HITACHI
DATA SYSTEMS

Hitachi Freedom Storage™ 5800/Thunder 9200™

Hitachi Path Manager for Solaris™

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Document Revision Level

Revision	Date	Description
MK-90DF511-P	January 2001	Preliminary Release
MK-90DF511-0	February 2001	Initial Release. Supersedes and replaces MK-90DF511-P.
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MK-90DF511-2	May 2001	Supersedes and replaces MK-90DF511-1.

Document Revision Level

The following source documents were used to produce this 5800/9200 user guide:

Hitachi Path Manager for Solaris User's Manual, Revision 8.

Sanrise1000 Series Storage Subsystem Hitachi Path Manager for Solaris Release Note, Revision 1.

DF350/DF4000 Storage Subsystem Hitachi Path Manager for Solaris Release Note, Revision 0.

Changes in this Revision

Added "System Parameter Settings" sections for the 9200 and the 5800 in Chapter 2 System Configuration Requirements.

Preface

The Hitachi Path Manager software resides on a Solaris host system that is attached to a 9200 or 5800 Hitachi Disk Array Subsystem. It uses redundant paths between the server and the disk storage to enhance performance and availability. The Hitachi Path Manager provides a failover function which permits applications to run without interruption when path errors occur. This function does not modify the application software.

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Chapter 1 Introducing the Hitachi Path Manager

The Hitachi Path Manager software, which resides in the host server with the disk device driver for the Hitachi Disk Array Subsystem, uses redundant paths between the host server and disk storage in a Hitachi Disk Array Subsystem to enhance performance and data availability. These connections comprise many different components through which data flows during input and output processes. Redundancy and the ability to switch between these components provides many different paths for the data to travel.

Note: You cannot run Path Manager in an environment where more than one host is attached to the same logical unit (LUN) on a Hitachi Disk Array Subsystem, for example, a multi-host environment.

The Hitachi Path Manager provides failover functionality. In most cases, host servers are configured with multiple host adapters and SCSI connections to a Hitachi Disk Array Subsystem that provides internal component redundancy. With dual clusters and multiple host interface adapters, the Hitachi Disk Array Subsystem provides more flexibility in the number of input-output paths that are available. When there is a failure, the Hitachi Path manager reroutes input-output operations from the failed path to the remaining paths. This prevents a bus adapter on the host server, external SCSI cable, or cluster or host interface adapter on the Hitachi Disk Array Subsystem from disrupting data access. In the event of failure in one input-output path, current operations are automatically switched to another input-output path. This automatic switching in the event of failure is called *failover*.

This document includes the following information:

- System Configuration Requirements
- Defining Failover
- Installing the Hitachi Path Manager on a Solaris Host
- Removing the Hitachi Path Manager from a Solaris Host
- Upgrading the Hitachi Path Manager
- Boot Device on the Subsystem
- Re-creating the vpath Configuration
- Changing a Hitachi Path Manager Hardware Configuration
- Using Commands
- Using Applications with the Hitachi Path Manager
- Error Messages
- Path Repair Procedure

Chapter 2 System Configuration Requirements

The minimum configuration specifications and requirements are listed for the following Hitachi Data Systems disk array subsystems:

- 9200 Disk Array Subsystem
- 5800 Disk Array Subsystem

2.1 9200 Disk Array Subsystem

The following 9200 disk array subsystem information is included in this section:

- Specifications
- Requirements
- Limitations
- Configuration
- System Parameter Settings

2.1.1 Specifications

9200 Specifications		Quantity
Host PC	Sparc system with Solaris 2.6, Solaris 7, or Solaris 8 (see Note 1)	1
Host Bus Adapters	– X6541A PCI bus cards – S-bus 1062A cards – Jaycor FCI-1063 (see Note 2) – Jaycor FC64-1063 (see Note 2)	2
Microprogram Version	Dual Controller system Microprogram version – SCSI: 0503 or later – FC: 0553 or later	1
Interface Adapter	SCSI or Fibre Channel	2
I/F Cables	SCSI or Fibre Channel	2

The software is provided on a single CD media. (For specific installation information, see Installing the Hitachi Path Manager on a Solaris Host on page 13.)

2.1.2 Requirements

Note 1: Install the following patches:

- Solaris 2.6
  - 105580-15: /kernel/drv/glm patch
  - 105600-19: /kernel/drv/isp patch
  - 105356-16: /kernel/drv/ssd and /kernel/drv/sd patchSolaris 7:
  - 109118-2: usoc driver patch
  - 109117-3: fcp driver patch
  - 109116-3: fctl & fp driver patch
  - 107458-10: sd and ssd:dad, sd, ssd, uata drivers patch
  - 107147-05: pci driver patch
  - 106925-04: glm driver patch
  - 106924-06: isp driver patch

Note 2: Install the following driver:

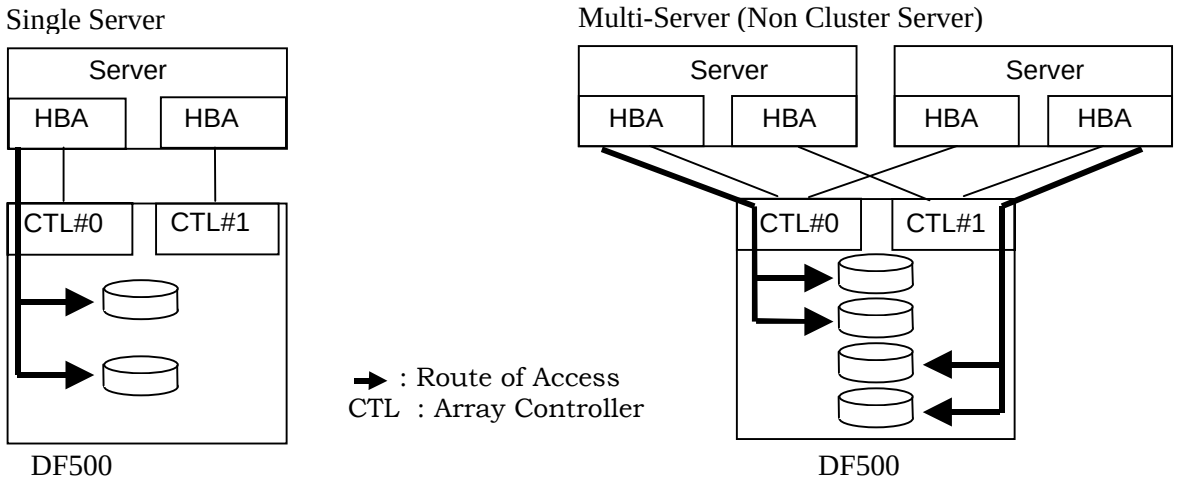
- JNI Fibre Channel SCSI HBA Driver: 2.5.8.HIT.07

2.1.3 Limitations

Hitachi Path Manager does not support the boot disk of the Hitachi Disk Array Subsystem. Install the OS and Hitachi Path Manager to the internal disk of the server.

2.1.4 Configuration

The system configuration information is as follows:



Note: If you connect the 9200 in the Multi-Server configuration, you must connect each cable per I/O port.

2.1.5 System Parameter Settings

To set the system parameters, refer to the following:

- Dual Type
- Dual Share Mode
- Host Connection Mode

2.1.5.1 Dual Type

Set “Dual Active Mode” in the **System Startup Attribute**.

2.1.5.2 Dual Share Mode

Set “Used” in the **Data Share Mode**.

2.1.5.3 Host Connection Mode

Set “ON” in the “Report inquiry page 83h” of “Host Connection Mode2” for all controllers/ports.

2.2 5800 Disk Array Subsystem

The following 5800 disk array subsystem information is included in this section:

- Specifications
- Requirements
- Limitations
- Configuration
- System Parameter Settings

2.2.1 Specifications

5800 Specifications		Quantity
Host PC	Sparc system with Solaris 2.6, Solaris 7, or Solaris 8 (see Note 1)	1
Host Bus Adapters	– X6541A PCI bus cards – S-bus 1062A cards – Jaycor FCI-1063 (see Note 2) – Jaycor FC64-1063 (see Note 2)	2
Microprogram Version	Dual Controller system Microprogram version – SCSI: x407/H or later x = 0 without SNMP x = 4 with SNMP)	1
Interface Adapter	SCSI or Fibre Channel	2
I/F Cables	SCSI or Fibre Channel	2

The software is provided on a single CD media. (For specific installation information, see Installing the Hitachi Path Manager on a Solaris Host on page 13.)

