

ETERNUS

Multipath Driver 2

User's Guide

for AIX

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Preface

This ETERNUS Multipath Driver User's Guide describes the features, functions, and operation of the "ETERNUS Multipath Driver" (hereafter referred to as "Multipath Driver") software on an AIX server. This manual describes how to use the Multipath Driver to manage the path control, connection status, and other features of Fujitsu storage systems "ETERNUS Disk storage system" (hereafter referred to as "storage system" unless otherwise specified). This manual is intended for system administrators who are connecting the storage system to an AIX server.

Third Edition
April 2012

The Contents and Structure of this Manual

This manual is composed of the following seven chapters and two appendices:

- Chapter 1 What is the Multipath Driver?

This chapter describes the features, functions, and connection patterns of the Multipath Driver.

- Chapter 2 Server Compatibility Requirements

This chapter describes the server compatibility requirements for the Multipath Driver.

- Chapter 3 Installing or Uninstalling the Multipath Driver

This chapter explains how to install or uninstall the Multipath Driver (in non-SAN Boot environments).

- Chapter 4 Installing or Uninstalling the Multipath Driver (for SAN Boot Environments)

This chapter explains how to install or uninstall the Multipath Driver (in SAN Boot environments).

- Chapter 5 Operating the Multipath Driver

This chapter explains how to use the main commands to operate various functions of the Multipath Driver.

- Chapter 6 Notes when Using the Multipath Driver

This chapter contains important notes for using the Multipath Driver.

- Chapter 7 Command Reference

This chapter explains the commands that control the Multipath Driver functions.

"Error Messages" and "iSCSI Connection Settings" are described as appendices.

Safe Use of this Product

Using this manual

This manual contains important information to ensure the safe use of this product. Be sure to thoroughly read and understand its contents before using the product. After reading, store this manual in a safe place for future reference.

FUJITSU has made every effort to ensure the safety of the users and other personnel, and to prevent property damage. When using this product, carefully follow the instructions described in this manual.

Acknowledgments

- AIX, RS/6000, pSeries, PowerHA, and Power Systems are trademarks of IBM Corp. in the U.S. and other countries.
- The company names and product names mentioned in this document are registered trademarks or trademarks of their respective companies.

Naming Conventions

- In this manual, "HBA" refers to a server-side Host Bus Adapter, Fibre Channel card, or Network Interface Card (NIC) that is used to connect an AIX server to the storage system.
- "CA" refers to a storage system Channel Adapter.
- "CM" refers to a storage system Controller Module.
- The following software bundle is described as "ETERNUS Web GUI".
 - Web-based GUI management tool that is provided with the storage system as standard
 - ETERNUSmgr that is attached to some storage systems
- Italics are used to show variables such as values and characters that appear in command parameters and output examples.

High Safety Required

This Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (hereinafter "High Safety Required Use"), including without limitation, nuclear reaction control in nuclear facility, air craft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system. You shall not use this Product without securing the sufficient safety required for the High Safety Required Use. If you wish to use this Product for High Safety Required Use, please consult with our sales representatives in charge before such use.

Related Manuals

Refer to the following related manuals for more information:

- The storage system manual
- The manual provided with ETERNUS Web GUI

Typographical Conventions

The following conventions are used in this guide.

**Caution**

A product-usage caution that must be followed.
Not doing so may result in loss of data.

**Note**

A note that provides additional information.

Release Information

ETERNUS Multipath Driver Modification History

There is no history of modifications for the ETERNUS Multipath Driver.

ETERNUS Multipath Driver Updates

The following table shows the updates for each ETERNUS Multipath Driver version:

(1/1)

Version	Modification details
2.0 (January 2010)	First version
2.1 (January 2011)	<ul style="list-style-type: none">• Added support for SAN Boot• Added support for AIX 7.1
2.2 (April 2012)	<ul style="list-style-type: none">• Added support for iSCSI• Added support for reducing paths without server rebooting

Revision Record

(1/1)

Version	Date	Location (Note)	Modifications
01	January 2010	—	—
02	January 2011	Chapter 4 and 6.2.2	Added descriptions for a SAN Boot environment
		7.2	Added a description about the "-A" and "-u" option for the "mpdrmdev" command
		7.4	Added a description about the "mpdunregdev" command
03	April 2012	2.1	Added descriptions for iSCSI
		3.1 - 3.4	Added descriptions for iSCSI
		3.5	<ul style="list-style-type: none"> Added descriptions for fscsi device settings Added descriptions for physical volume settings
		4.1	Added a note
		4.4	Added descriptions for fscsi device settings
		4.7	Added descriptions for physical volume settings
		5.2 - 5.5	Changed descriptions according to iSCSI support
		5.5.4.1	Added descriptions for reducing paths without server rebooting
		6.2.1	Added descriptions for physical volume settings
		7.1	Added the "iompadm delete" command
		7.3	Added the "mpdchdiskrsv" command
		Appendix A	Changed descriptions according to iSCSI support
		Appendix B	Added descriptions for iSCSI connection

Note: "Location" shows the chapter or section number in the latest version. An asterisk (*) shows that the chapter or section number is in the older version.

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Chapter 1 What is the Multipath Driver?

This chapter explains the features, functions, and operating environment of the Multipath Driver.

1.1 Features

The storage systems are designed to prevent the loss of data and down time due to a disk failure, thus creating a high-speed, high-capacity system with high reliability.

Note, however, that even use of a storage system cannot prevent down time if a path failure occurs (HBA, cable, CA, etc.).

The Multipath Driver creates a redundant multipath configuration that switches the failed path over to a standby path, thus allowing continuous operation not only for a disk failure but for a path failure as well.

The Multipath Driver connects a storage system and AIX server, with functions to diagnose the path status, and control commands.

1.2 Connections

The Multipath Driver is used to set up and control multiple connections between the server's HBAs and the storage system's CAs.

Multipath connections provide greater system control and improve reliability.

The Multipath Driver can also be used to set up and control connections via Fibre Channel switches, which means that the Multipath Driver can be used in a SAN environment.

Caution

In a multipath connection, all HBAs must be of the same type.
FC Hubs cannot be used.

1.3 Functions

The Multipath Driver performs the following functions.

(1) Automatic Multipath Configuration

When the Multipath Driver is installed, and the storage system is connected to an AIX server, the paths are automatically configured to perform path failover and load balancing.

(2) Failover

If a currently used path fails, the system automatically switches over to another path to access the storage system, allowing the host application to continue normal operation. The Failover function operates differently for each storage system model. For details, refer to ["1.3.3 Load Balancing/Failover" \(page 18\)](#).

(3) Load Balancing

Load balancing (load distribution) is performed on all available paths, improving data accessibility. The Load Balancing function operates differently for each storage system model. For details, refer to ["1.3.3 Load Balancing/Failover" \(page 18\)](#).

(4) Auto Path Check

Regular checks are performed on all paths even when they are not being accessed by an application. If an unusable path is detected, even on a standby path, it is disconnected from the system and its status is recorded in the error message. Finding defective paths before the request from the application occurs improves reliability.

(5) Auto Path Recovery

Regular checks are also performed on disconnected paths to reconnect those paths that have recovered from their failure. This function reinforces path redundancy and provides increased reliability.

(6) Path Disconnection

You can disconnect a specified path by placing it in Offline status. This allows any necessary maintenance work to be performed. The path can be reconnected after the maintenance.

1.3.1 Path Management

The Multipath Driver manages the status of each path based on whether the path is available for use by user I/O request processes. Current path status can be checked using the "iompadm info" command. (Refer to ["5.2 Multipath Status Display" \(page 43\)](#) for details on iompadm info.)

I/O request ready paths may be classified into the following three ready statuses:

Ready Status	Description
active	<ul style="list-style-type: none"> • Normal operating status (no failures have been detected). • If there are two or more active paths, load balancing is performed between them. • [active "online"] is displayed by the "iompadm info" command.
standby	<ul style="list-style-type: none"> • Path is connected to the non-assigned CM, which is (normally) on standby. • If the assigned CM (active) path fails, the standby path becomes the active path. • When the assigned CM path returns to active status, this path returns to standby. • [standby "online"] is displayed by the "iompadm info" command.
warning	<ul style="list-style-type: none"> • I/O errors have been detected on the path, and it is currently being monitored by Auto Path Check. • Warning status paths are checked every minute. • Each type of error is allowed a certain number of checks. If a path is determined to be usable before this limit is reached, its status is reverted to active or standby, otherwise its status is changed to fail. • Warning paths are never used for I/O if an active or standby path is available. • If no active or standby path is available, a warning path may be used for I/O. • [active "warning"] or [standby "warning"] is displayed by the "iompadm info" command.

I/O request not-ready paths may be classified into the following three unready statuses:

Unready Status	Description
fail	<ul style="list-style-type: none"> • I/O errors have been detected on the path, and Auto Path Check has judged it to be unusable. • Fail paths are checked every 10 minutes for replacement of the failed parts. • If the Auto Path Check detects no problem, the status reverts to warning. • After replacement of the failed parts, the "iompadm restart" command may be used to instantly return the path to active/standby status. • Fail paths will never be used for I/O. • [fail "error information"] is displayed by the "iompadm info" command (details of the error appears in "error information"). • Fail paths will never be used for I/O. Fail paths are only used for I/O when no active or standby paths exist. If the I/O succeeds, the fail paths are transitioned to warning status.

Unready Status	Description
fatal fail	<ul style="list-style-type: none"> Result of the Auto Path Check is constantly switching back and forth between normal and abnormal, so the appropriate checks cannot be performed. Fatal fail paths are not checked. After replacement of the failed parts, the "iompadm restart" command must be used to return the path to active/standby status. Fatal fail paths will never be used for I/O. [fail "forcible fail"] is displayed by the "iompadm info" command. Fatal fail paths will never be used for I/O. Fatal fail paths are only used for I/O when no active or standby paths exists. If the I/O succeeds, the fatal fail paths are transitioned to warning status.
stop	<ul style="list-style-type: none"> Path has been disconnected by the "iompadm change" command. Stop paths are not checked. The "iompadm restart" command must be used to return the path to active/standby status. Stop paths will never be used for I/O. However, if no active or standby path is available, a stop path may be returned to active status for use. [stop "stop by command"] is displayed by the "iompadm info" command.

These path status transitions are shown in the following figure.

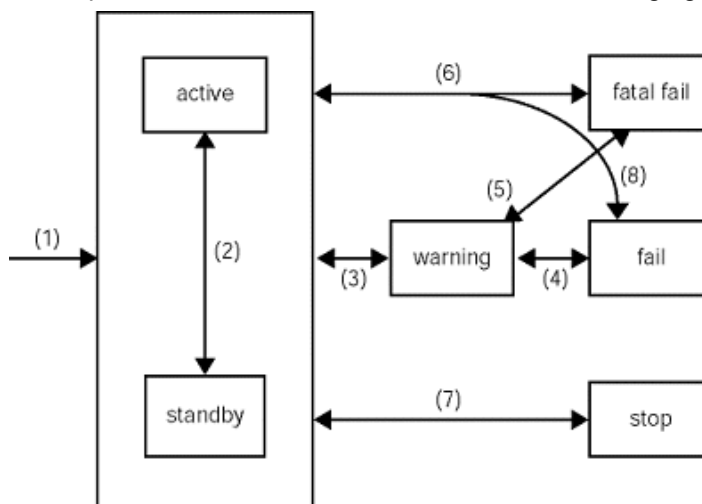


Figure 1.1 Path Status Transitions

(1) initialization → active/standby

The Multipath Driver automatically configures the path connections at system startup. Paths connected to assigned CMs are automatically set to active. Paths connected to non-assigned CMs are set to standby.

(2) standby ↔ active

- When an error in an active path is detected during I/O, or the path status changes from active to stop, the standby path becomes the active path if no other active path is available.
- When the path connected to the assigned CM is recovered and becomes the active path again, the activated standby path connected to the non-assigned CM returns to standby.

(3) active/standby \longleftrightarrow warning

- When a path error occurs during a normal I/O process or upon checking, the active/standby path status changes to warning.
- When the path is re-enabled by path checking, the path status returns to active/standby.

(4) warning \longleftrightarrow fail

- When judged as unusable as a result of the warning period checking, path status changes to fail.
- When the check result is normal for a failed path, its status changes to warning.

