

FUJITSU Storage ETERNUS Multipath Driver 3.0 User's Guide

for Oracle Solaris

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Preface

This manual describes the features, functions, activation, and configuration of the ETERNUS Multipath Driver (hereafter referred to as "Multipath Driver") software on a server running the Oracle Solaris (hereafter called the "Solaris OS").

This manual further provides operational instructions for managing connection paths, connection status, and other features of a FUJITSU Storage ETERNUS Disk storage system or GR series (hereafter called a "storage system" unless stated otherwise).

Two drivers are included in this package. This manual describes one of the drivers that supports the Hot Bus Adapter for the Multipath Driver 3.0.x (hereafter called 3.0 type driver).

Further ETERNUS and GR series support information is available at the following website:

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

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Intended Audience

This manual is intended for system administrators who are connecting a storage system device to a Solaris OS server on which the Multipath Driver software is installed.

Organization and Contents

- Chapter 1 What is the Multipath Driver?

This chapter explains the features, supported configurations, and functions of the Multipath Driver.

- Chapter 2 Multipath Driver Settings

This chapter provides instructions for interactively configuring the server to use the Multipath Driver. The Interactive configuration process entails the use of the Multipath Driver installation script. Although the details differ slightly, the same general process applies to both servers with Fujitsu HBAs (Fibre Channel cards or SAS cards) installed, and to those with non-Fujitsu HBAs (Emulex Fibre Channel cards) installed.

- Chapter 3 Adding or Removing Paths Between Storage Systems, LUNs, and Servers

This chapter provides procedures for adding and removing paths between storage system devices, LUNs, and servers in a multipath configuration. These are configuration-management tasks to perform as needed after initially configuring the server environment of the Multipath Driver.

- Chapter 4 Replacing Failed Components

This chapter provides configuration instructions to use when replacing failed hardware components that are part of the multipath configuration. Perform these tasks as needed after initially configuring the server environment of the Multipath Driver.

- Appendix A Multipath Control Commands

This appendix explains the commands used for managing multipath configurations with the Multipath Driver.

- Appendix B Miscellaneous Notes

This appendix provides important notes and precautions that cover a range of topics concerning the Multipath Driver.

- Appendix C Error Messages

This appendix describes the error messages generated by various functions of the Multipath Driver.

- Appendix D Additional Information

This appendix provides additional information about how the Multipath Driver works.

- Glossary

The glossary contains definitions for key terms used with the Multipath Driver.

Trademarks, Product Names, and Abbreviations

- "HBA" represents a Host Bus Adapter, which is a server-installed Fibre Channel card, SAS card, or SCSI card that connects to a storage system device.
- "CA" represents a Channel Adapter installed in a storage system device.
- Oracle Solaris might be described as Solaris, Solaris Operating System, or Solaris OS.

Related Manuals

This software product is installed on servers that are used with storage system devices. Refer to the following related manuals for more information:

- The manual for the relevant storage system device
- The manual provided with ETERNUSmgr/GRmgr

Typographical Conventions

The following conventions are used in this manual.

Caution

A Caution provides important or critical information to read before using a device or executing a procedure. Pay special attention to these Caution messages. Failure to do so may cause damage to the product or loss of user data.

Note

A Note provides additional information that relates to the topic preceding or following the Note message.

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.

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Modification History

This section provides a history of modifications for the Multipath Driver.

■ 3.0.1 modifications

● Modification outline

Changed the message specification when an error is detected during checks.
This modification suppresses the "giving up" message in the following example:

```
WARNING: /pci@21,700000/fibre-channel@0/mplbt@10,0 (mplbt431):  
information: giving up
```

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.0 or earlier | The "information: giving up" message is output when an error is detected during checks. |
| 3.0.1 | The "information: giving up" message is not output when an error is detected during checks. |

- Modification effect
No effect.

● Modification outline

The following additional message is output when the device status is changed to "Fail" by a request from PRIMECLUSTER GDS.

```
NOTICE: mplbh*: I/O Lun degraded. %s  
remaining online path number=%d
```

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.0 or earlier | A message for device blocking is not output when the device status is changed to "Fail" by a request from PRIMECLUSTER GDS. |
| 3.0.1 | A message for device blocking is output when the device status is changed to "Fail" by a request from PRIMECLUSTER GDS. |

- Modification effect
No effect.

■ 3.0.2 modifications

● Modification outline

Messages with the following sense codes are reported to the Machine Administration:

- 4/f2/*
 - 6/fb/81 – 6/fb/8f
- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|--|
| 3.0.1 or earlier | <ul style="list-style-type: none"> • When receiving "4/f2" sense codes, no message is output while retrying and no message is reported by the Machine Administration. • When receiving "6/fb/81 – 6/fb/8f" sense codes, no message is output while retrying and no message is reported by the Machine Administration. |
| 3.0.2 | <ul style="list-style-type: none"> • When receiving "4/f2" sense codes, the following message is output and reported by the Machine Administration: [Example] <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <pre>WARNING: /pci@17,4000/fibre-channel@2/mp1bt@10,0 (mp1bt35): FUJITSU XXXX SK: 4,ASC: 0xf2, ASCQ: 0xC,FRU: 0xD Information: FRU failed<0xC></pre> </div> <ul style="list-style-type: none"> • When receiving "6/fb/81 – 6/fb/8f" sense codes, the following message is output and reported by the Machine Administration: [Example] <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <pre>WARNING: /pci@17,4000/fibre-channel@2/mp1bt@10,0 (mp1bt35): FUJITSU XXXX SK: 6,ASC: 0xfb, ASCQ: 0x8x,FRU: 0xD</pre> </div> |

- Modification effect

New messages are reported by the Machine Administration.

- Modification outline

Added a message that is reported by the Machine Administration when there is a path that cannot be recognized when starting up the server.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|--|
| 3.0.1 or earlier | No message is output for a path that cannot be recognized when starting up the server. |
| 3.0.2 | The following message is output for a path that cannot be recognized when starting up the server. [Example] <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <pre>WARNING: /pci@16,2000/fibre-channel@1/mp1bt@10 (mp1bt0) this path was unrecognizable. -> (E6000- 130011-01-01-35)</pre> </div> |

- Modification effect
New messages are reported by the Machine Administration.

■ 3.0.3 modifications

- Modification outline

The target component that is being removed and a confirmation message are displayed when using "grmpdautoconf -d" to remove components. If redundancy is lost by removing this component, a message to that effect appears.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.2 or earlier | A message is not displayed and redundancy is not checked when removing a component. |
| 3.0.3 | When removing a component, the target component is displayed and a redundancy check is performed. If redundancy is lost after removing the component, a message to that effect appears. |

- Modification effect
When removing a component, a message to confirm the removal of the component appears. A response is required for the confirmation message.

- Modification outline

The path status is changed from Warning to Online Active or Standby by using the "iompadm restart" command when the path is in normal status. If an error occurs, the path status is changed to Offline Fail.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.2 or earlier | The Warning status of a path does not change when the "iompadm restart" command is executed. |
| 3.0.3 | When the path has no problem, the path status changes from Warning to Online Active or Standby when the "iompadm restart" command is executed. If an error occurs, the path status changes to Offline Fail. |

- Modification effect
This change affects the manuals and scripts that were written on the assumption that the path status is not changed from Warning status.

- Modification outline

Changed the period of time for a warning check operation when "CMD_INCOMPLETE/CMD_TIMEOUT/sense4/F9,B/F9,B/C0" occurs.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.2 or earlier | A warning check changes the path status to Online after a minimum of five minutes. A warning check changes the path status to Offline after a minimum of 15 minutes. |
| 3.0.3 | A warning check changes the path status to Online after a minimum of 15 minutes. A warning check changes the path status to Offline after a minimum of five minutes. If an error occurs within two hours, the path status changes to Offline Fail. In this case, the warning check changes the path status to Online after 60 minutes. |

- Modification effect
The period of time of a warning check is changed.

- Modification outline

The path status is not changed from Warning to Forcible Fail even when the path stays in Warning status for more than 60 minutes.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|--|
| 3.0.2 or earlier | The path status changes to Forcible Fail when the path stays in Warning status for 60 minutes. |
| 3.0.3 | The path status does not change to Forcible Fail when the path stays in Warning status for more than 60 minutes. |

- Modification effect
No effect.

- Modification outline

Issuing I/O to a path in Offline Fail status is attempted when an I/O issue path is lost.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---|
| 3.0.2 or earlier | I/O is not issued to a path in Offline Fail status. |
| 3.0.3 | Issues I/O to a path in Offline Fail status. |

- Modification effect
I/O responds normally when a path has no problem but the path status is Offline Fail.

- Modification outline

Integrated installers are no longer supported.

- Modification target
Multipath Driver
- Modification details

| Version | Modification details |
|------------------|---------------------------------------|
| 3.0.2 or earlier | Integrated installers are supported. |
| 3.0.3 | No support for integrated installers. |

- Modification effect
Integrated installers cannot be used.

- 3.0.4 modifications

None.

- 3.1.0 modifications

No effect for the 3.0 type driver.

Updates

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

| Version | Modifications |
|---------------------------|--|
| 3.0.0 (June 2008) | The first version. |
| 3.0.1 (September 2009) | <ul style="list-style-type: none"> • The following storage systems are supported: <ul style="list-style-type: none"> - ETERNUS DX60 - ETERNUS DX80 - ETERNUS DX90 • The following HBA driver is supported: <ul style="list-style-type: none"> - LPFC 6.30g |
| 3.0.2 (November 2009) | <ul style="list-style-type: none"> • The following storage systems are supported: <ul style="list-style-type: none"> - ETERNUS DX400 series - ETERNUS DX8000 series |
| 3.0.3 (April 2011) | <ul style="list-style-type: none"> • The following storage systems are supported: <ul style="list-style-type: none"> - ETERNUS DX80 S2 - ETERNUS DX90 S2 - ETERNUS DX400 S2 series |
| 3.0.4 (June 2013) | <ul style="list-style-type: none"> • The following storage systems are supported: <ul style="list-style-type: none"> - ETERNUS DX60 S2 - ETERNUS DX8000 S2 series |
| 3.1.0 (April 2014) | (Modifications for the 3.0 type driver) <ul style="list-style-type: none"> • The following storage systems are supported: <ul style="list-style-type: none"> - ETERNUS DX100 S3 - ETERNUS DX200 S3 - ETERNUS DX500 S3 - ETERNUS DX600 S3 |

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Chapter 1

What is the Multipath Driver?

This chapter explains the features, supported configurations, and functions of the Multipath Driver.

The ETERNUS Multipath Driver is a software package that resides on a server running the Solaris OS, where the server is used in conjunction with a storage system to allow multipath connections between server Host Bus Adapters (HBAs) and storage system Channel Adapters (CAs). The Multipath Driver enables automatic path failover, path recovery and, for some storage-system models, load balancing among redundant Active and Standby paths to greatly enhance storage availability and performance.

1.1 Features

The Multipath Driver software provides a command-line interface for managing the multipath configuration for a connected storage system device. Features include commands that:

- Display path status
- Perform concurrent upgrades
- Create or change multipath configurations
- Change the driver configuration

The command-line interface displays command responses to most executed operations, and the Multipath Driver generates messages for any error or status conditions that occur. See ["Appendix A Multipath Control Commands" \(page 93\)](#) for multipath control commands and ["Appendix C Error Messages" \(page 117\)](#) for error messages.

