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Configuration Guide for HP® OpenVMS™ Host Attachment

Hitachi Virtual Storage Platform
Hitachi Universal Storage Platform V/VM

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MK-96RD653-05

Contents

Preface

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

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

This preface includes the following information:

Intended Audience

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

Readers of this document should meet the following requirements:

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

Product Version

This document revision applies to the following microcode levels:

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

Document Revision Level

Revision	Date	Description
MK-96RD653-P	February 2007	Preliminary Release
MK-96RD653-00	May 2007	Initial Release, supersedes and replaces MK-96RD653-P
MK-96RD653-01	September 2007	Revision 1, supersedes and replaces MK-96RD653-00
MK-96RD653-02	November 2007	Revision 2, supersedes and replaces MK-96RD653-01
MK-96RD653-03	June 2009	Revision 3, supersedes and replaces MK-96RD653-02
MK-96RD653-04	July 2010	Revision 4, supersedes and replaces MK-96RD653-03
MK-96RD653-05	October 2010	Revision 5, supersedes and replaces MK-96RD653-04

Source Documents for this Revision

- MK-96RD653-05a-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).
- Corrected the queue depth value from 1024 to 2048 (Table 2-8).
- 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 Guide*, MK-90RD7027
- *Storage Navigator Messages*, MK-90RD7028
- *User and Reference Guide*, MK-90RD7042

Hitachi Universal Storage Platform V/VM documentation:

- *Storage Navigator Messages*, MK-96RD613
- *LUN Manager User's Guide*, MK-96RD615
- *LUN Expansion (LUSE) User's Guide*, MK-96RD616
- *Storage Navigator User's Guide*, MK-96RD621
- *Virtual LVI/LUN and Volume Shredder User's Guide*, MK-96RD630
- *User and Reference Guide*, MK-96RD635

HP OpenVMS documentation

Document Organization

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

Chapter	Description
Chapter 1, Introduction	Provides a brief overview of the Hitachi RAID storage systems, supported device types, and an installation roadmap.
Chapter 2, Installing the Storage System	Provides instructions for installing and connecting the Hitachi RAID storage system to an HP OpenVMS host.
Chapter 3, Configuring the New Disk Devices	Provides instructions for configuring the new devices on the Hitachi RAID storage system for use.
Chapter 4, Troubleshooting	Provides information for identifying and resolving problems.
Appendix A, Online Device Installation	Describes how OpenVMS lets you dynamically add or remove devices from a running system.
Appendix B, Using OpenVMS Alternate Pathing	Describes how the OpenVMS operating system automatically configures all the alternate paths to a device.
Appendix C, Using OpenVMS Clustering	Describes how to configure an OpenVMS cluster with the Hitachi RAID storage system.

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

This document uses the following typographic conventions:

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

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

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

Convention for Storage Capacity Values

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

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

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

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

Accessing Product Documentation

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

Getting Help

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

Comments

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

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

1

Introduction

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

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

About the Hitachi RAID Storage Systems

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

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

The Hitachi RAID storage systems provide heterogeneous connectivity to support multiple concurrent attachment to a variety of host operating systems, including Windows, VMware, OpenVMS and other UNIX platforms, 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 an HP OpenVMS 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).

Table 1-2 Device Specifications

Device Type	Category	Product Name (Note 1)	# of Blocks (512 B/blk)	# of Cylinders	# of Heads	# of Sectors per Track	Capacity (MB) (Note 2)
OPEN-3	SCSI disk	OPEN-3	4806720	3338	15	96	2347
OPEN-8	SCSI disk	OPEN-8	14351040	9966	15	96	7007
OPEN-9	SCSI disk	OPEN-9	14423040	10016	15	96	7042
OPEN-E	SCSI disk	OPEN-E	28452960	19759	15	96	13893
OPEN-L	SCSI disk	OPEN-L	71192160	49439	15	96	34761
OPEN-V	SCSI disk	OPEN-V	125827200 max ***Note 3***	***Note 4***	15	128	***Note 5***
OPEN-3*n	SCSI disk	OPEN-3*n	4806720*n	3338*n	15	96	2347*n
OPEN-8*n	SCSI disk	OPEN-8*n	14351040*n	9966*n	15	96	7007*n
OPEN-9*n	SCSI disk	OPEN-9*n	14423040*n	10016*n	15	96	7042*n
OPEN-E*n	SCSI disk	OPEN-E*n	28452960*n	19759*n	15	96	13893*n
OPEN-L*n	SCSI disk	OPEN-L*n	71192160*n	49439*n	15	96	34761*n
OPEN-V*n	SCSI disk	OPEN-L*n	***Note 3***	***Note 4***	15	128	***Note 5***
OPEN-3 VLL	SCSI disk	OPEN-3-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-8 VLL	SCSI disk	OPEN-8-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-9 VLL	SCSI disk	OPEN-9-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-E VLL	SCSI disk	OPEN-E-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-V VLL	SCSI disk	OPEN-V	***Note 3***	***Note 4***	15	128	***Note 5***
OPEN-3*n VLL	SCSI disk	OPEN-3*n-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-8*n VLL	SCSI disk	OPEN-8*n-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-9*n VLL	SCSI disk	OPEN-9*n-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-E*n VLL	SCSI disk	OPEN-E*n-CVS	***Note 3***	***Note 4***	15	96	***Note 5***
OPEN-V*n VLL	SCSI disk	OPEN-V*n	***Note 3***	***Note 4***	15	128	***Note 5***