(5) warning \longleftrightarrow fatal fail

- When the status stays in warning for a long period of time, or when the status frequently changes between active/standby and warning, it is determined that appropriate checks cannot be performed and the status changes to fatal fail, in which the target is not checked.

(6) fatal fail \longleftrightarrow active/standby

- When a failed path is re-enabled by the "iompadm restart" command, the path status changes back to active/standby.
- When the status frequently changes between active/standby and warning, it is determined that appropriate checks cannot be performed and the status changes to fatal fail, in which the target is not checked.

(7) active/standby \longleftrightarrow stop

- When the path is disconnected by the "iompadm change" command, the path status changes to stop.
- When the path is re-enabled by the "iompadm restart" command, the path status changes to active/standby.

(8) active/standby \longleftrightarrow fail

- When a serious failure is detected in the ordinary I/O process or active/standby check, the path status changes to fail.
- When the path is re-enabled by the "iompadm restart" command, the path status changes to active/standby.

When the path status changes, the path connected to the assigned CM becomes active, and the path connected to the non-assigned CM becomes standby. However, if there are no active paths connected to the assigned CM, the path connected to the non-assigned CM will become active.

1.3.2 Checks and Path Status Transitions

The following three types of checks are performed:

Target path status	Check interval	Post check status	Transition trigger
active/standby	10 minutes	active/standby	Checked normal.
		warning	Checked failure. $0 < \text{Error counter} < 200$
		fail	Checked failure. $\text{Error counter} == 200$
warning	1 minute	active/standby	Checked normal. $\text{Error counter} == 0$
		warning	Check result: $0 < \text{Error counter} < 200$
		fail	Checked failure. $\text{Error counter} == 200$
fail	10 minutes	warning	Checked normal. $\text{Error counter} == 100$
		fail	Checked failure. $\text{Error counter} == 200$

In the warning status, the transition to another status is determined by the error counter.

■ Check in active/standby

Active/Standby status paths are checked every 10 minutes.

When a failure is detected by the check, the status changes to either warning or fail. The warning error counter is determined by the failure cause. The status may change directly to fail if the detected failure is sufficiently serious.

The status changes in the same way when an error is detected during a normal I/O process.

■ Check in warning

Warning status paths are checked every minute.

When a failure is detected by the check, 10 is added to the error counter. When it is normal, 10 is deducted.

If the error counter reaches 0, the status becomes active/standby. If it reaches 200, the status becomes fail.

■ Check in fail

Fail status paths are checked every 10 minutes.

When a failure is detected by the check, the status does not change. When it is normal, the error counter is set to 100 and the status becomes warning.

● [Example 1]

Path status progression when a continuing error is detected by a normal active path I/O process.

Time passed	Path 1 status	Path 2 status	Operation
—	active	standby	—
0	warning (50)	active	Error in normal I/O process on Path 1. Path 1 status changes to warning, and the error counter is set by the error cause (the minimum value of 50 in this example). Retry after setting Path 2 active for the I/O process.
1 minute	warning (60)	active	Check error. 10 added.

Time passed	Path 1 status	Path 2 status	Operation
:	:	:	:
10 minutes	warning (150)	active	Check error. 10 added.
:	:	:	:
14 minutes	warning (190)	active	Check error. 10 added.
15 minutes	fail	active	Check error. 10 added. Error counter reaches 200 and the status changes to fail. Path degradation message is sent to the console.

● [Example 2]

Auto path recovery operation after a failed path is replaced.

Time passed	Path 1 status	Path 2 status	Operation
—	fail	active	Maintenance replacement procedure completes.
0 to 10 minutes	warning (100)	active	Check is performed 10 minutes after completion of the maintenance replacement. Post replacement check gives a normal result, so status changes to warning and the error counter is set to 100.
1 minute	warning (90)	active	Check normal. 10 deducted.
:	:	:	:
5 minutes	warning (50)	active	Check normal. 10 deducted.
:	:	:	:
9 minutes	warning (10)	active	Check normal. 10 deducted.
10 minutes	active	standby	Check normal. 10 deducted. Error counter reaches 0 and the status changes to active. Path 2 reverts to standby.

■ Transition to fatal fail

In the following cases, it is judged that the appropriate check cannot be performed and the path status changes to fatal fail, after which the path will not be checked. A "forcible path degrade" message is recorded in the error log.

- Path stays in warning status for one hour.
- Within one hour the path status changes from active/standby to warning and back 10 times.

1.3.3 Load Balancing/Failover

There are two types of storage systems. The first is a storage system whose access paths are assigned to one of the two CMs (hereafter referred to as "storage system with CM assigned"), the second is a storage system whose access paths are not assigned to a particular CM (hereafter referred to as "storage system with CM not assigned").

In the storage system with CM assigned, paths that belong to the assigned CM are active and other paths connected to non-assigned CM are standby.

In the storage system with CM not assigned, all paths are active, and used to access data.

Load balance and failover control operations vary according to the storage system type (whether the storage system has assigned CM or not) and number of paths.

For details on which storage systems have assigned CMs or not are provided in the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" found at the following URL:

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

■ Load balancing

The Multipath Driver uses all active paths to perform load balancing (load distribution) to improve accessibility.

Storage system with CM assigned (2-path connections)

For a storage system with CM assigned (2-path) connection, one path is connected to each controller. Of the two paths, the path connected to the assigned CM is active and the path connected to the non-assigned CM is on standby. If there is only one active path, load balancing is not performed.

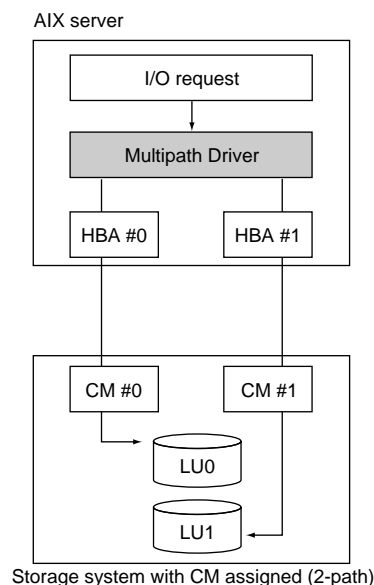


Figure 1.2 2-Path Load Balancing on a storage system with CM assigned

Storage system with CM assigned (4-path connections)

For a storage system with a 4-path configuration, two paths are connected to each of the two CMs, for a total of four paths.

The two paths connected to the assigned CM are active, and load balance control is executed on these two paths.

For an 8-path configuration, two paths are connected to each of the four CMs, for a total of eight paths.

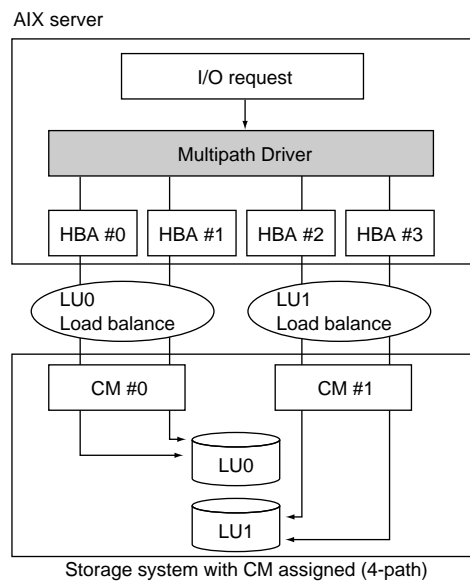


Figure 1.3 4-Path Load Balancing on a storage system with CM assigned

Storage system with CM not assigned

For a storage system that does not have an assigned CM, there is no concept of standby path, so all connected paths are active, and load balancing is performed over all paths.

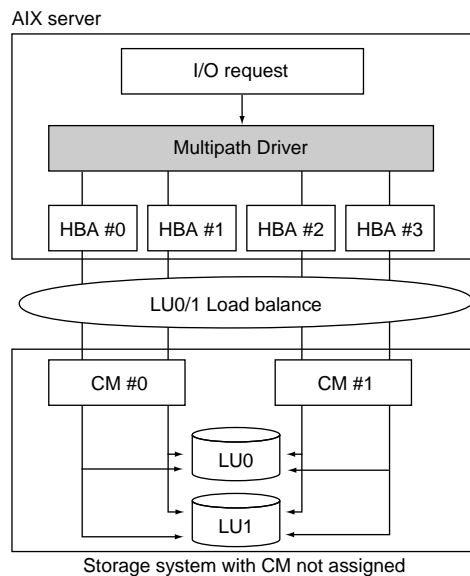


Figure 1.4 Multipath Load Balancing on a storage system with CM not assigned

■ Failover

When the Multipath Driver detects that an active path has failed, it switches to another path, disables the bad path, and continues executing the I/O requests. This can prevent the host application from shutting down unnecessarily.

Failover operates differently depending on the storage system type, as described below.

Storage system with CM assigned (2-path connections)

When an active path becomes unavailable, the standby path is activated to continue processing.

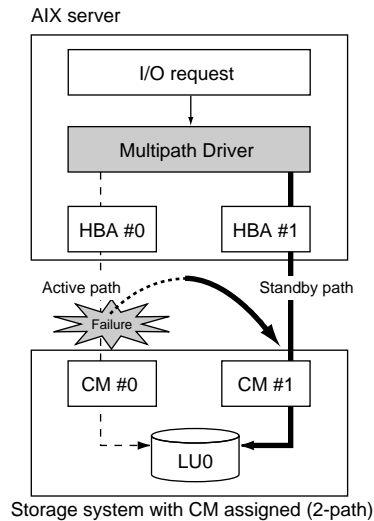


Figure 1.5 2-Path Failover on a storage system with CM assigned

Storage system with CM assigned (4-path or more connections)

- Example 1

In a 4-path connection, when one of two active paths becomes unavailable, processing continues on the remaining active path. Switching to the standby path is not performed because the CM still has one active path available.

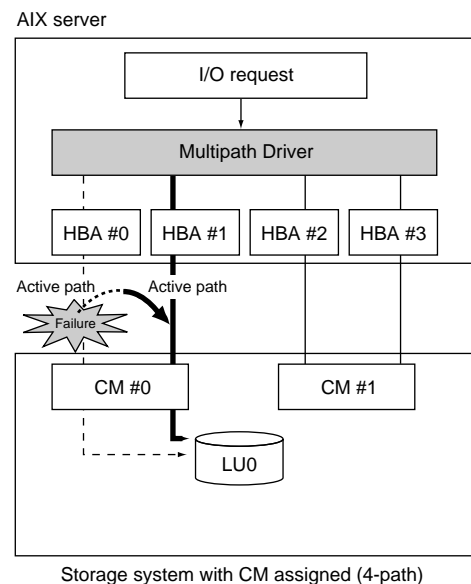


Figure 1.6 4-Path Failover, Active to Active

- Example 2

If both active paths for a CM become unavailable, a standby path is then switched to active state to continue processing. When there are two or more standby paths, load balancing is also performed.

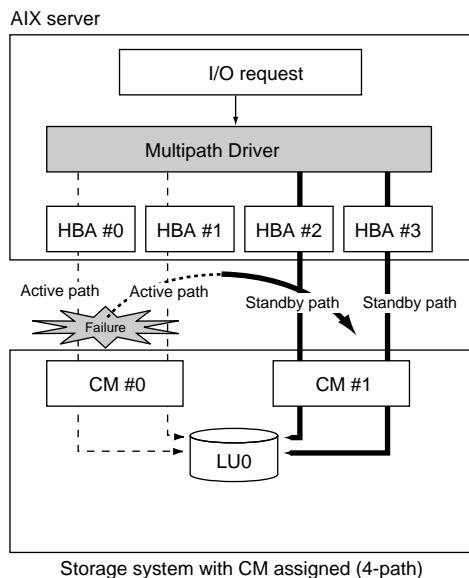


Figure 1.7 4-Path Failover, Active to Standby

Storage system with CM not assigned

When an active path becomes unavailable, it is disabled, leaving the remaining paths to continue load balancing in a degraded state.

