

# Configuration Guide for Solaris™ Host Attachment

Hitachi Virtual Storage Platform  
Hitachi Universal Storage Platform V/VM

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# 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](#)
- [Product Version](#)
- [Document Revision Level](#)
- [Source Documents for this Revision](#)
- [Changes in this Revision](#)
- [Document Organization](#)
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## 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 60-03-2x 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, <a href="#">Introduction</a>	Provides a brief overview of the Hitachi RAID storage systems, supported device types, and an installation roadmap.
Chapter 2, <a href="#">Installing the Storage System</a>	Provides instructions for installing and connecting the Hitachi RAID storage system to a Solaris host.
Chapter 3, <a href="#">Configuring the New Disk Devices</a>	Provides instructions for configuring the new devices on the Hitachi RAID storage system for use.
Chapter 4, <a href="#">Failover and SNMP Operations</a>	Describes how to configure the Hitachi RAID storage system for failover and SNMP.
Chapter 5, <a href="#">Troubleshooting</a>	Provides information for identifying and resolving problems.
Appendix A, <a href="#">Fibre Port Addressing</a>	Provides information about fibre port addressing.
Appendix B, <a href="#">Online Device Installation</a>	Provides instructions for online installation of new devices.
Appendix C, <a href="#">Using MPxIO (Sun Path Failover Software)</a>	Describes how to use Solaris Operating Environment Multi-path I/O with the Hitachi RAID storage system.
Appendix D, <a href="#">Note on Using Veritas Cluster Server</a>	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
<b>Bold</b>	Indicates text on a window, other than the window title, including menus, menu options, buttons, fields, and labels. Example: Click <b>OK</b> .
<i>Italic</i>	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: copy <i>source-file target-file</i> Angled brackets (< >) are also used to indicate variables.
screen/code	Indicates text that is displayed on screen or entered by the user. Example: # <code>pairdisplay -g oradb</code>
< > angled brackets	Indicates a variable, which is a placeholder for actual text provided by the user or system. Example: # <code>pairdisplay -g &lt;group&gt;</code> Italic font is also used to indicate variables.
[ ] square brackets	Indicates optional values. Example: [ a   b ] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a   b } indicates that you must choose either a or b.
vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [ a   b ] indicates that you can choose a, b, or nothing. { a   b } indicates that you must choose either a or b.
underline	Indicates the default value. Example: [ <u>a</u>   b ]
#	A <b>pound sign</b> 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](mailto: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.)



# 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)	<p>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 <i>Cross-OS File Exchange User's Guide</i>, or contact your Hitachi Data Systems account team.</p> <p>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).</p> <p>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.</p> <p>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.</p>

**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	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-8 VLL	SCSI disk	OPEN-8-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-9 VLL	SCSI disk	OPEN-9-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-E VLL	SCSI disk	OPEN-E-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-V VLL	SCSI disk	OPEN-V	<i>Note 5</i>	<i>Note 6</i>	15	128	<i>Note 7</i>
OPEN-3*n VLL	SCSI disk	OPEN-3*n-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-8*n VLL	SCSI disk	OPEN-8*n-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-9*n VLL	SCSI disk	OPEN-9*n-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-E*n VLL	SCSI disk	OPEN-E*n-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>
OPEN-V*n VLL	SCSI disk	OPEN-V*n	<i>Note 5</i>	<i>Note 6</i>	15	128	<i>Note 7</i>
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	<i>Note 5</i>	<i>Note 6</i>	15	116	<i>Note 7</i>
3390-3B VLL	FXmto	3390-3B-CVS	<i>Note 5</i>	<i>Note 6</i>	15	116	<i>Note 7</i>
3390-3C VLL	FXotm	OP-C-3390-3C-CVS	<i>Note 5</i>	<i>Note 6</i>	15	116	<i>Note 7</i>
FX OPEN-3 VLL	FXoto	OPEN-3-CVS	<i>Note 5</i>	<i>Note 6</i>	15	96	<i>Note 7</i>

**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 3390-3A/B/C VLL 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<sup>2</sup> or 1024<sup>2</sup> 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 ( $\uparrow \dots \uparrow$  means the value should be rounded up to the next integer):

- Number of data cylinders for OPEN-x VLL volume (except for OPEN-V) =  
**# of cylinders =  $\uparrow (\text{capacity (MB) specified by user}) \times 1024/720 \uparrow$**