Note 1: The command device (used for Command Control Interface (CCI) operations) is distinguished by **–CM** on the product name (e.g., OPEN-3-CM, OPEN-3-CVS-CM). The product name for VLL devices is OPEN-*x*-CVS, where CVS = custom volume size.

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

Note 3: The number of blocks for a VLL volume is calculated as follows:

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

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

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

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

Note 4: The number of data cylinders for a Virtual LVI/LUN volume is calculated as follows (↑...↑ means that the value should be rounded up to the next integer):

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

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

  # of cylinders = ↑37 × 1024/720↑ = ↑52.62↑
  = 53 cylinders
- Number of data cylinders for an OPEN-V VLL volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑

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

  # of cylinders = ↑50 × 16/15↑ = ↑53.33↑ = 54 cylinders
- Number of data cylinders for a VLL LUSE volume (except for OPEN-V) =
  # of cylinders = ↑ (capacity (MB) × 1024/720 ↑ × n

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

  # of cylinders = ↑37 × 1024/720↑ × 4 = ↑52.62↑ × 4 = 53 × 4 = 212
- Number of data cylinders for an OPEN-V VLL LUSE volume =
  # of cylinders = ↑ (capacity (MB) specified by user) × 16/15 ↑ × n

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

  # of cylinders = ↑50 × 16/15↑ × 4 = ↑53.33↑× 4 = 54 × 4 = 216
- Number of data cylinders for a 3390-3A/C =
  # of cylinders = (number of cylinders) + 9
- Number of data cylinders for a 3390-3B VLL volume =
  # of cylinders = (number of cylinders) + 7

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

Note 5: The size of an OPEN-*x* VLL volume is specified by capacity in MB, not number of cylinders. The size of an OPEN-V VLL volume can be specified by capacity in MB or number of cylinders. The user specifies the volume size using the Virtual LVI/LUN software.

Installation and Configuration Roadmap

The steps in Table 1-3 outline the general process you follow to install and configure the Hitachi RAID storage system on an HP OpenVMS operating system.

Table 1-3 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.	Connect the Hitachi RAID storage system to an HP OpenVMS host.
4.	Configure the fibre-channel HBAs for the installation
5.	Verify recognition of the new devices.
6.	Set up boot devices.
7.	Verify device recognition by HP OpenVMS.
8.	Initialize and mount the new devices, then set and verify the auto-mount parameters.

2

Installing the Storage System

This chapter describes how to install the Hitachi RAID storage system on an HP OpenVMS operating system:

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

Requirements

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

Table 2-1 Requirements

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

Preparing for Storage System Installation

The following sections describe pre-installation 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.

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, and VLL LUSE 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 HP OpenVMS 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. The user or Hitachi Data Systems representative installs the LUN Manager software. For instructions on installing LUN Manager, see the *Storage Navigator User's Guide*.

Configuring the Fibre-Channel Ports

Use LUN Manager to configure the fibre-channel ports with the appropriate fibre parameters. 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 HP OpenVMS operating system supports only fabric point-to-point connections to a switch. No direct connection is made to the storage system. Drivers for the fibre-channel HBAs are bundled with the operating system and work properly without any user setup required. Check with HP technical support to verify that the latest I/O-related patches are installed on the host.

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

Table 2-2 Fibre Parameter Settings

Fabric	Connection	Provides
Enable	FC-AL	*Not supported*
Enable	Point-to-Point	F-port (fabric port)
Disable	FC-AL	*Not supported*
Disable	Point-to-Point	*Not supported*

Notes:

- The Hitachi RAID storage systems support up to 2048 LUs per fibre-channel port (512 per host group).
- For a dual-path configuration, configure at least two ports on the storage system (for example, 1A and 2A). For a two-node OpenVMS cluster, configure at least four ports (for example, one host will use ports 1A and 2A, while the other host will use ports 1B and 2B).
- If you plan to connect different types of servers to the 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.
- In fabric environments, port addresses are assigned automatically by fabric switch port number and are not controlled by the port settings.