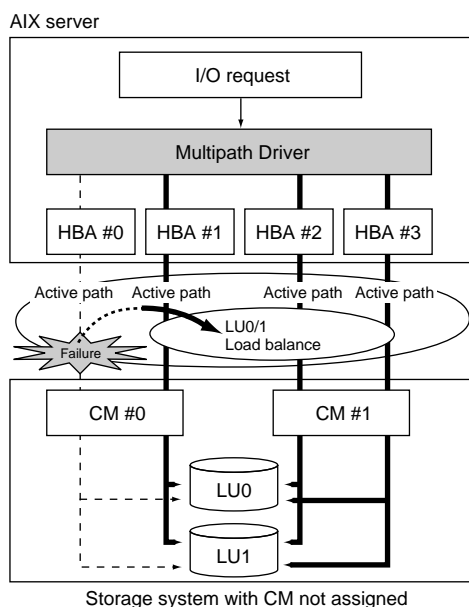


Figure 1.8 Multipath Failover, a storage system with CM not assigned

Chapter 2 Server Compatibility Requirements

This chapter describes the server compatibility requirements for the Multipath Driver.

2.1 Server Compatibility Requirements

Storage systems can be connected to the following servers. IBM HBAs must be used for server connection. Check your server details.

- Server hardware

Hardware name	Remarks
RS/6000	—
pSeries	—
Power Systems	—
System p	—

Caution

When a storage system is connected to multiple servers, one of which is allowed to control the storage system power supply via an RCI connection or a power control box, make sure that the storage system and Fibre Channel switches are never turned off while any of the other servers are still running. If the storage system or Fibre Channel switch is turned off before the server shuts down, data may be lost.

- Server OS

OS	Fix Level
AIX 5L V5.2 (*1) (*2)	Technology Level 09-CSP or later
AIX 5L V5.3	Technology Level 05-CSP or later
AIX 6.1	Not required
Virtual I/O Server (VIOS) 1.5 (*1)	Not required
Virtual I/O Server (VIOS) 2.1 (*1)	Not required

*1: SAN Boot environments are not supported.

*2: iSCSI interfaces are not supported.

When the Multipath Driver is used in a cluster configuration, use PowerHA (HACMP), which is a software product supplied by IBM Corp., and applications that support PowerHA (HACMP).

- Supported storage systems

Interface	Storage system
Fibre Channel	ETERNUS DX60/DX60 S2 ETERNUS DX80/DX80 S2 ETERNUS DX90/DX90 S2 ETERNUS DX400/DX400 S2 series ETERNUS DX8000/DX8000 S2 series ETERNUS2000 ETERNUS4000 (*1) ETERNUS8000 ETERNUS3000 (*2) ETERNUS6000 (*2)
iSCSI (*2)	ETERNUS DX60/DX60 S2 ETERNUS DX80/DX80 S2 ETERNUS DX90/DX90 S2 ETERNUS DX400/DX400 S2 series ETERNUS DX8000/DX8000 S2 series ETERNUS2000 ETERNUS4000 ETERNUS8000

*1: The ETERNUS4000 model 80 and 100 do not support SAN Boot environments.

*2: SAN Boot environments are not supported.

The latest information of hardware, OS, and supported storage system requirements are provided in the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" found at the following URL:

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

2.2 Installing or Uninstalling the Multipath Driver

The procedure for installing or uninstalling the Multipath Driver varies depending on whether the operating environment is a SAN Boot environment.

- For non-SAN Boot environments
Refer to ["Chapter 3 Installing or Uninstalling the Multipath Driver" \(page 25\)](#).
- For a SAN Boot environment
Refer to ["Chapter 4 Installing or Uninstalling the Multipath Driver \(for SAN Boot Environments\)" \(page 34\)](#).

Chapter 3 Installing or Uninstalling the Multipath Driver

This chapter explains how to install or uninstall the Multipath Driver. The commands described in this chapter must be executed by a root-level user.

For the installation procedure of the Multipath Driver in a SAN Boot environment, refer to ["Chapter 4 Installing or Uninstalling the Multipath Driver \(for SAN Boot Environments\)" \(page 34\)](#).

3.1 Installation Workflow

This section explains how to install the Multipath Driver on a server and connect it to the storage system.

Use the relevant User's Guide -Server Connection- of each storage system as a reference manual.

The actual work required will depend on whether the Multipath Driver is being newly installed or upgraded. The new installation workflow should also be used when upgrading from ETERNUS MPIO for IBM AIX, from Multipath Driver 1.0.x, or from FJspio (in a single path connection environment).

The workflow is as follows:

3.1.1 When Performing an Initial Installation of the Multipath Driver or Upgrading from ETERNUS MPIO for IBM AIX, Multipath Driver 1.0.x, or FJspio

Workflow

1

Set up the HBAs

Install the driver for the HBAs and set the driver parameters.



- ["3.2 Setting Up the HBAs" \(page 27\)](#)



2

Set up the storage system

Set up the storage system.



- ["3.3 Setting Up the Storage System" \(page 27\)](#)



3

Install the Multipath Driver (old driver uninstallation procedure included)

Install the Multipath Driver module.



- ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)" \(page 29\)](#)



4

Recognize the Logical Units

Acquire the Logical Units (LUs) from the storage system.



- ["3.5 Recognizing Logical Units" \(page 31\)](#)

3.1.2 When Updating an Existing Multipath Driver

Update the Multipath Driver. For more details, refer to ["3.6 Multipath Driver Update" \(page 32\)](#).

3.1.3 When Uninstalling the Multipath Driver

Uninstall the Multipath Driver. For more details, refer to ["3.7 Uninstalling Multipath Driver" \(page 33\)](#).

3.2 Setting Up the HBAs

■ For FC connection

Install the driver for the Fibre Channel card and set the parameter for the driver, following the procedures in User's Guide -Server Connection- for each storage system.

■ For iSCSI connection

For details about settings on iSCSI connection, refer to ["Appendix B iSCSI Connection Settings" \(page 82\)](#).

3.3 Setting Up the Storage System

Connect all paths between the storage system and a server with cables and set up the storage system following the procedure in User's Guide -Server Connection- of each storage system. This section explains notes about the settings when installing and using the Multipath Driver.

3.3.1 Host Response Settings

The following sections describe the appropriate Host Response settings for each storage system model.

Any Host Response settings for the storage system that are not described in this section are provided in User's Guide -Server Connection- of each storage system.

3.3.1.1 ETERNUS DX80 S2/DX90 S2, ETERNUS DX410 S2/DX440 S2, ETERNUS DX8100 S2/DX8700 S2 Host Response Settings

Select "AIX EMPD" for the host response setting.

3.3.1.2 ETERNUS DX60/DX60 S2, DX80, DX90 Host Response Settings

Item to be set	Option to be selected
Reservation Conflict Response for Test Unit Ready	Conflict
Host Specific Mode	AIX mode

Select the default option for all other settings.

3.3.1.3 ETERNUS DX400 series and ETERNUS DX8000 series Host Response Settings

Item to be set	Option to be selected
Reservation Conflict Response for Test Unit Ready	Conflict Response
Host Specific Mode	AIX Mode (Extended Address)

Select the default option for all other settings.

3.3.1.4 ETERNUS2000 Host Response Settings

Item to be set	Option to be selected
Reservation Conflict Response for Test Unit Ready	Conflict response
Host Specific Mode	AIX Mode

Select the default option for all other settings.

3.3.1.5 ETERNUS3000, and ETERNUS4000 model 80 and 100 Host Response Settings

Item to be set	Option to be selected
NACA(Normal Auto Contingent Allegiance) function of Inquiry Standard Data	Enable
Response Sense at the time of Firmware Hot Switching	Disable

Select the default option for all other settings.

3.3.1.6 ETERNUS4000, ETERNUS8000 Host Response Settings

Storage system	Host Specific Mode
ETERNUS4000 model 300, 500 ETERNUS8000 model 700, 900, 1100, 2100	AIX mode
ETERNUS4000 model 400, 600 ETERNUS8000 model 800, 1200, 2200	AIX Mode (Extended Address)
Item to be set	Option to be selected
Reservation Conflict Response for Test Unit Ready	Conflict Response

Select the default option for all other settings.

3.3.1.7 ETERNUS6000 Host Response Settings

Item to be set	Option to be selected
host specific mode	AIX mode

Select the default option for all other settings.

3.3.2 Reset Group Settings

When using the Multipath Driver, reset group settings are not required.

3.3.3 PowerHA (HACMP) Cluster Settings

When using the Multipath Driver with a PowerHA (HACMP) cluster server, exactly the same settings as for a single (unclustered) server should be used.

3.4 Multipath Driver Installation (Old Driver Uninstallation Included)

The following procedure shows how to install the Multipath Driver:

If ETERNUS MPIO for IBM AIX, Multipath Driver 1.0.x, or FJspio (single path connection environment) has been installed, it must be uninstalled. If a physical volume is recognized using a standard AIX driver, the physical volume must be deleted.

Procedure

- 1 Check the current physical volume/installed driver configuration
Check the storage system physical volumes and installed driver configuration.
 - For FC connection, input the following command:

```
# lsdev -p fscsi*  
# lsdev -p cbx*
```

- For iSCSI connection, input the following command:

```
# lsdev -p iscsi*
```

If ETERNUS MPIO for IBM AIX has previously been installed, the result will be as follows:

```
hdisk1 Available 10-68-01 MPIO E4000 - Fujitsu Storage Systems ETERNUS
```

If Multipath Driver 1.0.x has previously been installed, the result will be as follows:

```
hdisk1 Available 10-68-01 e4000 Fibre Channel Storage
```


If FJspio has been installed, the result will be as follows:

```
hdisk1 Available 10-68-01 E4000 - Fujitsu Storage Systems ETERNUS
```

If the standard AIX driver has been installed, the result will be as follows:

- For FC connection

```
hdisk1 Available 10-70-01 Other FC SCSI Disk Drive
```

- For iSCSI connection

```
hdisk1 Available Other iSCSI Disk Drive
```

If none of these is displayed, skip directly to [Step 5](#).

2 Take the volume groups offline

2-1 Check the volume groups that contain the physical volumes identified in [Step 1](#).

```
# lspv
```

The following type of message should appear:

hdisk0	00096600b56e30f2	rootvg	active
hdisk1	00096600f8ff100a	vg1	active

The third column shows the volume group and the fourth column shows the status of the volume group.

When either of the following situation applies, jump to [Step 3](#):

- "None" is displayed in the volume group column.
- The status is not displayed (the status is not active).

2-2 Check the MOUNT POINT of the file system.

```
# lsvg -l vg1
```

The following type of message should appear:

vg1:						
LV NAME	TYPE	LPs	PPs	PVs	LV STATE	MOUNT POINT
lv01	jfs	400	400	1	open/syncd	/lv01
loglv01	jfslog	1	1	1	open/syncd	N/A

2-3 Unmount any file system whose LV STATE is "open/syncd".

```
# unmount /lv01
```

2-4 Take the volume group offline.

```
# varyoffvg vg1
```

3 Delete the physical volumes

3-1 Identify the parent adapter devices for the physical volumes.

```
# lsparent -C -l hdisk1
```

The following type of message should appear:

```
fscsi0 Available 10-68-01 FC SCSI I/O Controller Protocol Device  
fscsi1 Available 10-70-01 FC SCSI I/O Controller Protocol Device
```




Note

The displayed device is "fscsiN" for FC connection and "iscsiN" for iSCSI connection.

3-2 Delete all the physical volumes of the displayed devices.

```
# rmdev -dp fscsi0  
# rmdev -dp fscsi1
```

4 Uninstall ETERNUS MPIO for IBM AIX, Multipath Driver 1.0.x, or FJspio

If ETERNUS MPIO for IBM AIX, Multipath Driver 1.0.x, or FJspio was found in [Step 1](#), uninstall it.

4-1 Check which driver is installed.

```
# lspp -l FJmpio.rte  
# lspp -l FJspio.rte  
# lspp -l cbxdpf.driver.obj
```

4-2 Uninstall the driver.

```
# installp -u FJmpio.rte  
# installp -u FJspio.rte  
# installp -u cbxdpf.driver.obj
```

A message prompting you to reboot the server is displayed after uninstalling the driver. Ignore this and proceed to the next step without rebooting.