2.2.2 Requirements

Note 1: Install the following patches:

- Solaris 2.6
  - 105580-15: /kernel/drv/glm patch
  - 105600-19: /kernel/drv/isp patch
  - 105356-16: /kernel/drv/ssd and /kernel/drv/sd patchSolaris 7:
- Solaris 7:
  - 109118-2: usoc driver patch
  - 109117-3: fcp driver patch
  - 109116-3: fctl & fp driver patch
  - 107458-10: sd and ssd:dad, sd, ssd, uata drivers patch
  - 107147-05: pci driver patch
  - 106925-04: glm driver patch
  - 106924-06: isp driver patch

Note 2: Install the following driver:

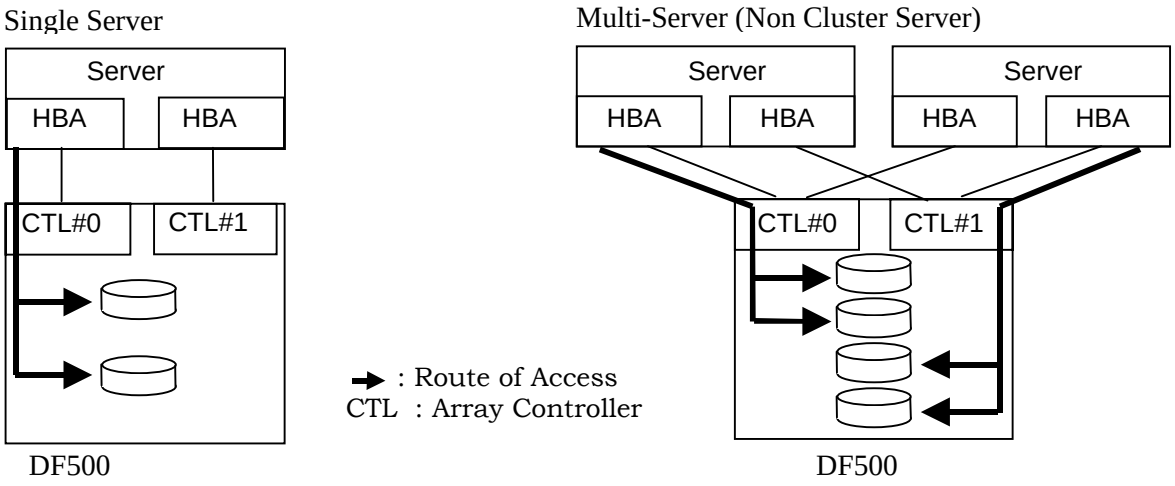
- JNI Fibre Channel SCSI HBA Driver: 2.5.8.HIT.07

2.2.3 Limitations

Hitachi Path Manager does not support the boot disk of the Hitachi Disk Array Subsystem. Install the OS and Hitachi Path Manager to the internal disk of the server.

2.2.4 Configuration

The system configuration information is as follows:



Note: If you connect the 5800 in the Multi-Server configuration, you must connect each cable per I/O port.

2.2.5 System Parameter Settings

To set the system parameters, refer to the following:

- Dual Configuration
- Dual Type
- Dual Share Mode
- Controller Serial Number (SERIAL NO)
- Option (OPTION, ENHANCE OPTION)

2.2.5.1 Dual Configuration

Set “DUAL MODE” in **Dual Configuration**.

Panel Display

```
DUAL CONFIG
  DUAL MODE
```

2.2.5.2 Dual Type

Set “DUAL ACTIVE” in **Dual Type**.

Panel Display

```
D U A L   T Y P E

  D U A L   A C T I V E
```

2.2.5.3 Dual Share Mode

Set “ON” in **Data Share Mode**.

Panel Display

```
D A T A   S H A R E   M O D E

  O N
```

2.2.5.4 Controller Serial Number (SERIAL NO)

Hitachi Path Manager recognizes the controller serial number; it is therefore able to discriminate between multiple systems. Set a voluntary number; the serial number is not a default setting.

Panel Display

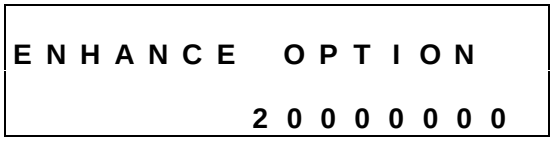
```
S E R I A L   N O

                    ? ? ? ?
```

Note: If two or more 5800s are connected, set the serial number of each unique system.

2.2.5.5 Option (OPTION, ENHANCE OPTION)

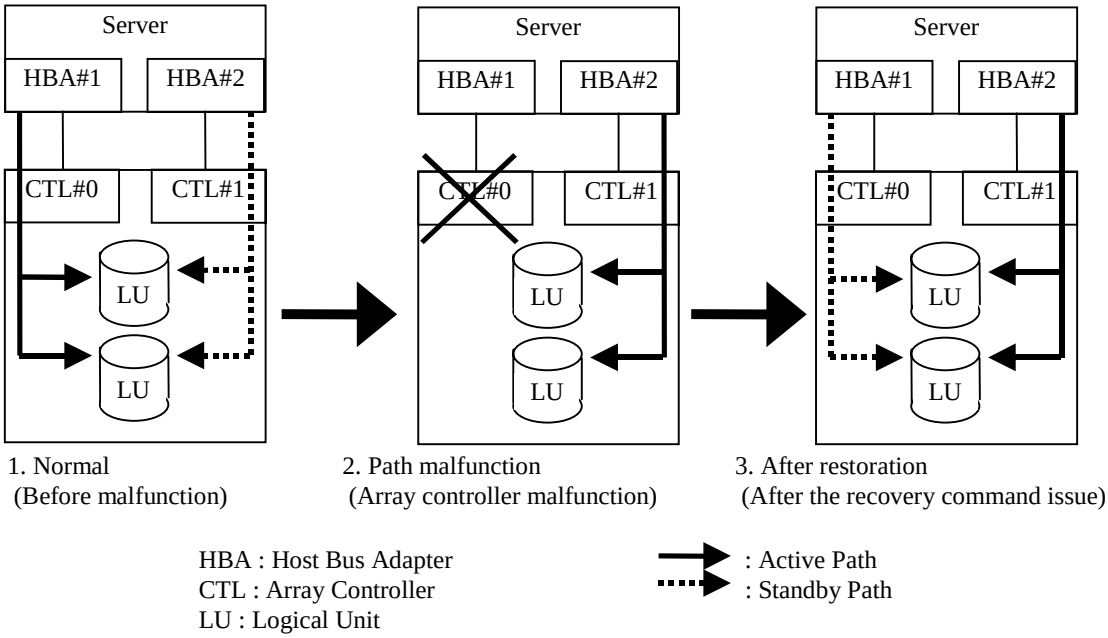
Set the option code 0000 and the enhance option code 20000000.

Panel Display



Chapter 3 Defining Failover

This function can be explained in three sections (see the diagram below):



1. Normal

   This function does not support the Load Balance function. One controller (HBA#1) always manages the I/O operation (Active Path) while the other Standby Path waits for failover action.

2. Path Malfunction

   When one controller (HBA#1) malfunctions, the other controller (HBA#2) accepts the I/O operation. This failover action is executed automatically and provides notification for course of error.

3. After the path which malfunctioned is repaired, you need to execute the command for the recovering path (see Path Repair Procedure on page 65). The repaired path is then available and is now the standby path. In failover only, both paths do not accept I/O access.

Chapter 4 Installing the Hitachi Path Manager on a Solaris Host

This chapter provides instructions to install and set up the Hitachi Path Manager on a Solaris host system attached to a Hitachi Disk Array Subsystem.

This section includes the following:

- Configuring Host Adapters for the Hitachi Path Manager
- Configuring the Disk Array Subsystem
- Reviewing Software and Hardware Requirements
- Understanding Your Current Installation
- Upgrading Hitachi Path Manager
- Installing the Hitachi Path Manager
- Post-Installation
- Hitachi Path Manager Components Installed

4.1 Configuring Host Adapters for the Solaris Hitachi Path Manager

Before you install and use the Hitachi Path Manager, you must configure your SCSI adapters.

4.2 Configuring the Disk Array Subsystem

Confirm and set the system parameters (see System Configuration Requirements on page 3).

4.3 Reviewing Software and Hardware Requirements

To install the Hitachi Path Manager on your Solaris host system, the following minimum software and hardware requirements must be met.

- The disk array subsystem must be configured for Solaris.
- The Solaris host system should be a Sparc system with Solaris 2.6, Solaris 7 or Solaris 8.
- The following SCSI adapters can be used on the Solaris host system:
  - X6541A PCI bus cards
  - S-bus 1062A cards
  - Jaycor FCI-1063 (F-port)
  - Jaycor FC641063 (F-port)

To install the Hitachi Path Manager and use the input/output Load Balancing and Failover features, at least two SCSI adapters are needed. The maximum number of SCSI adapters that are supported is eight.

Note: The Hitachi Path Manager LUNs support up to 8 paths each. The Hitachi Path Manager can control up to 256 LUNs.

The Hitachi Path Manager supports one SCSI adapter on the host system. With a single path, Load Balancing and Failover are not provided

A SCSI cable is needed to connect each SCSI host adapter to a storage system controller port.

4.4 Understanding Your Current Installation

Three types of software communicate directly with raw or block disk device interfaces such as the SCSI disk driver (sd) and the Hitachi Path Manager. These include:

- Unix file systems, when there is no volume manager present.
- Logical volume managers (LVMs), such as Sun's Solstice DiskSuite. LVMs allow the system manager to logically integrate. For example, several different physical volumes can integrate to create the image of a single large volume.
- Major application packages, for example, database managers (DBMs), when configured to do so for performance or reliability reasons. Not all DBMs require the use of raw partitions for data storage, but those that do support it need to provide many of the services usually provided by LVMs and file systems.

The method of installation that you choose for the Hitachi Path Manager is dependent upon your system configuration. Choose what is most appropriate for your system from the following examples:

- Your system does not use database products or volume managers.
- Your system has a previously installed application package. This application package communicates directly with the disk device drivers to access the multi-port storage subsystem. You will need to insert the new Hitachi Path Manager device layer between the application package and the Solaris disk device layer. This enables the application to communicate with the Hitachi Path Manager devices rather than with the disk device drivers.

  Note: To maintain data integrity, many applications, particularly DBMs, need to control device attributes (for example, ownership and permissions). While installing the Hitachi Path Manager, ensure the new Hitachi Path Manager devices that the applications will access in the future have the same attributes as the sd devices they replace. For additional information, refer to Using Applications with Hitachi Path Manager, and read the section specific to the application you will be using.
- You have the Hitachi Path Manager installed and working and you wish to upgrade the software. Refer to Upgrading the Hitachi Path Manager on page 23. Otherwise, refer to Installing the Hitachi Path Manager on page 15.

4.5 Installing the Hitachi Path Manager

Note: Hitachi Path Manager does not support the boot disk of the Hitachi Disk Array Subsystem. Install the Hitachi Path Manager and the OS in the internal disk of the server or the external disk, except for the Hitachi Disk Array Subsystem.

