ports. |
| Solaris system hardware | ▪ Sun SPARCstation series<br>▪ Sun SPARCserver series<br>▪ Sun SPARCcenter series<br>▪ Sun Ultra series<br>Contact Oracle to make sure the most current OS patches are installed. |
| Solaris operating system | Please refer to the Hitachi Data Systems interoperability site for specific support information for the Solaris operating system:<br>http://www.hds.com/products/interoperability<br>Root login access to the Solaris system is required. |
| Fibre-channel HBAs | The Hitachi RAID storage system supports fibre-channel HBAs equipped as follows:<br>▪ 8-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.<br>▪ 4-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.<br>▪ 2-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.<br>▪ 1-Gbps fibre-channel interface, including shortwave non-OFC optical interface and multimode optical cables with SC connectors.<br>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.<br>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.<br>Do not connect OFC-type fibre-channel interfaces to the storage system. For information about supported fibre-channel HBAs, optical cables, hubs, and fabric switches, contact your Hitachi Data Systems account team.<br>For information about supported HBAs, drivers, hubs, and switches, see the Hitachi Data Systems interoperability site:<br>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 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 Solaris 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.

## LUN Manager Software Installation

The LUN Manager software on Storage Navigator is used to configure the fibre-channel ports. For instructions on installing LUN Manager, 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 Solaris hosts.

The required host mode for Solaris is **09**. Do not select a host mode other than **09** for Solaris.

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

***Caution:*** Changing host modes on a 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 make sure that the host mode options (HMOs) are set for all host groups connected to Solaris hosts. Use the LUN Manager software to set the HMOs. 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 2-2 lists the HMOs for Solaris and specifies the conditions for setting the mode. Note that HMO 13 is common to all platforms.

***Caution:*** Changing HMOs on a storage system that is already installed and configured is disruptive and requires the server to be rebooted.

**Table 2-2 Host Mode Options for Solaris**

| HMO | Function | Description | Notes |
|---|---|---|---|
| 2 | Veritas Database Edition™/ Advanced Cluster | Select HMO 2 if you are using either:<br>▪ Veritas Database Edition™/Advanced Cluster for Real Application Clusters, **or**<br>▪ Veritas Cluster Server™ 4.0 or later (I/O fencing function). | **Mandatory.** Do not apply this option to Sun Cluster. |
| 7 | Automatic recognition function of LUN | Select HMO 7 when all of the following conditions are satisfied:<br>▪ You are using host mode **00 Standard** or **09 Solaris**, **and**<br>▪ You are using SUN StorEdge SAN Foundation Software Version 4.2 or later, **and**<br>▪ You want to automate recognition of increase and decrease of devices when a SUN HBA is connected. | Optional |
| 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<br>This mode is common to all host platforms. |
| 22 | 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:<br>ON: Normal response<br>OFF (default): Reservation Conflict<br>***Note:***<br>1. When HMO 22 is ON, the volume status (reserved/non-reserved) will be checked more frequently (several tens of msec per LU).<br>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.<br>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.<br>4. Set HMO 22 to ON when Veritas Cluster Server is connected. | ***Note:***<br>▪ Before setting HMO 22 ask your Hitachi Data Systems representative for assistance.<br>▪ 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 to configure the fibre-channel ports with the appropriate fibre parameters. You select the appropriate settings for each fibre-channel port based on the device to which the port is connected: Determine the topology parameters supported by the device, and set your topology accordingly. The Hitachi RAID storage system supports up to 2048 LUs per fibre-channel port.

Table 2-3 explains the fibre parameter settings for the Hitachi RAID storage system.

**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* |

***Notes:***

- 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 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 Solaris 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 HBAs

Configure the fibre-channel HBA(s) connected to the Hitachi RAID storage system. The HBAs have many configuration options. For information, refer to the documentation for your HBA(s). The following sections describe considerations to follow before installing the Hitachi RAID storage system.

## Verifying the HBA Installation

Before configuring the fibre-channel HBA(s), verify the HBA installation and recognition of the fibre-channel HBA and driver.

1. Log in to the Solaris system as **root** and confirm that all existing devices are powered on and properly connected to the Solaris system.
2. Display the host configuration using the **dmesg** command (see Figure 2-1). The fibre information (underlined in the following example) includes the recognition of the **fibre channel adapter**, **SCSI bus characteristics**, **world wide name**, and **FCA driver**. Ensure the host recognizes these four classes. If this information is not displayed or if error messages are displayed, the host environment may not be configured properly.

```
# dmesg

Nov  9 23:14
ems, Inc.
mem = 65536K (0x4000000)
avail mem = 60129280
Ethernet address = 8:0:20:92:32:48
root nexus = Sun Ultra 1 SBus (UltraSPARC 167MHz)
sbus0 at root: UPA 0x1f 0x0 ...
espdma0 at sbus0: SBus0 slot 0xe offset 0x8400000
esp0:   esp-options=0x46
esp0 at espdma0: SBus0 slot 0xe offset 0x8800000 Onboard device sparc9 ipl 4
sd0 at esp0: target 0 lun 0
sd0 is /sbus@1f,0/espdma@e,8400000/esp@e,8800000/sd@0,0
        <SUN2.1G cyl 2733 alt 2 hd 19 sec 80>
sd6 at esp0: target 6 lun 0
sd6 is /sbus@1f,0/espdma@e,8400000/esp@e,8800000/sd@6,0
fca0: JNI Fibre Channel Adapter (1062 MB/sec), model FC          <- Verify that
fca0:   SBus 1: IRQ 4: FCODE Version 11.0.9 [1a6384]: SCSI ID 125: AL_PA 01  <- these items
fca0:   Fibre Channel WWN: 100000e0690000d5                      <- are listed.
fca0:   FCA Driver Version 2.2.HIT.03, Oct 09, 1999 Solaris 2.5, 2.6

fca0:   All Rights Reserved.
fca0:   < Total IOPB space used: 1125824 bytes >
fca0:   < Total DMA space used: 565277 bytes >
root on /sbus@1f,0/espdma@e,8400000/esp@e,8800000/sd@0,0:a fstype ufs
zs0 at sbus0: SBus0 slot 0xf offset 0x1100000 Onboard device sparc9 ipl 12
zs0 is /sbus@1f,0/zs@f,1100000
zs1 at sbus0: SBus0 slot 0xf offset 0x1000000 Onboard device sparc9 ipl 12
zs1 is /sbus@1f,0/zs@f,1000000
keyboard is </sbus@1f,0/zs@f,1000000> major <29> minor <2>
mouse is </sbus@1f,0/zs@f,1000000:b> major <29> minor <3>
stdin is </sbus@1f,0/zs@f,1000000> major <29> minor <2>
 . . . . . .
```

**Figure 2-1 Displaying the Fibre Device Information (Jaycor FC-1063)**

## Setting the Disk and Device Parameters

The queue depth parameter (**max_throttle**) for the Hitachi RAID storage system devices must be set as specified in Table 2-5.

**Table 2-5 Max Throttle (Queue Depth) Requirements**

| Requirement for Queue Depth | Note |
|---|---|
| (Number of LUs) × (queue_depth) ≤ 2048<br>and<br>queue_depth ≤ 32 | It is recommended that queue_depth be specified between 8 and 16 per LU. |

You can adjust the queue depth for the devices later as needed (within the specified range) to optimize the I/O performance.

The required I/O time-out value (TOV) for Hitachi RAID storage system devices is 60 seconds (default TOV=60). If the I/O TOV has been changed from the default, change it back to 60 seconds by editing the **sd_io_time** or **ssd_io_time** parameter in the **/etc/system** file.

Several other parameters (e.g., FC fibre support) may also need to be set. Please refer to the user documentation that came with your HBA to determine whether other options are required to meet your operational requirements.

Use the same settings and device parameters for all Hitachi RAID storage system devices. For fibre-channel, the settings in the system file apply to the entire system, not to just the HBA(s).

To set the I/O TOV and queue depth:

1. Make a backup of the **/etc/system** file: **cp /etc/system /etc/system.old**
2. Edit the **/etc/system** file.
3. To set the TOV, add the following to the **/etc/system** file (see Figure 2-2): **set sd:sd_io_time=0x3c**

   For Sun generic HBA: **set ssd:ssd_io_time=0x3c**
4. To set the queue depth, add the following to the **/etc/system** file (see Figure 2-3): **set sd:sd_max_throttle = x** (for **x** see Table 2-5)

   For Sun generic HBA: **set ssd:ssd_max_throttle = x** (for **x** see Table 2-5)
5. Save your changes, and exit the text editor.
6. Shutdown and reboot to apply the I/O TOV setting.

```
*ident  "@(#)system     1.15    92/11/14 SMI" /* SVR4 1.5 */
*
* SYSTEM SPECIFICATION FILE
*
:
*       To set a variable named 'debug' in the module named 'test_module'
*
*               set test_module:debug = 0x13
                set sd:sd_io_time = 0x3c                    ← Add this line to /etc/system
                set ssd:ssd_io_time = 0x3c                  ← Add this line to /etc/system
                                                                    (for Sun generic HBA)
```

**Figure 2-2 Setting the I/O TOV**

```
:
*    To set a variable named 'debug' in the module named 'test_module'
*
*          set test_module:debug = 0x13

set sd:sd_max_throttle = 8                                  ← Add this line to /etc/system
set ssd:ssd_max_throttle = 8                                ← Add this line to /etc/system
                                                                    (for Sun HBA)
```

**Figure 2-3 Setting the Max Throttle (Queue Depth)**

# Connecting the Storage System to the Solaris Host

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

Table 2-6 summarizes the steps for connecting the Hitachi RAID storage system to the Solaris host. Some steps are performed by the Hitachi Data Systems representative, while others are performed by the user.

**Table 2-6 Steps for Connecting the Storage System to a Solaris Host**

| | Activity | Performed by | Description |
|---|---|---|---|
| 1. | Verify storage system installation. | Hitachi Data Systems representative | Confirm that the status of the fibre-channel ports and LDEVs is NORMAL. |
| 2. | Shut down the Solaris system. | User | Power off the Solaris system before connecting the Hitachi RAID storage system:<br>▪ Shut down the Solaris system.<br>▪ When shutdown is complete, power off the Solaris display.<br>▪ Power off all peripheral devices except for the Hitachi RAID storage system.<br>▪ Power off the host system. You are now ready to connect the Hitachi RAID storage system. |
| 3. | Connect the storage system to the Solaris system. | Hitachi Data Systems representative | Install fibre-channel cables between the storage system and the Solaris host. Follow all precautions and procedures in the Maintenance Manual. Check all specifications to ensure proper installation and configuration. |
| 4. | Power on the Solaris system. | User | Power on the Solaris system after connecting the Hitachi RAID storage system:<br>▪ Power on the Solaris system display.<br>▪ 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 Solaris system is powered on, restart the system to have the new devices recognized.<br>▪ Confirm the ready status of all peripheral devices, including the Hitachi storage system.<br>▪ Power on the Solaris system. |
| 5. | Boot the Solaris system. | User | When the **OK** prompt appears, boot the system using the **boot -r** command. The **-r** option tells the system to rebuild the devices. Using boot by itself will not build the new devices on the Hitachi RAID storage system. |

3

# Configuring the New Disk Devices

This chapter describes how to configure the new disk devices that you attached to the Solaris system:

- ☐ Setting and Recognizing the LUs
- ☐ Verifying Recognition of New Devices
- ☐ Partitioning and Labeling the New Devices
- ☐ Creating and Mounting the File Systems

For information about configuring the Hitachi RAID storage system for failover and SNMP, see Chapter 4.