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

**# of cylinders =  $\uparrow 37 \times 1024/720 \uparrow = \uparrow 52.62 \uparrow$  (rounded up to next integer) = 53 cylinders**

- Number of data cylinders for an OPEN-V VLL volume =  
**# of cylinders =  $\uparrow (\text{capacity (MB) specified by user}) \times 16/15 \uparrow$**

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

**# of cylinders =  $\uparrow 49 \times 16/15 \uparrow = \uparrow 52.26 \uparrow$  (rounded up to next integer) = 53 cylinders**

- Number of data cylinders for an OPEN-3/8/9/E VLL LUSE volume =  
**# of cylinders =  $\uparrow (\text{capacity (MB) specified by user}) \times 1024/720 \uparrow \times n$**

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

**# of cylinders =  $\uparrow 37 \times 1024/720 \uparrow \times 4 = \uparrow 52.62 \uparrow \times 4 = 53 \times 4 = 212$**

- Number of data cylinders for an OPEN-V VLL LUSE volume =  
**# of cylinders =  $\uparrow (\text{capacity (MB) specified by user}) \times 16/15 \uparrow \times n$**

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

**# of cylinders =  $\uparrow 49 \times 16/15 \uparrow \times 4 = \uparrow 52.26 \uparrow \times 4 = 53 \times 4 = 212$**

- 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.



# 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	<p>The availability of features and devices depends on the level of microcode installed on the Hitachi RAID storage system.</p> <p>Use the LUN Manager software on Storage Navigator to configure the fibre-channel ports.</p>
Solaris system hardware	<ul style="list-style-type: none"> <li>▪ Sun SPARCstation series</li> <li>▪ Sun SPARCserver series</li> <li>▪ Sun SPARCcenter series</li> <li>▪ Sun Ultra series</li> </ul> <p>Contact Oracle to make sure the most current OS patches are installed.</p>
Solaris operating system	<p>Please refer to the Hitachi Data Systems interoperability site for specific support information for the Solaris operating system:  <a href="http://www.hds.com/products/interoperability">http://www.hds.com/products/interoperability</a></p> <p>Root login access to the Solaris system is required.</p>
Fibre-channel HBAs	<p>The Hitachi RAID storage system supports fibre-channel HBAs equipped as follows:</p> <ul style="list-style-type: none"> <li>▪ 8-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.</li> <li>▪ 4-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.</li> <li>▪ 2-Gbps fibre-channel interface, including shortwave non-OFC (open fibre control) optical interface and multimode optical cables with LC connectors.</li> <li>▪ 1-Gbps fibre-channel interface, including shortwave non-OFC optical interface and multimode optical cables with SC connectors.</li> </ul> <p>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.</p> <p>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.</p> <p>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.</p> <p>For information about supported HBAs, drivers, hubs, and switches, see the Hitachi Data Systems interoperability site:  <a href="http://www.hds.com/products/interoperability">http://www.hds.com/products/interoperability</a></p>
Fibre-channel utilities and tools	<p>Refer to the documentation for your fibre-channel HBA for information about installing the utilities and tools for your adapter.</p>
Fibre-channel drivers	<p>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.</p>

## 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: <ul style="list-style-type: none"> <li>▪ Veritas Database Edition™/Advanced Cluster for Real Application Clusters, <b>or</b></li> <li>▪ Veritas Cluster Server™ 4.0 or later (I/O fencing function).</li> </ul>	<b>Mandatory.</b> 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: <ul style="list-style-type: none"> <li>▪ You are using host mode <b>00 Standard</b> or <b>09 Solaris</b>, <b>and</b></li> <li>▪ You are using SUN StorEdge SAN Foundation Software Version 4.2 or later, <b>and</b></li> <li>▪ You want to automate recognition of increase and decrease of devices when a SUN HBA is connected.</li> </ul>	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 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: ON: Normal response OFF (default): Reservation Conflict  <b>Note:</b> 1. When HMO 22 is ON, the volume status (reserved/non-reserved) will be checked more frequently (several tens of msec per LU). 2. When HMO 22 is ON, the host OS will not receive warning messages when a Mode Select command is issued to a reserved volume. 3. There is no impact on the Veritas Cluster Server software when HMO 22 is OFF. Set HMO 22 to ON when the software is experiencing numerous reservation conflicts. 4. Set HMO 22 to ON when Veritas Cluster Server is connected.	<b>Note:</b> <ul style="list-style-type: none"> <li>▪ Before setting HMO 22 ask your Hitachi Data Systems representative for assistance.</li> <li>▪ 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.</li> </ul>