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 HP OpenVMS hosts. The required host mode for HP OpenVMS is **05**. Do not select a host mode other than **05** for HP OpenVMS.

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

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

Setting the Host Mode Options

When each new host group is added, the storage administrator must be sure that all host mode options are set for all host groups connected to OpenVMS hosts.

Select the common host mode option **13** (see Table 2-3), or select host mode option **33** when the conditions in Table 2-4 are met. Use LUN Manager to set the host mode options. 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 mode options on a Hitachi RAID storage system that are already installed and configured may be disruptive and may require the server to be rebooted, depending upon the mode. Please read the instructions for each specific mode.

Table 2-3 Common Host Mode Option for OpenVMS

No.	Host Mode Option	Select if the Following Conditions are Met	Remarks
13	SIM report at link failure	When you want SIM notification when the number of link failures detected between ports exceeds the threshold.	Optional

Table 2-4 Host Mode Option for OpenVMS

No.	Host Mode Option	Select if the Following Conditions are Met	Remarks
33	Set/Report Device Identifier enable For a nickname of the device with hosts	Apply this when you want to enable commands to assign a nickname of the device with hosts. Apply this when you want to activate ID data assigned for LDEV.	Optional Available for USP V/VM microcode 60-05-0x or later (from Storage Navigator)

* Please set the user-assigned (logical) unit identifier (UUID) when you set host mode option 33 and host mode **05 OpenVMS** is used.

Verifying Host Fibre-Channel Adapter Installation

After configuring the fibre-channel ports on the Hitachi RAID storage system, use the following procedure to verify that the HBAs are set to fabric mode:

1. At the **P00>>** prompt, type **init** (on some AlphaServer models, type **set mode diag** instead).
2. Type **wwidmgr –show adapter** to display the HBA's topology settings.
3. If necessary, type **wwidmgr –set adapter** to change the topology to fabric mode.
4. Type the **init** command again to return to console to its default mode. Figure 2-1 shows this procedure on an AlphaServer 4000. In this example, the **set mode diag** command is used rather than the **init** command.
5. The system is resetting at this point. After the reset, verify that the adapter topology has been changed (see Figure 2-2).

   Although the default settings for the host HBA are adequate for most applications, there are some settings that the user can configure. Refer to the HBA documentation and the HP manual *Guidelines for OpenVMS Cluster Configurations* for information about these settings.

```
P00>>>set mode diag
Console is in diagnostic mode
P00>>>
P00>>>wwidmgr -show adapter
polling kgpsa0 (KGPSA-C) slot 2, bus 0 PCI, hose 1
kgpsaa0.0.0.2.1    PGA0        WWN 2000-0000-c92f-2953
polling kgpsa1 (KGPSA-C) slot 3, bus 0 PCI, hose 0
kgpsab0.0.0.3.0    PGB0        WWN 2000-0000-c92a-1db5
item    adapter                   WWN                 Cur. Topo  Next Topo
[ 0] kgpsab0.0.0.3.0      2000-0000-c92a-1db5           FABRIC     FABRIC
[ 1] kgpsaa0.0.0.2.1      2000-0000-c92f-2953           LOOP       LOOP
[9999] All of the above.
P00>>>wwidmgr -set adapter -item 1 -topo fabric
P00>>>wwidmgr -show adapter
item    adapter                   WWN                 Cur. Topo  Next Topo
[ 0] kgpsab0.0.0.3.0      2000-0000-c92a-1db5           FABRIC     FABRIC
[ 1] kgpsaa0.0.0.2.1      2000-0000-c92f-2953           LOOP       FABRIC
[9999] All of the above.
P00>>>init
ü□□P00>>>^X
```

Figure 2-1 Verifying HBAs are Set to Fabric Mode

```
P00>>>
P00>>>set mode diag
Console is in diagnostic mode
P00>>>wwidmgr -show adapter
polling kgpsa0 (KGPSA-C) slot 2, bus 0 PCI, hose 1
kgpsaa0.0.0.2.1    PGA0        WWN
polling kgpsa1 (KGPSA-C) slot 3, bus 0 PCI, hose 0
kgpsab0.0.0.3.0    PGB0        WWN 2000-0000-c92a-1db5
item    adapter                   WWN                 Cur. Topo  Next Topo
[ 0] kgpsab0.0.0.3.0      2000-0000-c92a-1db5           FABRIC     FABRIC
[ 1] kgpsaa0.0.0.2.1      2000-0000-c92f-2953           FABRIC     FABRIC
[9999] All of the above.
```