5 Install the Multipath Driver

Insert the CD-ROM in the server to install the Multipath Driver.

```
# installp -acQd /dev/cd0 FJSVmpd
```

End of procedure

3.5 Recognizing Logical Units

The procedure for recognizing logical units is described below.

Procedure

1 Recognize Logical Units

1-1 Use the "cfgmgr" command to force the server to recognize the Logical Unit (LU) configuration of the storage system.

```
# cfgmgr
```

Storage system Logical Units (LUs) recognized by the server are regarded as physical volumes (hdisks).

1-2 Confirm that the Multipath Driver has recognized these physical volumes.

```
# /usr/lpp/FJSVmpd/iompadm info
```

The following type of message should appear:

```
Multipath Group 0x00
hdisk1 : E4000-6A0299-0000
    fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)
    fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt1)
```

2 Set attributes for the fscsi devices

Perform this setting only for FC connections.

2-1 Check all of the fscsi devices.

```
# lsdev -l fscsi*
```

The following type of message should appear.

```
fscsi0 Available 05-08-01 FC SCSI I/O Controller Protocol Device
fscsi1 Available 0B-08-01 FC SCSI I/O Controller Protocol Device
```

2-2 Set the "fc_err_recov" attribute to "fast_fail" for all of the fscsi devices.

```
# chdev -Pl fscsi0 -a fc_err_recov=fast_fail
```

3 Reboot the server.

```
# shutdown -Fr
```

4 Change the disk reservation attribute of the physical volume

Refer to ["Changing the disk reservation attribute of physical volumes" \(page 55\)](#) in ["6.2.1 Considerations for All Types of Environments" \(page 55\)](#) to change the disk reservation attribute of the physical volume if required.

End of procedure

3.6 Multipath Driver Update

The following procedure shows how to update the Multipath Driver:

Procedure

1 Install the Multipath Driver

1-1 Insert the CD-ROM in the server to install the Multipath Driver.

```
# installp -acQd /dev/cd0 FJSVmpd
```


1-2 Reboot the server.

```
# shutdown -Fr
```

End of procedure

3.7 Uninstalling Multipath Driver

The following procedure shows how to uninstall the Multipath Driver:

Procedure

1 Take the volume groups offline

Execute the "iompadm info" command to check the physical volumes of the storage system.

```
# /usr/lpp/FJSVmpd/iompadm info
```

Follow [Step 2](#) in ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)" \(page 29\)](#) and take offline the volume groups that contain the physical volumes identified using the "iompadm info" command.

2 Delete the physical volumes

Delete the physical volumes, as described in [Step 3](#) of ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)" \(page 29\)](#).

3 Uninstall the Multipath Driver

3-1 Uninstall the Multipath Driver.

```
# installp -u FJSVmpd
```

3-2 Reboot the server.

```
# shutdown -Fr
```

End of procedure

Chapter 4 Installing or Uninstalling the Multipath Driver (for SAN Boot Environments)

This chapter explains how to install or uninstall the Multipath Driver in a SAN Boot environment. The commands described in this chapter must be executed by a root-level user. For the installation procedure of the Multipath Driver in non-SAN Boot environments, refer to ["Chapter 3 Installing or Uninstalling the Multipath Driver" \(page 25\)](#).

4.1 Notes on SAN Boot Environments

The following configurations are not supported in a SAN Boot environment:

- Path addition
- Path reduction without server rebooting
- Connection of a single Fibre Channel port and multiple storage system ports via a Fibre Channel switch

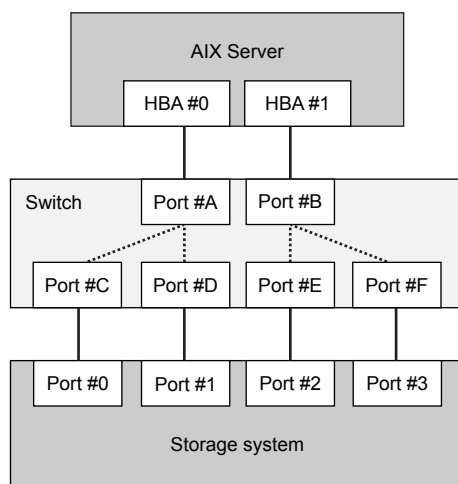


Figure 4.1 Unsupported configuration (Connection of a single HBA to multiple ports)

- A system volume (rootvg) that consists of multiple LUs (hdisk)
Since only one LU (hdisk) can be set as the system volume (rootvg), the LU that is used for the system volume must have a large capacity.

4.2 Installation Workflow

This section explains how to install the Multipath Driver on a server and connect it to the storage system.

Use the relevant User's Guide -Server Connection- of each storage system as a reference manual.

The workflow is as follows:

4.2.1 When Performing an Initial Installation of the Multipath Driver

Workflow

1

Set up the storage system

Set up the storage system.



- ["4.3 Setting Up the Storage System" \(page 36\)](#)



2

Install the OS

Install the OS.



- ["4.4 OS Installation" \(page 37\)](#)



3

Set up the Fibre Channel cards

Set the driver parameters for the Fibre Channel cards.



- ["4.5 Fibre Channel Card Setup" \(page 38\)](#)



4

Install the Multipath Driver

Install the Multipath Driver module.



- ["4.6 Multipath Driver Installation" \(page 39\)](#)



5

Recognize the Logical Units

Acquire the Logical Units (LUs) from the storage system.



- ["4.7 Recognizing Logical Units" \(page 39\)](#)

4.2.2 When Updating an Existing Multipath Driver

Update the Multipath Driver. For more details, refer to ["4.8 Multipath Driver Update" \(page 40\)](#).

4.2.3 When Uninstalling the Multipath Driver

Uninstall the Multipath Driver. For more details, refer to ["4.9 Uninstalling Multipath Driver" \(page 40\)](#).

4.3 Setting Up the Storage System

To set up the storage system, follow the procedure in ["3.3 Setting Up the Storage System" \(page 27\)](#).

Caution



Make sure to connect all the paths that are used for a multipath configuration between the storage system and a server with Fibre Channel cables.

This section explains notes about the settings when installing and using the Multipath Driver.

4.3.1 LU Format

When a LU in which data remains is to be used, perform "Format Logical Volume/Format Volume" for the LU. Refer to the relevant storage system manuals for details on how to perform "Format Logical Volume/Format Volume".

4.4 OS Installation

The following procedure shows how to install the OS:

Procedure

1 Install the OS

- 1-1** Boot from the install media CD/DVD of AIX to start the installer.
- 1-2** In the "Welcome to Base Operating System Installation and Maintenance" screen, press the [2] key to select "2 Change/Show Installation Settings and Install".
- 1-3** In the "Installation and Settings" screen, press the [1] key to select "1 System Settings". The "Change Disk(s) Where You Want to Install" screen appears.

Example for AIX 5.3

```
Change Disk(s) Where You Want to Install

Type one or more numbers for the disk(s) to be used for installation and
press
Enter. To cancel a choice, type the corresponding number and Press
Enter.
At least one bootable disk must be selected. The current choice is indi-
cated
by >>>.
Name      Location Code  Size(MB)    VG Status   Bootable
>>>  1  hdisk005-08-0170006NoneYesNo
      2  hdisk10B-08-0170006NoneYesNo

>>>  0  Continue with choices indicated above
      55 More Disk Options
      66 Disks not known to Base Operating System Installation
      77 Display More Disk Information
      88 Help ?
      99 Previous Menu

>>> Choice [0]:
```

hdiskN of the storage system is displayed for the number of connected paths.

- 1-4** Check that the hdisks of the storage system are displayed for the number of connected paths.

- 1-5** Select the hdisk of the storage system with the lowest number and press the [0] key.
In the example shown above, select hdisk0.



Note

Enter "77" twice to display "Physical Location Code" to check whether a hdisk belongs to the storage system.

- 1-6** Perform other settings if necessary and then start the installation.

2 Delete unnecessary physical volumes

- 2-1** After the installation is complete, log in to the server.
Check all the fscsi devices.

```
# lsdev -l fscsi*
```

The following type of message should appear:

```
fscsi0 Available 05-08-01 FC SCSI I/O Controller Protocol Device
fscsi1 Available 0B-08-01 FC SCSI I/O Controller Protocol Device
```

- 2-2** Delete all the physical volumes of the "fscsiN" devices that are not "fscsi0".

```
# rmdev -dp fscsi1
```

3 Set attributes for the fscsi devices

Set the "fc_err_recov" attribute to "fast_fail" for all of the fscsi devices.

```
# chdev -Pl fscsi0 -a fc_err_recov=fast_fail
```

End of procedure

4.5 Fibre Channel Card Setup

Follow the procedure in User's Guide -Server Connection- of each storage system to set the following parameters of the Fibre Channel card driver:

- Maximum number of COMMANDS to queue to the adapter
- INIT Link flags

Note that since the Fibre Channel cards are in Available status, select "yes" for "Apply change to DATABASE only" to change the parameter setting using the "smit" command.

4.6 Multipath Driver Installation

The following procedure shows how to install the Multipath Driver:

Procedure

1 Install the Multipath Driver

1-1 Insert the CD-ROM in the server to install the Multipath Driver.

```
# installp -acQd /dev/cd0 FJSVmpd
```

1-2 Shut down the server.

```
# shutdown -F
```

End of procedure

4.7 Recognizing Logical Units

The following procedure shows how to make the server recognize the Multipath Driver:

Procedure

1 Check the Logical Units (LU)

Start the server to force the server to acquire the Logical Units (LU) from the storage system.

Storage system Logical Units (LU) recognized by the server are regarded as physical volumes (hdisk).

Confirm that the Multipath Driver has recognized these physical volumes.

```
# /usr/lpp/FJSVmpd/iompadm info
```

The following type of message should appear:

```
Multipath Group 0x00
hdisk1 : E4000-6A0299-0000
  fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)
  fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt1)
```

2 Set the boot device order

Follow the procedure in ["6.2.2 Considerations for SAN Boot Environments" \(page 56\)](#) to set the boot device.

3 Change the disk reservation attribute of the physical volume

Refer to ["Changing the disk reservation attribute of physical volumes" \(page 55\)](#) in ["6.2.1 Considerations for All Types of Environments" \(page 55\)](#) to change the disk reservation attribute of the physical volume if required.

End of procedure

4.8 Multipath Driver Update

The following procedure shows how to update the Multipath Driver:

Procedure

1 Install the Multipath Driver.

1-1 Insert the CD-ROM in the server to install the Multipath Driver.

```
# installp -acQd /dev/cd0 FJSVmpd
```

1-2 Reboot the server.

```
# shutdown -Fr
```

End of procedure

4.9 Uninstalling Multipath Driver

The following procedure shows how to uninstall the Multipath Driver:

Procedure

1 Take the volume groups offline

Execute the "iompadm info" command to check the physical volumes of the storage system.

```
# /usr/lpp/FJSVmpd/iompadm info
```

Follow [Step 2](#) in ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)" \(page 29\)](#) and take offline the volume groups, which are not "rootvg", that contain the physical volumes identified using the "iompadm info" command.

2 Delete the physical volumes

2-1 Delete the physical volumes that are not system volumes.

```
# /usr/lpp/FJSVmpd/mpdrmdev -Ad hdisk0
```

2-2 Cancel recognition of the Multipath Driver.

```
# /usr/lpp/FJSVmpd/mpdunregdev
```

The following type of message should appear. Enter "y".

```
ETERNUS Multipath Driver uninstall tool for SAN Boot system.

Note:
  This command requires system reboot.
  After reboot, follow these steps to uninstall ETERNUS Multipath
  Driver.
    - Delete the ETERNUS Multipath Driver mpdt devices by "/usr/lpp/
    FJSVmpd/mpdrmdev -u" command.
    - Uninstall ETERNUS Multipath Driver by "installp -u FJSVmpd" com-
    mand.

Continue? (y/n) y      Enter "y".

Please reboot your system.
```

2-3 Reboot the server.

```
# shutdown -Fr
```

2-4 After the server reboots, delete all the virtual devices for the Multipath Driver.

```
# /usr/lpp/FJSVmpd/mpdrmdev -u
```

3 Uninstall the Multipath Driver

3-1 Uninstall the Multipath Driver.

```
# installp -u FJSVmpd
```

3-2 Reboot the server.

```
# shutdown -Fr
```

End of procedure

Chapter 5 Operating the Multipath Driver

This chapter explains how to use the main commands to operate various Multipath Driver functions.