For information about fibre port addressing (AL-PA to SCSI TID mapping) for Solaris systems, see Appendix A.

For information about online device installation, see Appendix B.

## Setting and Recognizing the LUs

Once the Hitachi RAID storage system is installed and connected, set and recognize the new LUs by adding the logical devices to the **sd.conf** file (**/kernel/drv/sd.conf**). The **sd.conf** file includes the SCSI TID and LUN for all LDEVs connected to the Solaris system. After editing the **sd.conf** file, you will halt the system and reboot.

To set and recognize LUs:

1. Log in as root, and make a backup copy of the **/kernel/drv/sd.conf file**:

   **cp -ip /kernel/drv/sd.conf /kernel/drv/sd.conf.standard**

2. Edit the **/kernel/drv/sd.conf file** as shown in Figure 3-1. Be sure to make an entry (SCSI TID and LUN) for each new device being added to the Solaris system.

   If the LUs have already been added to the **sd.conf** file, verify each new LU.

3. Exit the vi editor by entering the command:

   **ESC + :wq**

4. Halt the Solaris system:

   **halt**

5. Reboot the Solaris system:

   **boot -r**

6. Log in to the system as root, and verify that the system recognizes the Hitachi RAID storage system (see Figure 3-2):

   **dmesg | more**

7. Verify that the vendor name, product name, and number of blocks match the values shown in Figure 3-2.

```
# cp -ip /kernel/drv/sd.conf /kernel/drv/sd/conf/standard      ← Make backup of file.
#
# vi /kernel/drv/sd.conf                                       ← Edit the file (vi shown).
#ident  "@(#)sd.conf    1.8     93/05/03 SMI"
name="sd" class="scsi"                                         ← The SCSI class type name
        target=0 lun=0;                                          is used because the SCSI
                                                                 driver is used for fibre
name="sd" class="scsi"                                           channel.
        target=1 lun=0;

name="sd" class="scsi"
        target=2 lun=0;

name="sd" class="scsi"                                         ← Add this information for
        target=2 lun=1;                                          all new target IDs
                                                                 and LUNs.
name="sd" class="scsi"
        target=3 lun=0;

name="sd" class="scsi"
        target=4 lun=0;
#
# halt                                                         ← Enter halt.
Jan 11 10:10:09 sunss20 halt:halted by root
Jan 11 10:10:09 sunss20 syslogd:going down on signal 15
Syncing file systems... done
Halted

Program terminated
Type help for more information
OK

volume management starting.
The system is ready.

host console login: root                                       ← Log in as root.
Password:                                                      ← Password is not displayed.
Oct 11 15:28:13 host login: ROOT LOGIN /dev/console
Last login:Tue Oct 11 15:25:12 on console
Sun Microsystems inc.  SunOS 5.5       Generic September 1993
#
#
#
```

**Figure 3-1 Setting and Recognizing LUs**

```
# dmesg | more
  :
sbus0 at root: UPA 0x1f 0x0 ...
fas0:  rev 2.2 FEPS chip

SUNW,fas0 at sbus0: SBus0 slot 0xe offset 0x8800000 and slot 0xe offset 0x8810000 Onboard
device sparc9 ipl 4
SUNW,fas0 is /sbus@1f,0/SUNW,fas@e,8800000
sd0 at SUNW,fas0: target 0 lun 0
sd0 is /sbus@1f,0/SUNW,fas@e,8800000/sd@0,0
     <SUN2.1G cyl 2733 alt 2 hd 19 sec 80>
sd6 at SUNW,fas0: target 6 lun 0
sd6 is /sbus@1f,0/SUNW,fas@e,8800000/sd@6,0
WARNING: fca0: fmle: sc1: 000e0000  sc2: 00000000
fca0: JNI Fibre Channel Adapter (1062 MB/sec), model FC
fca0:  SBus 1 / IRQ 4 / FCODE Version 10 [20148b] / SCSI ID 125 / AL_PA 0x1
fca0:  Fibre Channel WWN: 100000e0690002b7
fca0:  FCA Driver Version 2.1+, June 24, 1998 Solaris 2.5, 2.6
fca0:  All Rights Reserved.
fca0:  < Total IOPB space used: 1100624 bytes >
fca0:  < Total DMA space used: 532644 bytes >
fca0: <HITACHI :OPEN-3         :5235> target 2 (alpa 0xe4) lun 0 online
sd192 at fca: target 2 lun 0
                      ↖ LUN = 0
                ↖ target ID = 2
sd192 is /sbus@1f,0/fca@1,0/sd@2,0

WARNING: /sbus@1f,0/fca@1,0/sd@2,0 (sd192)
       corrupt label - wrong magic number                    ← Not yet labeled.
        Vendor 'HITACHI', product 'OPEN-3', 4806720 512 byte blocks
                ↖ Vendor name              ↖ Number of blocks
                                  ↖ Product name
fca0: <HITACHI :OPEN-3          :5235> target 2 (alpa 0xdc) lun 2 online
sd193 at fca: target 2 lun 1           (LUN=1, target ID=2)
sd193 is /sbus@1f,0/fca@1,0/sd@2,1
WARNING: /sbus@1f,0/fca@1,0/sd@2,1 (sd193)
        corrupt label - wrong magic number
        Vendor 'HITACHI', product 'OPEN-3', 4806720 512 byte blocks
fca0: <HITACHI :OPEN-9          :5235> target 6 (alpa 0xdc) lun 0 online
sd.. at fca: target  lun 0   (LUN=0, target ID=6)
sd.. is /sbus@1f,0/fca@1,0/sd@4,0
WARNING: /sbus@1f,0/fca@1,0/sd@4,0 (sd..)
        corrupt label - wrong magic number                    ← Not yet labeled.
        Vendor 'HITACHI', product 'OPEN-9', 14423040 512 byte blocks
sd.. at fca: target 6 lun 0                                   ← Verify target ID.
        corrupt label - wrong magic number                    ← Not yet labeled.
        Vendor 'HITACHI', product 'OPEN-9', 14423040 512 byte blocks
sd.. is /sbus@1f,0/fca@1,0/sd@5,0
WARNING: /sbus@1f,0/fca@1,0/sd@5,0 (sd..)
        corrupt label - wrong magic number                    ← Not yet labeled.
        Vendor 'HITACHI', product '3390-3B', 5822040 512 byte blocks
sd.. is /sbus@1f,0/fca@1,0/sd@6,0
WARNING: /sbus@1f,0/fca@1,0/sd@6,0 (sd..)
        corrupt label - wrong magic number                    ← Not yet labeled.
        Vendor 'HITACHI', product '3390-3A', 5825520 512 byte blocks
sd.. is /sbus@1f,0/fca@1,0/sd@8,0
```

**Figure 3-2 Fibre Device Recognition**

***Note:*** If the FX volumes (e.g., 3390-3A/B/C) are customized, their block number may be lower than the number displayed in this example.

# Verifying Recognition of New Devices

After system start-up, log in as root and use the **dmesg | more** command to verify that the Solaris system recognizes the Hitachi storage system. Confirm that the displayed vendor names, product names, and number of blocks match the values in Figure 3-3. If the results are different than the intended system configuration, the path definition or fibre cabling might be wrong.

***Note:*** When the Solaris system accesses the multiplatform devices, the message "Request sense couldn't get sense data" may be displayed. You can disregard this message.

```
# dmesg | more
  :
sbus0 at root: UPA 0x1f 0x0 ...
fas0:  rev 2.2 FEPS chip

SUNW,fas0 at sbus0: SBus0 slot 0xe offset 0x8800000 and slot 0xe offset 0x8810000 Onboard device
sparc9 ipl 4
SUNW,fas0 is /sbus@1f,0/SUNW,fas@e,8800000
sd0 at SUNW,fas0: target 0 lun 0
sd0 is /sbus@1f,0/SUNW,fas@e,8800000/sd@0,0
     <SUN2.1G cyl 2733 alt 2 hd 19 sec 80>
sd6 at SUNW,fas0: target 6 lun 0
sd6 is /sbus@1f,0/SUNW,fas@e,8800000/sd@6,0
WARNING: fca0: fmle: sc1: 000e0000  sc2: 00000000
fca0: JNI Fibre Channel Adapter (1062 MB/sec), model FC
fca0: SBus 1 / IRQ 4 / FCODE Version 10 [20148b] / SCSI ID 125 / AL_PA 0x1
fca0: Fibre Channel WwN: 100000e0690002b7
fca0: FCA Driver Version 2.1+, June 24, 1998 Solaris 2.5, 2.6
fca0: All Rights Reserved.
fca0: < Total IOPB space used: 1100624 bytes >
fca0: < Total DMA space used: 532644 bytes >
fca0: <HITACHI :OPEN-3          :5235> target 2 (alpa 0xe4) lun 0 online
sd192 at fca: target 2 lun 0
                     ↖      ↖ LUN = 0
                       target ID = 2
sd192 is /sbus@1f,0/fca@1,0/sd@2,0
WARNING: /sbus@1f,0/fca@1,0/sd@2,0 (sd192)
        corrupt label - wrong magic number                          ← Not yet labeled.
        Vendor 'HITACHI', product 'OPEN-3',    4806720 512 byte blocks
                  ↖ Vendor name    ↖ Product name   ↖ Number of blocks
fca0: <HITACHI :OPEN-3          :5235> target 2 (alpa 0xdc) lun 1 online
sd193 at fca: target 2 lun 1           (LUN=1, target ID=2)
sd193 is /sbus@1f,0/fca@1,0/sd@2,1
WARNING: /sbus@1f,0/fca@1,0/sd@2,1 (sd193)
        corrupt label - wrong magic number
        Vendor 'HITACHI', product 'OPEN-3', 4806720 512 byte blocks
```

**Figure 3-3 Verifying New Devices**

This example shows two new disks on fca@1: target ID is 2, LUNs are 0 and 1, vendor name is "HITACHI", product name is "OPEN-3", and number of blocks is 4806720. LUNs 0 and 1 are assigned as device names sd192 and sd193, respectively. Details for other disks:

- vendor name "HITACHI", product name "OPEN-9" and 14423040 512-byte blocks
- vendor name "HITACHI", product name "3390-3B" and 5822040 512-byte blocks
- vendor name "HITACHI", product name "3390-3A" and 5825520 512-byte blocks

## Partitioning and Labeling the New Devices

After the Solaris system recognizes the new devices, partition and label the devices. All new devices, including all SCSI disk devices and FX devices, must be partitioned and labeled using the **format** utility (see ***WARNING*** below).

- Each SCSI disk device (e.g., OPEN-x) can have more than one partition.
- Each FX device (e.g., 3390-3A) must have one partition of fixed size.

The disk partitioning and labeling procedure involves the following tasks:

1. Defining and setting the disk type.
2. Setting the partition(s).
3. Labeling the disk (required for devices to be managed by HDLM).
4. Verifying the disk label.