Figure 2-2 Verifying Adapter Topology has been Changed

LUN 0 Requirement

OpenVMS needs to use host LUN 0. Therefore, be sure that host LUN 0 is assigned to each port that OpenVMS will be using. The HP AlphaServer console assigns a unique device identifier (UDID) to each device that it sees. This UDID is equal to the LDEV number for a LUN, except for LUN 0. In this case, the UDID equals -1. While this does not cause any problems, it requires special care in its use at boot time (see Setting Up Boot Devices).

Figure 2-3 shows an example of the **wwidmgr –show wwid** command. This example assumes that LDEVs have been assigned to ports 1A and 2A on the storage system with the LUN assignments shown in Table 2-5.

Table 2-5 LUN Assignments Used in Example

Host LUN on Ports 1A and 2A	LDEV Number
0	00:30
1	00:01
2	00:02
3	00:03
4	00:1F
5	00:00

Notice that host LUN 0 (LDEV 00:30) has disappeared because it is being used by OpenVMS. LDEV 00:00 (host LUN 5) has a UDID of -1. The other LUNs all have UDIDs equal to their LDEV numbers (in decimal). For example, an LDEV number of 00:1F appears to the AlphaServer as UDID 31.

Caution: Due to the way the AlphaServer console computes UDIDs, two disks from two different storage system controllers that have the same LDEV numbers are seen as the same disk by the AlphaServer console because they have the same UDID. To avoid this problem, be sure any multiple storage devices connected to the same AlphaServer host do not have disks with duplicate LDEV numbers.

```
P00>>>wwidmgr -show wwid
[0] UDID: 1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0001 (ev:none)
[1] UDID: 2 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0002 (ev:none)
[2] UDID: 3 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0003 (ev:none)
[3] UDID:31 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-001f (ev:none)
[4] UDID:-1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0000 (ev:none)
[5] UDID: 1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0001 (ev:none)
[6] UDID: 2 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0002 (ev:none)
[7] UDID: 3 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0003 (ev:none)
[8] UDID:31 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-001f (ev:none)
[9] UDID:-1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0000 (ev:none)
```

Figure 2-3 Example of Using wwidmgr –show wwid Command

Setting a UUID

OpenVMS names its fibre-channel devices in the form of “1dgaxxxxx”. The 1dga part is fixed (and indicates a FC LUN), and the “xxxxx” part is specified as returning (cu * 256 + ldev) in the Hitachi storage system. For example, 1dga1000 is CU:LDEV 03:e8, and 1dga2000 is CU:LDEV 07:e0. But it is difficult to name LUs in flexible manner, so the functionality that “xxxxx” part is specified by the user is required.

You can set an arbitrary ID to identify a logical volume from the host using LUN Manager with host mode option 33 on. This ID is called the user-assigned (logical) unit identifier (UUID). When an OpenVMS server host is used, a UUID can consist of a numerical value from 1 to 32,767. For USP V/VM this function is available for 60-05-0x microcode or later.

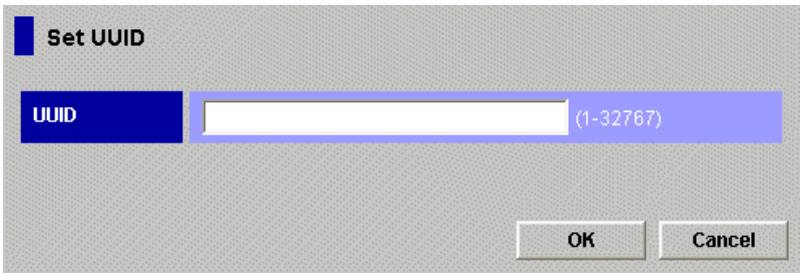

Figure 2-4 Set UUID Window (When an OpenVMS Server Host is Used)

If you want to add 1dga4000 in the future, you need to plan and prepare CU:LDEV 0f:a0 for the layout of the array. But by setting UUID=4000, “xxxxx” part is displayed as you specify.

Table 2-6 Relationship between LDEV number and OpenVMS Host with UUID with Host Mode Option 33

	LUN	LDKC:CU:LDEV	UUID	OpenVMS Device File Name
1	0000	00:00:30	3000	1dga3000
2	0001	00:00:31	4000	1dga4000
:	:	:	:	:

* Please set the UUID when you set host mode option 33 and host mode **05 OpenVMS** is used.