1. Insert and mount the installation CD-ROM.
2. Copy the Hitachi Path Manager files from the installation CD-ROM as follows:
   a) Prepare the work directory to store the Hitachi Path Manager files temporarily. For example, (using the terminal window):

      ```
      # cd /tmp/work
      ```

   b) Two binaries are available on the CD-ROM:

      ```
      \software\vpath32.tar and
      \software\vpath64.tar
      ```

   c) Copy the appropriate file from the CD to the work directory by using File Manager; these are archive files.
   d) Untar the installation package (using the terminal window):

      ```
      # tar xvf vpath32.tar
      ```

      or

      ```
      # tar xvf vpath64.tar
      ```

Directory	Applied System
vp32_xxx	32 bit system (Solaris 2.6 and Solaris 7 / Solaris 8 [32 bit mode])
vp64_xxx	64 bit system (Solaris 7 / Solaris 8 [64 bit mode])
* xxx = version of Hitachi Path Manager	

3. Install the Hitachi Path Manager by running **pkgadd** and pointing the **-d** option pkgadd to the current directory containing the Hitachi Path Manager package, copied by the previous procedure. See the following example.

```
# pkgadd -d .

The following packages are available:
  1  HITdpo     Hitachi Path Manager (32bit driver)
                (sparc) 1

Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]: 1

Processing package instance <HITdpo> from </export/home/pkgs/PATHMAN>

Hitachi Path Manager (32bit driver)
(sparc) 1.0.0
All Rights Reserved, Copyright (C) 2000, Hitachi,Ltd.
## Processing package information.
## Processing system information.
   1 package pathname is already properly installed.
## Verifying disk space requirements.
## Checking for conflicts with packages already installed.
## Checking for setuid/setgid programs.

This package contains scripts which will be executed with super-user
permission during the process of installing this package.

Do you want to continue with the installation of <HITdpo> [y,n,?] y

Installing HITACHI Vpath driver as <HITdpo>

## Installing part 1 of 1.
/etc/defvpath
/etc/rcS.d/S20vpath-config
/kernel/drv/vpathdd
/kernel/drv/vpathdd.conf
/opt/HITdpo/bin/cfgvpath
/opt/HITdpo/bin/datapath
/opt/HITdpo/bin/pathtest
/opt/HITdpo/bin/setlicense
/opt/HITdpo/bin/showvpath
/opt/HITdpo/devlink.vpath.tab
/opt/HITdpo/etc.profile
/opt/HITdpo/etc.system
/opt/HITdpo/vpath.msg
/usr/sbin/vpathmkdev
[ verifying class <none> ]
## Executing postinstall script.
cfgvpath: No /etc/vpathsave.cfg configuration file found
Vpath: Configuring 64 devices (8 disks * 8 slices)

Installation of <HITdpo> was successful.

The following packages are available:
  1  HITdpo     HITACHI Vpath driver
                (sparc) 1

Select package(s) you wish to process (or 'all' to process
all packages). (default: all) [?,??,q]: q

*** IMPORTANT NOTICE ***
        This machine must now be rebooted in order to ensure
        sane operation.  Execute
               shutdown -y -i6 -g0
        and wait for the "Console Login:" prompt.
```

The Hitachi Path Manager is now installed. Proceed to Post-Installation.

4.6 Post-Installation

Restart the system:

```
# /usr/sbin/shutdown -16 -g0 -y
```

Note: Hitachi Path Manager devices are found in **/dev/rdsk** and **/dev/dsk**. The device is named according to the Hitachi Path Manager instance number. A device with an instance number of 0 would be: **/dev/rdsk/vpath0a** where 'a' denotes the slice. Therefore, **/dev/rdsk/vpath0c** would be instance zero (0) and slice 2.

Running **format** displays both sd devices and pseudo Hitachi Path Manager devices.

Note: Using **format** with no arguments displays the sd devices in addition to the Hitachi Path Manager device. Use the Hitachi Path Manager device to partition, name, and label a Hitachi Path Manager volume. See the following example.

```
# format

AVAILABLE DISK SELECTIONS :
       0. c0t0d0 <ST34321A cyl 8892 alt 2 hd 15 sec 63>
          /pci@1f,0/pci@1,1/ide@3/dad@0,0
       1. c2t1d0 <xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pci@1f,0/pci@1/scsi@2,1/sd@1,0
       2. c2t4d0 < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pci@1f,0/pci@1/scsi@2,1/sd@4,0
       3. c2t8d0 < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pci@1f,0/pci@1/scsi@2,1/sd@8,0
       4. vpath0a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:0
       5. vpath1a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:1
       6. vpath2a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:2
Specify disk (enter its number): 6
selecting vpath2a
[disk formatted]


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>
```

Note: To correlate the Hitachi Path Manager device with the sd device, you can use the format volume naming utility to label the sd with the name of the Hitachi Path Manager device. To view the changes, exit and then reenter format. Note that the volume name appears to the right of all entries for the named volume (shown bold in the following example for emphasis).

```
# format


AVAILABLE DISK SELECTIONS:
       0. c0t0d0 < xxxxxxxx cyl 8892 alt 2 hd 15 sec 63>
          /pci@1f,0/pci@1,1/ide@3/dad@0,0
       1. c2t1d0 < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219> vpath0
          /pci@1f,0/pci@1/scsi@2,1/sd@1,0
       2. c2t4d0 < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219> vpath1
          /pci@1f,0/pci@1/scsi@2,1/sd@4,0
       3. c2t8d0 < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219> vpath2
          /pci@1f,0/pci@1/scsi@2,1/sd@8,0
       4. vpath0a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:0
       5. vpath1a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:1
       6. vpath2a < xxxxxxxx cyl 8150 alt 2 hd 10 sec 219>
          /pseudo/vpathdd@0:2
Specify disk (enter its number):
```

Partition and label the Hitachi Path Manager device in **format**. The Hitachi Path Manager partitions you have created can now be used for file system or raw access, just as you would use partitions accessed via the sd driver directly. Remember to use the Hitachi Path Manager device name in **vfstab** or in your database configuration files.

4.7 Hitachi Path Manager Components Installed

All the Hitachi Path Manager software components installed during installation are listed below. The variable base directory is the location specified to **pkgadd** as the package base area.

File	Location	Description
vpathdd	/kernel/drv	Hitachi Path Manager device driver
vpathdd.conf	/kernel/drv	PathManager device driver config file
Executables	/opt/HITdpo	Configuration and status tools
S20vpath-config	/etc/reS.d	Boot initialization script*
* This script must come before other LVM initialization scripts, such as Veritas Volume Manager and DiskSuite initialization scripts.		

The following system files are updated.

File	Location	Description
/etc/system	/etc	Forces the loading of the Hitachi Path Manager Device Driver
/etc/devlink.tab	/etc	Tells the system how to name Hitaci Path Manager devices in /dev

Chapter 5 Removing the Hitachi Path Manager from a Solaris Host

Note: The **/etc/vpathsave.cfg** file is not deleted in the removal procedure. This file contains the vpath configuration information. If you update the Hitachi Path Manager, or if you want to use the same SCSI devices and same vpath configuration after reinstallation, keep this file. If you change the device and vpath configuration, you must delete this file and install the Hitachi Path Manager.

To remove the Hitachi Path Manager, use the following procedure:

1. Discontinue the use of Hitachi Path Manager devices system-wide.
   e) For an Ffile system device:
   – Change the **vfstab** and **/etc/system** file from a **vpath** device to a **cxtxdx** device.
   – To stop using Hitachi Path Manager devices, reboot or unmount all Hitachi Path Manager file systems.
   f) For a database partition:
   – Edit the appropriate database configuration files to stop using Hitachi Path Manager devices. Restart the database.
2. Remove the current Hitachi Path Manager by using **pkgrm**. See the following example.

```
# pkgrm HITdpo

The following package is currently installed:
   HITdpo          Hitachi Path Manager (32bir driver)
                   (sparc) 1.0.0

Do you want to remove this package? y

## Removing installed package instance <HITdpo>

This package contains scripts which will be executed with super-user
permission during the process of removing this package.

Do you want to continue with the removal of this package [y,n,?,q] y
## Verifying package dependencies.
## Processing package information.
## Executing preremove script .
## Removing pathnames in class <none>
/usr/sbin/vpathmkdev
/opt/HITdpo/vpath.msg
/opt/HITdpo/etc.system
/opt/HITdpo/etc.profile
/opt/HITdpo/devlink.vpath.tab
/opt/HITdpo/bin
/opt/HITdpo <non-empty directory not removed>
/kernel/drv/vpathdd.conf
/kernel/drv/vpathdd
/etc/rcS.d/S20vpath-config
/etc/defvpath
## Updating system information.

Removal of <HITdpo> was successful.
```

Do NOT reboot at this time.

Chapter 6 Upgrading the Hitachi Path Manager

To upgrade the Hitachi Path Manager, you need to remove and reinstall the Hitachi Path Manager package.

Note 1: **Do NOT reboot between the removal and the reinstall.**
It is recoverable, but difficult.

Note 2: **Do NOT delete the *etc/vpathsave.cfg* file between the removal and reinstall.**
Hitachi Path Manager holds the vpath configuration information in this file. If this file is deleted before reinstalling Hitachi Path Manager, the vpath configuration may change.

Chapter 7 Boot Device on the Subsystem

Note: Hitachi Path Manager does not support the boot disk of the Hitachi Disk Array Subsystem. Install the Hitachi Path Manager and the OS in the internal disk of the server or the external disk, except for the Hitachi Disk Array Subsystem.

Chapter 8 Re-Creating the vpath Configuration

Hitachi Path Manager keeps the vpath configuration information in the **/etc/vpathsave.cfg** file. You can re-create the same vpath configuration by using the **/etc/vpathsave.cfg** backup file.