A good way to partition and label the disks is to partition and label all devices of one type (e.g., OPEN-3), then all devices of the next type (e.g., OPEN-9), and so on until you partition and label all new devices. You will enter this information into the Solaris system during the disk partitioning and labeling procedure.

***WARNING:*** Be extremely careful when using the Solaris **format** utility. Do not use any **format** commands not described in this document. The **format** utility is designed for Sun disks. Some **format** commands are not compatible with the Hitachi RAID storage system and can overwrite the data on the disk. The Hitachi RAID storage system will not respond to the **format** command (devices are formatted using the SVP), and will not report any defect data in response to the **defect** command.

To partition and label the new devices/disks:

1. Enter **`format`** at the root prompt to start the **format** utility (see Figure 3-4).
   a. Verify that all new devices are displayed. If not, exit the **format** utility (**`quit`** or **Ctrl-d**), and then be sure the SCSI/fibre-to-LDEV paths were defined for all devices and that all new devices were added to the driver configuration file). See Chapter 5 for troubleshooting information.
   b. Write down the character-type device file names (e.g., c1t2d0) for all of the new devices. You will need this information later to create the file systems.
2. When prompted to specify the disk, enter the number (from the list) for the device to be partitioned and labeled. Remember the device type of this device (e.g., OPEN-3).
3. When prompted to label the disk, enter **y** for "yes" and enter the desired label. Devices that will be managed by HDLM require a label. If you are sure that the device will not need a label, you can enter **n** for "no".
4. When the format menu appears, enter **`type`** to display the disk types. The disk types are listed in Table 1-2 (vendor name + product name, e.g., HITACHI OPEN-3).
5. If the disk type for the selected device is already defined, enter the number for that disk type and skip to step 7.

---

***Note:***

- Do not use HITACHI-OPEN-*x*-0315, HITACHI-3390-3A/B-0315. These disk types are created automatically by the Solaris system and cannot be used for the Hitachi RAID storage system devices.
- LU capacity must be less than 1 TB. In case of selecting other type, the disk type parameters described below cannot be set for an LU larger than 32,767 data cylinders.

---

6. If the disk type for the selected device is not already defined, enter the number for **other** to define a new disk type.
7. Enter the disk type parameters for the selected device using the data provided above. Be sure to enter the parameters exactly as shown in Figure 3-5.
8. When prompted to label the disk, enter **n** for "no".
9. When the format menu appears, enter **`partition`** to display the partition menu.
10. Enter the desired partition number and the partition parameters in Figure 3-6 and Table 3-1 through Table 3-8.
11. At the **partition>** prompt, enter **`print`** to display the current partition table.

12. Repeat steps 9 and 10 as needed to set the desired partitions for the selected device.

***Note:*** This step does not apply to the multiplatform devices (e.g., 3390-3A/B/C), because these devices can only have one partition of fixed size.

13. After setting the partitions for the selected device, enter **`label`** at the **`partition>`** prompt and enter **`y`** to label the device (see Figure 3-7).

***Note:*** The Solaris system displays the following warnings when an FX device (e.g., 3390-3A/B/C) is labeled. You can ignore these warnings.

```
Warning: error warning VTOC.
Warning: no backup labels.
Label failed.
```

14. Enter **`quit`** to exit the **partition** utility and return to the format utility.
15. At the **`format>`** prompt, enter **`disk`** to display the available disks. Be sure the disk you just labeled is displayed with the proper disk type name and parameters.
16. Repeat steps 2 through 15 for each new device to be partitioned and labeled. After a device type is defined (e.g., HITACHI OPEN-3), you can label all devices of that same type without having to enter the parameters (skipping steps 6 and 7). For this reason, you may want to label the devices by type (e.g., labeling all OPEN-3 devices, then all OPEN-9 devices, and so on) until all new devices have been partitioned and labeled.
17. When you finish partitioning and labeling the disks and verifying the disk labels, exit the **format** utility by entering **`quit`** or **Ctrl-d**.

```
# format                                                    ← Start format
utility.
Searching for disks...done

c1t2d0: configured with capacity of 2.29GB   (OPEN-3)  ← These devices are not yet labeled.
c1t2d1: configured with capacity of 2.29GB   (OPEN-3)  ←
c2t4d0: configured with capacity of 6.88GB   (OPEN-9)  ←
c2t5d0: configured with capacity of 2.77GB   (3390-3B) ←
c2t6d0: configured with capacity of 2.78GB   (3390-3A) ←
  ↖ These character-type device file names are used later to create the file systems.

AVAILABLE DISK SELECTIONS:

       0. c0t1d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>                ← Already labeled.
          /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@1,0
       1. c0t3d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>                ←Already labeled.
          /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@3,0
       2. c1t2d0 <HITACHI-OPEN-3-52-34                                ← Not yet labeled:
             ↖ LUN          ↖ Product version
           -          ↖ Vendor  ↖ Product ID
          –    ↖ Target Id
            ↖ Logical Controller ID
          /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@2,0    OPEN-3, TID=2, LUN=0
       3. c1t2d1 <HITACHI-OPEN-3-52-34                                ← Not yet labeled:
          /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@2,1    OPEN-3, TID=2, LUN=1
       4. c1t4d0 <HITACHI-OPEN-9-52-34                                ← Not yet labeled:
          /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@4,0    OPEN-9, TID=4, LUN=0
       5. c1t5d0 <HITACHI-3390-3B-52-34                               ←Not yet labeled:
          /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@5,0   3390-3B, TID=5, LUN=0
       6. c1t6d0 <HITACHI-3390-3A-52-34                               ← Not yet labeled:
          /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@6,0   3390-3A, TID=6, LUN=0
Specify disk (enter its number): 2                                    ← Select device.
selecting c1t2d0
[disk formatted]
Disk not labeled.  Label it now ? n                                   ← Enter "n" for no.
:
#
```

**Figure 3-4 Verifying New Devices for Disk Partitioning**

```
FORMAT MENU:
        disk       - select a disk
        type       - select (define) a disk type
        partition  - select (define) a partition table
        current    - describe the current disk
        format     - format and analyze the disk
        repair     - repair a defective sector
        label      - write label to the disk
        analyze    - surface analysis
        defect     - defect list management
        backup     - search for backup labels
        verify     - read and display labels
        save       - save new disk/partition definitions
        inquiry    - show vendor, product and revision
        volume     - set 8-character volume name
        quit

# format> type                                    ← Enter type.
:
AVAILABLE DRIVE TYPES
        0. Auto configure
            :
        14. SUN2.1G
        15. HITACHI-OPEN-3-0315                   ← Do not select this disk type.
        16. other                                   (see Note 3)
Specify disk type (enter its number):16           ← Enter number for "other" to define.
Enter number of data cylinders:3336               ← Enter value from Table 3-1 (Note 1)
Enter number of alternate cylinders[2]:2          ← Enter value from Table 3-1
Enter number of physical cylinders[3338]:           (press Enter for default)
Enter number of heads:15                          ← Enter value from Table 3-2
Enter number of physical sectors/track[defaults]:   (press Enter for default)
Enter rpm of drive [3600]:10000                   ← Enter value from Table 3-1 (Note 2)
Enter format time[defaults]:                        (press Enter for default)
Enter cylinder skew[defaults]:                      (press Enter for default)
Enter track skew[defaults]:                         (press Enter for default)
Enter track per zone[defaults]:                     (press Enter for default)
Enter alternate tracks[defaults]:                   (press Enter for default)
Enter alternate sectors[defaults]:                  (press Enter for default)
Enter cache control[defaults]:                      (press Enter for default)
Enter prefetch threshold[defaults]:                 (press Enter for default)
Enter minimum prefetch[defaults]:                   (press Enter for default)
Enter maximum prefetch[defaults]:                   (press Enter for default)
Enter disk type name(remember quotes):"HITACHI OPEN-3"   ← Enter name from Table 1-2.
selecting c1t2d0
[disk formatted]
No defined partition tables.
Disk not labeled.  Label it now ? n               ← Enter "n" for no.
format>
```

**Figure 3-5 Defining and Setting the Disk Type**

***Table Notes:***

***1:*** The number of cylinders for the 3390-3B is 3346, and the Hitachi RAID storage system returns '3346 cylinder' to the Mode Sense command, and '5822040 blocks' (Maximum LBA 5822039) to the Read capacity command. When 3390-3B is not labeled yet, Solaris displays 3344 data cylinders and 2 alternate cylinders. When 3390-3B is labeled by the Solaris format type subcommand, use 3340 for data cylinder and 2 for alternate cylinder. This is similar to the 3390-3B VLL.

***2:*** The Hitachi RAID storage system reports the RPM of the physical disk drive in response to the type subcommand parameter.

***3:*** It is also possible to follow the procedure using type => "0. Auto Configure" => label the drive without calculating detail values like as Cylinder, Header, Blocks/Tracks.

***4:*** Setting host mode 16 affects the geometry parameter reported by the Hitachi RAID storage system (see Table 3-1) as follows:

- Setting host mode option 16 to ON increases the number of cylinders by 4 and reduces the number of blocks per track by ¼.
- Setting host mode option 16 to OFF lowers the number of cylinders by ¼ and increases the number of blocks per track by 4. Therefore, if you use host mode 16, please account for these differences. For example, if you change the host mode option 16 from OFF to ON, you may want to make either of the following changes in the format menu:
- Increase the number of block setting per track by ¼ and the number of heads by 4.
- Increase the number of blocks per track to ¼, the number of cylinders by 2, and the number of heads by 2.

If the number of cylinders entered exceeds 65,533, the total LU block number equals or is less than 65,533. Use the Format Menu to specify the numbers of cylinders, heads, and blocks per track.

```
format> disk

AVAILABLE DISK SELECTIONS
        0. c0t1d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>
           /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@1,0
        1. c0t3d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>
           /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@3,0
        2. c1t2d0 <HITACHI OPEN-3 cyl 3336 alt 2 hd 15 sec 96> ...already labeled
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,0
        3. c1t2d1 <HITACHI-OPEN-3-52-34 .....>                  ...not yet labeled
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,1
        4. c1t4d0 <HITACHI-OPEN-9-52-34 .....>                 ...not yet labeled
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@4,0
        5. c1t5d0 <HITACHI-3390-3B-52-34 ....>                 ...not yet labeled
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@5,0
        6. c1t6d0 <HITACHI-3390-3A-52-34 ....>                 ...not yet labeled
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@6,0

Specify disk (enter its number): 3


FORMAT MENU:
        disk      - select a disk
        type      - select (define) a disk type
        partition - select (define) a partition table
        current   - describe the current disk
        format    - format and analyze the disk
        repair    - repair a defective sector
        label     - write label to the disk
        analyze   - surface analysis
        defect    - defect list management
        backup    - search for backup labels
        verify    - read and display labels
        save      - save new disk/partition definitions
        inquiry   - show vendor, product and revision
        volume    - set 8-character volume name
        quit
format> type                                                  ← Enter type.

AVAILABLE DRIVE TYPES
        0.Auto configure
          :
        13. SUN1.3G
        14. SUN2.1G
        15. HITACHI-OPEN-3-52-34
        16. HITACHI OPEN-3
        17. other
Specify disk type (enter its number):16                       ← Enter the number for
:                                                               the desired drive type.
selecting c0t2d0
[disk formatted]
No defined partition tables.
Disk not labeled.  Label it now ? n                           ← Enter n for no.
format>
```