5.1 Identifying Disks and Paths

5.1.1 Disk Device Identification

A storage system Logical Unit (LU) in a multipath configuration can be recognized by the Multipath Driver using the "iompadm info" command.

Example:

```
hdisk2 : E4000-130011-0000
```

Diagram illustrating the components of the disk ID E4000-130011-0000:

- E4000: Physical volume
- 1300: Storage system name
- 11: Serial number/Disk Device identification no.
- 0000: LUN

Disk ID segment	Description
Physical volume	The name of the physical volume
Storage system name	The model name of the connected storage system
Serial number/ Disk Device identification no.	Unique serial number ID or Disk Device identification no. of the connected storage system
LUN	The logical unit number

The above information allows you to confirm the connected storage system and the LUNs.

5.1.2 Path Identification

Path connections and status between the server and the storage system can be monitored using the "iompadm info" command. In the following example, the path identifier has been outlined.

Example:

```
hdisk2 : E4000-130011-0000
fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)
fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt16)
```

Diagram illustrating the components of the path identifier CM11-CA41-PORT03:

- CM11: Storage system name
- CA41: Serial number/Disk Device identification no.
- PORT03: LUN
- 03: Path identifier

The 3rd number is called the port number.

Details of the port numbers of each storage system model and their connections are provided in the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" found at the following URL:

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

5.2 Multipath Status Display

You can also use the "iompadm info" command to display the status of multiple paths for a device. The "iompadm" command is installed in the /usr/lpp/FJSVmpd directory. Only a root-level user can execute the "iompadm" command.

5.2.1 "iompadm info" Command

This command displays the status of the Multipath Driver. When a physical volume is specified, the path status of the storage system to which the specified physical volume is connected is displayed. Specify the physical volume using a format such as "hdisk1".

[Command Format]

```
iompadm info [physical_volume]
```

[Output Format]

```
Multipath Group: Control_number  
disk_device_id  
path_device path_status status_details path_id (mpdtN)
```

path_device: Path device name.
"fscsiN" for FC connection
"iscsiN" for iSCSI connection
N is an integer.

path_status: "active", "standby", "stop", or "fail" is displayed.

status_details: "online", "warning", "stop by command", or an error message is displayed.

mpdtN: Virtual device name. N is an integer.

[Output Example]

```
# /usr/lpp/FJSVmpd/iompadm info  
  
Multipath Group 0x00  
hdisk1 : E4000-130011-0000  
fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)  
fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt2)  
  
hdisk2 : E4000-130011-0001  
fscsi0 : active "online" CM11-CA41-PORT03 (mpdt1)  
fscsi1 : standby "online" CM10-CA00-PORT01 (mpdt3)
```


5.3 Disconnecting/Reconnecting Specified Paths

When performing maintenance, you can disconnect and/or reconnect a specified path using the "iompadm" command.

5.3.1 "iompadm change" Command

Use the "iompadm change" command to change a path's status to stop.

[Command Format]

```
iompadm change [change_unit] physical_volume port_number
```

When "adapter" is specified as the change unit, the path device must be also specified.

```
iompadm change adapter path_device
```

[Function Overview]

This command is used in preparation for hardware hot replacement. It disconnects all paths that use the target hardware (specified by path device, change unit, physical volume, and port number), and stops any I/O processes. If a change unit is not specified, the process is performed as if "controller" had been specified. Physical volume and port number can be checked from the output result of the "iompadm info" command.

This command transitions an active, standby, or warning status path to the stop status. This command cannot be used to transition fail or fatal fail paths to the stop status.

[Example]

```
# /usr/lpp/FJSPVmpd/iompadm change controller hdisk1 32
```

[Change Unit Specification]

Change Unit	Description
adapter (a)	Use this when replacing a cable between a HBA and Switch, or SFP connected to the cable. When "adapter" is specified as the unit of change, only path device may be specified for this parameter.
controller (c) (default)	Use this when replacing a cable directly connecting a HBA and CA, or a cable between a CA and Switch, or a SFP connected to the cable.
controllerunit (cu)	Use this when replacing a Channel Adapter.
groupmodule (g)	Use this when replacing a group module.

Details of the relationship between change units and storage systems are provided in the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" found at the following URL:

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

5.3.2 "iompadm restart" Command

Use the "iompadm restart" command to reinstate the active/standby status.

[Command Format]

```
iompadm restart [change_unit] physical_volume port_number
```

When "adapter" is specified as the unit of change, the path device must be specified as a parameter.

```
iompadm restart adapter path_device
```

[Function Overview]

This command is used to tidy up after hardware hot replacement. It recovers all paths that use the target hardware (specified by path device, change unit, physical volume, and port number). If a change unit is not specified, the process is performed as if "controller" had been specified. Physical volume and port number can be checked from the output result of the "iompadm info" command.

This command changes a fail, fatal fail or stop status path to active/standby. To change a warning status path to active/standby, change its status to stop status using the "iompadm change" command, and then use the "iompadm restart" command.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm restart controller hdisk1 32
```

[Change Unit Specification]

Refer to the explanation in ["5.3.1 "iompadm change" Command" \(page 44\)](#).

5.4 Multipath Recovery

To recover from a path failure in a multipath environment:

Procedure

- 1** Use the "iompadm info" command to identify the failed path.
- 2** Perform the necessary maintenance (change HBAs, cables, CAs, etc.) on the failed path.
- 3** Use the "iompadm restart" command to switch the recovered path back to an active/standby status.

End of procedure

For details on using the "iompadm restart" command, refer to ["5.3.2 "iompadm restart" Command" \(page 45\)](#).

5.5 Changing the Multipath Configuration

Caution



- Before starting an addition process, use the "iompadm info" command to check that the existing devices are in normal status.
- Before starting a reduction process, check that the device not to be reduced is in normal status.

5.5.1 Storage System, Path, and LU Addition

5.5.1.1 Addition without Server Rebooting

Using the "cfgmgr" command that is provided by the OS being used, extra storage systems, paths, and LUs can be added without needing to shut down the server. The "cfgmgr" command must be executed by a root-level user. Use the following procedure:

Procedure

1 Attach the hardware.

Proceed as follows, depending on the addition target.

- Storage system addition
Connect the server to the storage system to be added, and then set up the storage system so that the server can recognize LUs. For details on adding storage systems, refer to the storage system manual.
- Path addition
Connect the additional cables to the server and then set up the storage system so that the server can recognize LUs via the added cables. HBAs must be installed in the server and be set up following the procedure in ["3.2 Setting Up the HBAs" \(page 27\)](#) beforehand. For details of the storage system settings, refer to the storage system documentation.
- LU addition
Add a LU in the storage system. For details on adding LUs, refer to the storage system manual.

2 Incorporate the new hardware using the "cfgmgr" command.

[Example]

```
# cfgmgr
```


- 3** Use the "iompadm info" command to check that the new hardware has been correctly recognized and incorporated.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

End of procedure

5.5.1.2 Addition with Server Rebooting

Use the following procedure to add extra storage systems, paths, and LUs while the server is shut down:

Procedure

- 1** Shut down the server.
Shut down the server.
- 2** Attach the hardware.
Proceed as follows, depending on the addition target.
 - Storage system addition
Connect the server to the storage system to be added, and then set up the storage system so that the server can recognize LUs. For details on adding storage systems, refer to the storage system manual.
 - Path addition
Connect the additional cables to the server and then set up the storage system so that the server can recognize LUs via the added cables. HBAs must be installed in the server and be set up following the procedure in ["3.2 Setting Up the HBAs" \(page 27\)](#) beforehand. For details of the storage system settings, refer to the storage system documentation.
 - LU addition
Add a LU in the storage system. For details on adding LUs, refer to the storage system manual.
- 3** Restart the server.
Power on the server and boot it up.
- 4** Use the "iompadm info" command to check that the new hardware has been correctly recognized and incorporated.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

End of procedure

5.5.2 Storage System Reduction

5.5.2.1 Reduction without Server Rebooting

Using the "mpdrmdev" command, storage systems can be removed without needing to shut down the server. The "mpdrmdev" command is installed in the /usr/lpp/FJSVmpd directory. Only a root-level user may execute the "mpdrmdev" command. Use the following procedure:

Procedure

1 Take the volume groups offline.

Use the "iompadm info" command to identify the physical volume of the storage system that is to be removed.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

Take offline the volume groups that contain the physical volumes identified using the "iompadm info" command, as described in [Step 2](#) of ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)"](#) (page 29).

2 Remove the storage system using the "mpdrmdev -d -a *physical_volume_of_the_storage_system_that_is_to_be_removed*" command.

[Example]

```
# /usr/lpp/FJSVmpd/mpdrmdev -d -a hdisk1
```

3 Use the "iompadm info" command to check that the removed storage system has disappeared from view.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

4 Set up the hardware.

Disconnect the storage system that is to be removed (removing the connecting cables or turning the storage system off) from the server.

End of procedure

5.5.2.2 Reduction with Server Rebooting

Use the following procedure to remove storage systems after the server is shut down.

Procedure

- 1** Shut down the server.
Shut down the server.
- 2** Set up the hardware.
Disconnect the target storage system from the server (turn the storage system power off, disconnect the cables, etc.).
- 3** Restart the server.
Turn on the server to boot it up.
- 4** Use the "iompadm info" command to check that the removed storage system is displayed as "fail".
[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```
- 5** Remove the storage system using the "mpdrmdev -d -a *physical_volume_of_the_storage_system_that_is_to_be_removed*" command.
[Example]

```
# /usr/lpp/FJSVmpd/mpdrmdev -d -a hdisk1
```
- 6** Use the "iompadm info" command to check that the removed storage system has disappeared from view.
[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

End of procedure

5.5.3 LU Reduction

5.5.3.1 Reduction without Server Rebooting

Using the "mpdrmddev" command, LUs can be removed without needing to shut down the server. The "mpdrmddev" command is installed in the /usr/lpp/FJSVmpd directory. Only a root-level user may execute the "mpdrmddev" command. Use the following procedure:

Procedure

- 1 Take the volume groups offline.

Use the "iompadm info" command to identify the physical volume that corresponds to the LU that is to be removed.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

Take offline the volume groups that contain the physical volumes identified using the "iompadm info" command, as described in [Step 2](#) of ["3.4 Multipath Driver Installation \(Old Driver Uninstallation Included\)"](#) (page 29).

- 2 Remove the LU using the "mpdrmddev -d *physical_volume_that_is_to_be_removed*" command.

[Example]

```
# /usr/lpp/FJSVmpd/mpdrmddev -d hdisk1
```

- 3 Use the "iompadm info" command to check that the removed LU has disappeared from view.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

- 4 Set up the hardware.

Remove the LU (release the LU and make the LU recognition from the server impossible) in the storage system. For details of how to remove the LU, refer to the storage system manuals.

End of procedure

5.5.3.2 Reduction with Server Rebooting

Use the following procedure to remove LUs after the server is shut down.

Procedure

- 1** Shut down the server.
Shut down the server.
- 2** Set up the hardware.
Remove the LU (make the LU recognition from the server impossible) in the storage system. For details of how to remove the LU, refer to the storage system manuals.
- 3** Restart the server.
Turn on the server to boot it up.
- 4** Use the "iompadm info" command to check that the removed LU is displayed as "fail".
[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```
- 5** Remove the LU using the "mpdrmddev -d *physical_volume_that_is_to_be_removed*" command.
[Example]

```
# /usr/lpp/FJSVmpd/mpdrmddev -d hdisk1
```
- 6** Use the "iompadm info" command to check that the removed LU has disappeared from view.
[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

End of procedure

5.5.4 Path Reduction

This section describes how to remove the paths.

5.5.4.1 Reduction without Server Rebooting

Use the following procedure to remove paths without rebooting the server.

In a SAN Boot environment, paths cannot be removed without rebooting the server. Refer to ["5.5.4.2 Reduction with Server Rebooting" \(page 53\)](#) for details about removing paths in a SAN Boot environment.

Procedure

1 Check the path.

Use the "iompadm info" command to check that the path to be removed is in "fail" or "stop" status and that the paths that are not to be removed are in "online" status (active/standby).
[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

If a path that is to be removed is in "online" status (active/standby), use the "iompadm change" command to change the path status to "stop".

[Example]

```
# /usr/lpp/FJSVmpd/iompadm change adapter fscsi0
```



Note

- A path cannot be removed when the path has both online and fail status LUNs. Paths that are to be removed must be in "stop" status, and paths that are not to be removed must be in "online" status.
- When there are already defined LUNs, paths cannot be removed. Already defined LUNs must be deleted or made available.

2 Use the "iompadm delete" command to remove the path.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm delete
```

3 Use the "iompadm info" command to check that the path has been removed.

Use the "iompadm info" command to check that the removed path is not displayed.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

4 Set up the hardware.

Disconnect the target cable from the server (remove the connected cable, etc.). Remove HBAs (PCI Hot Plug) if required. For details on this procedure, refer to the manual of the server that is being used.