Features designed into the storage system prevent data loss and down time due to a disk failure. However, a storage system device cannot by itself prevent down time if a path failure (HBA, cable, CA, etc.) occurs. The Multipath Driver creates a redundant multipath configuration that automatically switches a failed path over to a Standby path, thus allowing continuous operation for a path failure.

1.2 Supported Configurations

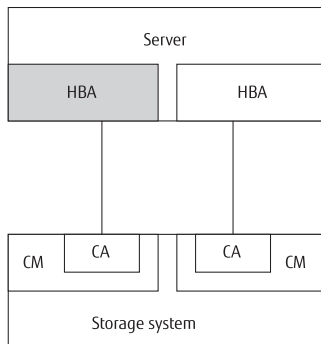
A multipath configuration logically combines multiple independent HBA-CA connections. Such a configuration provides greater system control, improves storage availability, and facilitates load balancing to optimize performance.

The following figures illustrate how independent HBA-CA connections can be logically combined into a multipath configuration with the Multipath Driver software.

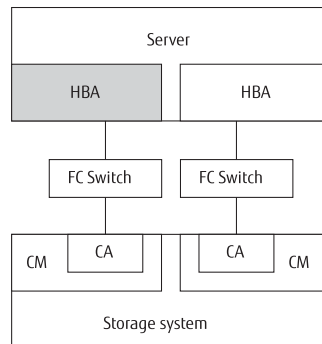
Caution

In a multipath configuration, all HBAs must be of the same type and from the same vendor. Each HBA must have access to LUN0 of the attached storage system device. Hubs cannot be used.

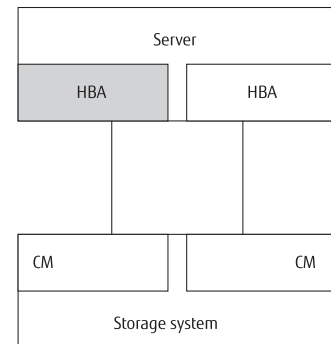
Example: Storage system direct connection
HBAs are connected to CAs in different CMs



Example: Storage system FC switch connection
HBAs are connected to CAs in different CMs via FC switches



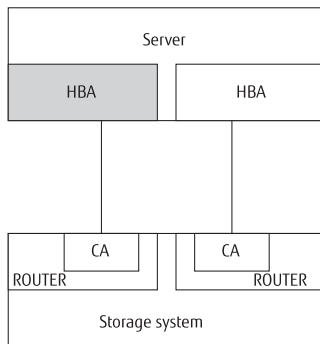
Example: Storage system SAS connection
HBAs are connected to different CMs



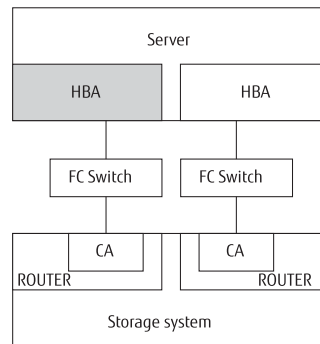
Caution

A multipath configuration may not be created when all of the paths to the storage system device only connect to the CAs of a single CM.

Example: Storage system direct connection
HBAs are connected to CAs in different routers



Example: Storage system FC switch connection
HBAs are connected to CAs in different routers
via FC switches



Caution

A multipath configuration may not be created when all of the paths to the storage system device only connect to the CAs of a single ROUTER.

Further ETERNUS and GR series support information is available at the following website:
<http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/>

1.3 Functions

The Multipath Driver software performs the following functions.

1.3.1 Failover

If a currently used path fails, the Multipath Driver automatically switches over to another configured path to access the storage system, thus allowing the host application to continue normal operation. For details, refer to ["1.5 Load Balancing/Failover" \(page 29\)](#).

1.3.2 Load Balancing

Load balancing (load distribution) acts on all available paths, improving accessibility. This function may be restricted depending on the type of storage system. For details, refer to ["1.5 Load Balancing/Failover" \(page 29\)](#).

1.3.3 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 a path on Standby, it is disconnected from the system and a status message is output to the console.

The Multipath Driver 2.0 and later include a function to exclude unstable paths that repeatedly cycle between the normal status and failed status.

1.3.4 Auto Path Recovery

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

The Multipath Driver 2.0 and later include a function to exclude unstable paths that repeatedly cycle between the normal status and failed status.

1.3.5 Path Disconnection

A specified path can be disconnected by placing it Offline. This allows any necessary maintenance work to be performed, after which the path can be reconnected by the Auto Path Recovery function or by using the "iopadm restart" command to recover the path.

1.3.6 Auto Multipath Configuration

After the Multipath Driver is installed and the server is connected to a storage system, a multipath configuration can be set up that automatically performs path failover and, for some storage-system models, load balancing. This function eliminates the need to perform any such settings.

1.3.7 Solaris Standard Disk Access Special File Support

The Multipath Driver 2.0 and later supports the use of the multipath function by accessing from a Solaris standard disk access special file `"/dev/[r]dsk/c*t*d*s*"`, which improves compatibility with Solaris commands (e.g. `format`). Dynamic Reconfiguration cannot be used with Solaris standard disk access special files.

An access special file used for GR Multipath Driver 1.0 `"/dev/FJSMplb/[r]dsk/mplb*s*"` is also available. Select one of these special files when configuring multipath for the first time. The former is described as Solaris standard special file, and the latter as `mplb` special file.

For a server on which the Dynamic Reconfiguration function is installed, the `mplb` special file is selected automatically.

When using with Fujitsu PRIMECLUSTER and PRIMECLUSTER GDS, or with SynfinityCluster, select the `mplb` special file.

1.4 Path Management

This section describes path status and path transitions managed by the Multipath Driver software.

1.4.1 Path Status

Paths are managed according to their path condition or status. There are two primary path statuses: Online and Offline. The Online status includes the sub-statuses Active, Standby, and Warning. The Offline status includes the sub-statuses Fail, Forcible Fail and Stop.

Path status can be checked using the "iompadm" command. Refer to ["A.1 Displaying Multipath Status" \(page 95\)](#) for procedure to execute commands.

Table 1.1 Path Status

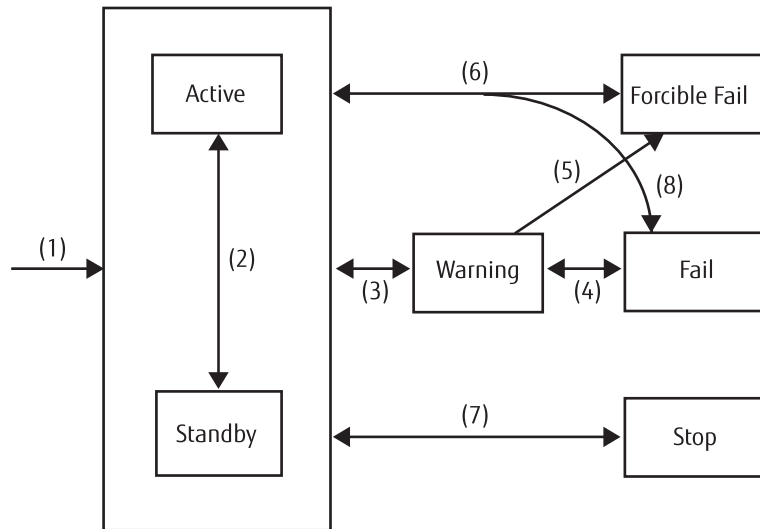
| Path Status | Path Sub-status | Description |
|-------------|-----------------|---|
| Online | Active | <p>This path is being used for I/O access and no I/O errors have been detected. When there are two or more Active paths, load balancing is performed between the Active paths.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c6t16d0s2 online active block "good status with active [E30004641- 130011-CM00-CA00-PORT30] (mplbt716) "</pre> |
| | Standby | <p>This path is in a status of readiness. It is not being used for I/O access. If the corresponding Active path fails, failover occurs and the Standby path becomes Active.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c5t16d0s2 online standby block "good status with standby [E30004641- 130011-CM01-CA01-PORT34] (mplbt42) "</pre> |
| | Warning | <p>This path has at least one but fewer than the threshold of recently detected I/O errors, and Auto Path Check is currently monitoring the situation. Warning paths are checked at one-minute intervals. If I/O errors stop, this path eventually returns to its previous Active or Standby status. If I/O errors exceed the threshold, the path status changes to Fail. When there is an Active path or Standby path available, the Warning path is not used for access. If there is no Active path or Standby path, the Warning path is used for access.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c6t16d0s2 online active block "warning, last event: [E30004641- 130011-CM00-CA00-PORT30] (mplbt716) "</pre> |

| Path Status | Path Sub-status | Description |
|-------------|-----------------|---|
| Offline | Fail | <p>This path is inactive and unavailable for failover. The number of I/O errors has exceeded the threshold, causing the path to be disabled automatically. Fail paths are checked at ten-minute intervals, in anticipation of the failed part having been replaced.</p> <p>If the check shows no problem, the path status changes back to Warning. After performing any necessary maintenance, you can allow the Auto Path Recovery function or use the "iompadm restart" command to recover the path.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c6t16d0s2 offline fail block "fail status by hardware trouble [E30004641- 130011-CM00-CA00-PORT30] (mplbt716)"</pre> |
| | Forcible Fail | <p>When the check result is unstable, repeatedly switching between the normal status and failed status, it is judged that appropriate checks cannot be performed and the path is excluded as a target. Forcible Fail paths are not checked. Either the "iompadm restart" command or a server restart must be used to return a Forcible Fail path to Active/Standby status.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c6t16d0s2 offline fail block " forcible fail status [E30004641- 130011-CM00-CA00-PORT30] (mplbt716)"</pre> |
| | Stop | <p>This path is inactive and unavailable for failover. The path has been disabled manually by using the "iompadm change" command. You can use the "iompadm restart" command to reactivate the path. Stop path is not checked. Normally, Stop path is not used for access. However, when no Active path or Standby path is available, the Stop path is returned to the Active status so that it may be accessed.</p> <p>[Example]</p> <pre style="border: 1px solid black; padding: 5px;">/dev/rdisk/c6t16d0s2 offline stop block "stop status by software indication [E30004641- 130011-CM00-CA00-PORT30] (mplbt716)"</pre> |

1.4.2 Changes in Path Conditions

Changes in path conditions, or status transitions, are shown in the following figure and described below.

Figure 1.1 Path Status Transitions



(1) Startup → Online (Active or 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 automatically set to Standby.

(2) Online (Active) ↔ Online (Standby)

When an error in a path is detected during an I/O operation, or the path status changes to Stop, the Standby path automatically becomes the Active path. When the original path is recovered and becomes the Active path again, the previously activated Standby path returns to Standby.

(3) Online (Active or Standby) ↔ Online (Warning)

When an I/O error occurs on either an Active or Standby path, the path status changes to Warning. If I/O errors stop, this path eventually returns to Active or Standby status. If the path is used by the multipath control commands again, this path eventually returns to Active or Standby.

(4) Online (Warning) ↔ Offline (Fail)

When I/O errors exceed the threshold, the path's Warning status changes to a Fail status. If the check result is normal during Fail status, the path status changes to Warning.

(5) Online (Warning) → Offline (Forcible Fail)

If the path frequently changes between Active/Standby status and Warning status, it is judged that accurate checks cannot be performed. The path is set to a Forcible Fail status and the path is no longer checked.

(6) Offline (Forcible Fail) ↔ Online (Active or Standby)

When a path is restored by issuing the "iompadm restart" command, the path status changes back to Online.