**Figure 3-6 Setting the Partition(s) (continues on the next page)**

```
FORMAT MENU:
        disk       - select a disk
        type       - select (define) a disk type
        partition  - select (define) a partition table
        current    - describe the current disk
        format     - format and analyze the disk
        repair     - repair a defective sector
        label      - write label to the disk
        analyze    - surface analysis
        defect     - defect list management
        backup     - search for backup labels
        verify     - read and display labels
        save       - save new disk/partition definitions
        inquiry    - show vendor, product and revision
        volname    - set 8-character volume name
        <cmd>      - execute <cmd>, then return
        quit
format> partition                                          ← Display partition menu.

PARTITION MENU
       0      - change ‘0’ partition
       1      - change ‘1’ partition
       2      - change ‘2’ partition
       3      - change ‘3’ partition
       4      - change ‘4’ partition
       5      - change ‘5’ partition
       6      - change ‘6’ partition
       7      - change ‘7’ partition
       select - select a predefined table
       modify - modify a predefined partition table
       name   - name the current table
       print  - display the current table
       label  - write partition map and label to the disk
       quit
partition> 0                                               ← Select partition number.
Part      Tag     Flag      Cylinders     Size       Blocks
  0  unassigned    wm        0 -           0          (0/0/0)

Enter partition id tag [root]:                             ← Press enter for default.
Enter partition permission flags [wm]:                     ← Press enter for default.
Enter new starting cyl [0]:                                ← Press enter for default.
Enter partition size [0b, 0c, 0.00mb]:3336c                ← Enter size (Table_3_1).
partition> print                                           ← Display partition table.
:                                                                  (see Note, below)
Current partition table (unnamed)
Part        Tag    Flag      Cylinders     Size              Blocks
  0        root    wm        0 -           0          (0/0/0)         0
  1        swap    wm        0 -           0          (0/0/0)         0
  2      backup    wu        0 - 3335     2.29 GB   (3336/0/0)   4803840
  3  unassigned    wu        0 -           0          (0/0/0)         0
  4  unassigned    wm        0 -           0          (0/0/0)         0
  5  unassigned    wm        0 -           0          (0/0/0)         0
  6         usr    wm      336 - 3335     204 GB     (2970/0/0)   4276800
  7  unassigned    wm        0 -           0          (0/0/0)         0
```

**Figure 3-6 Setting the Partition(s) (continued)**

```
PARTITION MENU
       0      - change ‘0’ partition
       1      - change ‘1’ partition
       2      - change ‘2’ partition
       3      - change ‘3’ partition
       4      - change ‘4’ partition
       5      - change ‘5’ partition
       6      - change ‘6’ partition
       7      - change ‘7’ partition
       select - select a predefined table
       modify - modify a predefined partition table
       name   - name the current table
       print  - display the current table
       label  - write partition map and label to the disk
       quit
partition> label                                                    ← Label the disk.
Ready to label disk, continue? Y                                    ← Enter Y for yes.
  * (see Note, below)
partition> quit                                                     ← Return to format.
format> disk                                                        ← Display disks.

AVAILABLE DISK SELECTIONS
        0. c0t1d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>
           /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@1,0
        1. c0t3d0 <SUN1.05 cyl 2036 alt 2 hd 14 sec 72>
           /iommu@f,e0000000/sbus@f,e0001000/espdma@f,400000/esp@f,800000/sd@3,0
        2. c1t2d0 <HITACHI OPEN-3 cyl 3336 alt 2 hd 15 sec 96>      ← Verify disk label.
                                                    ↖ Track size.
                                                ↖ Number of heads.
                                            ↖ Number of alternate cylinders.
                                        ↖ Number of data cylinders.
                                ↖ Disk type name.
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,0
        3. c1t2d1 <HITACHI-OPEN-3-0315 ..................... >        ← Not yet labeled.
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,1
        4. c1t4d0 <HITACHI-OPEN-9-0315 ..................... >        ← Not yet labeled.
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@4,0
        5. c1t5d0 <HITACHI-3390-3B-0315 ..................... >       ← Not yet labeled.
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@5,0
        6. c1t6d0 <HITACHI-3390-3A-0315 ..................... >       ← Not yet labeled.
           /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@6,0

Specify disk (enter its number): 3                  ← Enter number for next disk to label,
                                                      or press Ctrl-d to quit.
```

**Figure 3-7 Labeling the Disk and Verifying the Disk Label**

***Note:*** The Sun Solaris system displays the following warnings when an FX device (e.g., 3390-3A) is labeled. You can ignore these warnings:

```
Warning: error warning VTOC.
Warning: no backup labels. Label failed.
```

## Table 3-1 Device Geometry Parameters

| Device Type | # of Data Cylinders | # of Alternate Cylinders | RPM | Partition Size (sample) |
|---|---|---|---|---|
| OPEN-3 | 3336 | 2 | 10,000 | 3336c |
| OPEN-8 | 9964 | 2 | 10,000 | 9964c |
| OPEN-9 | 10014 | 2 | 10,000 | 10014c |
| OPEN-E | 19757 | 2 | 10,000 | 19757c |
| OPEN-L | 19013 | 2 | 10,000 | 19013c |
| OPEN-3*n | N1* | 2 | 10,000 | N4* |
| OPEN-8*n | N26* | 2 | 10,000 | N29* |
| OPEN-9*n | N5* | 2 | 10,000 | N8* |
| OPEN-E*n | N30* | 2 | 10,000 | N33* |
| OPEN-L*n | N34 | 2 | 10,000 | N37 |
| OPEN-x VLL | See Table 1-2 | 2 | 10,000 | See Table 1-2 |
| OPEN-3*n VLL | N22* | 2 | 10,000 | N25* |
| OPEN-8*n VLL | N22* | 2 | 10,000 | N25* |
| OPEN-9*n VLL | N22* | 2 | 10,000 | N25* |
| OPEN-E*n VLL | N22* | 2 | 10,000 | N25* |
| OPEN-V*n VLL | N22* | 2 | 10,000 | N25* |
| 3390-3A | 3346 | 2 | 10,000 | 3346c |
| 3390-3B | 3340 | 2 | 10,000 | 3340c |
| 3390-3C | 3346 | 2 | 10,000 | 3346c |
| FX OPEN-3 | 3336 | 2 | 10,000 | 3336c |
| 3390-3A VLL | See Table 1-2 | 2 | 10,000 | See Table 1-2 |
| 3390-3B VLL | See Table 1-2 | 2 | 10,000 | See Table 1-2 |
| 3390-3C VLL | See Table 1-2 | 2 | 10,000 | See Table 1-2 |
| FX OPEN-3 VLL | See Table 1-2 | 2 | 10,000 | See Table 1-2 |
| ***Note:*** For the values indicated by Nxx (e.g., N15, N22), see Table 3-2 through Table 3-8. | | | | |

## Table 3-2 Geometry Parameters for OPEN-3*n LUSE Devices

| n | Data Cylinders-N1 Partition Size-N4 | Heads-N2 | Blocks/ Track-N3 | Usable Blocks (N1+2)*N2*N3 | Provided Blocks =3338*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 2 | 6674 | 15 | 96 | 9613440 | 9613440 | 0 |
| 3 | 10012 | 15 | 96 | 14420160 | 14420160 | 0 |
| 4 | 13350 | 15 | 96 | 19226880 | 19226880 | 0 |
| 5 | 16688 | 15 | 96 | 24033600 | 24033600 | 0 |
| 6 | 20026 | 15 | 96 | 28840320 | 28840320 | 0 |
| 7 | 23364 | 15 | 96 | 33647040 | 33647040 | 0 |
| 8 | 26702 | 15 | 96 | 38453760 | 38453760 | 0 |
| 9 | 30040 | 15 | 96 | 43260480 | 43260480 | 0 |
| 10 | 16688 | 30 | 96 | 48067200 | 48067200 | 0 |
| 11 | 20026 | 33 | 80 | 52873920 | 52873920 | 0 |
| 12 | 20026 | 30 | 96 | 57680640 | 57680640 | 0 |
| 13 | 20026 | 39 | 80 | 62487360 | 62487360 | 0 |
| 14 | 23364 | 30 | 96 | 67294080 | 67294080 | 0 |
| 15 | 16688 | 45 | 96 | 72100800 | 72100800 | 0 |
| 16 | 26702 | 30 | 96 | 76907520 | 76907520 | 0 |
| 17 | 30040 | 34 | 80 | 81714240 | 81714240 | 0 |
| 18 | 30040 | 30 | 96 | 86520960 | 86520960 | 0 |
| 19 | 30040 | 38 | 80 | 91327680 | 91327680 | 0 |
| 20 | 16688 | 60 | 96 | 96134400 | 96134400 | 0 |
| 21 | 23364 | 45 | 96 | 100941120 | 100941120 | 0 |
| 22 | 30040 | 55 | 64 | 105747840 | 105747840 | 0 |
| 23 | 30040 | 46 | 80 | 110554560 | 110554560 | 0 |
| 24 | 20026 | 60 | 96 | 115361280 | 115361280 | 0 |
| 25 | 16688 | 45 | 160 | 120168000 | 120168000 | 0 |
| 26 | 20026 | 39 | 160 | 124974720 | 124974720 | 0 |
| 27 | 30040 | 45 | 96 | 129781440 | 129781440 | 0 |
| 28 | 23364 | 60 | 96 | 134588160 | 134588160 | 0 |
| 29 | 30040 | 58 | 80 | 139394880 | 139394880 | 0 |
| 30 | 16688 | 45 | 192 | 144201600 | 144201600 | 0 |
| 31 | 30040 | 62 | 80 | 149008320 | 149008320 | 0 |
| 32 | 26702 | 60 | 96 | 153815040 | 153815040 | 0 |
| 33 | 30040 | 55 | 96 | 158621760 | 158621760 | 0 |
| 34 | 30040 | 64 | 85 | 163428480 | 163428480 | 0 |

| n | Data Cylinders-N1 Partition Size-N4 | Heads-N2 | Blocks/ Track-N3 | Usable Blocks (N1+2)*N2*N3 | Provided Blocks =3338*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 35 | 30040 | 56 | 100 | 168235200 | 168235200 | 0 |
| 36 | 30040 | 60 | 96 | 173041920 | 173041920 | 0 |