Note: Keep a backup copy of the **/etc/vpathsave.cfg** file:

- After installing the Hitachi Path Manager.
- After changing the configuration by using the **cfgpath** command.

Three conditions in which the vpath configuration can be re-created are as follows:

- Hitachi Path Manager is Installed on the Servers
- Hitachi Path Manager is not Installed on the Servers
- Using the /etc/vpathsave.cfg Backup File

8.1 Hitachi Path Manager is Installed on the Servers

When two or more servers with the installed Hitachi Path Manager share the same vpath configuration, define the vpath configuration on each server.

1. Copy the **/etc/vpathsave.cfg** file from the primary server to the secondary server(s).
2. Execute the following command at the secondary server(s).

   ```
   cfgvpath -c
   ```

3. Reboot the secondary server(s).

8.2 Hitachi Path Manager is not Installed on the Servers

When two or more servers that have not installed the Hitachi Path Manager share the same vpath configuration, define the vpath configuration on each server(s).

1. Copy the **/etc/vpathsve.cfg** file from the primary server to the secondary server(s).
2. Install the Hitachi Path Manager on the secondary server(s). Refer to Installing the Hitachi Path Manager on a Solaris Host on page 13.

8.3 Using the /etc/vpathsave.cfg Backup File

After the reinstallation of the OS, you can re-create the same vpath configuration by using the **/etc/vpathsave.cfg** backup file.

1. Restore the **/etc/vpathsave.cfg** file.
2. Install the Hitachi Path Manager on the secondary server(s). Refer to the Installing the Hitachi Path Manager on a Solaris Host on page 13.

Chapter 9 Changing a Hitachi Path Manager Hardware Configuration

When adding or removing multi-port SCSI devices from your system, it is necessary to reconfigure the Hitachi Path Manager to recognize the new devices.

Note 1: Reboot the system in the middle of this procedure. A reboot must be performed in order to execute the following procedure.

Note 2: Stop the I/O process before this procedure is performed.

Note 3: The Hitachi Path Manager creates the vpath entry based on data in **/etc/vpathsave.cfg**. If you want to re-create the vpath entry to be that same as the new install procedure, execute the **cfgvpath** command after deleting the **/etc/vpathsave.cfg** file.

Note 4: Keep a backup copy of **/etc/vpathsave.cfg** to use in the event of a disk failure.

This section contains the following information:

- Adding Devices
- Removing Devices

9.1 Adding Devices

To add devices, follow this procedure:

1. Add the LU.
2. Shutdown the system and execute a reconfiguration boot.

   ```
   # /usr/sbin/shutdown –i0 –g0 –y
   ```

3. Reboot the system from the ok prompt:

   ```
   # ok> boot -r
   ```

4. This will access the current Hitachi Path Manager entries, not the new entries, during reboot. After the reboot, the new disks are recognized. Run the Hitachi Path Manager Configuration commands to make the necessary changes to **/etc/vpath.cfg**.

   ```
   # cfgvpath –c
   ```

5. Shut down the system and execute a reconfiguration boot.

   ```
   # /usr/sbin/shutdown –i0 –g0 –y
   ```

6. Reboot the system from the ok prompt:

   ```
   # ok> boot -r
   ```

7. Reconfigure the device.

   ```
   # drvconfig
   # vpathmkdev
   ```

8. Shut down the system and execute a reconfiguration boot.

   ```
   # /usr/sbin/shutdown –i0 –g0 –y
   ```

9. Reboot the system from the ok prompt:

   ```
   # ok> boot -r
   ```

9.2 Removing Devices

1. Remove the LU.
2. Shutdown the system and execute a reconfiguration boot.

   ```
   # /usr/sbin/shutdown –i0 –g0 –y
   ```

3. Reboot the system from the ok prompt:

   ```
   # ok> boot -r
   ```

4. This will access the current Hitachi Path Manager entries, not the new entries, during reboot. After the reboot, the new disks are recognized. Run the Hitachi Path Manager Configuration commands to make the necessary changes to **/etc/vpath.cfg**.

   ```
   # cfgvpath –c
   ```

5. Shut down the system and execute a reconfiguration boot.

   ```
   # /usr/sbin/shutdown –i0 –g0 –y
   ```

6. Reboot the system from the ok prompt:

   ```
   # ok> boot -r
   ```

If the number of LU is not the same as the number of the vpath after changing a hardware configuration, execute the following procedure:

1. Delete the data in the **etc/vpathsave.cfg** file. Do **NOT** delete this file.
2. Execute the **cfgvpath -c** command.
3. Reboot the system from the pk prompt with the -r option. (boot-r)
4. Execute the **drvconfig** and **vpathmkdev** commands. The configuration data is saved in the **vpathsave.cfg** file.
5. Reboot the system from the pk prompt with the -r option. (boot -r)

Chapter 10 Using Commands

The Hitachi Path Manager provides commands which enable you to display the status of adapters that are used to access managed devices, or to display the status of devices that the device driver manages. You can set individual path conditions either to online or offline, or set all paths that are connected to an adapter or bus either to online or offline. This chapter describes these commands.

Note: No graphic user interface (GUI) is used with this product. Use the command line to enter these commands.

Table 5.1 provides a list of the commands, a brief description, and where to go in this chapter for more information.

Table 10.1 Commands

Command	**Description**	Page Number
datapath	▪ Displays information about adapters. ▪ Displays information about devices. ▪ Sets all device paths that are attached to an adapter. ▪ Sets the path of a device.	
cfgvpath	Used to create and configure the Hitachi Path Manager devices. The program is run automatically when installing Hitachi Path Manager, but it can also be run at the command line.	
defvpath	Used to reconfigure the existing Hitachi Path Manager devices after a system boot.	
showvpath	Outputs the mapping between the Hitachi Path Manager devices and the underlying disks.	

10.1 datapath

This section contains a description of the datapath commands:

- datapath query adapter
- datapath query device
- datapath set adapter
- datapath set device

The following syntax conventions are used:

- Use the word **datapath** to begin all Hitachi Path Manager commands.
- Use the word **query** to display information.
- Use the word **set** to change the state of the datapath.
- All commands apply to either an **adapter** or a **device**. This will be the last word in the command.

Note: You must log on as an Administrator user to use these commands.

10.1.1 datapath query adapter

The **datapath query adapter** command displays information about a single adapter or all adapters. After the server completes startup, use this command to confirm that Hitachi Path Manager can use all the paths.

Note: When this command is executed while the **format** command is active, Hitachi Path Manager may display an increase in the number of "Active" paths, rather than display the actual number of paths. If this occurs, execute this command after the **format** command.

10.1.1.1 Syntax

`datapath query adapter` [*adapter_number*]

10.1.1.2 Parameters

adapter_number

The adapter number for which you want information displayed. If you do not enter an adapter number, information about all adapters is displayed.

10.1.1.3 Examples

datapath query adapter

This example might provide the following output:

```
Active Adapters :2
Adpt#    Adapter Name       State     Mode     Select     Errors     Paths     Active
0        QLGC,isp@0,10000   NORMAL    ACTIVE    36098        0         4         4
1        QLGC,isp@0,10000   DEGRAD    ACTIVE     2124        6         4         2
```

The following table defines the terms used in the previous example:

Term	Definition
Adpt #	The number of the adapter.
Adapter Name	The name of the adapter.
State	The condition of the named adapter. It can be either: **NORMAL** Adapter is in use. **DEGRADED** One or more paths are not functioning. **FAILED** The adapter is no longer being used by the Hitachi Path Manager.
Mode	The mode of the named adapter. It is either **ACTIVE** or **OFFLINE**.
Select	The number of times this adapter was selected for input or output.
Errors	The number of errors on a path that is attached to this adapter.
Paths	The number of paths that are attached to this adapter.
Active	The number of functional paths that are attached to this adapter. The number of functional paths is equal to the number of paths minus any that are failed or offline.

10.1.2 datapath query device

The **datapath query device** command displays information about a single device or all devices. If you do not enter a device number, information about all devices is displayed. After the server completes startup, use this command to confirm that Hitachi Path Manager can use all the devices.

10.1.2.1 Syntax

datapath query device [*device_number*]

10.1.2.2 Parameters

device_number

The device number for which you want information displayed. If you do not enter a device number, information about all devices is displayed.

10.1.2.3 Examples

datapath query device

This example might provide the following output:

```
DEV#:    0   DEVICE NAME: vpath0a  TYPE: xxxxxx     SERIAL: xxxxxxxx
===========================================================================
Path#            Adapter/Hard Disk    State        Mode    Select    Errors
  0          isp@0,10000:devctl    OPEN   NORMAL      4520         0
  1          isp@1,10000:devctl    OPEN   NORMAL      4520         0

DEV#:    1   DEVICE NAME: vpath0b TYPE: xxxxxx     SERIAL: xxxxxxxx
===========================================================================
Path#            Adapter/Hard Disk    State        Mode    Select    Errors
  0          isp@0,10000:devctl    CLOSE  NORMAL         0         0
  1          isp@1,10000:devctl    CLOSE  NORMAL         0         0

DEV#:    2   DEVICE NAME: vpath0c TYPE: xxxxxx     SERIAL: xxxxxxxx
===========================================================================
Path#            Adapter/Hard Disk    State        Mode    Select    Errors
  0          isp@0,10000:devctl    OPEN   NORMAL        15         0
  1          isp@1,10000:devctl    OPEN   NORMAL        16         0

       :
       :
       :

DEV#:    7   DEVICE NAME: vpath0h TYPE: xxxxxx     SERIAL: xxxxxxxx
===========================================================================
Path#            Adapter/Hard Disk    State        Mode    Select    Errors
  0          isp@0,10000:devctl    CLOSE  NORMAL         0         0
  1          isp@1,10000:devctl    CLOSE  NORMAL         0         0
```

The following table defines the terms in the previous example:

Term	Definition
Dev#	The number of this device.
Name	The name of this device.
Type	The device product ID from Inquiry data.
Serial	The logical unit (LUN) serial number for this device.
Path#	The path number.
State	The condition of the named device. **OPEN** Path is in use. **CLOSE** Path is not being used. **DEAD** Path is no longer being used. It was either removed by the Hitachi Path Manager due to errors, or manually removed using the datapath command.
Mode	The mode of the named device. It is either **NORMAL** or **OFFLINE**.
Select	The number of times this path was selected for input or output.
Errors	The number of errors on a path that is attached to this device. This number may be counted up when the device driver detects the error without recording the error log, such as raw read over the end of data.