Notes:

- When UUID is used, consider that ID data for LDEV should be unique in the system.
- When changing the server host OS from HP-UX to OpenVMS, or from OpenVMS to HP-UX, you cannot continue to use the same UUID. Delete the UUID, and then set the proper UUID that each server host can use.

Connecting the Storage System to the HP OpenVMS Host

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

Table 2-7 summarizes the steps for connecting the Hitachi RAID storage system to the HP OpenVMS system host. Some steps are performed by the Hitachi Data Systems representative, while others are performed by the user.

Table 2-7 Connecting the Storage System to an HP OpenVMS Host

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

Configuring the Host Fibre-Channel HBA(s)

Configure the fibre-channel HBA(s) connected to the Hitachi RAID storage system. The HBAs have many configuration options. This section provides the following minimum requirements for configuring host fibre-channel adapters for operation with the storage system. For more information, refer to the documentation for your fibre-channel HBA(s).

- The queue depth requirements for devices on the Hitachi RAID storage system are specified in Table 2-8.
- The BIOS might need to be disabled to prevent the system from trying to boot from the Hitachi RAID storage system.

Several other parameters (e.g., FC, fabric) 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.

Note: Use the same settings and device parameters for all devices on the Hitachi RAID storage system.

Table 2-8 Queue Depth Requirements

Parameter	Required Value
IOCB Allocation (Queue depth) per LU	≤ 32 per LU
IOCB Allocation (Queue depth) per port (MAXTAGS)	≤ 2048 per port

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

Verifying New Device Recognition

The final step before configuring the new disk devices is to verify that the HP AlphaServer console recognizes the new devices. The devices must be installed and formatted and the fibre-channel ports configured before the host system is powered on. If they are not, the user must shut down and restart the system to allow the system to recognize the new devices.

To verify new device recognition:

1. Enter the **init** command at the console prompt (usually P00>>>). On some models of the HP AlphaServer it may be necessary to enter the command **set mode diag** instead.
2. Enter the **wwidmgr -show wwid** command to verify that the devices are present.
3. Enter the **init** command to reset the console. Figure 2-5 shows an example.

```
P00>>>set mode diag
Console is in diagnostic mode
P00>>>wwidmgr -show wwid
[0] UDID: 1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0001 (ev:none)
[1] UDID: 2 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0002 (ev:none)
[2] UDID: 3 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0003 (ev:none)
[3] UDID:31 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-001f (ev:none)
[4] UDID:-1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0000 (ev:none)
[5] UDID: 1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0001 (ev:none)
[6] UDID: 2 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0002 (ev:none)
[7] UDID: 3 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0003 (ev:none)
[8] UDID:31 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-001f (ev:none)
[9] UDID:-1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0000 (ev:none)
P00>>>init
```

Figure 2-5 Example of Verifying New Devices

3

Configuring the New Disk Devices

This chapter describes how to configure the new disk devices that you attached to the HP OpenVMS system host in the previous chapter:

- ☐ Setting Up Boot Devices
- ☐ Verifying Device Recognition by HP OpenVMS
- ☐ Initializing and Mounting New Devices
- ☐ Setting and Verifying the Auto-Mount Parameters

Setting Up Boot Devices

For the OpenVMS system to use devices on the Hitachi RAID storage system at boot time the user must make them visible to the OpenVMS system. This is done by using either the **wwidmgr –quickset** or **wwidmgr –set** command. Up to four devices can be made visible to OpenVMS at boot time. The procedure for using the **wwidmgr –quickset** command is described below.

Notice that the **wwidmgr –quickset –item** command is used to set up host LUN 5 (LDEV 00:00) because its UDID is -1. The **wwidmgr –quickset –udid** command is used to set up the other three LUNs because they all have UDIDs that are not equal to -1. The maximum of four LUNs has been set up – host LUNs 1, 2, 3, and 5. The **wwidmgr –show reachability** command is used to verify that all four LUNs can be seen at boot time. Lastly the **init** command is entered to reset the AlphaServer console.