**Notes:**

**N1**,**N2**,**N3**: Use value in Table 3-1.

**N4**: Use same value as N1. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 6674c for OPEN-3*2).

## Table 3-3 Geometry Parameters for OPEN-8*n LUSE Devices

| n | Data Cylinders-N26 Partition Size-N29 | Heads -N27 | Blocks/ Track-N28 | Usable Blocks (N26+2)*N27*N28 | Provided Blocks =9966*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 2 | 19930 | 15 | 96 | 28702080 | 28702080 | 0 |
| 3 | 29896 | 15 | 96 | 43053120 | 43053120 | 0 |
| 4 | 29896 | 20 | 96 | 57404160 | 57404160 | 0 |
| 5 | 29896 | 25 | 96 | 71755200 | 71755200 | 0 |
| 6 | 29896 | 30 | 96 | 86106240 | 86106240 | 0 |
| 7 | 29896 | 35 | 96 | 100457280 | 100457280 | 0 |
| 8 | 29896 | 40 | 96 | 114808320 | 114808320 | 0 |
| 9 | 29896 | 45 | 96 | 129159360 | 129159360 | 0 |
| 10 | 29896 | 50 | 96 | 143510400 | 143510400 | 0 |
| 11 | 29896 | 55 | 96 | 157861440 | 157861440 | 0 |
| 12 | 29896 | 60 | 96 | 172212480 | 172212480 | 0 |
| 13 | 29896 | 52 | 120 | 186563520 | 186563520 | 0 |
| 14 | 29896 | 56 | 120 | 200914560 | 200914560 | 0 |
| 15 | 29896 | 60 | 120 | 215265600 | 215265600 | 0 |
| 16 | 29896 | 64 | 120 | 229616640 | 229616640 | 0 |
| 17 | 29896 | 34 | 240 | 243967680 | 243967680 | 0 |
| 18 | 29896 | 36 | 240 | 258318720 | 258318720 | 0 |
| 19 | 29896 | 38 | 240 | 272669760 | 272669760 | 0 |
| 20 | 29896 | 40 | 240 | 287020800 | 287020800 | 0 |
| 21 | 29896 | 42 | 240 | 301371840 | 301371840 | 0 |
| 22 | 29896 | 44 | 240 | 315722880 | 315722880 | 0 |
| 23 | 29896 | 46 | 240 | 330073920 | 330073920 | 0 |
| 24 | 29896 | 48 | 240 | 344424960 | 344424960 | 0 |
| 25 | 29896 | 50 | 240 | 358776000 | 358776000 | 0 |
| 26 | 29896 | 52 | 240 | 373127040 | 373127040 | 0 |
| 27 | 29896 | 54 | 240 | 387478080 | 387478080 | 0 |
| 28 | 29896 | 56 | 240 | 401829120 | 401829120 | 0 |

| n | Data Cylinders-N26 Partition Size-N29 | Heads -N27 | Blocks/ Track-N28 | Usable Blocks (N26+2)*N27*N28 | Provided Blocks =9966*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 29 | 29896 | 58 | 240 | 416180160 | 416180160 | 0 |
| 30 | 29896 | 60 | 240 | 430531200 | 430531200 | 0 |
| 31 | 29896 | 62 | 240 | 444882240 | 444882240 | 0 |
| 32 | 29896 | 64 | 240 | 459233280 | 459233280 | 0 |
| 33 | 32614 | 60 | 242 | 473584320 | 473584320 | 0 |
| 34 | 29896 | 64 | 255 | 487935360 | 487935360 | 0 |
| 35 | 30655 | 64 | 256 | 502284288 | 502286400 | 2112 |
| 36 | 31531 | 64 | 256 | 516636672 | 516637440 | 768 |

**Notes:**

**N26**,**N27**,**N28** : Use values in Table 1-2.

**N29**: Use same value as N26. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 19930c for OPEN-8*2).

***Note:*** Data cylinders must be less than or equal to **32767**, heads must be less than or equal to **64**, blocks per track must be less than or equal to **256** when these values are specified as parameters of Solaris format type subcommand. The whole data blocks of OPEN-3*2 ~ OPEN-3*36 can be used by above parameters.

### Table 3-4 Geometry Parameters for OPEN-9*n LUSE Devices

| n | Data Cylinders-N5 Partition Size-N8 | Heads -N6 | Blocks/ Track-N7 | Usable Blocks (N5+2)*N6*N7 | Provided Blocks =10016*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 2 | 20030 | 15 | 96 | 28846080 | 28846080 | 0 |
| 3 | 30046 | 15 | 96 | 43269120 | 43269120 | 0 |
| 4 | 30046 | 20 | 96 | 57692160 | 57692160 | 0 |
| 5 | 30046 | 25 | 96 | 72115200 | 72115200 | 0 |
| 6 | 30046 | 30 | 96 | 86538240 | 86538240 | 0 |
| 7 | 30046 | 35 | 96 | 100961280 | 100961280 | 0 |
| 8 | 30046 | 40 | 96 | 115384320 | 115384320 | 0 |
| 9 | 30046 | 45 | 96 | 129807360 | 129807360 | 0 |
| 10 | 30046 | 50 | 96 | 144230400 | 144230400 | 0 |
| 11 | 30046 | 55 | 96 | 158653440 | 158653440 | 0 |
| 12 | 30046 | 60 | 96 | 173076480 | 173076480 | 0 |
| 13 | 30046 | 52 | 120 | 187499520 | 187499520 | 0 |
| 14 | 30046 | 56 | 120 | 201922560 | 201922560 | 0 |
| 15 | 30046 | 60 | 120 | 216345600 | 216345600 | 0 |
| 16 | 30046 | 64 | 120 | 230768640 | 230768640 | 0 |

| n | Data Cylinders-N5 Partition Size-N8 | Heads -N6 | Blocks/ Track-N7 | Usable Blocks (N5+2)*N6*N7 | Provided Blocks =10016*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 17 | 30046 | 34 | 240 | 245191680 | 245191680 | 0 |
| 18 | 30046 | 36 | 240 | 259614720 | 259614720 | 0 |
| 19 | 30046 | 38 | 240 | 274037760 | 274037760 | 0 |
| 20 | 30046 | 40 | 240 | 288460800 | 288460800 | 0 |
| 21 | 30046 | 42 | 240 | 302883840 | 302883840 | 0 |
| 22 | 30046 | 44 | 240 | 317306880 | 317306880 | 0 |
| 23 | 30046 | 46 | 240 | 331729920 | 331729920 | 0 |
| 24 | 30046 | 48 | 240 | 346152960 | 346152960 | 0 |
| 25 | 30046 | 50 | 240 | 360576000 | 360576000 | 0 |
| 26 | 30046 | 52 | 240 | 374999040 | 374999040 | 0 |
| 27 | 30046 | 54 | 240 | 389422080 | 389422080 | 0 |
| 28 | 30046 | 56 | 240 | 403845120 | 403845120 | 0 |
| 29 | 30046 | 58 | 240 | 418268160 | 418268160 | 0 |
| 30 | 30046 | 60 | 240 | 432691200 | 432691200 | 0 |
| 31 | 30046 | 62 | 240 | 447114240 | 447114240 | 0 |
| 32 | 30046 | 64 | 240 | 461537280 | 461537280 | 0 |
| 33 | 30985 | 64 | 240 | 475960320 | 475960320 | 0 |
| 34 | 31924 | 64 | 240 | 490383360 | 490383360 | 0 |
| 35 | 31298 | 63 | 256 | 504806400 | 504806400 | 0 |
| 36 | 31689 | 64 | 256 | 519225344 | 519229440 | 4096 |

**Notes:**

**N5**,**N6**,**N7**: Use value in Table 3-1 and Table 3-2.

**N8**: Use same value as N5. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 20030c for OPEN-9*2).

**Table 3-5 Geometry Parameters for OPEN-E*n LUSE Devices**

| n | Data Cylinders-N30 Partition Size-N33 | Heads-N31 | Blocks/ Track-N32 | Usable Blocks (N30+2)*N31*N32 | Provided Blocks =9966*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 2 | 19757 | 30 | 96 | 56905920 | 56905920 | 0 |
| 3 | 19757 | 45 | 96 | 85358880 | 85358880 | 0 |
| 4 | 19757 | 60 | 96 | 113811840 | 113811840 | 0 |
| 5 | 19757 | 30 | 240 | 142264800 | 142264800 | 0 |
| 6 | 19757 | 45 | 192 | 170717760 | 170717760 | 0 |
| 7 | 19757 | 60 | 168 | 199170720 | 199170720 | 0 |
| 8 | 19757 | 60 | 192 | 227623680 | 227623680 | 0 |
| 9 | 19757 | 60 | 216 | 256076640 | 256076640 | 0 |
| 10 | 19757 | 60 | 240 | 284529600 | 284529600 | 0 |
| 11 | 27166 | 60 | 192 | 312975360 | 312982560 | 7200 |
| 12 | 29636 | 60 | 192 | 341429760 | 341435520 | 5760 |
| 13 | 32106 | 60 | 192 | 369884160 | 369888480 | 4320 |
| 14 | 27660 | 60 | 240 | 398332800 | 398341440 | 8640 |
| 15 | 29636 | 60 | 240 | 426787200 | 426794400 | 7200 |
| 16 | 31612 | 60 | 240 | 455241600 | 455247360 | 5760 |
| 17 | 31612 | 60 | 255 | 483694200 | 483700320 | 6120 |
| 18 | 31257 | 64 | 256 | 512147456 | 512153280 | 5824 |

**Notes:**

**N30**,**N31**,**N32**: Use value in Table 3-1.

**N33**: Use same value as N30. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 19757c for OPEN-E*2).

***Note:*** Data cylinders must be less than or equal to **32767**, heads must be less than or equal to 64, blocks per track must be less than or equal to 256 when these values are specified as parameters of Solaris format type subcommand. The whole data blocks of OPEN-E*2~OPEN-E*10 can be used by above parameters. About OPEN-E*11~OPEN-E*18, some blocks must become unusable.

**Table 3-6 Geometry Parameters for OPEN-L*n LUSE Devices**

| n | Data Cylinders-N34 Partition Size-N37 | Heads-N35 | Blocks/ Track-N36 | Usable Blocks (N34+2)*N35*N36 | Provided Blocks =49439*15*96*n | Diff. |
|---|---|---|---|---|---|---|
| 2 | 19013 | 64 | 117 | 142384320 | 142384320 | 0 |
| 3 | 30422 | 36 | 195 | 213576480 | 213576480 | 0 |
| 4 | 30422 | 45 | 208 | 284768640 | 284768640 | 0 |
| 5 | 30422 | 60 | 195 | 355960800 | 355960800 | 0 |
| 6 | 30422 | 60 | 234 | 427152960 | 427152960 | 0 |
| 7 | 30897 | 63 | 256 | 498339072 | 498345120 | 6048 |

**Notes:**

**N34**, **N35**, **N36**: Use value in Table 3-1.

**N37**: Use same value as N34. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 19013c for OPEN-L*2).

***Note:*** Data cylinders must be less than or equal to **32767**, heads must be less than or equal to 64, blocks per track must be less than or equal to 256 when these values are specified as parameters of Solaris format type subcommand. The whole data blocks of OPEN-L*2~OPEN-L*6 can be used by above parameters. About OPEN-L*7, some blocks must become unusable.