The following table shows the relationship between state and mode.

State	Mode	Contents
CLOSE	NORMAL	Path is not being used.
OPEN	NORMAL	Path is in use.
DEAD	NORMAL	Path is not longer being used. It was removed by Path Manager due to I/O errors.
DEAD	OFFLINE	Path is no longer being used. It was manually removed using the **datapath** command.

10.1.3 datapath set adapter

The **datapath set adapter** command sets all device paths that are attached to an adapter either to online or offline.

Note: This command will not remove the last path to a device.

10.1.3.1 Syntax

datapath set adapter *adapter_number* {online|offline}

10.1.3.2 Parameters

adapter_number

The adapter number that you want to change.

online

Set adapter online.

offline

Set adapter offline.

10.1.3.3 Examples

```
datapath set adapter 0 online
```

10.1.4 datapath set device

The **datapath set device** command sets the path of a device either to online or offline.

10.1.4.1 Syntax

datapath set device *device_number* **path** *path_number* {online|offline}

10.1.4.2 Parameters

device_number

The device number that you want to change.

path_number

The path number that you want to change.

online

Set path online.

offline

Remove the path from service.

Note: You cannot remove the last path to a device from service. This prevents data access failure.

10.1.4.3 Examples

```
datapath set device 0 path 0 online
```

10.2 cfgvpath

The **cfgvpath** command examines the current SCSI disk configuration and determines which disks are part of the Hitachi Path Manager and which disks are alternate paths to other disks rather than new disks. It creates entries within **/etc/vpath.cfg** to reflect mapping between the Hitachi Path Manager devices and SCSI disks. This information is sent to the Hitachi Path Manager configuration device and Hitachi Path Manager devices are created.

If you want to re-create the vpath entry to be the same as the new install procedure, execute the cfgvpath command after deleting the **/etc/vpathsave.cfg** file.

The **cfgvpath** command is run automatically during installation. It should also be run any time devices are removed from or added to the system, with the –c option, to force the system to discard the previous entries.

10.2.1 Syntax

The command format is shown below:

cfgvpath -c

The –c option is used for re-configuration.

Note: If **cfgvpath** is run twice, nothing will happen. It will detect that a Hitachi Path Manager device is already configured and ignore an attempt to configure it a second time.

Keep a backup copy **/etc/vpathsave.cfg** to use for backup in the event of a system disk failure.

10.3 defvpath

The **defvpath** command reads the entries in **/etc/vpath.cfg** (created by **cfgvpath**) and sends the information to the Hitachi Path Manager configuration device which creates the Hitachi Path Manager devices.

The **defvpath** command is run automatically during boot time, out of **/etc/rcS.d/S20vpath-config**. It can also be run when the **/etc/vpath.cfg** is correct and a failure occurred that prevented it from being run properly at boot time. However, it is best to run **cfgvpath –f** and reboot if problems occur.

10.3.1 Syntax

The command format is shown below:

defvpath [–f]

The –f option is used to force re-configuration; it deletes the old configuration within the device driver before starting the configuration.

Note: If **defvpath** is run twice, nothing will happen. It will detect that a Hitachi Path Manager device is already configured and ignore an attempt to configure it a second time.

10.4 showpath

The **showvpath** command outputs the mapping between Hitachi Path Manager devices and the underlying disks.

Note: When you write to output a standard UNIX file, use the script command.

If you use the redirection for output, it is different from the console display.

10.4.1 Examples

```
vpath0:
  c1t0d0s0      /devices/sbus@1f,0/fcaw@3,0/sd@0,0:a,raw
  c2t1d0s0      /devices/sbus@1f,0/fcaw@1,0/sd@1,0:a,raw
vpath1:
  c1t0d1s0      /devices/sbus@1f,0/fcaw@3,0/sd@0,1:a,raw
  c2t1d1s0      /devices/sbus@1f,0/fcaw@1,0/sd@1,1:a,raw
vpath2:
  c1t0d2s0      /devices/sbus@1f,0/fcaw@3,0/sd@0,2:a,raw
  c2t1d2s0      /devices/sbus@1f,0/fcaw@1,0/sd@1,2:a,raw
vpath3:
  c1t0d3s0      /devices/sbus@1f,0/fcaw@3,0/sd@0,3:a,raw
  c2t1d3s0      /devices/sbus@1f,0/fcaw@1,0/sd@1,3:a,raw
```

This example shows slice “a” for each raw disk device, however, slices a-h exist for all the disks. There are block devices for each Hitachi Path Manager device.

Chapter 11 Using Applications with Hitachi Path Manager

This section describes how to use the following applications with Hitachi Path Manager:

- Standard UNIX Applications
- Solstice DiskSuite
- NFS File Server
- Veritas Volume Manager
- Oracle
- Veritas Cluster Server

11.1 Standard UNIX Applications

Standard UNIX applications such as newfs, fsck, mkfs, and mount that normally accept a disk device or raw disk device as a parameter, will also accept the Hitachi Path Manager device as a parameter. Similarly, entries in files such as vfstab, dfstab in the format of cntndnsn can be replaced by entries for the corresponding Hitachi Path Manager **vpathNs** devices . Make sure that the replaced devices are replaced with the corresponding Hitachi Path Manager device. Run the **showvpath** command to list all the Hitachi Path Manager devices and their underlying disks.

Note 1: Hitachi Path Manager does not support the following root partitions: (/), /var, /usr, /opt, /tmp and swap.

Note 2: Do not execute the **newfs** command for the same vpath device simultaneously. When this occurs, the number of "Active" paths displayed is different from the actual number of paths; reboot the server after Hitachi Path Manager is installed.

Note 3: After executing the **newfs** command, verify that the "DEAD" device does not exist by using the **datapath query device** command. If the "DEAD" device exists, re-run the **newfs** command for this device.

11.2 Solstice DiskSuite

The following procedure describes how to create SUN Solstice DiskSuite devices with the Hitachi Path Manager. For additional information, refer to the SUN DiskSuite Administrator Guide and User's Guide.

When you install Solstice DiskSuite and the Hitachi Path Manager, note the following:

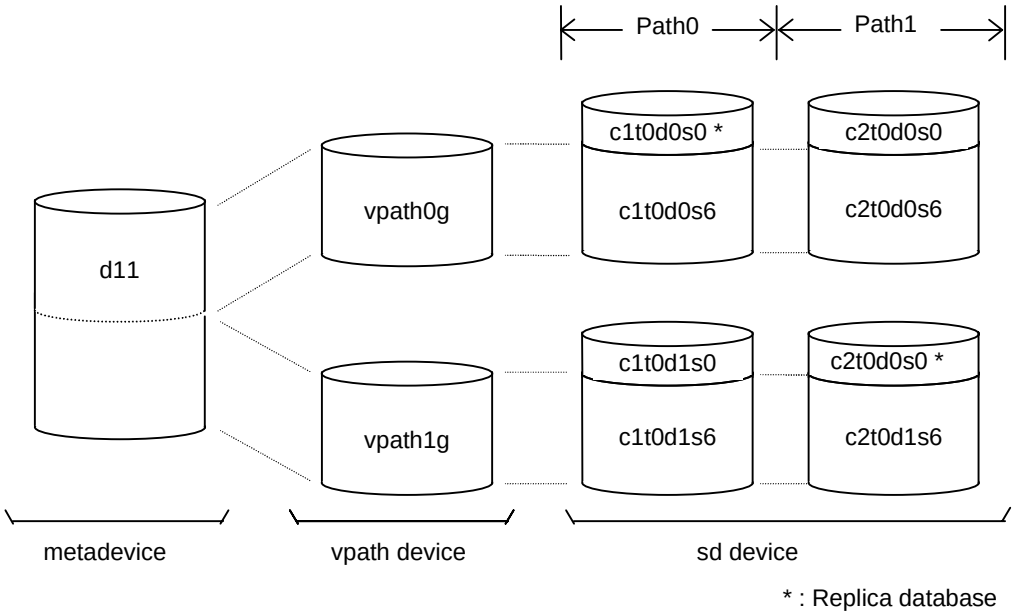
- Use **cxtxdxsx** for the state database. **DO NOT** use **vpathNx**.
- Use **vpathNx** to create the metadevices.
- Assign each partition for the state database and the metadevices separately.
- Edit the **/etc/opt/SUNWmd/md**.tab file to specify the configuration information and run the metainit command to create DiskSuite objects.
- Copy **S45vpath-md** file into **/etc/rcS.d**. (This file is in **/opt/HITdpo/bin**.)

The following procedure is an example for Solstice DiskSuite 4.2.

1. Move to the directory where DiskSuite is installed and obtain root privileges:

   ```
   # cd /usr/opt/SUNWmd/sbin
   ```

   The following example uses DiskSuite commands to create DiskSuite replica databases and metadevices. A replica is a copy of the state database. In this example, two LUNs were accessed for replica database operations via sd devices over different SCSI paths.



2. Create two replicas:

   ```
   # ./metadb  -c1  -a  -f  c1t0d0s0
   # ./metadb  -c1  -a  -f  c2t0d1s0
   ```

   These two sd devices correspond to vpath0a and vpath1a.