## 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	<i>Not supported</i>



**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: JN1 Fibre Channel Adapter (1062 MB/sec), model FC
fca0: SBus 1: IRQ 4: FCODE Version 11.0.9 [1a6384]: SCSI ID 125: AL PA 01
fca0: Fibre Channel WWN: 100000e0690000d5
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>
. . . . .
```

← Verify that  
← these items  
← are listed.

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 and 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
*          set ssd:ssd_io_time = 0x3c
*
*          ← Add this line to /etc/system
*          ← 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
*          set ssd:ssd_max_throttle = 8
*
*          ← Add this line to /etc/system
*          ← 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: <ul style="list-style-type: none"> <li>▪ Shut down the Solaris system.</li> <li>▪ When shutdown is complete, power off the Solaris display.</li> <li>▪ Power off all peripheral devices except for the Hitachi RAID storage system.</li> <li>▪ Power off the host system. You are now ready to connect the Hitachi RAID storage system.</li> </ul>
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: <ul style="list-style-type: none"> <li>▪ Power on the Solaris system display.</li> <li>▪ 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.</li> <li>▪ Confirm the ready status of all peripheral devices, including the Hitachi storage system.</li> <li>▪ Power on the Solaris system.</li> </ul>
5.	Boot the Solaris system.	User	When the <b>OK</b> prompt appears, boot the system using the <code>boot -r</code> command. The <code>-r</code> option tells the system to rebuild the devices. Using boot by itself will not build the new devices on the Hitachi RAID storage system.





# 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
#
# vi /kernel/drv/sd.conf
#ident "@(#)sd.conf 1.8 93/05/03 SMI"
name="sd" class="scsi"
    target=0 lun=0;

name="sd" class="scsi"
    target=1 lun=0;

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

name="sd" class="scsi"
    target=2 lun=1;

name="sd" class="scsi"
    target=3 lun=0;

name="sd" class="scsi"
    target=4 lun=0;
#
# 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
Password:
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
#
#
#

```

← *Make backup of file.*  
 ← *Edit the file (vi shown).*  
 ← *The SCSI class type name is used because the SCSI driver is used for fibre channel.*  
 ← *Add this information for all new target IDs and LUNs.*  
 ← *Enter halt.*  
 ← *Log in as root.*  
 ← *Password is not displayed.*

**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: scl: 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
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
corrupt label - wrong magic number                               ← Verify target ID.
Vendor 'HITACHI', product 'OPEN-9', 14423040 512 byte blocks                               ← Not yet labeled.
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: scl: 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
  16. other
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
                                                (press Enter for default)
Enter number of physical cylinders[3338]:
Enter number of heads:15                    ← Enter value from Table 3-2
                                                (press Enter for default)
Enter number of physical sectors/track[defaults]:
Enter rpm of drive [3600]:10000             ← Enter value from Table 3-1 (Note 2)
                                                (press Enter for default)
Enter format time[defaults]:
Enter cylinder skew[defaults]:
Enter track skew[defaults]:
Enter track per zone[defaults]:
Enter alternate tracks[defaults]:
Enter alternate sectors[defaults]:
Enter cache control[defaults]:
Enter prefetch threshold[defaults]:
Enter minimum prefetch[defaults]:
Enter maximum prefetch[defaults]:
Enter disk type name(remember quotes):"HITACHI OPEN-3" ← Enter name from Table 1-2.
selecting clt2d0
[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  $\frac{1}{4}$ .
- Setting host mode option 16 to OFF lowers the number of cylinders by  $\frac{1}{4}$  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  $\frac{1}{4}$  and the number of heads by 4.
- Increase the number of blocks per track to  $\frac{1}{4}$ , 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/esp@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/esp@f,400000/esp@f,800000/sd@3,0
  2. clt2d0 <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. clt2d1 <HITACHI-OPEN-3-52-34 ....> ...not yet labeled
    /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,1
  4. clt4d0 <HITACHI-OPEN-9-52-34 ....> ...not yet labeled
    /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@4,0
  5. clt5d0 <HITACHI-3390-3B-52-34 ....> ...not yet labeled
    /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@5,0
  6. clt6d0 <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/esp@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/esp@f,400000/esp@f,800000/sd@3,0
 2. clt2d0 <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. clt2d1 <HITACHI-OPEN-3-0315 ..... >                    ← Not yet labeled.
   /iommu@f,e0000000/sbus@f,e0001000/....,isp@0,10000/sd@2,1
 4. clt4d0 <HITACHI-OPEN-9-0315 ..... >                    ← Not yet labeled.
   /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@4,0
 5. clt5d0 <HITACHI-3390-3B-0315 ..... >                  ← Not yet labeled.
   /iommu@f,e0000000/sbus@f,e0001000/....,isp@1,10000/sd@5,0
 6. clt6d0 <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 <a href="#">Table 1-2</a>	2	10,000	See <a href="#">Table 1-2</a>
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 <a href="#">Table 1-2</a>	2	10,000	See <a href="#">Table 1-2</a>
3390-3B VLL	See <a href="#">Table 1-2</a>	2	10,000	See <a href="#">Table 1-2</a>
3390-3C VLL	See <a href="#">Table 1-2</a>	2	10,000	See <a href="#">Table 1-2</a>
FX OPEN-3 VLL	See <a href="#">Table 1-2</a>	2	10,000	See <a href="#">Table 1-2</a>