## Table 3-7 Geometry Parameters for OPEN-*x**n VLL-LUSE Devices (Example)

| Data Cylinders-N22 Partition Size-N25 | Heads-N23 | Blocks/ Track-N24 | Usable Blocks (N22+2)*N23*N24 | Provided Blocks-N21 | Diff. |
|---|---|---|---|---|---|
| 98 | 15 | 96 | 144000 | 35MB×2 volumes<br>↑35×1024/720↑×2=100<br>100×15×96=144000 | 0 |
| 2590 | 15 | 96 | 3732480 | 50MB×36 volumes<br>↑50×1024/720↑×36=2592<br>2592×15×96=3732480 | 0 |
| 284 | 15 | 96 | 411840 | 100MB×2 volumes<br>↑100×1024/720↑×2=286<br>286×15×96=411840 | 0 |
| 5694 | 15 | 96 | 8202240 | 500MB×8 volumes<br>↑500×1024/720↑×8=5696<br>5696×15×96=8202240 | 0 |
| 22758 | 30 | 96 | 65548800 | 2000MB×2 volumes<br>↑2000×1024/720↑×16=45520<br>45520×15×96=65548800 | 0 |
| 27455 | 40 | 188 | 206476640 | 2800MB×36 volumes<br>↑2800×1024/720↑×36=143388<br>143388×15×96=206478720 | 2080 |

**Notes:**

**N21** # of blocks of LUSE composed by VLL volumes are calculated by:

**N21** = N20 × (# of heads) × (# of sectors per track).

**N22:** N20 – 2, Use total cylinder – 2.

**N23, N24:** Use value in Table 3-1 and Table 3-2.

**N25:** Use same value as N22.

**Table 3-8 Geometry Parameters for OPEN-V*n VLL-LUSE Devices (Example)**

| Data Cylinders-N22<br>Partition Size-N25 | Heads-N23 | Blocks/Track-N24 | Usable Blocks (N22+2)*N23*N24 | Provided Blocks-N21 | Diff. |
|---|---|---|---|---|---|
| 48 | 15 | 128 | 92160 | 45 MB volumes<br>↑ 45 × 16/15 ↑ = 48<br>48 × 15 × 128 = 92160 | 0 |
| 27305 | 30 | 128 | 104858880 | 50 GB volumes<br>↑ 50 × 1024 × 16/15 ↑ = 54614<br>54614 × 15 × 128 = 104858880 | 0 |
| 10921 | 150 | 128 | 209721600 | 10 GB × 10 volumes<br>↑ 10 × 1024 × 16/15 ↑ × 10 = 109230<br>109230 × 15 × 128 = 209721600 | 0 |
| 32767 | 100 | 128 | 419443200 | 20 GB × 10 volumes<br>↑20 × 1024 × 16/15↑ × 10 = 218460<br>218460 × 15 × 128 = 419443200 | 0 |

**Notes:**

**N21** # of blocks of LUSE composed by VLL volumes are calculated by:

**N21** = N20 × (# of heads) × (# of sectors per track).

**N22:** N20 – 2, Use total cylinder – 2.

**N23, N24:** Use value in Table 3-1 and Table 3-2.

**N25:** Use same value as N22.

- For OPEN-V, because the capacity is not fixed, AutoConfig is recommended for the geometry setting.
- The geometry setting is also available manually as needed. In this case, the OPEN-V geometry of X GB can be calculated according to the equations in ***Example 1*** and ***Example 2*** using the values of N22, N23, and N24:

***Example 1:***

N22(Cyl)×N23(Head)×N24(Block/Trk)×512(Byte) = or < X GB（=×1024×1024×1024 Byte）is as follows:

```
16000(Cyl)×256(Head)×256(Block)×512(Byte)=536870912000Byte=500GB
32000(Cyl)×128(Head)×256(Block)×512(Byte)=536870912000Byte=500GB
```

***Example 2*** (a variation of ***Example 1***):

22(Cyl)×N23(Head)×N24(Block/Trk) = or < X GB（=×1024×1024×1024 Byte）/ 512 (Byte) = Usable Blocks is as follows:

```
15000(Cyl)×256(Head)×256(Block)×512(Byte)=536870912000Byte=468.75GB<500GB
```

# Creating and Mounting the File Systems

After you partition and label all new disks, create and mount the file systems for the SCSI disk devices (e.g., OPEN-*x*). Table 3-9 summarizes the steps for creating and mounting the file systems for the new SCSI disk devices.

**Table 3-9 Steps for Creating and Mounting the File Systems**

| | Task |
|---|---|
| 1. | Create the file systems |
| 2. | Create and verify the mount directories |
| 3. | Mount and verify the file systems |
| 4. | Set the auto-mount parameters (optional) |

***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. Create the file system using the **newfs -C <maxcontig>** command (see Figure 3-8).
   a. Use 6 or one of the following multiples of 6 as the **maxcontig** value for all SCSI disk devices on the Hitachi RAID storage system: 12, 18, 24, or 30. If 6 is used, the Solaris system will access 48 KB as a unit (6 × 8 KB), which matches the track size of the OPEN-x devices. These **maxcontig** values (6, 12, 18, 24, 30) optimize the I/O performance by keeping the I/O data range on one track. The **maxcontig** value that you choose depends on your applications, and you can always change the **maxcontig** parameter to a different value at any time.
   b. Use the character-type device file as the argument. For example:

      **/dev/rdsk/c1t2d0s0**
2. When the confirmation appears, verify that the device file name is correct. If so, enter **y** for yes. If not, enter **n** for no, and then repeat step (1) using the correct device file name.
3. Repeat steps (1) and (2) for each new SCSI disk device on the storage system. Be sure to use the same **maxcontig** value for all Hitachi RAID storage system devices.

```
# newfs -C 6 /dev/rdsk/c1t2d0s0                                  ← Create file system.
newfs:construct a new file system /dev/rdsk/c1t2d0s0:(y/n) y     ← Verify correct device.
/dev/rdsk/c1t2d0s0: 4803840 sectors in 3336 cylinders of 15 tracks, 96 sectors
    2345.6MB in 209 cyl groups (16 c/g, 11.25MB/g, 5440 i/g)
super-block backups (for fsck -F ufs -o b=#) at:
 32, 23168, 46304, 69440, 92576, 115712, 138848, 161984, 185120, 208256,
  :
4747616, 4770752, 4792352,
# newfs -C 6 /dev/rdsk/c1t2d1s0                                  ← Create file system on
                                                                   next disk using same
                                                                   maxcontig value.
```

**Figure 3-8 Creating the File Systems**

## Creating and Verifying the Mount Directories

After you create the file systems, create and verify the mount directories for the new SCSI disk devices. Each logical partition requires a unique mount directory, and the mount directory name should identify the logical volume and the partition.

To create the mount directories for the newly installed SCSI disk devices:

1. Go to the root directory (see Figure 3-9).
2. Use the **mkdir** command to create the mount directory.

   To delete a mount directory, use the **rmdir** command (e.g., **rmdir /USP_LU00**).
3. Choose a name for the mount directory that identifies both the logical volume and the partition. For example, to create a mount directory named USP_LU00, enter:

   **mkdir /USP_LU00**
4. Use the **ls -x** command to verify the new mount directory.
5. Repeat steps 2 and 3 for each logical partition on each new SCSI disk device.

```
# cd                                                    ← Go to the root directory.
# pwd                                                   ← Display current directory.
/
# mkdir /USP_LU00                                      ← Create new mount directory.
# ls –x                                                 ← Verify new mount directory.
USP_LU00  bin    dev      device    etc      export correctly
floppy     home   hstsboof kadb      kernel   lib
#
```

**Figure 3-9 Creating and Verifying a Mount Directory**

## Mounting and Verifying the File Systems

After you create the mount directories, mount and verify the file systems for the new SCSI disk devices. The file system for each logical partition should be mounted and verified to ensure that all new logical units are fully operational.

To mount and verify the file systems for the new devices (see Figure 3-10):

1. Mount the file system using the mount command. Be sure to use the correct block-type device file name and mount directory for the device/partition. For example, to mount the file **/dev/dsk/c1t2d0s0** with the mount directory **/USP_LU00**, enter:

   **mount /dev/dsk/c1t2d0s0 /USP_LU00**

   To unmount a file system, use the **umount** command (e.g., **umount /USP_LU00**).

***Note:*** If you already set the auto-mount parameters (see Setting and Verifying the Auto-Mount Parameters), you do not need to specify the block-type device file, only the mount directory.

2. Repeat step 1 for each partition of each newly installed SCSI disk device.
3. Display the mounted devices using the **df -k** command, and verify that all new SCSI disk devices are displayed correctly. OPEN-x devices will display as OPEN-3, OPEN-9, OPEN-E, OPEN-L devices.
4. As a final verification, perform some basic UNIX operations (e.g., file creation, copying, and deletion) on each logical unit to ensure the new file systems are fully operational.

```
# mount /dev/dsk/c1t2d0s0 /USP_LU00          ← Mount file system.
                ↖ Block-type device file name
# mount /dev/dsk/c1t2d1s0 /USP_LU01     ← Mount next file system.
                              ↖ Mount directory name
# mount /dev/dsk/c1t2d2s0 /USP_LU02     ← Mount next file system.
 :
 :
#
# df –k                                                    ← Display file systems.
File system         Kbytes    used    avail  capacity   Mounted on
/dev/dsk/c0t3d0s0    28775   27706        0    100%     /
/dev/dsk/c0t3d0s6   269191  234897     7384     97%     /usr
/proc                    0       0        0      0%     /proc
fd                       0       0        0      0%     /dev/fd
/dev/dsk/c0t3d0s4s   57567   29515    22302     57%     /var
swap                142204      20   142184      0%     /tmp
/dev/dsk/c0t3d0s7   462119  206000   209909     50%     /export/home
/dev/dsk/c0t3d0s5    47975   42059     1126     97%     /opt
/dev/dsk/c1t2d0s0  2256436       9  2030787      0%     /USP_LU00
                                                        ↖ Verify file systems.
/dev/dsk/c1t2d1s0  2256436       9  2030787      0%     /USP_LU01
                                                              ↖ OPEN-3 device.
/dev/dsk/c1t2d2s0  6774358       9  6548709      0%     /USP_LU02
                                                              ↖ OPEN-9 device.
:
# mount /dev/dsk/c1t2d0s0 /USP_LU00          ← Mount file system.
# cd /USP_LU00                          ← Go to mount directory.
# cp /bin/vi /USP_LU00/vi.back1                  ← Copy a file.
# ls –l                                                  ← Verify the file copy.
drwxr-xr-t   2 root     root       8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys     2617344 Mar 15 11:41  vi.back1
# cp vi.back1 vi.back2                                      ← Copy file again.
# ls –l                                                ← Verify file copy again.
drwxr-xr-t   2 root     root       8192 Mar 15 11:35  lost+found
-rwxr-xr-x   1 root     sys     2617344 Mar 15 11:41  vi.back1
-rwxr-xr-t   1 root     sys     2617344 Mar 15 11:52  vi.back2
# rm vi.back1                                             ← Remove test files.
# rm vi.back2                                             ← Remove test files.
```

**Figure 3-10 Mounting and Verifying the File System**

## Setting and Verifying the Auto-Mount Parameters

You can add any or all of the new SCSI disk devices to the **/etc/vfstab** file to specify the auto-mount parameters for each device. Once a device is added to this file, you can mount the device without having to specify its block-type device file name (e.g., mount /USP_LU00), since the **/etc/vfstab** file associates the device with its mount directory.