3. Verify the database replicas by entering.

   ```
   # ./metadb  -i
   ```

4. To create a stripe across two vpath devices, add the following line to the **/etc/opt/SUNWmd/md.tab** file:

```
  :
#
    d11     1 2 /dev/dsk/vpath0g  /dev/dsk/vpath1g      
#
 :
```

5. Enter:

   # ./`metainit` -a

6. Copy the S45vpath-md file in /opt/HITdpo/bin init into /etc/rcS.d:

   ```
   # cp  /opt/HITdpo/bin/S45vpath-md  /etc/rcS.d
   ```

7. Create a file system using the disksuite metadevice:

   ```
   # newfs  /dev/md/rdsk/d11
   ```

8. Mount the file system:

   ```
   # mount  /dev/md/dsk/d11  /mnt
   ```

11.3 NFS File Server

The procedures in this section show how to install the Hitachi Path Manager for use as an Exported File System (NFS).

The Solaris answerbook Solaris 2.*x* System Administrator Handbook is recommended.

Note: You must have system administrator knowledge to perform these procedures.s

This section contains the following:

- Installing NFS on a New System
- Installing Hitachi Path Manager on a System with NFS Previously Installed

11.3.1 Installing NFS on a New System

Note: No NFS file systems need to be switched over to Hitachi Path Manager.

Follow the instructions in this section if you are installing exported file systems on Hitachi Path Manager devices for the first time.

1. Carry out the basic installation steps as described in Installing the Hitachi Path Manager on page 15.
2. Determine which Hitachi Path Manager (vpathNs) volumes you will use as file system devices. Partition the selected volumes using the Solaris “format” utility.
3. Create file systems on the selected Hitachi Path Manager devices using the appropriate utilities for the type of file system you will use. If you are using the standard Solaris LJFS file system, use the following command:

   ```
   # newfs /dev/rdsk/vpathNs
   ```

   N is the Path Manager device instance of the selected volume, and s is the slice, or partition, identifier in the range [a-h]; remember that Path Manager partitions [a-h] correspond “sd” slices [0-7].
4. Create mount points for the new file systems.
5. Install the file systems into **/etc/vfstab**. Set the **mount at boot** field to **yes**.
6. Install the file system mount points into **/etc/dfs/dfstab** for export.
7. Reboot.

11.3.2 Installing Hitachi Path Manager on a System with NFS Previously Installed

Follow the instructions in this section if you have NFS already configured for exported file systems residing on a multi-port subsystem and you wish to use Hitachi Path Manager partitions instead of sd partitions to access them.

1. Make a list of the mount points for all currently exported file systems by looking in **/etc/dfs/dfstab**.
2. Match the mount points found in step 1 with "sd" device link names (files named /dev/(r)dsk/cntndnsn) by looking in **/etc/vfstab**.
3. Carry out the basic installation steps as described in Installing the Hitachi Path Manager on a Solaris Host on page 13.
4. Match the sd device link names found in step 2 with Hitachi Path Manager device link names (files named **/dev/(r)dsk/vpathNs**) by executing the command **showvpath**.
5. Make a backup copy of the current **/etc/vfstab** file.
6. Edit **/etc/vfstab**, replacing each instance of an "sd" device link named **/dev/(r)dsk/cntndnsn** with the corresponding Hitachi Path Manager device link. Remember that Hitachi Path Manager partitions [a-h] correspond to sd slices [0-7].
7. Reboot. Verify that each exported file system passes the boot time "fsck pass", that each mounts properly, and that each is exported and available to NFS clients.

If there is a problem with any exported file system after step 7, restore the original **/etc/vfstab** file and reboot to restore NFS service. Then review your steps and try again.

11.4 Veritas Volume Manager

For these procedures, refer to the *Veritas Volume Manager System Administrator's Guide*. These procedures were tested using Veritas Volume Manager 3.0.1. The SUN patches 105223 and 105357 must be installed with Veritas Volume Manager (this is a Veritas Volume Manager requirement, not a Hitachi Path Manager requirement).

Note 1: You must disable the DMP of Veritas Volume Manager before you add a Hitachi Path Manager device to Veritas Volume Manager, since Hitachi Path Manager can not coexistence with DMP. (Refer to "To Disable DMP" section of "Veritas Volume Manager for Solaris Hardware Application Note".)

Note 2: You must have system administrator knowledge to perform these procedures.

Note 3: Hitachi Path Manager does not support the following for root partitions: (/), /var, /usr, /opt, /tmp and swap.

This section contains the following:

- Installing Veritas Volume Manager on a New System
- Installing Hitachi Path Manager on a System with Veritas Volume Manager Previously Installed

11.4.1 Installing Veritas Volume Manager on a New System

Note 1: No Veritas Volumes need to be switched over to Hitachi Path Manager.

Follow the instructions in this section if you are installing both Veritas Volume Manager and Hitachi Path Manager on the multi-port subsystem's server for the first time.

After installing Hitachi Path Manager as described in Installing the Hitachi Path Manager on a Solaris Host on page 13, install Veritas Volume Manager .

Note 2: Since disk data is initialized when you install Veritas Volume Manager, back up data before installing, and restore them after installing the Hitachi Path Manager and the Veritas Volume Manager.

Note 3: During installation, Veritas Volume Manager requires that at least one disk device be added to the Veritas Volume Manager root disk group (rootdg). This device must be a standard Solaris hard disk device, and not a Hitachi Path Manager device. It is important that the last disk in the rootdg is a regular disk, and not a Hitachi Path Manager device, therefore it is recommended that you use a different disk group for your Hitachi Path Manager disks.

Hitachi Path Manager disks may only be added to a Veritas Volume Manager disk group as a whole; any previous partitioning is ignored. The c partition (the whole disk) is used, so the Hitachi Path Manager device name for the disk in the /dev/dsk and /dev/rdsk directories would, for example, be vpath0c. Veritas Volume Manager always looks in these directories by default, so only the device name is needed, i.e., vpath0c, when giving Veritas Volume Manager commands.

Partitioning of the given disk once it has been added to a Veritas Volume Manager disk group is achieved by dividing the Veritas Volume Manager "disk" into Veritas Volume Manager sub-disks.

This section contains the following:

- Adding a Hitachi Path Manager Device to Veritas Volume Manager
- Creating a New Disk Group from a Hitachi Path Manager Device
- Creating a New Volume Group from a Hitachi Path Manager Device

11.4.1.1 Adding a Hitachi Path Manager Device to Veritas Volume Manager

If you have installed the Veritas Volume Manager and have uninstalled it before, you must disable the DMP of Veritas Volume Manager before you add a Hitachi Path Manager device to Veritas Volume Manager. Hitachi Path Manager cannot coexistence with DMP. (Refer to the "To Disable DMP" section of the "Veritas Volume Manager for Solaris Hardware Application Note".)

Enter the following command.

```
vxdisk -f init vpath0c
```

After executing this command, the Veritas Volume Manager Graphical User interface tool vmsa may be used to perform all the following steps.

11.4.1.2 Creating a New Disk Group from a Hitachi Path Manager device

The following command creates a new disk group from the Hitachi Path Manager physical device. The new disk group is called **htcdg** and the disk **vpath0c** is used in this example:

```
vxdg init htcdg vpath0c
```

Note: You can add a Hitachi Path Manager device to an existing disk group using **vxdgadd**.

11.4.1.3 Creating a new volume group from a Path Manager device

The following command formats the maximum size of the disk into blocks:

```
/usr/sbin/vxassist –g htcdg –p maxsize [vpath0c]
```

Write down the output of the last command and use it in the next command. The following command creates a volume group called **htcvg** within the disk group **htcdg**:

```
/usr/sbin/vxassist –g htcdg make htcvg 17846272 layout=nostripe
```

Note: You may change the size of the volume group and use less than the maximum number of blocks.

11.4.2 Installing Hitachi Path Manager on a System with Veritas Volume Manager Previously Installed

Multi-pathing must be disabled in the versions of Veritas Volume Manager that support multi-pathing. The Veritas Volume Manager Release Notes explain how to disable multi-pathing. (Disabling Multi-Pathing does not work on release 2.5.4; you need to upgrade to at least Veritas Volume Manager 2.5.6. These procedures were tested on Solaris 2.6 under version 3.0.1 of Veritas Volume Manager.)

Note: Disable the DMP of Veritas Volume Manager before adding a Hitachi Path Manager device to Veritas Volume Manager; Hitachi Path Manager cannot coexistence with DMP. (Refer to “To Disable DMP” section of “Veritas Volume Manager for Solaris Hardware Application Note”.)

Note: In order to use Hitachi Path Manager with Veritas Volume Manager, the disk used by the Hitachi Path Manager needs to be initialized. Back up the data before installation, and restore it after the Hitachi Path Manager installation.

This section describes the Veritas Volume Manager command line instructions which are needed to reconfigure the Veritas Volume Manager volume to use a Hitachi Path Manager disk device. The following is a brief overview of this procedure:

1. Add the Hitachi Path Manager device, which corresponds to the existing disk, to the disk group.
2. Set the size of the Veritas Volume Manager device to that of the original disk.
3. Set the size of the original device to zero.

This provides a disk group with twice the number of devices, although the size remains the same as the original. This new disk group will use the Hitachi Path Manager devices, not the original disk which has been set to zero size.

It is assumed that the user has the Veritas Volume Manager volume configured to enable the Solaris disk device driver to directly access the multi-port subsystem drives. The Hitachi Path Manager devices refer to the same devices. These instructions allow the user to replace all sd references to the original hard disks that occur in the Veritas Volume Manager volume’s configuration with references to the Hitachi Path Manager devices. Before proceeding, record the multi-port subsystem device links **/dev/(r)dsk/cntndnsn** being used as Veritas Volume Manager volume device files. Determine the corresponding Hitachi Path Manager device **/dev/(r)dsk/vpathNs** link using the command **showvpath** and also record this information.