End of procedure

5.5.4.2 Reduction with Server Rebooting

Use the following procedure to remove paths while the server is shut down:

Procedure

- 1** Shut down the server.
Shut down the server.
- 2** Set up the hardware.
Disconnect the target cable from the server (remove the connected cable, etc.).
- 3** Restart the server.
Turn on the server to boot it up.
- 4** Use the "iompadm info" command to check that the removed path is displayed as "fail".

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

- 5** Remove the path using the "mpdrmddev *name_of_virtual_device_on_path_that_is_to_be_removed*" command.

[Example]

```
# /usr/lpp/FJSVmpd/mpdrmddev mpdt0
```

- 6** Use the "iompadm info" command to check the results.

[Example]

```
# /usr/lpp/FJSVmpd/iompadm info
```

End of procedure

5.6 Multipath Driver Related Log

The Multipath Driver creates the following log file in the /var/tmp directory.

File name	Maximum size	Description
mpdstrtc (mpdstrtc.1, mpdstrtc.2)	Approximately 1MB per file	I/O error information log. When the log file reaches the maximum size, the accumulated log data is cascaded to backup (→ mpdstrtc.1 → mpdstrtc.2 → lost) and the log file is reset (cleared).

Chapter 6 Notes when Using the Multipath Driver

This chapter provides important additional information for using the Multipath Driver. For the latest information, refer to the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" found at the following URL.

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

6.1 Configuring a Logical Unit (LU)

■ Path configuration conditions

Use the ports on different controllers for multipath configurations to prevent all the paths from being inaccessible when a controller (controller module or router) fails.

■ LU configuration conditions

Set the Logical Unit numbers (LUNs) for paths in a multipath connection to the same LUNs used on the storage system.

In the following example, the Multipath Driver will not operate properly if the two paths are mapped to different LUNs. Set the same LUNs for both paths, as shown on the left side of the following diagram.

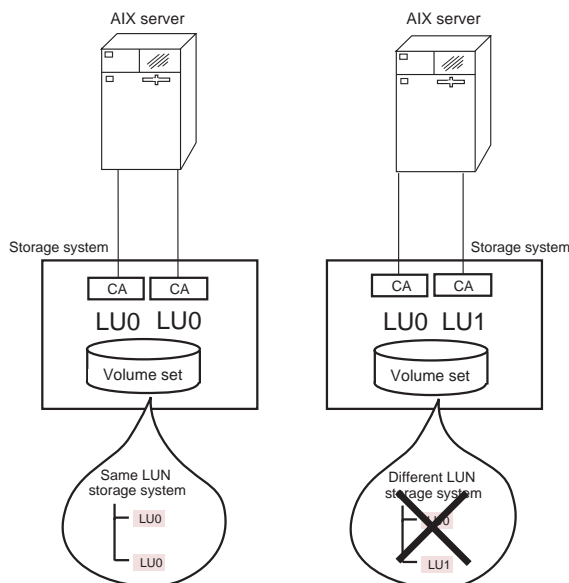


Figure 6.1 Use identical LUNs

6.2 Considerations for AIX Servers

6.2.1 Considerations for All Types of Environments

■ Stopping and restarting a storage system

To stop or restart a storage system during operation, first shut down the AIX server.

■ Error messages

When a large number of error messages are being output in a short time or the system is under a heavy load, some of the error messages may not be output to the error log.

■ Maximum number and size of disks

The maximum number and size of disks that may be used depend solely on the OS specification. There is no limitation inherent in the Multipath Driver.

■ Maximum number of storage systems that can be recognized

A single AIX server can recognize up to 256 storage systems (inclusive of the use of LUN Mappings, Affinity Groups, and zoning).

■ Changed CM assignments in a storage system with assigned CMs

Path status (active/standby) will only reflect changes in the CM assignments after the server is rebooted.

■ Changing the disk reservation attribute of physical volumes

Disk reservation is performed for physical volumes (hdisks) of the Multipath Driver by default. The "reserve_policy" attribute of a hdisk indicates whether the disk reservation is enabled or disabled.

Attribute	Value	Meaning
reserve_policy	single_path	Disk reservation is enabled (default)
	no_reserve	Disk reservation is disabled

In the following environment, use the "mpdchdiskrsv" command to change the default value of the "reserve_policy" attribute to "no_reserve".

- When using a volume group with the concurrent function for PowerHA
- For PowerHA 7.1
- When the software that is being used requires the "reserve_policy" attribute of the hdisk to be "no_reserve" (example: Virtual I/O Server, Oracle RAC)

The following procedure shows how to change the default setting.

Procedure

- 1 Use the "mpdchdiskrsv -n" command to change the default value of the "reserve_policy" attribute to "no_reserve".
This command changes the "reserve_policy" for all the hdisks of the Multipath Driver to "no_reserve". The "reserve_policy" for the hdisk that is newly created when an LU is added is also set to "no_reserve".

```
# /usr/lpp/FJSVmpd/mpdchdiskrsv -n
```

The following type of message should appear. Enter "y"

```
Changes default reserve_policy of hdisk
Value:no_reserve
Note:
  This command requires system reboot.
Continue? (y/n)y
bosboot -a

bosboot: Boot image is 45900 512 byte blocks.

Change Success. Reboot your system.
```

- 2 Reboot the server.

```
# shutdown -Fr
```

End of procedure

6.2.2 Considerations for SAN Boot Environments

■ Maintenance mode using the CD/DVD boot

To use the maintenance mode when system volumes are accessed using the CD/DCD boot of the installation media, "Release Reservation/Cancel Reservation" must be performed (*1) for the LU that contains the system volume from the storage system.

- *1: Refer to the relevant storage system manuals for details on how to perform "Release Reservation/Cancel Reservation".

■ System backup

Backing up the system using the "smit mksysb" command is supported for tape media only. Follow the procedure below to restore a system that is backed up in tape media.

Procedure

- 1** Before restoring the system, perform "Release Reservation/Cancel Reservation" (*2) for the system volume in which the system is to be restored.
- 2** Check that all the paths are connected properly.
- 3** Restore the system.
- 4** After the system is restored and the server is restarted, perform "Release Reservation/Cancel Reservation" (*2) for the system volume in which the system is restored. Restart the server.
- 5** Set the boot device order by referring to ["Boot device order setting" \(page 57\)](#).

*2: Refer to the relevant storage system manuals for details on how to perform "Release Reservation/Cancel Reservation".

End of procedure

■ Boot device order setting

● Boot device order setting

Only the booted path is set as the boot device by default.
To start the server via each path, set the boot device order.

Check the path.

```
# lsdev -l fscsi* -HF"name physloc"
```

The following type of message should appear:

```
name      physloc

fscsi0    U787E.001.AAA7360-P2-C1-T1
fscsi1    U787E.001.AAA7360-P2-C2-T1
```

The boot device order starts from the lowest value to the highest value of *N* in fscsi*N*.
In the example shown above, the boot device order is as follows:

No. 1 boot device = fscsi0

No. 2 boot device = fscsi1

The No. 1 boot device is already set. Set the boot devices from No.2 onward in the SMS menu of the server.

For more details on how to set the boot device order using the SMS menu, refer to the manuals of the server that is being used.

- "bootlist" command

Start the server with all the paths in online status before executing the "bootlist" command to set the boot device.

The "bootlist" command can set the boot device only to the booted path.

Additional boot device settings that were performed using the SMS menu of the server are cleared when the "bootlist" command is executed. In this case, additional settings for the boot device using the SMS menu of the server need to be performed again.

For more details on how to perform the boot device setting using the SMS menu, refer to ["Boot device order setting" \(page 57\)](#).

- How to check the boot device

Since "-" may be displayed for some devices as the result of the boot device check when the "-o" option is specified, specify both the "-o" and the "-v" options. The following example shows the boot device check when the boot device is fscsi0 and fscsi1 in order, which are paths for hdisk0.

Procedure

- 1 Check the mpdt (virtual device) of each path for hdisk0.

```
# /usr/lpp/FJSVmpd/iompadm info
```

The following type of message should appear:

```
Multipath Group 0x00
hdisk0 : E4000-6A0299-0000
      fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)
      fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt1)
```

- 2 Check the ww_name and lun_id for mpdt0 and mpdt1.
Check mpdt0.

```
# lsattr -El mpdt0 -a ww_name,lun_id
```

The following type of message should appear:

```
ww_name 0x2141000b5d6a0299 FC World Wide Name      False
lun_id   0x0                Logical Unit Number ID False
```

Check mpdt1.

```
# lsattr -El mpdt1 -a ww_name,lun_id
```

The following type of message should appear:

```
ww_name 0x2140000b5d6a0299 FC World Wide Name      False
lun_id   0x0                Logical Unit Number ID False
```

- 3 Check the boot device.

```
# bootlist -m normal -o -v
```


The following type of message should appear:

```
'ibm,max-boot-devices' = 0x5
NVRAM variable:
  (boot-device=/pci@800000020000003/pci@2,4/fibre-channel@1/
  disk@2141000b5d6a0299 /pci@800000020000003/pci@2,2/fibre-channel@1/
  disk@2140000b5d6a0299)
Path name:
  (/pci@800000020000003/pci@2,4/fibre-channel@1/disk@2141000b5d6a0299)
match_specific_info: ut=disk/fcp/fjmpdtE4000_D
hdisk0
Path name:
  (/pci@800000020000003/pci@2,2/fibre-channel@1/disk@2140000b5d6a0299)
-
```

disk@2141000b5d6a0299

Format: "disk@" + ww_name_for_mpd + ["," + lun_id_for_mpd]

This is not displayed
when the lun_id is "0x0".

The boot device setting is properly set when the "ww_name" and the "lun_id" of mpdt are the same as the ones checked in [Step 2](#).

End of procedure

6.3 Troubleshooting

If you notice anything unusual, check the following points.

- Is the error message one of the messages in ["Appendix A Error Messages" \(page 71\)](#)?
If it is, follow the instructions in "Appendix A Error Messages".
Contact us according to your support contract for the messages whose action is "Contact a Fujitsu engineer".
- When the command outputs an error message, refer to ["Chapter 7 Command Reference" \(page 61\)](#).
- Check this guide or the "ETERNUS Multipath Driver 2 (for AIX) Installation Information" obtained from the following URL to see if there are any applicable points to note:
<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

If you cannot find any solutions, contact us according to your support contract.

The following information is required to contact us according to your support contract.

- Information related to the AIX server in use
 - Model name
 - HBA information
 - HBA product ID
 - OS
 - Version
 - Applied updates

- Following information related to the Multipath Driver in use
 - Product version and applied updates
 - Information obtained from the "mpdsnap" command
Refer to ["7.4 mpdsnap Command" \(page 69\)](#) for details on the "mpdsnap" command.
- Information related to the storage system in use
 - Product ID
 - Firmware version
 - RAID group settings
 - Zone settings (or Affinity group settings)
- Information related to Fibre Channel switch, if used
 - Product ID
 - Zone settings
- SAN connection diagram including the AIX server, storage system, and Fibre Channel switch (if used)

6.4 Frequently Asked Questions

Power-related problems	
Storage system is not recognized by the server.	<p>The storage system may not be recognized if turned on after the server. The storage system must be turned on before the server.</p> <p>If the storage system is not recognized, perform the following operation after the storage device has started up:</p> <ul style="list-style-type: none">• Execute the "cfgmgr" command. # <code>cfgmgr</code>
Server is booted with the cable disconnected.	<p>If the server is booted with paths disconnected, the storage system is not recognized.</p> <p>Perform the same operation as described in "Storage system is not recognized by the server". Execute the "cfgmgr" command.</p>

Chapter 7 Command Reference

This chapter explains the commands that control the Multipath Driver functions. Root-level user is required to execute these commands.