To set the auto-mount parameters for the desired devices (see Figure 3-11):

1. Make a backup copy of the **/etc/vfstab** file:

   **cp /etc/vfstab /etc/vfstab.standard**

2. Edit the **/etc/**vfstab file to add one line for each device to be auto-mounted. Table 3-10 shows the auto-mount parameters. If you make a mistake while editing, exit the **vi** editor without saving the file, and then begin editing again.
3. Reboot the Solaris system after you are finished editing the **/etc/vfstab** file.
4. Use the **df -k** command to display the mounted devices and verify that the desired devices were auto-mounted.

```
# cp -ip /etc/vfstab /etc/vfstab.standard                    ← Make backup before editing.
# vi /etc/vfstab                                                          ← Edit the file.
#device            device              mount       FS      fsck  mount   mount
#to mount          to fsck             point       type    pass  at boot options
  ①                ②                   ③           ④       ⑤     ⑥       ⑦←See Table 3-9.


/proc              -                   /proc       procfs  -     no      -
fd                 -                   /dev/fd     fd      -     no      -
swap               -                   /tmp        tmpfs   -     yes     -
/dev/dsk/c0t3d0s0  /dev/rdsk/c0t3d0s0  /           ufs     1     no      -
/dev/dsk/c0t3d0s6  /dev/rdsk/c0t3d0s6  /usr        ufs     2     no      -
/dev/dsk/c0t3d0s7  /dev/rdsk/c0t3d0s7  /export     ufs     3     yes     -
/dev/dsk/c0t3d0s5  /dev/rdsk/c0t3d0s5  /opt        ufs     4     yes     -
/dev/dsk/c0t3d0s1  -                   -           swapfs  -     no      -
/dev/dsk/c1t2d0s0  /dev/rdsk/c1t2d0s0  /USP_LU00   ufs     5     yes     -  ← Add one line
/dev/dsk/c1t2d1s0  /dev/rdsk/c1t2d1s0  /USP_LU01   ufs     5     yes     -    for each LUN.
```

**Figure 3-11 Setting the Auto-Mount Parameters**

**Table 3-10 Auto-Mount Parameters**

| Parameter # | Name | Enter: |
|---|---|---|
| ① | Device to mount | Block-type device file name |
| ② | Device to fsck | Character-type device file name |
| ③ | Mount point | Mount directory name |
| ④ | FS type | File system type (e.g., ufs) |
| ⑤ | Fsck pass | Order for performing file system checks |
| ⑥ | Mount at boot | Yes = auto-mounted at boot/mountall<br>No = not auto-mounted at boot/mountall |
| ⑦ | Mount options | Desired mount options:<br>- no options (typical)<br>-ro read-only access (e.g., for 3390- 3B devices) |

4

# Failover and SNMP Operations

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 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.

- ☐ 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 the Veritas Cluster Server and Sun Cluster host failover products for the Solaris operating system. Be sure to configure the host failover software and any other high-availability (HA) software as needed to recognize and operate with the newly attached Hitachi RAID storage system devices.

***Note:*** You must set **HOST MODE=09** before installing Sun Cluster, or the Quorum Device will not be assigned to the Hitachi RAID storage system.

For assistance with Veritas Cluster Server operations, refer to the Veritas user documentation, see Appendix D Note on Using Veritas Cluster Server, or contact Symantec technical support. For assistance with Sun Cluster operations, refer to the Sun Cluster user documentation, or contact the vendor's technical support. For assistance with specific configuration issues related to the Hitachi RAID storage system, please contact your Hitachi Data Systems representative.

# Path Failover

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

***Note:*** Devices that will be managed by HDLM must have a label (see Partitioning and Labeling the New Devices).

For assistance with Hitachi Dynamic Link Manager, refer to the *Hitachi Dynamic Link Manager for Solaris User's Guide* or contact your Hitachi Data Systems representative. For assistance with Veritas Volume Manager operations, refer to the Veritas user documentation or contact Symantec 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 via the SVP (see Figure 4-1). When the SNMP manager requests status information or when a service information message (SIM) occurs, the SNMP agent on the Hitachi RAID 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 Hitachi RAID 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 Solaris server host. For assistance with SNMP manager configuration on the Solaris server host, refer to the user documentation, or contact the vendor's technical support.

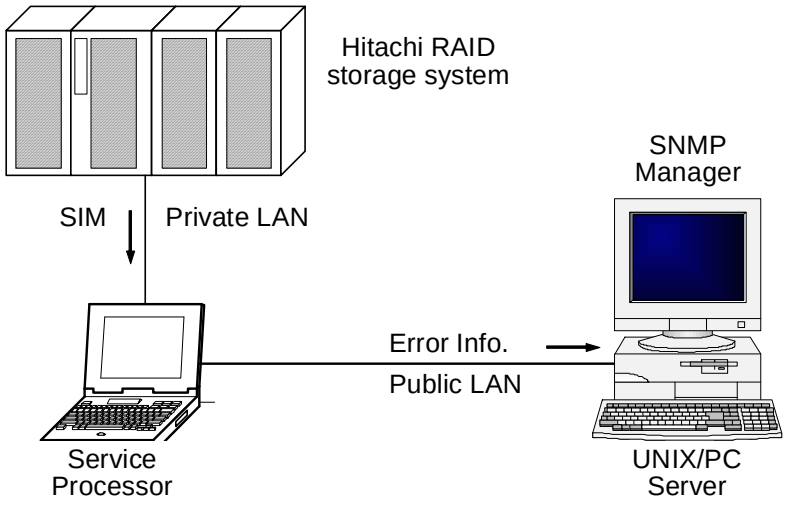



**Figure 4-1 Example of an SNMP Environment**

5

# Troubleshooting

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

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

# General Troubleshooting

Table 5-1 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 5-1 Troubleshooting**

| Error Condition | Recommended Action |
|---|---|
| The logical devices are not recognized by the system. | Ensure the READY indicator lights on the storage system are ON.<br>Ensure the fibre-channel cables are correctly installed and firmly connected.<br>Run **dmesg** to recheck the fibre buses for new devices.<br>Verify the contents of **/kernel/drv/sd.conf** file. |
| File system cannot be created (**newfs** command) | Ensure the character-type device file is specified for **newfs** command.<br>Verify that logical unit is correctly labeled by UNIX **format** command. |
| The file system is not mounted after rebooting. | Ensure the system was restarted properly.<br>Ensure the file system attributes are correct.<br>Ensure the **/etc/vfstab** file is correctly edited. |
| The Solaris system does not reboot properly after hard shutdown. | If the Solaris system is powered off without executing the shutdown process, wait three minutes before restarting the Solaris system. This allows the storage system's internal time-out process to purge all queued commands so that the storage system is available (not busy) during system startup. If the Solaris system is restarted too soon, the storage system will continue trying to process the queued commands, and the Solaris system will not reboot successfully. |
| The Hitachi RAID storage system performed a self-reboot because the system was busy or it logged a panic message. | Reboot the Solaris system. |
| The Hitachi RAID storage system responds Not Ready, or displays Not Ready and timed itself out. | Contact the Hitachi Data Systems Support Center. |
| The system detects a parity error. | Ensure the HBA is installed properly. Reboot the Solaris system. |

# Verbose Mode

One way to troubleshoot Solaris operations involves the "verbose" mode for the HBA configuration file. This section provides examples of error messages that may occur. A possible debugging method is to select the device and turn on verbose mode, then attempt the boot process again. Verbose error messages provide information that will help isolate the problem. Use the steps in Figure 5-1 to turn on the verbose flag. Figure 5-2 contains examples of error messages.

```
ok  " /sbus/fca" select-dev
ok   true to fca-verbose
ok   boot fcadisk
```

**Figure 5-1 Turning on Verbose Flag**

```
Error message:
Cannot Assemble drivers for /sbus@1f,0/fcaw@1,0/sd@0,0:a
Cannot Mount root on  /sbus@1f,0/fcaw@1,0/sd@0,0:a
Problem:
The process of copying the OS to the fibre channels was not complete, or the drive
specified on the boot command is not the same as the one the OS was constructed on.
```

```
Error message:
Can't open boot device
Problem:
The wwn specified with the set-bootn0-wwn does not correspond to the wwn of the device.
Could also be a cable problem – the adapter cannot initialize.
```

```
Error message:
The file just loaded does not appear to be bootable
Problem:
The bootblk was not installed on the target.
```

```
Error message:
mount: /dev/dsk/c0t0d0s0 – not of this fs type
Problem:
At this point the process hangs. This happens if the /etc/vfstab
File has not been updated on the fibrechannel boot drive to reflect the new target.
```

```
Error message:
Get PortID request rejected by nameserver
Problem:
The wwn of the target is not correct. Select the adapter and perform set-bootn0-wwn. If
this is correct, check the switch to see that target is properly connected.
```

```
Error message:
Can't read disk label
Problem:
The selected target is not a Solaris filesystem.
```

**Figure 5-2 Examples of Error Messages (continues on the next page)**

```
Error message:
Nport init failed –
Problem:
Card is connected to an arbitrated loop device, but wants to initialize as an NPORT. The
bootn0-wwn property has probably been set to a valid WWN.
```

```
Error message:
Panic dump not saved
Problem:
After the system is successfully booted to Solaris from the fibrechannel and a panic occurs
the panic does not get saved to the swap device.
This can be the result not properly defined the swap partition.
Use the format command to view the slices on the fibre channel drive.
Take the partition option, then the print option.
The swap partition should look something like this:
      1      swap      wm      68-459      298.36MB      (402/0/0)      611040
Sizes and cylinders will probably be different on your system. Make sure that the flag is
wm and that the sizes are defined (not 0). Then use the label option from partition to
write the label to the drive. After this the panic should be saved to the swap partition.
If the partition needs to be changed chose the partition option, and enter 1 to select
slice 1.
```

**Figure 5-2 Examples of Error Messages (continued)**

# Calling the Hitachi Data Systems Support Center

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

- The circumstances surrounding the error or failure.
- The content of any error messages displayed on the host system(s).
- The content of any error messages displayed by Storage Navigator.
- 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

# A

# Fibre Port Addressing

In a FC-AL (fibre channel arbitrated loop) configuration, the host communicates with the devices comprising the loop with 8 bit AL-PA (arbitrated loop physical address, also called the port address). The number of available port addresses is 126. (There are 127 port addresses, but address 00H is reserved for fibre connection.)

Devices communicate with hosts using individual port addresses. However, hosts map SCSI protocol to fibre channel devices. The hosts access the device's LUs using the device files /dev/dsk/c*t*d* and /dev/rdsk/c*t*d*. SCSI and fibre channel devices are accessed the same way; however, the device files for SCSI and fibre channel devices are configured differently. Table A-1 lists the AL-PA and the corresponding SCSI address.