**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
<b>Notes:</b>						
<b>N5,N6,N7:</b> Use value in <a href="#">Table 3-1</a> and <a href="#">Table 3-2</a> .						
<b>N8:</b> 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
<p><b>Notes:</b>  <b>N30,N31,N32:</b> Use value in <a href="#">Table 3-1</a>.  <b>N33:</b> Use same value as N30. Specify as NNNNc, where NNNN = # of cylinders and c = cylinder (e.g. enter 19757c for OPEN-E*2).</p>						



**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 ↑35×1024/720↑×2=100 100×15×96=144000	0
2590	15	96	3732480	50MB×36 volumes ↑50×1024/720↑×36=2592 2592×15×96=3732480	0
284	15	96	411840	100MB×2 volumes ↑100×1024/720↑×2=286 286×15×96=411840	0
5694	15	96	8202240	500MB×8 volumes ↑500×1024/720↑×8=5696 5696×15×96=8202240	0
22758	30	96	65548800	2000MB×2 volumes ↑2000×1024/720↑×16=45520 45520×15×96=65548800	0
27455	40	188	206476640	2800MB×36 volumes ↑2800×1024/720↑×36=143388 143388×15×96=206478720	2080
<p><b>Notes:</b>  <b>N21</b> # of blocks of LUSE composed by VLL volumes are calculated by:  <b>N21</b> = N20 × (# of heads) × (# of sectors per track).  <b>N22:</b> N20 - 2, Use total cylinder - 2.  <b>N23, N24:</b> Use value in <a href="#">Table 3-1</a> and <a href="#">Table 3-2</a>.  <b>N25:</b> Use same value as N22.</p>					

**Table 3-8 Geometry Parameters for OPEN-V\*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.
48	15	128	92160	45 MB volumes ↑ 45 × 16/15 ↑ = 48 48 × 15 × 128 = 92160	0
27305	30	128	104858880	50 GB volumes ↑ 50 × 1024 × 16/15 ↑ = 54614 54614 × 15 × 128 = 104858880	0
10921	150	128	209721600	10 GB × 10 volumes ↑ 10 × 1024 × 16/15 ↑ × 10 = 109230 109230 × 15 × 128 = 209721600	0
32767	100	128	419443200	20 GB × 10 volumes ↑ 20 × 1024 × 16/15 ↑ × 10 = 218460 218460 × 15 × 128 = 419443200	0
<p><b>Notes:</b>  <b>N21</b> # of blocks of LUSE composed by VLL volumes are calculated by:  <b>N21</b> = N20 × (# of heads) × (# of sectors per track).  <b>N22:</b> N20 - 2, Use total cylinder - 2.  <b>N23, N24:</b> Use value in <a href="#">Table 3-1</a> and <a href="#">Table 3-2</a>.  <b>N25:</b> Use same value as N22.</p>					

- 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:**

$N22(\text{Cyl}) \times N23(\text{Head}) \times N24(\text{Block/Trk}) \times 512(\text{Byte}) = \text{or} < X$   
 GB (= × 1024 × 1024 × 1024 Byte) is as follows:

$16000(\text{Cyl}) \times 256(\text{Head}) \times 256(\text{Block}) \times 512(\text{Byte}) = 536870912000\text{Byte} = 500\text{GB}$ $32000(\text{Cyl}) \times 128(\text{Head}) \times 256(\text{Block}) \times 512(\text{Byte}) = 536870912000\text{Byte} = 500\text{GB}$
--

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

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

$15000(\text{Cyl}) \times 256(\text{Head}) \times 256(\text{Block}) \times 512(\text{Byte}) = 536870912000\text{Byte} = 468.75\text{GB} < 500\text{GB}$
---

## 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 ( $6 \times 8$  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/rdisk/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/rdisk/c1t2d0s0                               ← Create file system.
newfs:construct a new file system /dev/rdisk/c1t2d0s0:(y/n) y   ← Verify correct device.
/dev/rdisk/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/rdisk/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/clt2d0s0 /USP_LU00      ← Mount file system.
      ↖ Block-type device file name
# mount /dev/dsk/clt2d1s0 /USP_LU01     ← Mount next file system.
      ↖ Mount directory name
# mount /dev/dsk/clt2d2s0 /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/clt2d0s0  2256436 9    2030787 0%     /USP_LU00
      ↖ Verify file systems.
/dev/dsk/clt2d1s0  2256436 9    2030787 0%     /USP_LU01
      ↖ OPEN-3 device.
/dev/dsk/clt2d2s0  6774358 9    6548709 0%     /USP_LU02
      ↖ OPEN-9 device.
:
# mount /dev/dsk/clt2d0s0 /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.

#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 <a href="#">Table 3-9</a> .
/proc	-	/proc	procfs	-	no	-
fd	-	/dev/fd	fd	-	no	-
swap	-	/tmp	tmpfs	-	yes	-
/dev/dsk/c0t3d0s0	/dev/rdisk/c0t3d0s0	/	ufs	1	no	-
/dev/dsk/c0t3d0s6	/dev/rdisk/c0t3d0s6	/usr	ufs	2	no	-
/dev/dsk/c0t3d0s7	/dev/rdisk/c0t3d0s7	/export	ufs	3	yes	-
/dev/dsk/c0t3d0s5	/dev/rdisk/c0t3d0s5	/opt	ufs	4	yes	-
/dev/dsk/c0t3d0s1	-	-	swapfs	-	no	-
/dev/dsk/c1t2d0s0	/dev/rdisk/c1t2d0s0	/USP_LU00	ufs	5	yes	- ← Add one line
/dev/dsk/c1t2d1s0	/dev/rdisk/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 No = not auto-mounted at boot/mountall
⑦	Mount options	Desired mount options: - no options (typical) -ro read-only access (e.g., for 3390- 3B devices)

## 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.

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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](#)).

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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

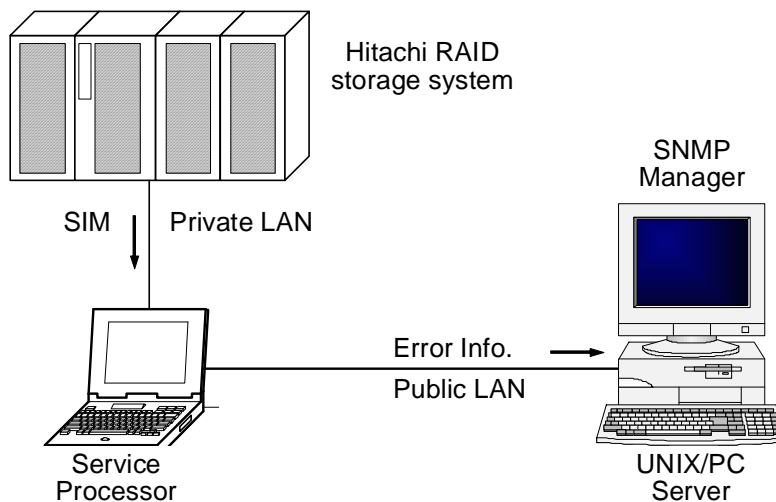
SNMP is a part of the TCP/IP protocol suite that supports maintenance functions for storage and communication devices. The Hitachi RAID storage systems use SNMP to transfer status and management commands to the SNMP Manager on the UNIX/PC server host via the SVP (see [Figure 4-1](#)). When the SNMP manager 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