7.1 iompadm Commands

Format

```
/usr/lpp/FJSVmpd/iompadm <subcommand> [arg]
```

There are six sub commands.

- info: displays the multipath status
- change: changes the status of a specified path to stop
- restart: returns the status of a specified path to active/standby
- delete: removes a path without server rebooting
- help: displays simplified directions for the "iompadm" command
- version: displays the Multipath Driver version

Multiple "info", "change", "restart", or "delete" subcommands cannot be run at the same time.

Explanation

This command shows the path status and controls the paths (stops/restarts) in a multipath connection controlled by the Multipath Driver.

Subcommands

```
iompadm info [physical_volume]
```

When a physical volume connected to the storage system managed by the Multipath Driver has been specified, this subcommand displays the recognized disks and path status. If a `physical_volume` is not specified, information on all the connected physical volume is displayed.

Refer to the "Output Format" section for details of output information.

```
iompadm change [change_unit] [physical_volume] port_number
```

When specifying an "adapter" as the `change_unit`, the path device must be specified for the parameter.

```
iompadm change adapter path_device
```

This subcommand transitions an active, standby, or warning status path to the stop status and blocks the path. This subcommand cannot be used to transition fail or fatal fail paths to the stop status. When executed with no `change_unit` specified, the operation is performed as if "controller" was specified.

Refer to ["5.3 Disconnecting/Reconnecting Specified Paths" \(page 44\)](#) for details of change_unit.

```
iompadm restart [change_unit] physical_volume port_number
```

When specifying an "adapter" as the change_unit, the path device must be specified for the parameter.

```
iompadm restart adapter path_device
```

This subcommand returns the status of a specified path to active/standby status and restarts path use. When a fail or fatal fail status path becomes usable, this command may be used to change its status to active/standby. To change a warning status path to active/standby, change its status to stop status using the "iompadm change" command, and then use the "iompadm restart" command. When executed with no change_unit specified, the operation is performed as if "controller" was specified.

Refer to ["5.3 Disconnecting/Reconnecting Specified Paths" \(page 44\)](#) for details of change_unit.

```
iompadm delete
```

This command removes paths without server rebooting. Paths in fail or stop status are deleted.

```
iompadm version
```

Displays the Multipath Driver version number.

```
iompadm help
```

Displays the directions for the "iompadm" command.

Return Codes

The following return codes are available when using a script:

"0" is returned for a normal status

Other than "0" is returned for an abend (and an error message is sent to the standard error output).

Output Format

```
Multipath Group 0x00
Disk_Device_ID_for_disk_#1
    First_Path_status_of_disk_#1
    Second_Path_status_of_disk_#1

Disk_Device_ID_for_disk_#2
    First_Path_status_of_disk_#2
    Second_Path_status_of_disk_#2
```


The following table explains the elements of the output message.

Element	Description
Multipath Group	Shows the name of the storage system
Disk Device ID	Shows the name of each disk device controlled by the Multipath Driver Refer to "5.1.1 Disk Device Identification" (page 42) for details.
PATH	Shows the present path status of each disk device using the following format: path_device, path_status, status_details, path_id

"path_status" may be any of the following: "active", "standby", "stop", or "fail".

"status_details" are explained in the table shown below. If the status details indicate an error situation, further information can be found by executing the "errpt" command.

Item	Detail	Description
1	online	Online status (Normal status)
2	warning	Warning status. After warning, items 8 onward may appear.
3	stop by command	Path is stopped by the "iompadm change" command.
4	forcible fail	Fatal fail status. To restore the online path status, fix the root problem, then use "iompadm restart". Diagnostic restoration is not possible.
5	LUN trouble	LU fail status. Diagnostic restoration may be possible.
6	no such device	Disk was not recognized on server startup.
7	HBA open error	Failed to open the HBA.
8	hardware trouble	A hardware error that requires the path to be blocked was detected.
9	HBA host I/O bus error	A host I/O bus busy error was received from the HBA.
10	HBA transport layer error	A transport layer error was received from the HBA.
11	time out	A timeout notice was received from the HBA.
12	no device response	A cable disconnection notice was received from the HBA driver because of disconnection of the path between the FC switch and storage system.
13	adapter hardware error	A hardware error was received from the HBA.
14	adapter software error	A software error was received from the HBA.
15	transport dead	A cable disconnection notice was received from the HBA driver because of disconnection of the path between the FC switch and server.
16	reservation conflict status	A reservation conflict notice was received from the storage system.
17	device busy status	A Busy notice was received from the storage system.
18	device queue full status	A Queue Full notice was received from the storage system because of high I/O load.
19	%s (SK/SC/SSC)	Sense information was received from the storage system. Sense information appears in %s, sense key appears in SK, sense code appears in SC, and sub sense code appears in SSC.
20	recovered from fail status	Status has been changed from fail to warning following diagnostic.
21	ENXIO error	An ENXIO error occurred.

Item	Detail	Description
22	I/O error(%x)	An error with error value %x occurred, where %x is a hexadecimal number.
23	SCIOLSTART error	Failed to execute the SCIOLSTART ioctl.

Output Example

```
Multipath Group 0x00
hdisk1 : E4000-130011-0000
  fscsi0 : active "online" CM11-CA41-PORT03 (mpdt0)
  fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt2)

hdisk2 : E4000-130011-0001
  fscsi0 : active "online" CM11-CA41-PORT03 (mpdt1)
  fscsi1 : standby "online" CM10-CA40-PORT01 (mpdt3)
```

Error Messages

This section explains the main error messages and the resolution process.
If any error message other than following appears, contact your Fujitsu engineer.

must be super-user

Cause

Someone other than superuser executed the command.

Action

Execute the command as an authorized superuser.

ODM lock

Cause

Multiple "iompadm" commands were started at the same time.

Action

Wait until one command finishes before entering the next.

invalid subcommand

Cause

An invalid subcommand has been entered.

Action

Enter a valid subcommand.

invalid parameter

Cause

There is an error in the command argument.

Action

Specify a valid value for the command argument.

fail to start path: Multipath Group %x

Cause

The path status cannot be changed to Online using the "iompadm restart" command. %x is a hexadecimal number.

Action

Check the path status using the "iompadm info" command. Also check the status of the connection between the server and storage system, fix any problems, and execute the "iompadm restart" command again.

Cannot delete the path of %s because the online path is not found.

Cause

The path cannot be deleted using the "iompadm delete" command because a path is not online. %s is a virtual device name (mpdt*).

Action

Check that the status of paths that are not to be removed is online using the "iompadm info" command. If these paths are not online, change the status to online, and then execute the "iompadm delete" command again.

%s is online

Cause

The path cannot be deleted using the "iompadm delete" command because the path has both online and fail status LUNs. %s is a virtual device name (mpdt*).

Action

Change the status of the path that is to be removed to "stop" using the "iompadm change" command, and then execute the "iompadm delete" command again.

%s is defined

Cause

The path cannot be deleted using the "iompadm delete" command because the LU for the path that is to be removed has already been defined. %s is a virtual device name (mpdt*).

Action

Delete the defined LU using the "mpdrmddev" command or make the defined LU available using the "cfgmgr" command, and then execute the "iompadm delete" command again.

7.2 mpdrmddev Command

Format

```
For removing storage systems or LUs:  
/usr/lpp/FJSVmpd/mpdrmddev [-d] [-a|-A] physical_volume  
  
For removing paths with server rebooting:  
/usr/lpp/FJSVmpd/mpdrmddev virtual_device  
  
For removing all the virtual devices (in a SAN Boot environment):  
/usr/lpp/FJSVmpd/mpdrmddev -u
```

Explanation

This command is used when the Multipath Driver removes storage systems, LUs or paths. A storage system or a LU can be removed by performing the following settings:

- d removes the specified physical volume or the virtual device (mpdt*) related to the specified physical volume from the ODM. When this option is not specified, the specified physical volume or the virtual device (mpdt*) related to the specified physical volume remains registered and stays in the ODM.
- a removes the storage system to which the specified physical volume belongs.
- A removes only the unused physical volumes in the storage system to which the specified physical volume belongs. Any physical volumes that are being used are not removed.

A path can be removed with server rebooting by performing the following settings:

virtual_device removes the path to which the specified virtual device belongs.

Specify the following option to remove all the virtual devices:

- u removes all the virtual devices registered in the system. This option is only used when the Multipath Driver is uninstalled in a SAN Boot environment.

Return Codes

The following return codes are available when using a script:

"0" is returned for a normal status

Other than "0" is returned for an abend (and an error message is sent to the standard error output).

Error Messages

This section explains the main error messages and the resolution process.
If any error message other than following appears, contact your Fujitsu engineer.

This command can be used only by the super-user.

Cause

Someone other than superuser executed the command.

Action

Execute the command as an authorized superuser.

%s is not a multipath device.

Cause

%s is not a physical volume managed by the Multipath Driver. %s is a physical volume name (hdisk*).

Action

Specify an appropriate physical volume.

Cannot remove %s.

Cause

A virtual device %s cannot be removed. %s is a virtual device name (mpdt*).

Action

Check that the volume group to which the specified physical volume belongs is offline.

%s is available yet.

Cause

A virtual device %s is enabled. %s is a virtual device name (mpdt*).

Action

For this command, paths cannot be removed while a virtual device is enabled. Refer to ["5.5.4.1 Reduction without Server Rebooting" \(page 52\)](#) for details of how to perform hot removal of paths.

7.3 mpdchdiskrsv Command

Format

```
/usr/lpp/FJSVmpd/mpdchdiskrsv [-n|-s|-d]
```

Explanation

This command changes the default value for the "reserve_policy" attribute of the hdisk. When "reserve_policy" is set using this command, the server must be rebooted. This command changes "reserve_policy" for all the hdisks of the Multipath Driver to the specified value (the new value is applied after the server is rebooted). The "reserve_policy" for the hdisk that is newly created when an LU is added is also set to the specified value.

- n Changes "reserve_policy" to "no_reserve"
- s Changes "reserve_policy" to "single_path" (default value)
- d Displays the current value

Return Codes

The following return codes are available when using a script:
"0" is returned for a normal status
Other than "0" is returned for an abend (and an error message is sent to the standard error output).

Error Messages

This section explains the main error messages and the resolution process.
If any error message other than following appears, contact your Fujitsu engineer.

This command can be used only by the super-user.

Cause

Someone other than superuser executed the command.

Action

Execute the command as an authorized superuser.

"bosboot -qa" No space left on device. %s:%d KB required

Cause

There is not enough free disk space to execute the "bosboot" command.
%s is a directory. %d is a number.

Action

Increase the free space of the displayed directory, and then execute the "mpdchdiskrsv" command again.

7.4 mpdsnap Command

Format

```
/usr/lpp/FJSVmpd/mpdsnap
```

Explanation

This command collects information for troubleshooting.

Send the mpdsnap.tar.gz file created in the current directory by executing this command, and other necessary information, to the Support desk.

Return Codes

The following return codes are available when using a script:

"0" is returned for a normal status

Other than "0" is returned for an abend (and an error message is sent to the standard error output).

Error Messages

This section explains the main error messages and the resolution process.

If any error message other than following appears, contact your Fujitsu engineer.

This command can be used only by the super-user.

Cause

Someone other than superuser executed the command.

Action

Execute the command as an authorized superuser.

7.5 mpdunregdev Command

Format

```
/usr/lpp/FJSVmpd/mpdunregdev
```

Explanation

This command cancels recognition of the Multipath Driver.

This command is used only when the Multipath Driver is uninstalled in a SAN Boot environment.

Return Codes

The following return codes are available when using a script:

"0" is returned for a normal status

Other than "0" is returned for an abend (and an error message is sent to the standard error output).

Error Messages

This section explains the main error messages and the resolution process.
If any error message other than following appears, contact your Fujitsu engineer.

This command can be used only by the super-user.

Cause

Someone other than superuser executed the command.

Action

Execute the command as an authorized superuser.