If the path frequently changes between Active/Standby status and Warning status, it is judged that accurate checks cannot be performed. The path is set to a Forcible Fail status and the path is no longer checked.

(7) Online (Active or Standby) ↔ Offline (Stop)

When a path is taken Offline by issuing the "iompadm change" command, the path status changes to Stop.

When a path is activated with the "iompadm restart" command, the path status changes to Online.

When changing the status to Active/Standby, the path connected to the assigned CM is set to Active and the path connected to the non-assigned CM is set to Standby, switching to Active when there is no Active path connected to the assigned CM.

(8) Online (Active or Standby) ↔ Offline (Fail)

When a serious failure occurs during either normal I/O or Active/Standby checking, the path status changes to Offline.

When a path is restored by issuing the "iompadm restart" command, the path status changes back to Online.

1.4.3 Checks and Status Transitions

The following checks are performed.

| Path status | Interval | Path status after check | Transition conditions |
|----------------|------------|-------------------------|--|
| Active/standby | 10 minutes | Active/standby | Check result is normal. |
| | | Warning | Check result is abnormal. 0<error counter<200 |
| | | Fail | Check result is abnormal. Error counter ==200 (==600 for some errors) |
| Warning | 1 minute | Active/standby | Checked normal. Error counter ==0 |
| | | Warning | Check result is abnormal. 0<error counter<200 (<600 for some errors) |
| | | Fail | Check result is fail. Error counter ==200 (==600 for some errors) |
| Fail | 10 minutes | Warning | Check result is normal. Error counter ==100 (==600 for some errors) |
| | | Fail | Check result is abnormal. Error counter ==200 (==600 for some errors) |

In the Warning status, the status transition is determined by the error counter.

■ Check Active/Standby

Regular checks are performed at 10-minute intervals during the Active/Standby status. If a failure is detected, the status changes to Warning or Fail. The error counter is determined depending on the cause of failure. For major problem, a single failure may result in the Fail status. When a failure is detected during normal I/O process, the same transition is performed. When the status transitions to Fail, a message indicating that the status has changed appears. For details of this message, refer to ["C.2 Path Control Error Messages" \(page 123\)](#).

■ Check Warning

Regular checks are performed at 1-minute intervals during the Warning status. If a failure is detected, 10 is added to the error counter. If it is normal, 10 is deducted. When the updated error counter becomes 0, the path status changes to Active/Standby. When it becomes 200, the path status changes to Fail. If a serious error occurs, the path status changes to Fail at the first error. When the status transitions to Fail, a message indicating that the status has changed appears. For details of this message, refer to ["C.2 Path Control Error Messages" \(page 123\)](#). Note that no message appears when the status transitions to Active/Standby.

■ Check Fail

Regular checks are performed at 10-minute intervals during the Fail status. If a failure is detected, the status does not change. If the path is normal, the error counter is set to 100 (600 for some errors), the path status changes to Warning, and a message indicating that the path has recovered appears. For details of this message, refer to ["C.2 Path Control Error Messages" \(page 123\)](#).

● Example 1

Operations when an error is detected during normal I/O process of an Active path, and the error continues to occur.

| Time | Path 1 status | Path 2 status | Operations |
|------------|---------------|---------------|--|
| - | Active | Standby | - |
| 0 | Warning (50) | Active | Path 1 error during normal I/O process. Path 1 changes to Warning status, and the error counter is set by the cause of the error. (Taking the minimum value of 50 in this example.) I/O process is retried on activated Path 2. |
| 1 minute | Warning (60) | Active | Check detects an error. 10 is added to the error counter. |
| : | : | : | : |
| 10 minutes | Warning (150) | Active | Check detects an error. 10 more added. |
| : | : | : | : |
| 14 minutes | Warning (190) | Active | Check detects an error. 10 more added. |
| 15 minutes | Fail | Active | Check detects an error. 10 more added. Error counter value reaches 200 so the path status changes to Fail. Path degraded message is sent to the console. |

● Example 2

Auto recovery operations after the Fail path is replaced by maintenance.

| Time | Path 1 status | Path 2 status | Operations |
|----------------|---------------|---------------|--|
| - | Fail | Active | Replacement completed. |
| 0 - 10 minutes | Warning (100) | Active | Normal 10-minute interval check is performed some time within 10 minutes of the maintenance. Since the check result is normal after successful maintenance, the path status becomes Warning and the error counter is set to 100. |
| +1 minute | Warning (90) | Active | Check finds normal. 10 is deducted from the error counter. |
| : | : | : | : |
| +5 minutes | Warning (50) | Active | Check finds normal. 10 more deducted. |
| : | : | : | : |
| +9 minutes | Warning (10) | Active | Check finds normal. 10 more deducted. |
| +10 minutes | Active | Standby | Check finds normal. 10 more deducted. Error counter value reaches 0 so that path status changes to Active. Path 2 changes to Standby. |

■ Forcible Fail transition

In the following cases, it is judged that accurate checks cannot be performed, so the path is changed to the Forcible Fail status and no longer checked. A status message "forcible path degrade" is output to the console.

- In the hour since the last transition from Active/Standby to Warning status, the same transition occurred 10 times.

1.5 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 (a storage system with path preference). The second is a storage system whose access paths are not assigned to a particular CM (a storage system with no path preference).

Path preference can be understood as the following behavior. Storage systems allow access to a LUN through multiple paths. Some storage systems, however, offer higher performance when accessed from a path through the CM to which the target LUN is assigned, while access through the non-assigned CM has degraded performance. The Multipath Driver recognizes storage systems that exhibit path preference, and insures that access is made through the preferred path for higher performance.

In a storage system with path preference, paths that belong to the assigned CM are Active and other paths connected to a non-assigned CM are on Standby. In a storage system with no path preference, all paths are Active and used to access data. All paths offer equal performance.

Load balancing and failover control operations vary according to storage-system characteristics: its number of paths and whether it employs path preference.

Further information about Multipath Driver support for storage systems with path preferences and storage systems without path preferences is available at the following website:

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

1.5.1 Load Balancing

The Multipath Driver uses all Active paths to perform load distribution (load balance control) to improve accessibility.

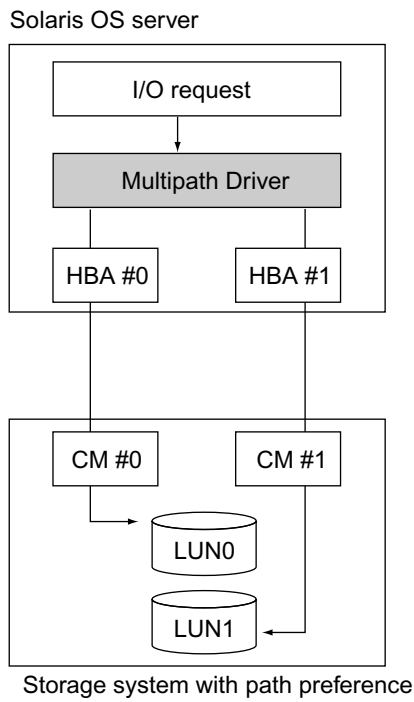
Note

The figures in this section are simplified diagrams of the load-balancing concept that do not depict actual connections.

■ Storage system with path preference (two path connections)

For a storage system with a two-path configuration, one path is connected to each controller module. 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 Two-Path Load Balancing on a Storage System With Path Preference



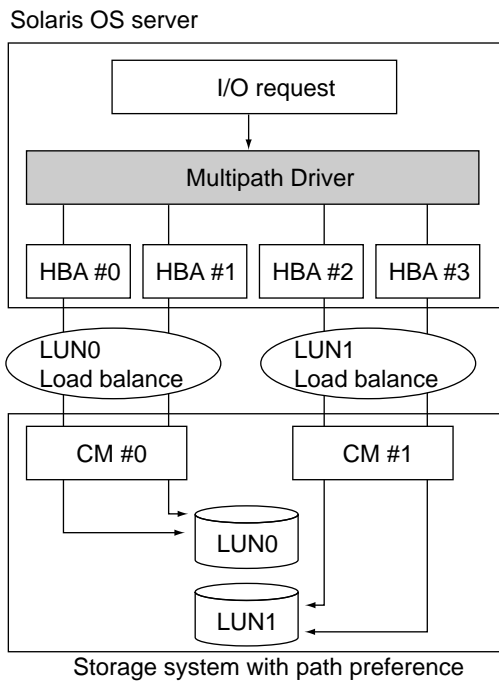
■ Storage system with path preference (four or more path connections)

For a storage system with a four-path configuration, two paths are connected to each CM, for a total of four paths. The two paths connected to the assigned CM are Active and load-balancing control is executed on these two paths.

Caution

The load balancing function is optimized for use on a storage system with no path preference.

Figure 1.3 Four-Path Load Balancing on a Storage System With Path Preference

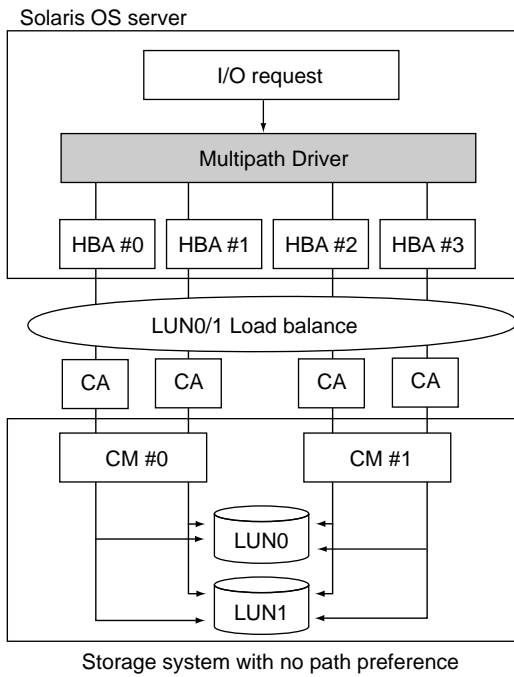


■ Storage system with no path preference

For a storage system that has no path preference, there is no concept of a Standby path. All connected paths are Active and load balancing is performed over all paths.

The maximum number of paths that the Multipath Driver can control is eight.

Figure 1.4 Multipath Load Balancing on a Storage System With No Path Preference



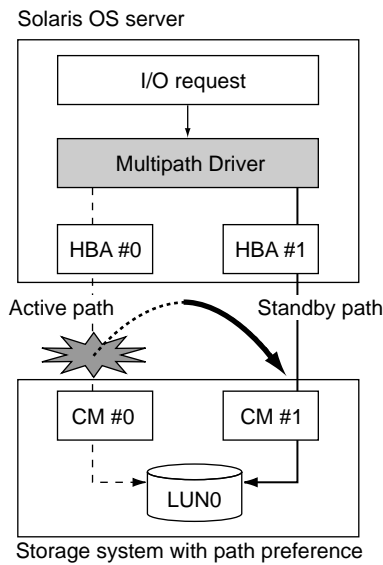
1.5.2 Failover

When the Multipath Driver detects that an Active path has failed, it switches to another configured path and executes the I/O request. This can prevent the host application from shutting down unnecessarily.

■ Storage system with path preference (two path connections)

When an Active path becomes unavailable, the Standby path is activated to continue processing.