# 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. Ensure the fibre-channel cables are correctly installed and firmly connected. Run <code>dmesg</code> to recheck the fibre buses for new devices. Verify the contents of <code>/kernel/drv/sd.conf</code> file.
File system cannot be created ( <code>newfs</code> command)	Ensure the character-type device file is specified for <code>newfs</code> command. Verify that logical unit is correctly labeled by UNIX <code>format</code> command.
The file system is not mounted after rebooting.	Ensure the system was restarted properly. Ensure the file system attributes are correct. Ensure the <code>/etc/vfstab</code> 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  "/sbin/fca" select-dev
ok  true to fca-verbose
ok  boot fca-disk
```

**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      wnn      68-459      298.36MB      (402/0/0)      611040
Sizes and cylinders will probably be different on your system. Make sure that the flag is
wnn 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>

## 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/rdisk/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



# 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.

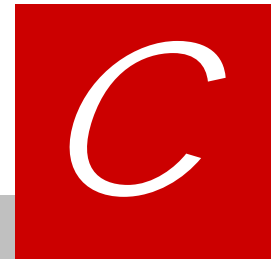
---

## 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.



# 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.

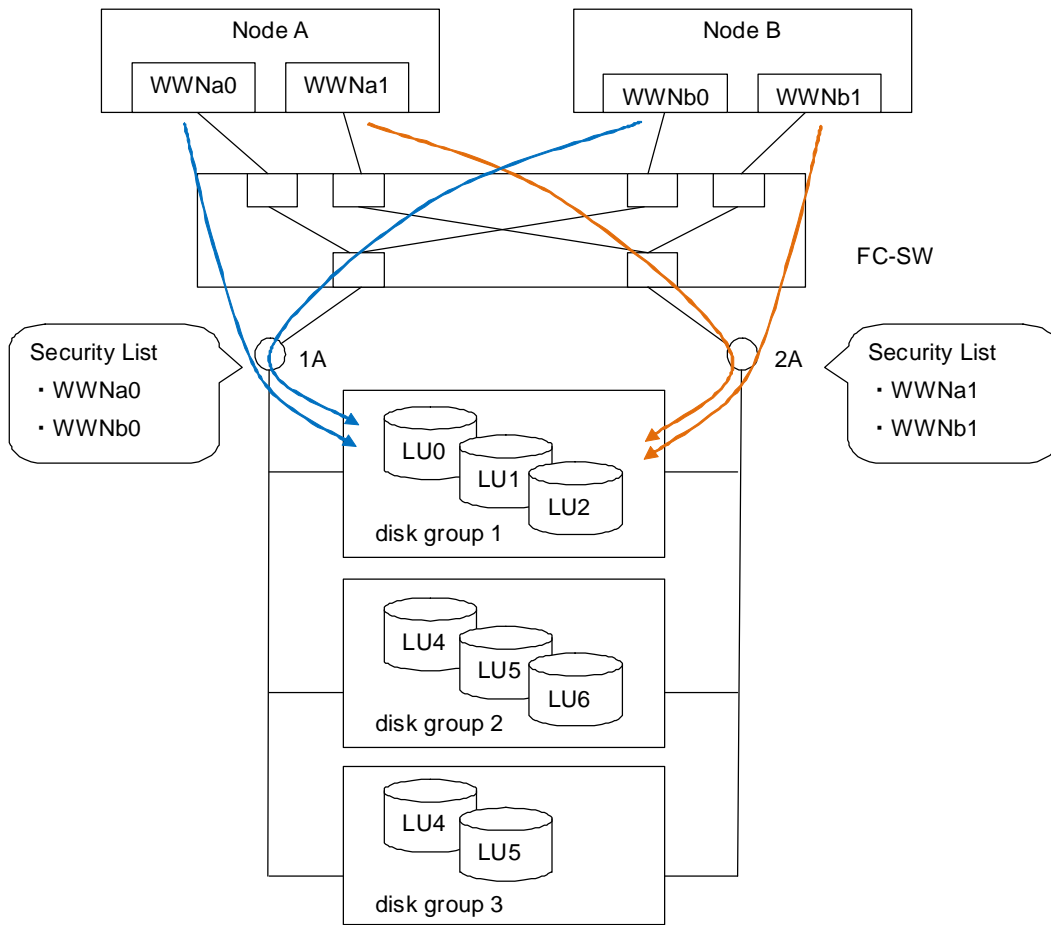
**Calculation formula for the number of used entries of key registration table:**

(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
mta	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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