Once the AlphaServer console has been reset, the boot devices on the storage system can be seen by using the **show dev** command. The commands **set bootdef_dev** and **set boot_osflags** can be used to set the device as the default boot device. This allows the user to enter simply **boot** at the command prompt rather than **boot dgd1.1001.0.1.0 –flags 0,0**.

```
P00>>>wwidmgr -show wwid
[0] UDID: 1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0001 (ev:none)
[1] UDID: 2 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0002 (ev:none)
[2] UDID: 3 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0003 (ev:none)
[3] UDID:31 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-001f (ev:none)
[4] UDID:-1 WWID:01000010:5006-0e80-0042-8311-0000-0121-0000-0000 (ev:none)
[5] UDID: 1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0001 (ev:none)
[6] UDID: 2 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0002 (ev:none)
[7] UDID: 3 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0003 (ev:none)
[8] UDID:31 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-001f (ev:none)
[9] UDID:-1 WWID:01000010:5006-0e80-0042-8313-0000-0121-0000-0000 (ev:none)
P00>>>wwidmgr -quickset -item 4
Disk assignment and reachability after next initialization:
5006-0e80-0042-8311-0000-0121-0000-0000
                          via adapter:         via fc nport:        connected:
dga10765.1001.0.2.1      kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
P00>>>wwidmgr -quickset -udid 1
Disk assignment and reachability after next initialization:
5006-0e80-0042-8311-0000-0121-0
                          via adapter:         via fc nport:        connected:
dga10765.1001.0.2.1      kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0001
                          via adapter:         via fc nport:        connected:
dga1.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
P00>>>wwidmgr -quickset -udid 2
Disk assignment and reachability after next initialization:
5006-0e80-0042-8311-0000-0121-0000-0000
                          via adapter:         via fc nport:        connected:
dga10765.1001.0.2.1      kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0001
                          via adapter:         via fc nport:        connected:
dga1.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0002
                          via adapter:         via fc nport:        connected:
dga2.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
P00>>>wwidmgr -quickset -udid 3
Disk assignment and reachability after next initialization:
5006-0e80-0042-8311-0000-0121-0000-0000
                          via adapter:         via fc nport:        connected:
dga10765.1001.0.2.1      kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0001
                          via adapter:         via fc nport:        connected:
dga1.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0002
                          via adapter:         via fc nport:        connected:
dga2.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0003
                          via adapter:         via fc nport:        connected:
dga3.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
P00>>>wwidmgr -show reachability
Disk assignment and reachability after next initialization:
5006-0e80-0042-8311-0000-0121-0000-0000
                          via adapter:         via fc nport:        connected:
dga10765.1001.0.2.1      kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0001
                          via adapter:         via fc nport:        connected:
dga1.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0002
                          via adapter:         via fc nport:        connected:
dga2.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
5006-0e80-0042-8311-0000-0121-0000-0003
                          via adapter:         via fc nport:        connected:
dga3.1001.0.2.1          kgpsaa0.0.0.2.1      5006-0e80-0042-8311      Yes
P00>>> init
```

Verifying Device Recognition by HP OpenVMS

Once the OpenVMS operating system has been booted, it is necessary to verify the correct recognition of the Hitachi RAID storage system devices. Use the **show device** command to verify that the OpenVMS operating system can see the devices on the storage system. The devices will have names in the form **1dgaYYYYY** where **YYYYY** is the UDID of the device or a 5-digit number assigned by the AlphaServer console if the UDID is -1. It is important to note that this is not the host LUN (H-LUN) number seen by the fibre-channel HBA.

The host LUN number might be different than the LDEV number. This means that a user can change the location of a device by assigning it to a different HBA or by giving it a different host LUN number and the OpenVMS device name will not change because it is based on the LDEV number which does not change. The **show dev/mul** command can be used to see devices that have multiple paths from the host.

Figure 3-1 shows the use of the **show dev** and **show dev/mul** commands.

```
$ show dev dga
Device        Device           Error    Volume         Free    Trans Mnt
 Name         Status           Count     Label        Blocks   Count Cnt
$1$DGA0:   (ES402)  Online       0
$1$DGA1:   (ES402)  Mounted      2     OVMS731A      18978021   396   1
$1$DGA2:   (ES402)  Online       0
$1$DGA3:   (ES402)  Online       0
$1$DGA31:  (ES402)  Online       0

$ show dev/mul
Device          Device           Error                Current
 Name           Status           Count  Paths           path
$1$DGA0:   (ES402) Online           0    2/ 2  PGB0.5006-0E80-0042-8313
$1$DGA1:   (ES402) Mounted          2    2/ 2  PGB0.5006-0E80-0042-8313
$1$DGA2:   (ES402) Online           0    2/ 2  PGB0.5006-0E80-0042-8313
$1$DGA3:   (ES402) Online           0    2/ 2  PGB0.5006-0E80-0042-8313
$1$DGA31:  (ES402) Online           0    2/ 2  PGB0.5006-0E80-0042-8313
Device          Device           Error                Current
 Name           Status           Count  Paths           path
$1$GGA30:       Online              0    2/ 2  PGB0.5006-0E80-0042-8313
```

Figure 3-1 Example of Using show dev and show.dev/mul Commands

Initializing and Mounting New Devices

After the HP OpenVMS operating system recognizes the new devices, the devices must be mounted and initialized so that they can be used for I/O operations. Use the **initialize** command to write an OpenVMS volume label to the device and then use the **mount** command to enable the OpenVMS operating system to perform I/O to it.