Figure 1.5 Two-Path Failover on a Storage System With Path Preference

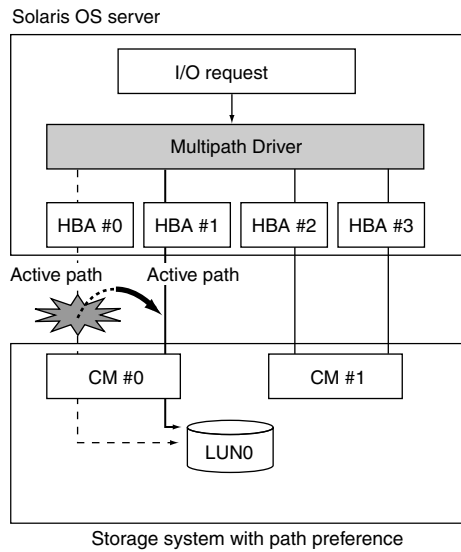


■ Storage system with path preference (four or more path connections)

● Example 1

Even if multiple path failures occur, I/O processing can continue as long as there remains at least one Active path. Switching to the Standby path is not performed because the CM still has one Active path available.

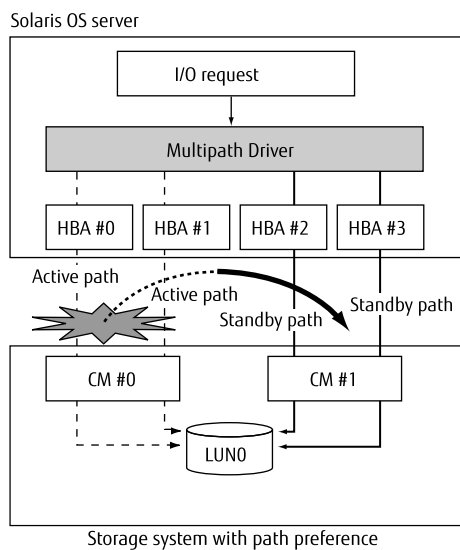
Figure 1.6 Four-Path Failover, Active to Active



● Example 2

If all Active paths have failed, a Standby path automatically replaces a failed path to allow uninterrupted I/O processing to continue. When there are two or more Standby paths, load balancing is also performed.

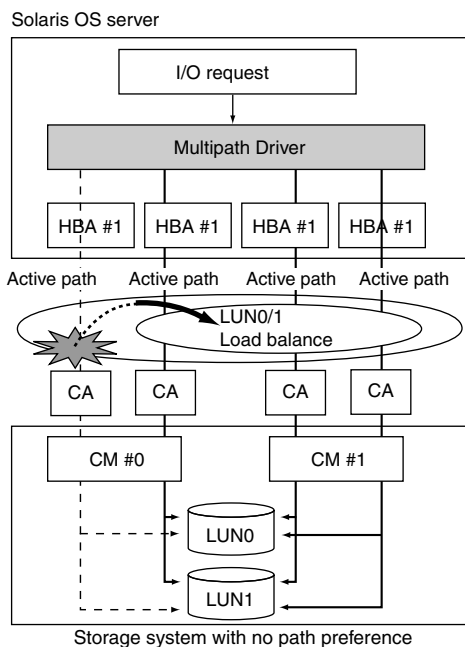
Figure 1.7 Four-Path Failover, Active to Standby



■ Storage system with no path preference

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

Figure 1.8 Multipath Failover, a Storage System With No Path Preference



1.6 Special File Name Comparison

The Solaris standard special file and the mplb special file support different functions and environments.

| Available functions and environments | Solaris standard special file | mplb special file |
|---|--|--|
| Access path name | /dev/dsk/c*t0d*s* /dev/rdisk/c*t0d*s* | /dev/FJSMplb/dsk/mplb*s* /dev/FJSMplb/rdisk/mplb*s* |
| Path specification for format command | Not required | Required format /dev/FJSMplb/rdisk/mplb*s2 |
| PRIMECLUSTER / SynfinityCluster | Not available | Available |
| Dynamic Reconfiguration function | Not available | Available |
| SAN boot | Not available | Available |
| Solaris container: Access method from non-global zone | add fs add device | add fs add device Refer to "D.8 Performing "add device" for mplb Special Files in Non-Global Zones" (page 155) . |
| EFI label | Available | Available "s7" becomes the special file indicating all the disks. |
| Support for 1TB or more LUN | Available | Available |

Caution

- Select either the Solaris standard special file or the mplb special file when configuring multipath for the first time (when executing the "grmpdautoconf" command). Refer to ["Chapter 2 Multipath Driver Settings" \(page 37\)](#) for details.
- When a server supports the Dynamic Reconfiguration function, the mplb special file is automatically selected. If the Dynamic Reconfiguration function is not intended to be used, the Solaris standard special file can be used by executing the "grmpdautoconf" command with the "-p" option. When using the Dynamic Reconfiguration function while using the Solaris standard special file, the multipath configuration must be released. Using the Solaris standard special file in a Dynamic Reconfiguration environment should only be decided after careful consideration of all the pertinent factors.
- A Solaris standard special file and a mplb special file cannot be used together. In addition, the access special file cannot be changed after configuring multipath. When changing the access special file, all of the multipath configurations must be released.
- When using the Solaris standard special file, the controller number (c*) in the special file name is automatically assigned. In addition, "0" is assigned for the target number (t*). These numbers cannot be changed.
- When a mplb special file is used and the label is changed from EFI to VTOC or from VTOC to EFI, perform reconfigure reboot after changing the label.

Chapter 2

Multipath Driver Settings

This chapter provides instructions for interactively configuring the server to use the Multipath Driver. The interactive configuration process entails the use of the Multipath Driver installation script.

Although the details differ slightly, the same general process applies to servers with Fujitsu HBAs (Fibre Channel cards or SAS cards) installed and to those with non-Fujitsu HBAs (Emulex Fibre Channel cards) installed.

Note

Before using the instructions in this chapter, you must first install the Multipath Driver. Refer to the software information for the FUJITSU Storage ETERNUS Multipath Driver 3.0.

2.1 Introduction

The interactive configuration process makes use of the Multipath Driver installation script to automatically create the optimum multipath connections for a server environment with a connected storage system device. This process does not allow alternative environment settings for the various drivers while the installation script is operational. The workflow is as follows.

Workflow

1

The following inquiry appears when installation is completed.

```
*** Installation of MPD was successful. ***
Do you want to make a multipath configuration now ? [y,n,?,q]
```

When Fujitsu HBAs are used

When non-Fujitsu Fibre Channel cards are used

2

Input "y" in response to the inquiry.

Input "y" in response to the inquiry.

Input "n" in response to the inquiry.

3

Set up the Fujitsu HBA driver.
Edit the Fujitsu HBA driver configuration file.
For Fibre Channel, this is "fjpfca.conf" .
For SAS, it is "fjjsa.conf".

1. Check the connected storage system
2. Set up the storage system and Fibre Channel switch
3. Select the access paths
4. Define the HBA driver configuration



- ["2.2.1 Fujitsu HBA Driver Settings" \(page 45\)](#)

Configured the Fibre Channel settings.

Execute the "grmpdauto-conf" command.

4

Set up the multipath driver.

Create a multipath driver configuration file and multipath management special file.

1. Define the multipath driver configuration
2. Check and write the disk labels
3. Respond to the cluster system inquiry
4. Select the access special file



- ["2.3 Server Environment Validation" \(page 56\)](#)



5

Define the disks.

Perform the following for each logical unit required.

1. Adjust the partition configuration
2. Create a file system
3. Adjust the "/etc/vfstab" settings



- ["2.4 Disk Settings \(Partitioning and File System\)" \(page 64\)](#)

2.1.1 Fujitsu Fibre Channel HBAs

For servers with Fujitsu Fibre Channel HBAs installed, the Multipath Driver setup procedure is as follows:

- Use the interactive configuration process to activate the Fibre Channel card driver (fjpfca driver) (["2.2.1 Fujitsu HBA Driver Settings" \(page 45\)](#))
- Use the interactive configuration process to activate the Fujitsu multipath driver (mplb driver) (["2.3 Server Environment Validation" \(page 56\)](#))

Also, for Fujitsu HBAs, please note the following:

- If the storage system is not connected to the server via a Fibre Channel switch, set the storage system's loop ID to 0x10 or greater in hexadecimal (16 or greater in decimal). Numbers used in sd.conf cannot be used as the loop ID.
- While the Solaris OS is able to issue an unlimited number of I/O requests, sometimes a Simultaneous I/O Limit setting helps to maximize system performance. When using a Fibre Channel card, this and other environment settings are automatically made if you use the process described in ["2.2 HBA Driver Settings" \(page 44\)](#).
- If a Fibre Channel switch is used, the "grmpdautoconf" command automatically assigns a target ID (16 or greater). Numbers used in sd.conf will not be assigned.
- The Fiber Channel driver can be setup through methods other than the "grmpdautoconf" command. If the storage system is connected via a Fibre Channel switch, set the target ID to 16 or greater. Numbers used in sd.conf cannot be used as the target ID. Use lower case letters to describe the setting. Upper case letters may cause "grmpdautoconf" command failures.
- A path routed through multiple Fibre Channel switches cannot be selected this way as an access path. To select such a path, type "n" at the following prompt and then run the "grmpdautoconf" command with the "-X" option.
- When specifying the Solaris standard special file as an access special file for a server on which the Dynamic Reconfiguration function is installed, after installation of the Multipath Driver modules (or packages) type "n" in response to the following prompt, and then run the "grmpdautoconf" command with the "-p" option. When the -p option is specified, the Dynamic Reconfiguration function cannot be used.
- A multipath configuration may not be created when all of the paths to the storage system device only connect to the CAs of a single CM.

```
*** Installation of MPD was successful. ***  
  
Do you want to make a multipath configuration now ? [y,n,?,q]
```


2.1.2 Non-Fujitsu HBAs

For servers with non-Fujitsu HBAs (Emulex Fibre Channel cards) installed, the Multipath Driver setup procedure is as follows:

- Manually (or otherwise) activate the Fibre Channel card driver for the non-Fujitsu HBAs being used (["2.2.2 Non-Fujitsu HBA Driver Settings" \(page 52\)](#))
- Use the interactive configuration process to activate the Fujitsu multipath driver (mplb driver) (["2.3 Server Environment Validation" \(page 56\)](#))

Also, for non-Fujitsu HBAs, please note the following:

- Make sure an appropriate driver for the non-Fujitsu HBA has been properly installed and set up.
- When using a non-Fujitsu HBA to connect to the storage system device, set the target ID as follows:
- Make sure the target IDs of the storage system and other connected SCSI devices are unique.
- For Fibre Channel interfaces, set the target ID of the storage system device to 0x10 or greater in hexadecimal (16 or greater in decimal).
- Disable the Automap function, and use the target binding function instead.
- If the server's Fibre Channel card is not connected via a Fibre Channel switch, make sure to set the storage system's loop ID to 16 or greater.
- While the Solaris OS is able to issue an unlimited number of I/O requests, sometimes a Simultaneous I/O Limit setting helps to maximize system performance. When using non-Fujitsu HBAs, follow the instructions of the respective HBA driver manual to perform this setting. Refer to the Storage System Manager for the appropriate setting values.
- When specifying the Solaris standard special file as an access special file for a server on which the Dynamic Reconfiguration function is installed, after installation of the Multipath Driver modules (or packages) type "n" in response to the following prompt, and then run the "grmpdautoconf" command with the "-p" option. When the -p option is specified, the Dynamic Reconfiguration function cannot be used.
- A multipath configuration may not be created when all of the paths to the storage system device only connect to the CAs of a single CM.

```
*** Installation of MPD was successful. ***  
  
Do you want to make a multipath configuration now ? [y,n,?,q]
```