The following example outlines a general method for replacing the sd device with the corresponding Hitachi Path Manager device in an existing Veritas Volume Manager volume.

Note: At least one device in the **rootdg** must be something other than a Hitachi Path Manager disk. Do not attempt to change all the disks in the **rootdg** to Hitachi Path Manager devices.

The example given here uses the following identifiers:

Identifier	Definition
htcvg	Veritas Volume Manager volume group.
htcvg-01	Plex associated with the htcvg volume group.
disk01-01	Veritas VM disk containing the original Sun hard disk device.
vpath0c	Hitachi Path Manager device referring to the same hard disk as disk01-01.
clt1d0s2	sd disk associated with vpath0c and disk01-01.
disk02	Veritas VM disk containing the vpath0c device.
rootdg	Name of the Veritas Volume Manager disk group to which htcvg belongs.

The following example assumes that the original volume, **htcvg**, contains one sub-disk; however, this method is easy to adapt to other cases.

1. Complete the basic installation steps as described in Installing the Hitachi Path Manager on page 15.
2. Display information about the disk used in the **htcvg** volume:

   ```
   vxdisk list c1t1d0
   ```

   The resulting display includes information about the disk, including its public and private offset and length:

   ```
   public:  slice=4 offset=0 len=17846310
   private:  slice=3 offset=1 len=2189
   ```

   From this information, calculate the parameters privlen (length of the private region) and puboffset (offset of the public region). In this case, privlen=2189, and puboffset=2190 because puboffset is one block more than the length of privlen.
3. Initialize the Hitachi Path Manager device for use by Veritas Volume Manager as a simple disk, using the privlen and puboffset values from Step 2.

   ```
   vxdisk -f init vpath0c puboffset=2190 privlen=2189
   ```

   Note: When a disk is initialized for use by Veritas Volume Manager, it is re-partitioned as a sliced disk containing a private region at slice 3 and a public region at slice 4. The length and offsets of these regions can be displayed using:

   ```
   vxdisk list cntndn
   ```

When using an sd device as a Hitachi Path Manager device, you must initialize the Hitachi Path Manager disk as a simple disk. This simple disk uses only a single slice (slice 2). The private region starts at block 1, after the disk's VTOC region, which is situated at block 0. Note that the length of the private region varies with the type of disk used and with the public region following the private region.

4. Add the Hitachi Path Manager device to the disk group.

   ```
   vxdg -g rootdg adddisk disk02=vpath0c
   ```

5. Stop the volume and verify that the file systems that are part of this volume are not mounted.

   ```
   umount /htcvgfs
   vxvol -g rootdg stop htcvg
   ```

6. Use the following to obtain the volume length (in sectors) for use later. For this example, a volume length of 17846310 is assumed.

   ```
   vxprint htcvg
   ```

7. Dissociate the plex.

   ```
   vxplex -g rootdg dis htcvg-01
   vxvol -g rootdg set len=0 vol01
   ```

Note: Do not delete the plex. The plex should remain to serve as backup should backing out of the Hitachi Path Manager installation be necessary.

8. Create a sub-disk from the Hitachi Path Manager VM disk.

   ```
   vxmake -g rootdg sd disk02-01 disk02,0,17846310
   ```

   Use "len" from step 6.

9. Create a new plex called "htcvg-02" containing the disk02-01 sub-disk.

   ```
   vxmake -g rootdg plex htcvg-02 sd=disk02-01
   ```

10. Attach the plex to the volume.

    ```
    vxplex -g rootdg att htcvg htcvg-02
    vxvol set len=17846310 htcvg
    ```

    Use "len" from Step 6.

11. Make the volume active.

    ```
    vxvol -g rootdg init active htcvg
    ```

Verify that everything is working well and delete the original disk.

The following Veritas Volume Manager commands are useful to know:

Information Commands
vxprint -ht
vxdg list
vxdisk list [disk_name]

Deletion Commands
vxdg -g htcdg destroy htcvg
vxdg -g htcdg rmdisk vpath0c
/etc/vx/bin/vxdiskunsetup -c

11.5 Oracle

The following procedures were tested with Oracle 8.0.5 Enterprise server, with the 8.0.5.1 patch set from Oracle.

Note 1: For these procedures, you must be familiar with Oracle software and have access to Oracle documentation

Note 2: You must have system administrator knowledge to perform these procedures.

This section contains the following:

- Installing Oracle on a New System
- Installing Hitachi Path Manager on a System with Oracle Previously Installed

11.5.1 Installing Oracle on a New System

Note: No Oracle databases need to be switched over to Hitachi Path Manager.

This section contains the following:

- Using a File System
- Using Raw Partitions

11.5.1.1 Using a File System

1. Install Hitachi Path Manager as described in Installing the Hitachi Path Manager on a Solaris Host on page 13.
2. Create and mount file systems on one or more Hitachi Path Manager partitions (Oracle recommends 3 mount points on different physical devices).
3. Follow the *Oracle Installation Guide* for instructions on installing to a file system.

During the installation, you will be asked to name 3 mount points. Supply the mount points where the file systems you created on the Hitachi Path Manager partitions in Step 2 are mounted.

11.5.1.2 Using Raw Partitions

Replace the raw devices with the Hitachi Path Manager devices.

Note 1: Change the ownership and permissions of the Hitachi Path Manager devices; use the same permissions of the raw devices you are replacing.

Note 2: Verify that ALL the databases are closed before performing these changes.

Note 3: Do not use disk cylinder 0 (sector 0); this is the disk label. Using this will corrupt the disk. For example, slice 2 on SUN is the whole disk; if you use this device without re-partitioning it to start at sector 1, it will corrupt the disk label.

1. Install the Hitachi Path Manager following the instructions in Installing the Hitachi Path Manager on a Solaris Host on page 13.
2. Create the Oracle Software Owner user in the server's local **/etc/passwd** file. Complete the rest of the Oracle pre-installation tasks described in chapter 2 of the *Oracle Installation Guide*.

   Plan to install Oracle8 on a file system residing on a Hitachi Path Manager partition. Set up the oracle user's ORACLE_BASE and ORACLE_ HOME environment variables to be directories of this file system.

   Create two more Hitachi Path Manager resident file systems on two other Hitachi Path Manager volumes. Each of the resulting three mount points should have a subdirectory named oradata, to be used as a control file and redo log location for the Installer's Default Database (a sample database). Oracle recommends using raw partitions for redo logs. To use Hitachi Path Manager raw partitions as redo logs, create symbolic links from the three redo log locations to Hitachi Path Manager raw device links (files named **/dev/rdsk/vpathNs**, where N is the Hitachi Path Manager instance number, and "s" is the partition id) that points to partitions of the appropriate size.
3. Determine which Hitachi Path Manager ("vpathNs") volumes you will use as Oracle8 database devices.
4. Partition the selected volumes using the Solaris format utility. If Hitachi Path Manager raw partitions are to be used by Oracle8 as database devices, leave sector 0/disk cylinder 0 of the associated volume unused. This protects UNIX disk labels from corruption by Oracle.
5. Make sure the Oracle Software Owner has read and write privileges to the selected Hitachi Path Manager raw partition device files under the **/devices/pseudo** directory.
6. Set up symbolic links in the oradata directory under the first of the three mount points created in step (2) to link the database files to Hitachi Path Manager raw device links (files named **/dev/rdsk/vpathNs**) pointing to partitions of the appropriate size.
7. Install Oracle8 Server following instructions in Chapter 3, "Installation Tasks," of the *Oracle Installation Guide*. Log in as the Oracle Software Owner when you run **orainst /m**. Select the "Install New Product - Create Database Objects" option. Select "Raw Devices" for storage type. Specify the raw device links set up in steps (2) and (3) for the redo logs and database files of the default database.

8. To set up other Oracle8 databases, set up control files, redo logs, and database files following guidelines in the Oracle8 Administrator's Reference. Make certain the raw devices and file systems that you set up reside on Hitachi Path Manager volumes. Launch **sqlplus**. Use the create database SQL command, specifying the control, log, and "system" data files that you have set up. Next, use the create tablespace SQL command to set up each of the temp, rbs, tools, and users database files that you created. Finally, use the create rollback segment SQL command to create the three redo log files that you set up. For the syntax of these three create commands, see the *Oracle8 Server SQL Language Reference Manual*.

11.5.2 Installing Hitachi Path Manager on a System with Oracle Previously Installed

Write down the pre-existing disk information in this section, to make certain that the disk devices are replaced by the Hitachi Path Manager devices in the same configuration as the original.

This section contains the following:

- Using File Systems
- Using Raw Partitions

11.5.2.1 Using File Systems

1. Record the raw disk partitions being used (they are in the **cntndnsn** format) or the partitions where the Oracle file system(s) reside(s). You can get this information from **/etc/vfstab** once you know where the Oracle files are. Your database administrator can tell you where the Oracle files are, or you can check for directories with the name "oradata."
2. Perform the basic installation steps in Installing the Hitachi Path Manager on a Solaris Host on page 13.
3. Change to the directory where you installed the Path Manager utilities; enter:

   ```
   showvpath
   ```

   Check the display to see whether you find a **cntndn** that is the same as the one where the Oracle files are located.

   Example: If the Oracle files are on c1t8d0s4, look for c1t8d0s2.

If you find it, you will know that **/dev/dsk/vpath0c** is the same as **/dev/dsk/c1t8d2s2** (Path Manager partition identifiers end in abcdefg rather than s0 s1 s2 etc.). Write this down.

showvpath

```
 ...
 ...
 vpath0c
     c1t8d0s2   /devices/pci@1f,0/pci@1/scsi@2/sd@1,0:c,raw
     c2t8d0s2
/devices/pci@1f,0/pci@1/scsi@2,1/sd@1,0:c,raw
 ...
 ...
```

4. Use the Hitachi Path Manager partition identifiers instead of the original Solaris identifiers when mounting the file systems.