Figure 3-2 shows an example of using these two commands.

```
$ initialize $1$dga0
_Label: vol0
$
$ mount $1$dga0
_Label: vol0
_Log name: logvol0
%MOUNT-I-MOUNTED, VOL0 mounted on _$1$DGA0: (ES402)
$ show dev dga
Device          Device             Error    Volume        Free     Trans Mnt
 Name           Status             Count    Label        Blocks    Count Cnt
$1$DGA0:   (ES402)  Mounted alloc    1      VOL0         20975073     1   1
$1$DGA1:   (ES402)  Mounted          2      OVMS731A     18978021   396   1
$1$DGA2:   (ES402)  Online           0
$1$DGA3:   (ES402)  Online           0
$1$DGA31:  (ES402)  Online           0
$
```

Figure 3-2 Example of Using initialize and mount Commands

The label and log name are chosen by the user. These commands can also be entered as single line commands, as shown in Figure 3-3.

```
$initialize $1$dga0 vol0
$mount $1$dga0 vol0 logvol0
```

Figure 3-3 Example of Entering Commands as Single Line Commands

Setting and Verifying the Auto-Mount Parameters

The user can automatically mount the devices on the Hitachi RAID storage system after each reboot of the OpenVMS operating system. This task can be automated by adding the necessary mount commands to the SYSTARTUP_VMS.COM file. For more information, see the OpenVMS user documentation.

4

Troubleshooting

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

Troubleshooting

Table 4-1 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.

For troubleshooting information on Hitachi Storage Navigator, see the *Storage Navigator User's Guide* for the storage system.

For information on errors messages displayed by Storage Navigator, see the *Storage Navigator Messages* document for the storage system.

Table 4-1 Troubleshooting

Error Condition	Recommended Action
The logical devices are not recognized by the system.	Make sure that the READY indicator lights on the Hitachi RAID storage system are ON. Make sure that the fibre cables are correctly installed and firmly connected. Shut down the OpenVMS system, and verify that the devices can be seen by the HP AlphaServer console.
The file system is not mounted after rebooting.	Make sure that the SYSTARTUP_VMS.COM file contains the mount commands.
The red alarm light on the Hitachi RAID storage system is on.	Please contact the Hitachi Data Systems Support Center.
System hangs, or devices are declared and then system hangs.	Ensure that the latest patches are applied to the OpenVMS operating system.

Calling the Hitachi Data Systems Support Center

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

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

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

A

Online Device Installation

The OpenVMS system allows the user to dynamically add or remove devices from a running system. First, start the SYSMAN utility:

```
RUN SYS$SYSTEM:SYSMAN
```

Then enter the following commands:

```
SYSMAN> IO SCSI_PATH_VERIFY
SYSMAN> IO AUTOCONFIGURE
```

The following example shows the addition of LUN 26 to an existing configuration that already includes LUNs 1 through 25 and LUN 200. In this example, LUN 26 is added as device `$1$dga26` between LUNs 25 and 200. The OpenVMS operating system creates device names of the form `$1$dgaYYYYY` – where `YYYYY` is the UDID of the device assigned by the AlphaServer console. This number is not the same as the host LUN number seen by the fibre-channel HBA (the LUN on the Hitachi RAID storage system). In this example, the host LUN number (LUN) of `$1$dga26` is 30. This same procedure can be used to reconfigure the system after devices have been removed or replaced.

```
$
$ show dev/mul
Device                  Device           Error        Current
 Name                   Status           Count  Paths   path
$1$DGA1:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA2:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA3:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA4:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA5:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA6:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA7:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA8:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA9:       (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA10:      (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA11:      (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA12:      (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA13:      (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA14:      (ES401)  Online               0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA15:      (ES401)  Online               0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA16:      (ES401)  Online               0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA17:      (ES401)  Online               0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA18:      (ES401)  Online               0   3/ 3  PGB0.5006-0E80-0042-79B0
```

```
$1$DGA19:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA20:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA21:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA22:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA23:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA24:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA25:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA200:     (ES401)  Online              0   2/ 2  PGB0.5006-0E80-0042-79B0
Device                  Device          Error        Current
 Name                   Status          Count  Paths   path
$1$GGA0:                Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$ run sys$system:sysman
SYSMAN> io scsi_path_verify
SYSMAN> io autoconfigure
SYSMAN> exit
$ show dev/mul
Device                  Device          Error        Current
 Name                   Status          Count  Paths   path
$1$DGA1:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA2:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA3:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA4:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA5:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA6:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA7:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA8:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA9:       (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA10:      (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA11:      (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA12:      (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA13:      (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA14:      (ES401)  Online              0   3/ 3  PGC0.5006-0E80-0042-79B0
$1$DGA15:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA16:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA17:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA18:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA19:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA20:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA21:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA22:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA23:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA24:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA25:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA26:      (ES401)  Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$1$DGA200:     (ES401)  Online              0   2/ 2  PGB0.5006-0E80-0042-79B0
Device                  Device          Error        Current
 Name                   Status          Count  Paths   path
$1$GGA0:                Online              0   3/ 3  PGB0.5006-0E80-0042-79B0
$
```