2.1.3 Fujitsu SAS Cards

For servers with Fujitsu SAS cards installed, the Multipath Driver setup procedure is as follows:

- Use the interactive configuration process to activate the Fibre Channel card driver (fjpfca driver) ("[2.2.1 Fujitsu HBA Driver Settings](#)" (page 45))
- Use the interactive configuration process to activate the Fujitsu multipath driver (mplb driver) ("[2.3 Server Environment Validation](#)" (page 56))

Also, for Fujitsu SAS cards, please note the following:

- Target IDs are assigned automatically. The target IDs that are assigned cannot be changed.
- When specifying the Solaris standard special file as an access special file for a server on which the Dynamic Reconfiguration function is installed, after installation of the Multipath Driver modules (or packages) type "n" in response to the following prompt, and then run the "grmpdautoconf" command with the "-p" option. When the -p option is specified, the Dynamic Reconfiguration function cannot be used.
- A multipath configuration may not be created when all of the paths to the storage system device only connect to the CAs of a single CM.

```
*** Installation of MPD was successful. ***  
  
Do you want to make a multipath configuration now ? [y,n,?,q]
```

2.1.4 About the Interactive Configuration Process

After completing the installation of Multipath Driver modules (or packages), the installation script presents the following prompt:

```
*** Installation of MPD was successful. ***  
  
Do you want to make a multipath configuration now ? [y,n,?,q]
```

Fujitsu HBAs: If the server on which the Multipath Driver is being installed uses Fujitsu HBAs (Fibre Channel cards), the "y" response should be chosen to start the interactive configuration part of the installation script. If the Solaris standard special file is specified as an access special file for a server on which the Dynamic Reconfiguration function is installed, the "n" response should be chosen.

Non-Fujitsu HBAs: If the server on which the Multipath Driver is being installed uses non-Fujitsu HBAs (Emulex Fibre Channel cards), the "n" or "q" response should be chosen to terminate the installation script. This is to allow the HBA driver to be setup before continuing with the interactive configuration process. If the Solaris standard special file is specified as an access special file for a server on which the Dynamic Reconfiguration function is installed, the "n" response should be chosen.

Fujitsu SAS cards: If the server on which the Multipath Driver is being installed uses Fujitsu SAS cards, the "y" response should be chosen to start the interactive configuration part of the installation script. If the Solaris standard special file is specified as an access special file for the server has the Dynamic Reconfiguration function installed, the "n" response should be chosen.

2.1.5 Starting the Interactive Configuration Process

The interactive multipath configuration process may be started with the "grmpdautoconf" command:

```
# /usr/sbin/grmpdautoconf
```

2.1.6 Halting the Interactive Configuration Process

If a problem occurs during the interactive configuration process, it may be halted by pressing the "q" key. Interrupting the interactive script prior to reaching a proper exit point will result in the following dialog:

```
ETERNUS multipath configuration is not completed !!  
If you exit grmpdautoconf, the multipath configuration is not saved.  
  
Do you want to exit grmpdautoconf?  
  Yes ---> hit 'y' key  
  No  ---> hit 'n' key  
Please input  [y,n] y  <--- Enter
```

Yes: Terminates the installation. Settings created by the interactive configuration process are lost.

No: Cancels the interrupt, allowing the interactive configuration process to resume.

If the interactive configuration process fails, analyze the interactive error messages or the fjpca driver and multipath driver error messages shown on the console, and check the storage system devices, switches, and cables again, then start the interactive configuration process again.

2.2 HBA Driver Settings

Use the instructions in this section to activate the HBA driver settings.

Note

- Before changing any server settings, make sure that the settings of the connected storage system device are correct and that its power is on.
- Before proceeding with the multipath driver environment setup, check that `sd.conf` (the `sd` driver configuration file) contains no definition lines in the following format for the logical units (LU) that are to be managed by the Multipath Driver. If any such lines are found, they should be deleted and the server restarted, otherwise problems may occur. (*1)

```
name="sd" class="scsi" target=XX lun=X;
```

The desired `sd.conf` LU definition lines are as shown below, and may be automatically generated between the "# Start" and "# End" lines by use of the `grmpdautoconf` command. These lines should not be manually added or edited after generation.

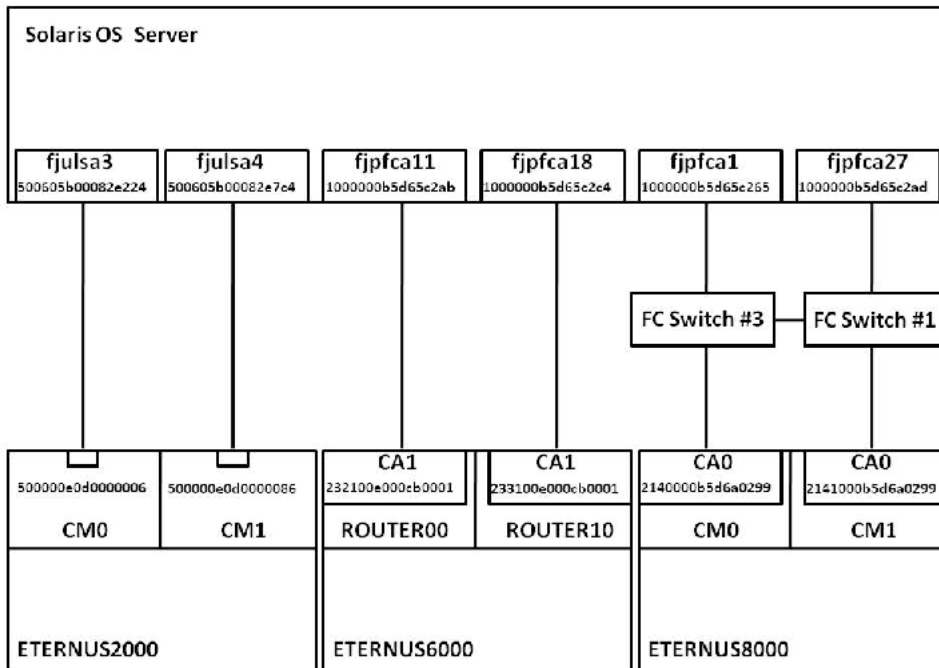
```
# Start eternusmpd configuration -- do NOT alter or delete this line
:
name="sd" parent="mplbh" target=0 lun=X;
:
# End eternusmpd configuration -- do NOT alter or delete this line
```

- *1: If SAN Boot is to be used, the boot disk list in the `sd.conf` file must be edited beforehand. Follow the procedure given in the "SAN Boot Configuration Guide" for each server.

2.2.1 Fujitsu HBA Driver Settings

This section describes the HBA driver settings required for the following configuration example. For non-Fujitsu Fibre Channel cards, skip to ["2.2.2 Non-Fujitsu HBA Driver Settings" \(page 52\)](#).

Figure 2.1 Configuration example of HBA driver settings



(1) Confirm the HBA and storage system devices

The installation script displays a complete list of all Fibre Channel cards and SAS cards mounted on the server, and all storage system devices connected to those cards. Confirm that this list corresponds to the HBA actually mounted and the storage system devices actually connected.

● Example

Select and define access paths for system configuration.
 Search devices ...display device and access paths list after searching.

| switch | WWN | device | slot/port |
|--------|------------------|----------|--------------|
| - | 1000000b5d65c2ab | fjpfca11 | /IOU#0/PCI#4 |
| - | 1000000b5d65c2c4 | fjpfca18 | /IOU#1/PCI#2 |
| - | 232100e000cb0001 | E6000 | RT00CA1P3 |
| - | 233100e000cb0001 | E6000 | RT10CA1P3 |
| - | 500000e0d0000006 | E2000 | CM0P0 |
| - | 500000e0d0000086 | E2000 | CM1P0 |
| - | 500605b00082e224 | fjulsa3 | IOU#1/PCI#1 |
| - | 500605b00082e7c4 | fjulsa4 | /IOU#0/PCI#3 |
| 1 | 1000000b5d65c2ad | fjpfca27 | /IOU#1/PCI#3 |
| 1 | 2141000b5d6a0299 | E8000 | CM1CA0P1 |
| 3 | 1000000b5d65c265 | fjpfca1 | /IOU#0/PCI#2 |
| 3 | 2140000b5d6a0299 | E8000 | CM0CA0P1 |

* E8000:ETERNUS8000, ETERNUS4000 (excluding ETERNUS4000 models 80 and 100)

| instance | Adapter WWN | Switch | ETERNUS(GR) | | Status |
|----------|---------------------------|--------|------------------|-----------------|--------|
| | | | WWN | product | |
| [] 1 | fjpfca1 1000000b5d65c265 | 3-1 | 2141000b5d6a0299 | E8000 CM1CA0P1 | New |
| | fjpfca1 1000000b5d65c265 | 3 | 2140000b5d6a0299 | E8000 CM0CA0P1 | New |
| | fjpfca27 1000000b5d65c2ad | 1-3 | 2140000b5d6a0299 | E8000 CM0CA0P1 | New |
| [] 2 | fjpfca27 1000000b5d65c2ad | 1 | 2141000b5d6a0299 | E8000 CM1CA0P1 | New |
| | fjpfca11 1000000b5d65c2ab | - | 232100e000cb0001 | E6000 RT00CA1P3 | AL |
| | fjpfca18 1000000b5d65c2c4 | - | 233100e000cb0001 | E6000 RT10CA1P3 | AL |
| | fjulsa3 500605b00082e224 | - | 500000e0d0000006 | E2000 CM0P0 | AL |
| | fjulsa4 500605b00082e7c4 | - | 500000e0d0000086 | E2000 CM1P0 | AL |

The first part of the above output presents the following columns of data:

- switch:** The number (domain ID) of the fabric switch connected to the device. A dash (-) indicates an AL connection.
- WWN:** The device's WWN (World Wide Name).
- device:** The model name of the storage system device, or the instance name of the HBA.
- slot/port:** PCI slot name of the server (Fujitsu Server only) and port name of storage system device

The second part of the above output presents the following columns of data:

- Adapter:** HBA's instance name and WWN.
- Switch:** The domain ID of the Fibre Channel switch connected to the Fibre Channel card and the storage system device. A hyphenated pair of domain IDs shows that the Fibre Channel card and the storage system device are connected to different switches. For example, a "1-2" switch number indicates the Fibre Channel card is connected to the Fibre Channel switch with domain ID "1" and the storage system device is cascade-connected to the Fibre Channel switch with domain ID "2".
When a SAS card is used, "-" is displayed.
- ETERNUS (GR):** The storage system device's WWN product (model) name and target storage system device. A dash (-) indicates that the target device is a GR710, GR720 or GR730.

| | |
|----------------|--|
| Status: | Displays "New", "Exist", or "AL". |
| New: | Displayed when a new device is added to the Fibre Channel switch. This path is unused because it is not defined in fjpca.conf file. |
| Exist: | Displayed for the following cases: <ul style="list-style-type: none">• A path that used in the multipath driver• A path not used in the multipath driver, but is described in fjpca.conf file and a definition recognized by the fibre channel driver. All paths with "Exist" status are targeted for LUN addition when used in the multipath driver. |
| AL: | For an AL connection. All devices with an AL connection are targeted for LUN addition or multipath configuration. |

(2) Setup the storage system device and Fibre Channel switch

Respond to the inquiry about whether you want to setup the storage system device or Fibre Channel switch.