The boot disk %s is not configured by ETERNUS Multipath Driver.

Cause

This command is executed in a non-SAN Boot environment. %s is a physical volume name (hdisk*).

Action

This command only needs to be executed in a SAN Boot environment.

Appendix A Error Messages

When an error occurs, an error log is recorded. The error log can be referenced using the "errpt" command.

A.1 Error Messages

The Multipath Driver error message has four types of messages:

Message type	DESCRIPTION in errpt
Messages regarding path status	PATH OFFLINE
	PATH ONLINE
	LUN OFFLINE
	LUN ONLINE
Messages regarding I/O errors	DISK OPERATION ERROR
Messages regarding configuration errors	CONNECTION CONFIGURATION ERROR
Messages regarding internal errors	SOFTWARE ERROR

The following sections explain the details data of each error type displayed by "errpt -a" command, their causes and suggested responses.



Note

If the error message continues to appear even after performing the suggested action, contact a Fujitsu engineer.

■ Messages regarding path status

NOTICE :Multipath Group %x :%s(%x, --)

I/O path failed.

Number of online paths left = %d

Cause

The status of the indicated path changed to fail. The final %d in the message indicates the number of online state paths that remain. %s is a path device and %x is a hexadecimal number.

Action

Identify the failed path using the "iompadm info" command, respond as necessary to resolve the problem, and recover the path using the "iompadm restart" command.

WARNING:Multipath Group %x :%s(%x, --)

forcible path degrade.

Cause

The status of the indicated path changed to fatal fail because the path was found to be unstable.
%s is a path device and %x is a hexadecimal number.

Action

Identify the failed path using the "iompadm info" command, respond as necessary to resolve the problem, and recover the path using the "iompadm restart" command.

WARNING:Multipath Group %x

I/O path failed, no more online path.

Cause

All the paths have changed to fail status. %x is a hexadecimal number.

Action

Respond as necessary to resolve the path failure problems, and recover the paths using the "iompadm restart" command.

WARNING:Multipath Group %x :%s(%x, %x)

I/O LUN failed.

Number of online paths left for this LUN = %d

Cause

The indicated paths for the indicated LUN have changed to fail status.

The final %d in the message indicates the number of online state paths that remain for that LUN. %s is a path device and %x is a hexadecimal number.

Action

Identify the failed LU using the "iompadm info" command, respond as necessary to resolve the problem, and recover the paths using the "iompadm restart" command.

WARNING:Multipath Group %x

I/O LUN failed, no more online path for this LUN.

Cause

All paths connected to the indicated LUN have changed to fail status. %x is a hexadecimal number.

Action

Identify the failed LU using the "iompadm info" command, respond as necessary to resolve the problem, and recover the paths using the "iompadm restart" command.

NOTICE :Multipath Group %x :%s(%x, --)

Use of I/O path was restarted.

Cause

The status of the indicated path has returned to online. %s is a path device and %x is a hexadecimal number.

Action

No action is required.

NOTICE :Multipath Group %x :%s(%x, %x)

Use of I/O path was restarted from STOP status.

Cause

The status of the indicated path has returned to online from stop. %s is a path device and %x is a hexadecimal number.

Action

No action is required.

NOTICE :Multipath Group %x :%s(%x, %x)

Use of I/O LUN was restarted.

Cause

The indicated paths for the indicated LUN have recovered. %s is a path device and %x is a hexadecimal number.

Action

No action is required.

■ Messages regarding I/O errors

Either NOTICE or WARNING is displayed as the "level" in the following messages.

level:Multipath Group %x :%s(%x, %x)

ERROR=0x1

HBA Host I/O Bus Error

Cause

The indicated HBA has reported a Host I/O Bus error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

level:Multipath Group %x :%s(%x, %x)

ERROR=0x2

HBA Transport Layer Error

Cause

The indicated HBA has reported a Transport Layer error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

level:Multipath Group %x :%s(%x, %x)

ERROR=0x3

Timeout

Cause

The indicated HBA has reported a Timeout error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

level:Multipath Group %x :%s(%x, %x)

ERROR=0x4

No Device Response

Cause

Connection between the FC switch and storage system is not established. %s is a path device and %x is a hexadecimal number.

Action

Check the connection between the FC switch and storage system, and respond as necessary to resolve the problem.

level:Multipath Group %x :%s(%x, %x)

HBA ERROR=%x

Cause

The indicated HBA has reported some kind of error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

level:Multipath Group %x :%s(%x, %x)

Check Condition Too Long

Cause

The indicated storage system has reported a check condition. %s is a path device and %x is a hexadecimal number.

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

Device Busy

Cause

The storage system is in Busy status. %s is a path device and %x is a hexadecimal number.

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

Queue Full

Cause

I/O load on the storage system is too high. %s is a path device and %x is a hexadecimal number.

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

STATUS ERROR=%x

Cause

The indicated storage system has reported some kind of error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

level:Multipath Group %x :%s(%x, %x)

SK=%x SC=%x SSC=%x FRU=%x

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x4 SC=0x40 SSC=%x FRU=%x

Diagnostic failure<hexadecimal es_qual_code>

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x4 SC=0xf1 SSC=%x FRU=%x
FRU failed

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x4 SC=0xf2 SSC=%x FRU=%x
FRU failed

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x6 SC=0x11 SSC=0x90 FRU=%x
While rebuild processing, fill the broken data into some sectors of disk.

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x6 SC=0xf9 SSC=0xe0 FRU=%x
timeout unit attention

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x6 SC=0xf2 SSC=0x88 FRU=%x
Finish rebuild processing, but fill the broken data into some sectors of disk.

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)

Action

Check the storage system and respond as necessary.

level:Multipath Group %x :%s(%x, %x)

SK=0x6 SC=0xf2 SSC=%x FRU=%x
Operation condition changed<Z=%x>

Cause

Sense data has been received from the indicated storage system. %s is a path device and %x is a hexadecimal number. SK, SC, SSC, and FRU indicate the following:

SK : sense key (hexadecimal)
SC : sense code (hexadecimal)
SSC : sub sense code (hexadecimal)
FRU : failure point (hexadecimal)
Z : logical sum of SSC and 0x07

Action

Check the storage system and respond as necessary.

WARNING:Multipath Group %x :%s(%x, --)

Incomplete CDB=%x

Cause

I/O from the diagnosis function failed. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

WARNING:Multipath Group %x :%s(%x, --)

ENXIO ERROR

Cause

An ENXIO error occurred. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

WARNING:Multipath Group %x :%s(%x, --)

I/O error(%x)

Cause

An I/O error occurred. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

WARNING:Multipath Group %x :%s(%x, --)

SCIOLSTART ERROR=%x

Cause

The SCIOLSTSRRT ioctl has terminated with an error. %s is a path device and %x is a hexadecimal number.

Action

Contact a Fujitsu engineer.

WARNING:Multipath Group %x :%s(%x, --)

IOCTL(%s) ERROR=%x

Cause

The ioctl has terminated with an error. %s is a path device and %x is a hexadecimal number. The last %s is an ioctl name (such as IOCINFO).

Action

No action is required.

■ Messages regarding configuration errors

WARNING:Multipath Group %x :%s(%x, --)

this path was unrecognizable. -> %s

Cause

The path indicated by %s could not be recognized at the time of server startup. The last %s is storage system information, specifically: storage_system_name - serial_number/device_identification_no. - path_identification (example: E4000-130011-CM11-CA41-PORT03). For details of the path identifier, refer to ["5.1.2 Path Identification" \(page 42\)](#). %s is a path device and %x is a hexadecimal number.

Action

Check the connection status between the indicated path and storage system and the status of the storage system, fix any problems, and execute the "cfgmgr" command.

WARNING:%s: Invalid LUN Mapping.

Cause

The LUN configuration recognized by multiple paths is not the same. %s is storage system information, specifically: storage_system_name - serial_number/device_identification_no - LUN_V (example: E4000-130011-0042).

Action

Set the correct LUN Mapping for the storage system indicated by %s and execute the "cfgmgr" command.

WARNING:%s :The number of paths exceeds a maximum.

Cause

The number of paths connected to the storage system is more than the maximum value. %s is storage system information, specifically: storage_system_name - serial_number/device_identification_no. - LUN_V (example: E4000-130011-0042).

Action

Reduce the number of paths (indicated by %s) between the server and storage system to eight or less and restart the server.

WARNING:Multipath Group %x :<%s>

Device configuration is without redundancy.

Cause

The server is connected to the storage system without redundancy (example: all paths are connected to the same CM). %s is storage system information, specifically: storage_system_name - serial_number/device_identification_no. (example: E4000-130011). %x is a hexadecimal number.

Action

Connect the server and the storage system indicated by the %s with a redundant configuration and restart the server.

WARNING:Multipath Group %x :<%s>

Device configuration is without CFL redundancy.
All paths connect to (ZZ%x, ZZ%x).

Cause

The condition of the connected storage system is such that performing concurrent firmware loading (CFL) would cause all paths to become closed. ZZ is a RT for the ETERNUS6000 and a CM for a storage system other than the ETERNUS6000, while %x is a number (the group number). For the position of the actual RT or CM in the device, refer to the "ETERNUS Multipath Driver 2 (for AIX) Installation Information", which may be found at the following URL:

<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/download/>

In the following connection cases, all paths would be closed during the CFL operation:

- ETERNUS6000
When the server is connected to RT00 and RT01 only, or to RT10 and RT11 only.
- Storage systems other than ETERNUS6000
When the server is connected to even-numbered (group number) CMs only, or odd-numbered CMs only.

%s is the storage system information, specifically: storage_system_name - serial_number/device_identification_no. (example: E8000-012345).

Action

Connect the server and the indicated storage system (%s) in a configuration that is path-redundant with respect to CFL and restart the server.

■ **Messages regarding internal errors**

If any message regarding internal errors is output, contact a Fujitsu engineer.

Appendix B iSCSI Connection Settings

This appendix describes the iSCSI connection settings for the AIX iSCSI software initiator.

■ iSCSI connection settings

The procedure for iSCSI connection settings is described below.

Procedure

1 Set the NIC.

Set an IP address that can communicate with the iSCSI CA ports of the storage system.

2 Check the name of the iSCSI software initiator.

Check the required initiator name for the storage system settings.

```
# lsattr -El iscsi0
```

3 Edit the target file.

Set the connection targets in the /etc/iscsi/targets file.

```
IP-address PortNumber iSCSIname ["CHAP Password"]
```

IP-address: Specify the IP address for an iSCSI CA port of the storage system.

PortNumber: Specify "3260" (default) for the port number.

iSCSIname: Specify the IQN for an iSCSI CA port of the storage system.

CHAP Password: Specify "CHAP Password".

Only unidirectional CHAP authentication is supported.

This parameter can be omitted when CHAP authentication is not used.

[Example]

```
192.168.10.100 3260 iqn.2000-09.com.fujitsu:storage-system.e4000m3:00000299
192.168.11.100 3260 iqn.2000-09.com.fujitsu:storage-system.e4000m3:00001299
```

End of procedure

■ Performance related settings

To optimize the current performance, perform the following settings.

Procedure

1 Set the en device and network options.

Perform the en device settings.

```
# chdev -l enN -a rfc1323=1
# chdev -l enN -a tcp_recvspace=262144
# chdev -l enN -a tcp_sendspace=262144
```

Perform the network option settings.

```
# no -p -o tcp_nagle_limit=0
# no -p -o sb_max=1048576
```

2 Set Jumbo Frame.

Check whether Jumbo Frame is supported by referring to the relevant manuals of the storage system that is being used. If Jumbo Frame is supported, enable Jumbo Frame for the iSCSI ports on the storage system.

After Jumbo Frame is enabled for the storage system, perform the following steps to enable Jumbo Frame for the NIC on the server.

This setting is not required if Jumbo Frame is not supported.

Complete the en/ent definitions.

```
# rmdev -l enN
# rmdev -l entN
```

Perform the ent device settings.

```
# chdev -l entN -a jumbo_frames=yes
```

Configure en/ent.

```
# mkdev -l entN
# mkdev -l enN
# chdev -l enN -a mtu=9000
```

End of procedure



Note

For more details on tuning information, refer to the "iSCSI performance considerations" AIX manual.

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