B

Using OpenVMS Alternate Pathing

The OpenVMS operating system automatically configures all the alternate paths to a device. Only one of these paths can be active at one time. The command **show dev/full** *dev-name* can be used to view all of the available paths to a device. The user can manually change paths by issuing the **set dev** *dev-name* **/path=***path-name* **/switch** command.

Various SAN configurations can be supported by the OpenVMS operating system. To find out about the latest supported configurations, please contact your local Hitachi Data Systems representative.

Using OpenVMS Clustering

Configuring an OpenVMS cluster with the Hitachi RAID storage system involves the following steps:

1. Install the storage system and connect it to the OpenVMS hosts to be used in the cluster (see Installing the Storage System). In addition consult the HP *Guidelines for Creating OpenVMS Cluster Configurations* manual for details on the types of cluster configurations OpenVMS will support.
2. Verify new device recognition at the HP AlphaServer console (see Verifying New Device Recognition).
3. Set up boot devices (see Setting Up Boot Devices). At least one device is needed to be the OpenVMS cluster system disk. If you are building a two-node cluster, then a second disk is needed to act as the quorum disk. Other OpenVMS cluster disks can be created if desired. Please see the *HP OpenVMS Cluster Systems* manual for details.
4. Install the first cluster member on the USP V/VM device on the Hitachi RAID storage system.
5. Boot the first cluster member.
6. Install the quorum disk if this is a two-node cluster.
7. Install the second cluster member.
8. Install other cluster members if desired.

   Steps 4 through 8 are described in the *HP OpenVMS Cluster Systems* manual and should proceed with no trouble once the HP AlphaServer recognizes the devices on the Hitachi RAID storage system. Some care needs to be taken, however, when building a two-node cluster with respect to adding the quorum disk. The quorum disk requires a file called QUORUM.DAT to be present for its operation. One way to get this file installed on the disk is to use the following procedure: Install the first cluster member without a quorum disk (i.e., answer 'no' to the prompt asking whether this cluster will contain a quorum disk).

9. Once the first member is booted install the quorum disk using the procedure described in the *HP OpenVMS Cluster Systems* manual.
10. Add the second member. When the prompt appears asking if the cluster contains a quorum disk, answer **yes**.
11. Boot the second member. When the second member runs its GENDATA process the QUORUM.DAT file will be added to the quorum disk as required.

    Once the second member has booted, reboot the first member to verify that it can also use the quorum disk.

Acronyms and Abbreviations

AL	arbitrated loop
AL-PA	arbitrated loop physical address
B	byte
blk	block
CVS	custom volume size
FC	fibre-channel
FCP	fibre-channel protocol
GB	gigabyte
Gbps	gigabit per second
HBA	host bus adapter
H-LUN	host logical unit number
HP	Hewlett-Packard Company
I/O	input/output
KB	kilobyte
LU	logical unit
LUN	logical unit number
LUSE	LUN Expansion
LVI	logical volume image
LVM	Logical Volume Manager
MB	megabyte
OFC	open fibre control
PA	physical address
PB	petabyte
PC	personal computer
RAID	redundant array of independent disks
SCSI	small computer system interface
SIM	service information message
SNMP	simple network management protocol

TB	terabyte
TID	target ID
UDID	unique device identifier
USP V/VM	Hitachi Universal Storage Platform V and VM
UUID	user-assigned (logical) unit identifier
VLL	Virtual LVI/LUN
VSP	Hitachi Virtual Storage Platform
WWN	worldwide name

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