If these settings have not been made already, you can perform the settings now by pressing the "y" key for Yes.

If the settings are already complete, or the Fibre Channel card and storage system device are not connected, press the "n" key for No & Skip. Then proceed to the next step.

```
Do you want to set a host affinity & set a switch zoning?  
Yes          ---> hit the 'y' key.  
No & skip    ---> hit the 'n' key.  
Quit         ---> hit the 'q' key.  
Please input [y,n,q] n <--- Enter
```

Yes: Sets the storage system device or Fibre Channel switch settings

No & skip: Does not perform the settings and skips to the next step

Quit: Interrupts the interactive configuration process and terminates installation. Interactive settings thus far are lost.

(3) Select the access paths

The interactive configuration process creates access paths to the storage system device. You must choose either "manual selection" or "automatic selection".

Note the following to decide which process to use and follow the screen instructions.

- "Automatic selection" sets access to all newly added paths ("New" status).
- All existing paths ("Exist" status) are already targeted for LUN addition.
- All devices with an AL connection are already targeted for LUN addition or multipath configuration.

```
Do you want to select access paths by manual or by automatic?  
  
** If you select automatic selection, all paths which status is "New"  
are set as the object of multipath configuration.  
** All paths which status is "Exist" are always set as the object of  
LUN addition.  
** All devices connected by AL are always the target of LUN addition  
and the target of adding multipaths.  
  
manual selection ---> hit the 'm' key.  
automatic selection ---> hit the 'a' key.  
Quit ---> hit the 'q' key.  
Please input [m,a,q] m <--- Enter
```

Manual selection: Allows you to select access paths manually

Automatic selection: Selects access paths automatically

Quit: Interrupts the interactive configuration process and terminates installation. Interactive settings thus far are lost.

● **Manually Selecting Access Paths**

If you select "manual selection," a list of storage system devices connected to the server is displayed. From this list, select path connection(s) for a multipath configuration.

● **Example**

| Adapter | Switch | ETERNUS (GR) | | Status |
|-----------------|------------------|--------------|-------------------|--------------------|
| instance | WWN | | WWN | product |
| [] 1 f jpfca1 | 1000000b5d65c265 | 3-1 | 2141000b5d6a0299 | E8000 CM1CA0P1 New |
| f jpfca1 | 1000000b5d65c265 | 3 | 2140000b5d6a0299 | E8000 CM0CA0P1 New |
| f jpfca27 | 1000000b5d65c2ad | 1-3 | 2140000b5d6a0299 | E8000 CM0CA0P1 New |
| [] 2 f jpfca27 | 1000000b5d65c2ad | 1 | 2141000b5d6a0299 | E8000 CM1CA0P1 New |
| f jpfca11 | 1000000b5d65c2ab | - | 232100e000cb0001 | E6000 RT00CA1P3 AL |
| f jpfca18 | 1000000b5d65c2c4 | - | 233100e000cb0001 | E6000 RT10CA1P3 AL |
| f jjsa3 | 500605b00082e224 | - | 500000e0d0000006 | E2000 CM0P0 AL |
| f jjsa4 | 500605b00082e7c4 | - | 500000e0d00000086 | E2000 CM1P0 AL |

Adapter: HBA's instance name and WWN.

Switch: The domain ID of the Fibre Channel switch connected to the Fibre Channel card and the storage system device. A hyphenated pair of domain IDs shows that the Fibre Channel card and the storage system device are connected to different switches. For example, a "1-2" switch number indicates the Fibre Channel card is connected to the Fibre Channel switch with domain ID "1" and the storage system device is cascade-connected to the Fibre Channel switch with domain ID "2".

When a SAS card is used, "-" is displayed.

ETERNUS (GR): The storage system device's WWN product (model) name and target storage system device. A dash (-) indicates that the target device is a GR710, GR720 or GR730.

Status: Displays "New", "Exist", or "AL".

New: Displayed when a new device is added to the Fibre Channel switch.

Exist: Displayed for a previously existing device. All paths with "Exist" status are targeted for LUN addition.

AL: For an AL connection. All devices with an AL connection are targeted for LUN addition or multipath configuration.

In response to the following query, enter the access path numbers that you want to include in the multipath configuration. You can set multiple path numbers at the same time.

● Example

```
Select Numbers of "New" device which you want to add multipath.

** Display access paths list once again after your input.
** Selected paths appear as asterisks on the screen.
** In case of inputting incorrect number, input its number again
to possibility of it.
** All devices which status is "Exist" are always the target of
LUN addition.
** All devices connected by AL are always the target of LUN addition
and the target of adding multipaths.

    select  ---> hit Number ( Number Number ...)
    complete ---> hit 'x' key
    quit    ---> hit 'q' key
Please input  [PathNumber,x,q] 1 3    <--- Enter
```

Select: Allows you to enter the numbers of path connections to add to the multipath configuration

Complete: Creates the access paths for the selected connections

Quit: Interrupts the interactive configuration process and terminates installation. Interactive settings thus far are lost.

If a listed device does not show a "New" status, you cannot enter an access path number. In such a case, press the "x" key for Complete. The devices showing "AL" or "Exist" will be processed automatically.

● Example

| Adapter instance | Switch WWN | ETERNUS(GR) | | Status product |
|------------------|---------------------------|-------------|------------------|--------------------|
| | | WWN | WWN | |
| | fjpfca1 1000000b5d65c265 | 3-1 | 2141000b5d6a0299 | E8000 CM1CA0P1 New |
| [*] 1 | fjpfca1 1000000b5d65c265 | 3 | 2140000b5d6a0299 | E8000 CM0CA0P1 New |
| | fjpfca27 1000000b5d65c2ad | 1-3 | 2140000b5d6a0299 | E8000 CM0CA0P1 New |
| [*] 2 | fjpfca27 1000000b5d65c2ad | 1 | 2141000b5d6a0299 | E8000 CM1CA0P1 New |
| | fjpfca11 1000000b5d65c2ab | - | 232100e000cb0001 | E6000 RT00CA1P3 AL |
| | fjpfca18 1000000b5d65c2c4 | - | 233100e000cb0001 | E6000 RT10CA1P3 AL |
| | fjulsa3 500605b00082e224 | - | 500000e0d0000006 | E2000 CM0P0 AL |
| | fjulsa4 500605b00082e7c4 | - | 500000e0d0000086 | E2000 CM1P0 AL |

Check the selected access paths. If an incorrect access path number has been selected, reenter the correct access path number. Or, if you have forgotten to select an access path, enter its access path number now.

Repeat this operation until all desired access paths have been selected.

Check the specified access paths. If there are no errors, press the "x" key for Complete.

● Example

```
Select Numbers of "New" device which you want to add multipaths.  
** Display access paths list once again after your input.  
** Selected paths appear as asterisks on the screen.  
** In case of inputting incorrect number, input its number again  
to possibility of it.  
** All devices which status is "Exist" are always the target of  
LUN addition.  
** All devices connected by AL are always the target of LUN addition  
and the target of adding multipaths.  
  
select    ---> hit Number ( Number Number ...)  
complete ---> hit 'x' key  
quit      ---> hit 'q' key  
Please input  [PathNumber,x,q]  x  <--- Enter
```

● Automatically Selecting Access Paths

If you select "automatic selection," access paths will be created automatically for the storage system device connected to the server.

(4) Setup the HBA drivers

The interactive configuration process automatically creates definition files for the HBA driver and multipath driver, as well as creating access paths. Interactive processing first performs the environment settings for the HBA driver. After completing the environment settings for the HBA driver, the following message appears.

Note that this message does not appear for the SAS driver (fjuls).

● Example

```
Please wait for update configuration of fjpgca.

/tmp/grmpdautoconf/fjpgca.conf seems to be correct.

*****

*port definition*

instance      status  options
-----
fjpgca1       found   nport
fjpgca27      found   nport

*target definition*

instance      t-id    wwn                status  throt  alias
-----
fjpgca1       16      0x2140000b5d6a0299  detect  255    UNDEF
fjpgca27      16      0x2141000b5d6a0299  detect  255    UNDEF
fjpgca11      16      no binding          detect  40     UNDEF
fjpgca18      16      no binding          detect  40     UNDEF

check new target definition
-----
New target binding find(fjpgca1t16, wwn=0x2140000b5d6a0299, throttle=255).
New target binding find(fjpgca27t16, wwn=0x2141000b5d6a0299, throttle=255).

check new max throttle setting
-----

check new port definition
-----
fjpgca1:change nport mode
fjpgca27:change nport mode
```

Proceed to ["2.3 Server Environment Validation" \(page 56\)](#).

2.2.2 Non-Fujitsu HBA Driver Settings

The appropriate HBA driver must be properly configured and activated before the Fujitsu multipath driver. This section provides instructions for servers that use the non-Fujitsu Emulex HBA.

For servers with a different type of non-Fujitsu HBA, refer to the manual provided by the manufacturer of that HBA.

2.2.2.1 For Emulex HBAs

The following instructions assume that Emulex HBAs are installed in the server. These instructions establish the correct system environment for transferring control to the Multipath Driver.

(1) Set persistent bindings for Emulex HBAs with target values of 16 or higher.

Two methods are given here for setting persistent bindings for Emulex HBAs. The first method is to view and directly edit the Emulex configuration file, `/kernel/drv/lpfc.conf`. The second method uses the Emulex utility, `/usr/sbin/lpfc/lputil`, to update the Emulex configuration file.

An excerpt from an example `lpfc.conf` file follows that shows the `fcplib-WWPN` setting.

● Example

```
.....  
.....  
# BEGIN: LPUTIL-managed Persistent Bindings  
  fcplib-WWPN="260000e000a804de:lpfc0t16", #(target 16)  
              "220000e000a804de:lpfc2t17"; #(target 17)  
.....  
.....
```

In the example above, there are two Emulex HBAs connected to an ETERNUS device. Using the `ETERNUSmgr`, the ETERNUS device should have been set up so that each LUN will be seen from each HBA, until the multipath manager is installed.

- Using the Direct Method
One method to view and set values is to directly edit the `/kernel/drv/lpfc.conf` file. An example of setting the WWPN and target values can be seen in the example above. Note that the `/kernel/drv/lpfc.conf` file's `automap` function setting must also be disabled.
- Using the Emulex Utility
Another method to view and set values in the `lpfc.conf` file is to use the Emulex utility, `/usr/sbin/lpfc/lputil`. This utility also provides helpful information. It shows the WWPN values for both sides of a Fibre Channel connection: the server's Emulex HBAs and the ETERNUS device's CA ports.

The following example shows how to use the "lputil" utility. Comments are inserted in bold-italic font.