**Table A-1 Fibre Port Addressing**

| AL-PA | T value | AL-PA | T value | AL-PA | T value | AL-PA | T value |
|---|---|---|---|---|---|---|---|
| EF | 0 | CD | 16 | B2 | 32 | 98 | 48 |
| E8 | 1 | CC | 17 | B1 | 33 | 97 | 49 |
| E4 | 2 | CB | 18 | AE | 34 | 90 | 50 |
| E2 | 3 | CA | 19 | AD | 35 | 8F | 51 |
| E1 | 4 | C9 | 20 | AC | 36 | 88 | 52 |
| E0 | 5 | C7 | 21 | AB | 37 | 84 | 53 |
| DC | 6 | C6 | 22 | AA | 38 | 82 | 54 |
| DA | 7 | C5 | 23 | A9 | 39 | 81 | 55 |
| D9 | 8 | C3 | 24 | A7 | 40 | 80 | 56 |
| D6 | 9 | BC | 25 | A6 | 41 | 7C | 57 |
| D5 | 10 | BA | 26 | A5 | 42 | 7A | 58 |
| D4 | 11 | B9 | 27 | A3 | 43 | 79 | 59 |
| D3 | 12 | B6 | 28 | 9F | 44 | 76 | 60 |
| D2 | 13 | B5 | 29 | 9E | 45 | 75 | 61 |
| D1 | 14 | B4 | 30 | 9D | 46 | 74 | 62 |

| AL-PA | T value | AL-PA | T value | AL-PA | T value | AL-PA | T value |
|---|---|---|---|---|---|---|---|
| CE | 15 | B3 | 31 | 9B | 47 | 73 | 63 |
| 72 | 64 | 55 | 80 | 3A | 96 | 23 | 112 |
| 71 | 65 | 54 | 81 | 39 | 97 | 23 | 113 |
| 6E | 66 | 53 | 82 | 36 | 98 | 1F | 114 |
| 6D | 67 | 52 | 83 | 35 | 99 | 1E | 115 |
| 6C | 68 | 51 | 84 | 34 | 100 | 1D | 116 |
| 6B | 69 | 4E | 85 | 33 | 101 | 1B | 117 |
| 6A | 70 | 4D | 86 | 32 | 102 | 18 | 118 |
| 69 | 71 | 4C | 87 | 31 | 103 | 17 | 119 |
| 67 | 72 | 4B | 88 | 2E | 104 | 10 | 120 |
| 66 | 73 | 4A | 89 | 2D | 105 | 0F | 121 |
| 65 | 74 | 49 | 90 | 2C | 106 | 08 | 122 |
| 63 | 75 | 47 | 91 | 2B | 107 | 04 | 123 |
| 5C | 76 | 46 | 92 | 2A | 108 | 02 | 124 |

# 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 Solaris 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 Verifying Recognition of New Devices). This procedure should be performed by the system administrator (i.e., super-user).

***Note:*** For additional instructions about online installation and deinstallation of LUs, see the Maintenance Manual.

## Sun Fibre-Channel Host Bus Adapter Installation

The following procedures apply to online installation of the Sun fibre-channel HBA:

1. Set up the Solaris server:
   - Confirm that the Sun fibre-channel HBA(s) are installed.
   - Confirm that Sun StorEdge SAN Foundation Software version 4.2 or later is installed.
2. Set up the Hitachi RAID storage system:
   - Ensure the latest microcode is loaded. Non-disruptive version-up requires alternate path.
   - Install the front-end director(s) and LDEVs, and connect fibre cable if necessary.
   - Execute online LU installation from the service processor (SVP) or using the Storage Navigator software.
   - Verify the SCSI path configuration.
3. Execute the **`Format`** command. Solaris will recognize the new volumes.
4. If new volumes are not recognized, the following operation is not needed. Refer to the Solaris documentation as needed.

- Disconnect and reconnect the fibre cable connected to the paths on which you are adding LUs.
- Use the following command to display available paths to the HBAs:
  **`luxadm –e port`**
- With the path from the output, issue the following command:
  **`luxadm –e forcelip path`**
- Use the following command to display devices:
  **`cfgadm –al`**
- Bring fabric devices back onto the system.
- Execute the **`Format`** command.

C

# Using MPxIO Path Failover Software

The Hitachi RAID storage systems are compatible with the Solaris Operating Environment Multi-path I/O (MPxIO) multi-pathing driver that offers hardware transparency and multi-pathing capabilities. MPxIO is fully integrated within the Solaris operating system (beginning with Solaris 8) and enables I/O devices to be accessed through multiple host controller interfaces from a single instance of the I/O device.

MPxIO enables you to more effectively to represent and manage devices that are accessible through multiple I/O controller interfaces within a single instance of the Solaris operating system. The MPxIO architecture:

- Helps protect against I/O outages due to I/O controller failures. Should one I/O controller fail, MPxIO automatically switches to an alternate controller.
- Increases I/O performance by load balancing across multiple I/O channels.

For the Hitachi RAID storage system to work with MPxIO:

1. Configure the Hitachi RAID storage system to use a host mode of **09** (see Setting the Host Mode).
2. Modify the configuration file **/kernel/drv/scsi_vhci.conf** to enable MPxIO to manage the path failover:

   **mpxio-disable="no";**

***Note:*** You do not have to edit **/kernel/drv/sd.conf**.

3. Connect the Hitachi RAID storage system to the Solaris system.
4. Reboot the server.

5. After reboot, login to the system and issue the following command:

   **cfgadm -la**

   The following information appears:

```
bigc2 > cfgadm -la
Ap_Id                  Type         Receptacle   Occupant     Condition
ac0:bank0              memory       connected    configured   ok
ac0:bank1              memory       connected    configured   ok
ac1:bank0              memory       connected    configured   ok
ac1:bank1              memory       connected    configured   ok
ac2:bank0              memory       connected    configured   ok
ac2:bank1              memory       connected    configured   ok
ac3:bank0              memory       connected    configured   ok
ac3:bank1              memory       connected    configured   ok
c0                     scsi-bus     connected    configured   unknown
c0::dsk/c0t2d0         disk         connected    configured   unknown
c0::dsk/c0t3d0         disk         connected    configured   unknown
c0::dsk/c0t6d0         CD-ROM       connected    configured   unknown
c0::rmt/0              tape         connected    configured   unknown
c5                     fc-fabric    connected    configured   unknown
c5::20000001730037eb   unavailable  connected    unconfigured failed
c5::200000017380a45b   unknown      connected    unconfigured unknown
c5::210000e08b042791   unknown      connected    unconfigured unknown
c5::210000e08b049755   unknown      connected    unconfigured unknown
c5::210100e08b276f6d   unknown      connected    unconfigured unknown
c5::500060e8029eb604   disk         connected    configured   unknown
c5::50060e80034e5a05   disk         connected    configured   unknown
c5::50060e8004272f01   disk         connected    configured   unknown
c6                     fc-fabric    connected    configured   unknown
c6::200000017300380d   unavailable  connected    unconfigured failed
c6::200000017300a45b   unknown      connected    unconfigured unknown
c6::210000e08b076f6d   unknown      connected    unconfigured unknown
c6::210100e08b242791   unknown      connected    unconfigured unknown
c6::500060e8029eb614   disk         connected    unconfigured unknown
c6::50060e80034e5a15   disk         connected    unconfigured unknown
c6::50060e8004272f11   disk         connected    configured   unknown
```

6. Check for the target not configured (in red). Then issue the following command to see the unconfigured LUNs:

**cfgadm -c configure c6::500060e8029eb614  c6::50060e80034e5a15**

# 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

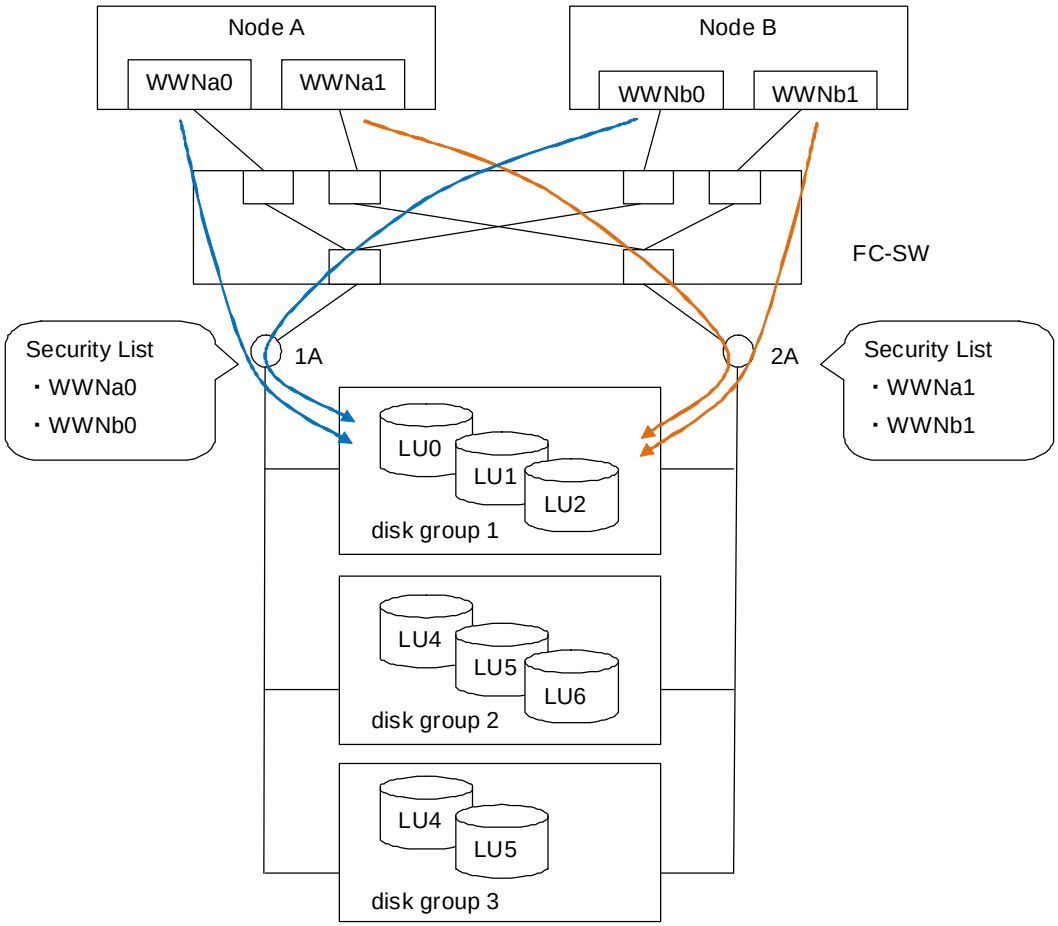
When the Hitachi RAID storage system receives a request to register the reserve key, the reserve key and port WWN of node are recorded on a key registration table of each port of the storage system where the registration request is received. The number of reserve keys that can be registered to one storage 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) × (port WWN number 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 fail. 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 |
| CHF | channel adapter-fibre (also called front-end director) |
| CVS | custom volume size |
| cyl | cylinder |
| FC | fibre-channel |
| FCA | fibre-channel adapter |
| FX | Hitachi Cross-OS File Exchange |
| GB | gigabyte |
| Gbps | gigabits per second |
| HBA | host bus adapter |
| HDLM | Hitachi Dynamic Link Manager |
| I/O | input/output |
| KB | kilobyte |
| LBA | logical block address |
| LDEV | logical device |
| LU | logical unit |
| LUN | logical unit number |
| LUSE | LU Size Expansion |
| LVI | logical volume image |
| LVM | Logical Volume Manager |
| MB | megabyte |
| msec | millisecond |
| mto | mainframe-to-open |
| OFC | open fibre control |
| otm | open-to-mainframe |
| oto | open-to-open |
| PA | physical address |
| PB | petabyte |

| | |
|---|---|
| PC | personal computer system |
| PCI | peripheral component interconnect |
| RAID | redundant array of independent disks |
| rpm | revolutions per minute |
| SCSI | small computer system interface |
| SIM | service information message |
| SNMP | simple network management protocol |
| SVP | service processor |
| TID | target ID |
| TOV | time-out value |
| trk | track |
| USP V/VM | Hitachi Universal Storage Platform V/VM |
| VCS | Veritas Cluster Server |
| VLL | Virtual LVI/LUN |
| VSP | HitachiVirtual Storage Platform |
| VTOC | volume table of contents |
| WWN | world-wide name |

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