   Example: If you originally used:

   ```
   mount /dev/dsk/c1t3d2s4 /oracle/mp1
   ```

   Use (presuming you had found vpath2e to be the Path Manager identifier):

   ```
   mount /dev/dsk/vpath2e /oracle/mp1
   ```

   Follow the directions in the *Oracle Installation Guide* for setting ownership and permissions.

11.5.2.2 Using Raw Partitions

Follow the instructions in this section if you have Oracle8 already installed and wish to reconfigure it to use Hitachi Path Manager partitions instead of sd partitions (i.e. partitions accessed through **/dev/rdsk/cntndnsn** files). If the Oracle8 installation is accessing either Veritas Volume Manager logical volumes or Solstice DiskSuite metadevices instead of sd devices, turn instead to the appropriate sections of this document for installing the Hitachi Path Manager with those applications.

All Oracle8 control, log, and data files are accessed either directly from mounted file systems, or via links from the oradata sub directory of each Oracle mount point set up on the server. Therefore, the process of converting an Oracle installation from sd to Hitachi Path Manager has two parts:

- Changing the oracle mount points' physical devices in **/etc/vfstab** from "sd" device partition links to the Hitachi Path Manager device partition links that access the same physical partitions
- Recreating any links to raw sd device links to point to raw Hitachi Path Manager device links that access the same physical partitions.

The steps for conversion are as follows:

1. Back up your Oracle8 databases - include all database files, control files, and redo logs.
2. Obtain the sd device names for the Oracle8 mounted file systems by looking up the Oracle8 mount points in **/etc/vfstab** and extracting the corresponding "sd" device link name (e.g. **/dev/rdsk/c1t4d0s4**)
3. Launch sqlplus. Execute the command:

   select * from sys.dba_data_files;

   This will list out the locations of all data files in use by Oracle. Determine the underlying device on which each data file resides, either by looking up mounted file systems in **/etc/vfstab** as in step 2 , or by extracting raw device link names directly from the select command output. E.g. **/dev/rdsk/c1t0d0s3**
4. Doing an "ls –l" on each device link found in step 3 and extracting the link source device file name.

   ```
   # ls –l /dev/rdsk/c1t1d0s4
   ```

   ```
   /dev/rdsk/c1t1d0s4 /devices/pci@1f,0/pci@1/scsi@2/sd@1,0:e
   ```
5. Write down the file ownership and permissions by doing an ls –lL on either the files in **/dev/** or **/devices** (the two results are identical).

   ```
   # ls –lL /dev/rdsk/c1t1d0s4
   ```

   ```
   crw-r--r-- oracle dba 32,252 Nov 16 11:49 /dev/rdsk/c1t1d0s4
   ```
6. Install Path Manager following the instructions described in the section Installing the Hitachi Path Manager on a Solaris Host on page 13.
7. Match each **cntndnsn** device with its associated **vpathNs** device link name by executing **showvpath**. Remember that **vpathNs** partition names use the letters [a-h] in the "s" position to indicate slices [0-7] in the corresponding **cntndnsn** slice names. Fill in the "Path Manager Device Nodes" column by executing ls -l on each Hitachi Path Manager Device Link and tracing back to the link source file.
8. Change the attributes of each Hitachi Path Manager device to match the attributes of the corresponding disk device using the **chgrp**, and **chmod** commands.
9. Make a copy of the existing **/etc/vfstab** file for recovery purposes. Edit **/etc/vfstab**, changing each Oracle Device Link to its corresponding Hitachi Path Manager Device Link.
10. For each link found in an oradata directory, recreate the link using the appropriate Hitachi Path Manager device link as the source file instead of the associated sd device link listed in the Oracle Device Link column. As you perform this step, generate a reversing shell script that can restore all the original links in case of error.
11. Reboot the server. Verify that all file system and database consistency checks pass.

11.6 Veritas Cluster Server

When the cluster environment is configured, Hitachi Path Manager can use the following:

- Solaris 2.6 or Solaris 7 or 8
- Veritas Cluster Server Ver. 1.1.2 or Ver. 1.3 *

  * If you use Hitachi Path Manager with VCS 1.3, **DO NOT** use Disk Reservation Agent in VCS 1.3.

Coordinate the vpath configuration of each server. DPO holds the vpath configuration information in the */etc/vpathsave.cfg* file. Therefore, you can re-create the same vapath configuration by using the */etc/vpathsave.cfg* file as follows:

- When two or more servers with the installed Hitachi Path Manager share the same vpath configuration, define the vpath configuration on each server.

1. Copy the **/etc/vpathsave.cfg** file from the primary server to the secondary server(s).
2. Execute the following command at the secondary server(s).

   ```
   cfgvpath -c
   ```

3. Reboot the secondary server(s).

   ```
   reboot
   ```

- When two or more servers that have not installed the Hitachi Path Manager share the same vpath configuration, define the vpath configuration on each server(s).

1. Copy the **/etc/vpathsve.cfg** file from the primary server to the secondary server(s).
2. Install the Hitachi Path Manager on the secondary server(s). Refer to Installing the Hitachi Path Manager on a Solaris Host on page 13.

Chapter 12 Error Messages

Hitachi Path Manager monitors the connection between the host and the subsystem and reroutes (fails over) the I/O data path if an error is detected. The Hitachi Path Manager daemon reports any errors, diagnostic messages, and failover recovery messages to the system console and to the **/var/adm/messages** file. These messages are as follows:

- **WARNING: vpath XX path Y removed from service**

  The Hitachi Path Manager removed the path Y of vpath XX device due to path errors, and rerouted I/O operation from the removed path to the remaining paths.

  (This message is sent to every device that detected the path failure.)

  Since the SCSI driver sends error messages prior to the transmission of this message, it will be useful for maintaining the failed path.

  Maintain the failed path, then issue the **datapath set ~ online** command (**datapath set adapter Z online** command or **datapath set device XX path Y online** command) to restore. (Refer to Path Repair Procedure on page 65.)

- **WARNING: vpath XX path Y on adapter Z manually removed from service**

  The path Y of vpath XX device was removed by the **datapath set ~ offline** command (**datapath set adapter Z offline** command or **datapath set device XX path Y offline** command) compulsorily.

  The Hitachi Path Manager reroutes I/O operation from the offline path to the remaining path.

  (This message is sent to every device that issues this command.)

  To recover the removed path, use the **datapath set ~ online** command (**datapath set adapter Z online** command or **datapath set device XX path Y online** command).

- **WARNING: vpath XX path Y on adapter Z manually restored to service**

  The path Y / adapter Z of vpath XX device was recovered by the **datapath set ~ online** command (**datapath set adapter Z online** command or **datapath set device XX path Y online** command).

- **WARNING: vpathxx: serial#mismatch**

  The Hitachi Path Manager detected the difference between the internal information and received information from the disk array subsystem.

  If this message is displayed and the device state is OPEN, ignore it since DPO executed the recovery process.

- **WARNING: scsi hung timeout for vpathxx**

  The Hitachi Path Manager detected the I/F failure (ex. Timeout).

Chapter 13 Troubleshooting

In the event of system failure, please contact Hitachi Data Systems Customer Support with the following data.

- Time the problem or failure occurred
- Procedures which occurred immediately prior to the problem or failure
- System configuration information

  If you use the 5800 or the 9200 Disk Array Subsystem with the Resource Manager 9200 program, you will save the information (System Parameters and RAID/LU and component status) as text format data. This procedure is described in "File Output of Configuration : System Parameters" and "Outputting Configuration Information to File : RAID/LU and Component Status" of section 3.9: "Outputting Configuration Information to File" within the *Hitachi Freedom Storage™ Thunder 9200™ Resource Manager 9200 User's Guide* (for GUI).
- Other needed information:

1. Server information
   - The result of "uname –a"
2. System patch information
   - The result of "showrev –p"
3. System configuration
   - The result of "format"
   - The result of "find /devices"
4. Hitachi Path Manager configuration
   - The result of "datapath query adapter" command
   - The result of "datapath query device" command
   - The result of "showvpath"
5. Hitachi Path Manager program Version
   - The result of "pkginfo HITdpo"
6. Mount Information
   - The result of "df –k"
7. etc.
   - /var/adm/messages file
   - /etc/vpathsave.cfg file

Chapter 14 Path Repair Procedure

When one path has malfunctioned, failover action is executed automatically. But, after you repair the path, you need to execute the following procedure to recover the failed path.

1. Repair the failed path using the appropriate manual for the Hitachi Disk Array Subsystem.
2. After repairing the failed path, confirm the state by using the **datapath query adapter** command. (Refer to datapath query adapter on page 32.) If the DEGRADE path is displayed, change the state from offline to online for this path by using the **datapath set adapter** command. (Refer to datapath set adapter on page 37.)

   Note 1: If you execute the raw I/O process, the path state may be changed to online automatically. If this happens automatically, you do not need to follow the procedures for setting the state to online.

   Note 2: We recommend that you execute this command immediately after the recovery operation; if the surviving path experienced a failure prior to recovery of the repaired path the system will be severely impacted or will experience an outage.

   Note 3: For SCSI I/F, reboot the system after repair procedures.
3. Confirm the state of adapter by using **datapath query adapter** command. (Refer to datapath query adapter on page 32.)
4. When the “Failover” function of Hitachi Path Manager is used, the repaired path does not accept the I/O immediately, so it is necessary to check this path. To verify the repaired path is functioning properly, use the following procedure.
   a) Execute the **format** command.
   b) Verify that the state of the repaired path is “NORMAL” by using the **datapath query adapter** command. If the state is “FAILED”, repair this path again.