● Example

```
# /usr/sbin/lpfc/lputil

LightPulse Common Utility for Solaris/SPARC. Version 1.5a0 (12/18/2002).
Copyright (c) 2002, Emulex Network Systems, Inc.

Emulex Fibre Channel Host Adapters Detected: 4
Host Adapter 0 (lpfc0) is an LP9802 (Ready Mode)
Host Adapter 1 (lpfc1) is an LP9802 (Ready Mode)
Host Adapter 2 (lpfc2) is an LP9802 (Ready Mode)
Host Adapter 3 (lpfc3) is an LP9802 (Ready Mode)

MAIN MENU

  1. List Adapters
  2. Adapter Information
  3. Firmware Maintenance
  4. Reset Adapter
  5. Persistent Bindings

  0. Exit

Enter choice => 1

Host Adapter 0 (lpfc0) is an LP9802 (Ready Mode)
Host Adapter 1 (lpfc1) is an LP9802 (Ready Mode)
Host Adapter 2 (lpfc2) is an LP9802 (Ready Mode)
Host Adapter 3 (lpfc3) is an LP9802 (Ready Mode)
```

```
MAIN MENU

1. List Adapters
2. Adapter Information
3. Firmware Maintenance
4. Reset Adapter
5. Persistent Bindings

0. Exit

Enter choice => 5

PERSISTENT BINDINGS MENU

1. Display Current Bindings
2. Display All Nodes
3. Duplicate Adapter Bindings
4. Bind Target Manually
5. Bind Automapped Targets
6. Delete Binding(s)

0. Return to Main Menu

Enter choice => 1

Persistent Bindings:
  1. Adapter: 0, Target: 16, WWPN: 26-00-00-e0-00-a8-04-de
  2. Adapter: 2, Target: 17, WWPN: 22-00-00-e0-00-a8-04-de

(NOTE: These are the values that you see in lpfc.conf after setting the values
using this utility. Below are the selections that show how to get the informa-
tion for setting the WWPN values.)
```

PERSISTENT BINDINGS MENU

1. Display Current Bindings
2. Display All Nodes
3. Duplicate Adapter Bindings
4. Bind Target Manually
5. Bind Automapped Targets
6. Delete Binding(s)

0. Return to Main Menu

Enter choice => 2

0. lpfc0
1. lpfc1
2. lpfc2
3. lpfc3

Select an adapter (0-3) => 0

Visible Nodes:

| Node | Target | WWPN | WWNN |
|-----------------|--------|-------------------------|-------------------------|
| ----- | ----- | ----- | ----- |
| In Transition | 0 | 10-00-00-00-c9-3a-97-a3 | 20-00-00-00-c9-3a-97-a3 |
| Mapped FCP Node | 16 | 26-00-00-e0-00-a8-04-de | 20-00-00-e0-00-a8-04-de |

(NOTE: The target value was defaulted to 0 until it was set to 16.)

Press any key to continue:

PERSISTENT BINDINGS MENU

1. Display Current Bindings
2. Display All Nodes
3. Duplicate Adapter Bindings
4. Bind Target Manually
5. Bind Automapped Targets
6. Delete Binding(s)

0. Return to Main Menu

Enter choice => 2

0. lpfc0
1. lpfc1
2. lpfc2
3. lpfc3

Select an adapter (0-3) => 2

```
Visible Nodes:
Node           Target  WWPN           WWNN
-----
In Transition      0  10-00-00-00-c9-3a-97-96  20-00-00-00-c9-3a-97-96
Mapped FCP Node   17  22-00-00-e0-00-a8-04-de  20-00-00-e0-00-a8-04-de

(NOTE: The target value was defaulted to 0 until it was set to 17.)

Press any key to continue:

PERSISTENT BINDINGS MENU

1. Display Current Bindings
2. Display All Nodes
3. Duplicate Adapter Bindings
4. Bind Target Manually
5. Bind Automapped Targets
6. Delete Binding(s)

0. Return to Main Menu

Enter choice => 4

(NOTE: If the WWPN has not been bound to the desired target, enter 4 to
bind the target manually. Set the WWPN and desired target value (16 or
higher) for each Emulex HBA connected to an ETERNUS device.

Using the Manual method allows for setting a non-zero target value. The
WWPN should be entered without the dashes (i.e., 220000e000a804de instead
of 22-00-00-e0-00-a8-04-de.)
```

Finally, disable the `/kernel/drv/lpfc.conf` file's `automap` function setting.

(2) Reboot the server.

Use the `"shutdown -y -i6 -g0"` command to restart the server.

2.3 Server Environment Validation

Use the instructions in this section to configure and check the server environment settings.

(1) Use the `"grmpdautoconf"` command to start the interactive process [non-Fujitsu HBAs only]

For servers with non-Fujitsu HBAs, after installing the HBA driver and rebooting the server, execute the `"grmpdautoconf"` command to start the interactive multipath configuration process.

```
# /usr/sbin/grmpdautoconf
```

(2) Set the environment of the "multipath" drivers

The interactive configuration process automatically creates definition files for the multipath driver, as well as creating the access paths. It also creates the appropriate environment settings for the multipath driver. Before starting, the following message appears:

● Example

```
Please wait for update configuration of multipath driver ...  
!!!!CAUTION: This process requires long time !!!!!
```

● Note

- The multipath driver configuration process may take some time to complete.
- If a fatal error occurs while creating the HBA configuration or multipath driver configuration, a message similar to the following will be shown:

```
A fatal error occurred !!  
The error might be due to one of the following causes:  
- sd.conf is missing.  
- fjpgca.conf or the description of fjpgca.conf is missing.  
- The description of the sd.conf is incorrect  
- There is no space in /tmp  
- A cable, a FC switch, or a ETERNUS device is disconnected
```

An inquiry appears about whether to exit or resume the interactive configuration process:

```
grmpdautoconf is disabled, and multipath configuration is not  
completed. If you want to exit grmpdautoocnf, the multipath  
configuration is not saved.  
  
Do you want to exit grmpdautoconf ?  
Yes, exit grmpdautoconf ---> hit the 'y' key  
No, retry grmpdautoconf ---> hit the 'n' key  
y <--- Enter
```

Yes: Exits the interactive configuration process, terminating installation, and discards the environment settings

No: Resumes the interactive configuration process

Examine the cause of the error. If you can, solve the problem and select "No" to resume interactive processing.

▶ Caution

Once the OS has incorporated the HBA driver and multipath driver, the OS specifications may become unchangeable. After solving any physical connection problems and resuming the interactive process, if an error occurs, exit the interactive configuration process and reboot the system.

(3) Create and confirm the disk label

The interactive configuration process can create a disk label automatically if there is no disk label for the created access paths.

The following message appears when the creating a disk label:

```
Please wait ... Checking disk label in progress.  
!!!!CAUTION: This process requires long time !!!!!
```

 **Caution**

If there is no disk label information, the following message may be output to the console, but this does not mean there is a problem.

- Console

```
WARNING: corrupt label wrong magic number
```

(4) Install or do not install the product to a cluster system

The interactive configuration process inquires about whether to install the product to either SynfinityCluster or the PRIMECLUSTER cluster system (hereafter called a "cluster system").

Respond to the following inquiry according to the environment of the server receiving the installation:

```
Do you want to use ETERNUS series as a shared disk of a Cluster System?  
** In case of installation of PRIMECLUSTER/SafeCluster, you have to use  
   facility of multipath setting offered by its product.  
** Please conduct a review of maxthrottle.  
  
   Yes ---> hit the 'y' key  
   No  ---> hit the 'n' key  
Please input  [y,n]  n  <--- Enter
```

Yes: Installs the product to the cluster system, and the multipath configuration is created automatically by shared disks of the cluster system. This terminates the installation script without any loss of interactive settings up to this point.

No: Does not install the product to the cluster system and the multipath configuration is not created automatically by shared disks of the cluster system. The interactive configuration process continues.

When installing the product to a cluster system, a multipath configuration can be created automatically by the shared disks. If these functions are for use by the cluster system, the created multipath will be registered automatically to the resource database. For this reason, interactive processing is not recommended. Instead, allow the cluster system's auto-configuration to create the multipath configuration.

 **Caution**

- If "y" is input here, do not add or remove LUNs, paths, or storage system devices using the "grmpdautoconf" command before the automatic configuration of the cluster system. Do not connect or disconnect the cables, change the paths, or change the configuration of the storage system. Since multipath settings have not been completed, the "grmpdautoconf" command cannot be executed normally.
To change the configuration, perform the automatic configuration of the cluster system, complete multipath settings, and then execute the "grmpdautoconf" command.
- If "y" is input here, and then the "format" command is executed before the automatic configuration of the cluster system, then Solaris standard disk access special files (/dev/[r]dsk/c*t*d*s*) for Multipath Driver that have been converted to multipath configuration files will appear. The links of these special files are shown as "/devices/mplbx/mplbh@...". After automatic configuration of the cluster system, these files will no longer appear.
- The controller number (c*) of the Solaris standard disk access special files name is automatically assigned by Solaris OS and "0" is assigned as the target number (t*). Therefore, even if under a cluster configuration, the Solaris standard disk access special files names may differ between the nodes. These numbers cannot be changed. When PRIMECLUSTER/SynfinityCluster is used, it is not an error that the "c*t*d*s*" part of the Solaris standard disk access special files names are different for different nodes, because automatic resource registration is used to convert the Solaris standard disk access special files to mplb special files.
- If, after inputting "y" here, the LUN mapping or host affinity setting needs to be changed or deleted, first allow the automatic configuration of the cluster system, to complete the multipath settings. Then release and reconfigure the multipath as described in ["D.4 Changing or Deleting a LUN Mapping or Host Affinity" \(page 147\)](#).
- If "y" is mistakenly input for a non-cluster system, the "grmpdautoconf" command will terminate with the multipath settings incomplete. In this case, execute the "grmpdautoconf" command again to start the interactive multipath configuration process, and then input "n" for the cluster system inquiry.
- If "n" is mistakenly input for a cluster system, the multipath settings are completed in a malconfigured (non-cluster) status. In this case, cancel the incorrectly set multipath as detailed in ["3.3 Removing a LUN" \(page 72\)](#) and ["3.5 Removing a Storage System Device" \(page 76\)](#) set the target logical unit to allow it to be recognized by the server, and then execute the "grmpdautoconf" command again to redo the multipath settings.
- Input "n" when using PRIMECLUSTER with the Solaris Volume Manager or any other non-GDS Volume Manager.

The interactive configuration process automatically sets a limit on the number of I/Os that can be issued simultaneously. However, because the storage system device is accessed by multiple servers in a cluster system, you must manually set the HBA driver settings. Follow the instructions in the manual of your storage system device. Also refer to the instructions in the "FUJITSU PCI Fibre Channel User's Guide", or the manual provided with your HBA, as necessary.

(5) Select the Disk Access Special File type

Respond to the inquiry about whether you want applications to use the Solaris standard special files (/dev/[r]dsk/c*t*d*s*) or the mplb special files (/dev/FJSVmplb/[r]dsk/mplb*s*) for I/O access. Select "s" to use the Solaris standard special files, or "m" to use the mplb special files.

● Example

```
Select either as an access special file.
Solaris standard special file (/dev/[r]dsk/c*t*d*s*)
mplb special file (/dev/FJSVmplb/[r]dsk/mplb*s*)
/dev/[r]dsk/c*t*d*s*      ---> 's'
/dev/FJSVmplb/[r]dsk/mplb*s* ---> 'm'
Please input [s,m] m <--- Enter
```

s: Sets use of the Solaris standard special files.
m: Sets use of the mplb special files.

 **Caution**

- Solaris standard special files and mplb special files cannot both be used. Disk access special files may not be modified after multipath configuration. Release all multipath configurations before attempting to modify a disk access special file.
- For Solaris standard special files, a special file name controller number (c*) is automatically assigned by the OS, while "0" is assigned as the target number (t*). These numbers cannot be changed.
- For a server with Dynamic Reconfiguration function, an mplb special file is automatically selected if the "grmpdautoconf" command is not executed with the "-p" option. The disk access special files selection inquiry does not appear.

(6) Create the Disk Access Special Files

Create the disk access special files. The disk access special files are created to match the special file type selected in [Step \(5\)](#).

● (Example) For Solaris standard special files

```
Path      : Action: Element path      : LUN : Storage      :
c7t0d0s2 : new   : c2t16d0s2 c19t16d0s2 : 0   : E4000- 6A0299 :
c7t0d1s2 : new   : c2t16d1s2 c19t16d1s2 : 1   : E4000- 6A0299 :
c7t0d2s2 : new   : c2t16d2s2 c19t16d2s2 : 2   : E4000- 6A0299 :
c8t0d0s2 : new   : c3t28d0s2 c18t28d0s2 : 0   : E2000- 000000 :
c8t0d1s2 : new   : c3t28d1s2 c18t28d1s2 : 1   : E2000- 000000 :
c8t0d2s2 : new   : c3t28d2s2 c18t28d2s2 : 2   : E2000- 000000 :
c9t0d0s2 : new   : c16t16d0s2 c17t16d0s2 : 0   : E6000- 000001 :
c9t0d1s2 : new   : c16t16d1s2 c17t16d1s2 : 1   : E6000- 000001 :
c9t0d2s2 : new   : c16t16d2s2 c17t16d2s2 : 2   : E6000- 000001 :
=== Reconfigure plan ===
Multi path: 0
Create new multi path: 9
Add path for multi path: 0 (instance)
Delete path from multi path: 0 (instance)
```

● (Example) For mplb special files

```
Path : Action : Element path : LUN : Storage :  
mplb0 : new : c2t16d0s2 c19t16d0s2 : 0 : E4000- 6A0299 :  
mplb1 : new : c2t16d1s2 c19t16d1s2 : 1 : E4000- 6A0299 :  
mplb2 : new : c2t16d2s2 c19t16d2s2 : 2 : E4000- 6A0299 :  
mplb3 : new : c3t28d0s2 c18t28d0s2 : 0 : E2000- 000000 :  
mplb4 : new : c3t28d1s2 c18t28d1s2 : 1 : E2000- 000000 :  
mplb5 : new : c3t28d2s2 c18t28d2s2 : 2 : E2000- 000000 :  
mplb6 : new : c16t16d0s2 c17t16d0s2 : 0 : E6000- 000001 :  
mplb7 : new : c16t16d1s2 c17t16d1s2 : 1 : E6000- 000001 :  
mplb8 : new : c16t16d2s2 c17t16d2s2 : 2 : E6000- 000001 :  
=== Reconfigure plan ===  
Multi path: 0  
Create new multi path: 9  
Add path for multi path: 0 (instance)  
Delete path from multi path: 0 (instance)
```

If the multipath configuration does not complete normally due to a hardware error, etc., the installation script displays an error message and inquires about whether to continue the interactive configuration process. Analyze any fjpgca or multipath driver error message that is displayed on the console error message or by the interactive process. Then the multipath creation process can be either cancelled or resumed.

For details on the messages output by interactive processing, refer to error messages listed in ["Appendix C Error Messages" \(page 117\)](#).

● Example

```
An Error occurs during multipath configuration !!  
grmpdautoconf is exited, and GR multipath configuration is not completed.  
  
Do you want to cancel the multipath configuration?  
Yes ----> hit 'y' key  
No ----> hit 'n' key  
Please input [y,n] y <--- Enter
```

Yes: The partially completed settings of the multipath configuration are lost, and the interactive configuration process is terminated. The environment of the created multipath configuration is saved.

No: The settings made up until the error occurred are saved for the created multipath configuration, and the interactive configuration process is resumed.

 **Caution**

- When this procedure is performed, the following message may appear on the execution terminal or console, but this does not mean there is a problem.

Refer to ["Appendix B Miscellaneous Notes" \(page 109\)](#) for details of this message.

- Execution terminal

```
Cannot unload module: mplb  
Will be unloaded upon reboot.  
Forcing update of mplb.conf.
```

- Console

```
WARNING: Duplicate instance 4095 of node "mplb" ignored.
```

- For configurations where storage system redundancy is lost while the Concurrent Firmware Loading (CFL), an error message will be displayed even if the CFL is completed successfully. In this situation, the configuration should be changed before performing the CFL. Remove the target devices, change the cable connections so that storage system redundancy is maintained during the CFL, and then re-configure the multipath using the "grmpdautoconf" command. For details of redundancy during CFL, refer to ["Appendix D Storage System Redundancy during Concurrent Firmware Loading" \(page 145\)](#).

● (Example) For mplb special files

```
Path: Action : Element path          : LUN : Storage
mplb0: new: c2t16d0s2 c3t16d0s2 :0 : E8000- 6A0022 :
mplb1: new: c2t16d1s2 c3t16d1s2 :1 : E8000- 6A0022 :
mplb2: new: c2t16d2s2 c3t16d2s2 :2 : E8000- 6A0022 :
=== Reconfigure plan ===
Multi path: 0
Create new multi path: 3
Add path for multi path: 0 (instance)
Delete path from multi path: 0 (instance)

Confirmation of redundancy of ETERNUS Concurrent Firmware Loading
mplb0: It is a configuration without the redundancy of Concurrent Firmware Loading.
mplb1: It is a configuration without the redundancy of Concurrent Firmware Loading.
mplb2: It is a configuration without the redundancy of Concurrent Firmware Loading.

The instance without the redundancy of Concurrent Firmware Loading exists. Please confirm
connection configuration. Please execute the following work when you change connection con-
figuration.

1. Deletion of target instance for configuration change
2. Change in connection configuration
3. Reboot of server
4. Re-creation of multipath by grmpdautoconf
=====

Configuration was successfully.
```

 **Caution**

If the LUN mapping or host affinity settings for a multipath logical unit are to be changed or deleted after the Multipath Driver environment has been setup, the multipath will need to be released and reconfigured. For details, refer to ["D.4 Changing or Deleting a LUN Mapping or Host Affinity" \(page 147\)](#).

2.4 Disk Settings (Partitioning and File System)

The settings made so far will allow the logical units of the storage system device to be accessed by the Solaris OS environment using the multipath functions via `/dev/[r]dsk/c*t*d*s*` if Solaris standard special files are used or via `/dev/FJSMplb/[r]dsk/mplb*s*` if mplb special files are used. If needed, perform the following procedures for each logical unit.

These procedures are the same as with normal disks. For details, refer to the "System Administration Guide: Basic Administration" or "System Administration Guide: Devices and File Systems".

(1) Change the Partition Configuration

This only needs to be done if the partition configuration of the new logical unit is to be changed from the default.

When a mplb special file is set, specify the path name as the argument for the "format" command as follows.

```
# format /dev/FJSMplb/rdsk/mplb*s2
```

When a mplb special file is set and the label is changed from EFI to VTOC or from VTOC to EFI, perform reconfigure reboot after changing the label.

(2) Create a File System

If needed, create a file system in the new logical unit.

(3) Modify `/etc/vfstab`

After a file system has been created in the new logical unit, it needs to be added to `/etc/vfstab` to enable it to be auto-mounted.

When the configuration is changed from single path to multipath, it is also necessary to change the special file name settings in `/etc/vfstab`.

Chapter 3

Adding or Removing Paths Between Storage Systems, LUNs, and Servers

This chapter provides procedures for adding and removing paths between storage system devices, LUNs, and servers in a multipath configuration. These are configuration-management tasks to perform as needed after initially configuring the server environment of the Multipath Driver.

For configuration instructions to use when replacing failed hardware components, refer instead to ["Chapter 4 Replacing Failed Components" \(page 78\)](#).

Caution

The following message may be output to the console when adding or removing hardware, but this does not mean there is a problem.

```
WARNING: Duplicate instance 4095 of node "mplb" ignored.  
  
WARNING: Disk pathname (e.g. /pci@1f,0/fibre-channel@1/mplbt@0,2(mplbt16))  
SCSI transport failed: reason`aborted`: retrying command
```

3.1 Adding a LUN

This section provides procedures for adding LUNs to a multipath configuration on a server. The multipath configuration can be upgraded to include a new LUN by using the "grmpdautoconf" command without having to shut down the server.

(1) Create a LUN.

Create a LUN and add it to the storage system device.

For information on how to create a LUN, refer to the manual of the storage system device.

(2) Initiate an interactive settings process with the "grmpdautoconf" command.

Execute the "grmpdautoconf" command to begin a process that will create a multipath configuration for the added LUN.

```
# /usr/sbin/grmpdautoconf
```

When connecting with non-Fujitsu HBAs, skip to step (6).

Note

The "grmpdautoconf" command is activated when the Multipath Driver is installed. The execution of this command initiates an interactive settings process. Respond to all prompts for successful use of this command.

- (3) Confirm the added LUN and whether to set host affinity and switch zoning (Fujitsu HBAs Only).

A list of storage system devices that are connected to the server appears. Make sure the Adapter port of the added HBA has a WWN, and that its status is "Exist" or "AL."

```

switch                WWN                device                slot/port
-----
100000000e244187     fjpfca5                -
100000000e24418d     fjpfca3                -
210000e000a80236     E3000                CM0CA0P0
270000e000a80236     E3000                CM1CA1P0

Adapter              Switch              ETERNUS (GR)         Status
instance            WWN                WWN                product
-----
fjpfca3 100000000e24418d  230000e000a80236 E3000  CM0CA1P0  AL
fjpfca5 100000000e244187  270000e000a80236 E3000  CM1CA1P0  AL

Do you want to set Host affinity & set a switch zoning?

Yes          ---> hit the 'y' key.
No & skip    ---> hit the 'n' key.
Quit         ---> hit the 'q' key.

Please input  [y,n,q] n <--- Enter
  
```

y: The Adapter port does not have a WWN. After entering "y," check the settings of the storage system device and the status of its connection to the server.

n: The Adapter port already has a WWN, as indicated in the example above.

q: Cancels the upgrade process.

- (4) Choose automatic or manual selection of access paths (Fujitsu HBAs Only).

```

Do you want to select access paths by automatic or by manual?
** If you select automatic selection, all paths which status is "New"
are set as the object of multipath configuration.
** All paths which status is "Exist" are always set as the object of
LUN addition.
** All devices connected by AL are always the target of LUN addition
and the target of adding multipaths.

manual selection    ---> hit the 'm' key.
automatic selection ---> hit the 'a' key.
Quit                ---> hit the 'q' key.

Please input  [m,a,q] a <--- Enter
  
```

m: The storage system device, access path, or LUN added to the original storage system device is recognized differently by each of the server's HBAs.

a: The storage system device, access path, or LUN added to the original storage system device is recognized by all of the server's HBAs, as indicated in the example above. Host affinity is set in the storage system device.

q: Cancels the upgrade process.

- (5) Set the environment of the HBA (Fujitsu HBAs Only).

Refer to (4) "[Setup the HBA drivers](#)" (page 50) of "[2.2.1 Fujitsu HBA Driver Settings](#)" (page 45) for details on the procedure.

(6) Set the environment of the "multipath" drivers.

An environment settings message similar to the one shown below appears:

```
Please wait for update configuration of multipath driver ...
!!!!CAUTION: This process requires long time !!!!!
```

During this time, a label is being written for the LUN. A message such as the following may appear while the label is being written.

```
Please wait for check disklabels.
!!!!CAUTION: This process requires long time !!!!!
```

(7) Install or do not install the product to a cluster system.

When the setting is to use mplb access special file, the interactive settings process inquires about whether to install the product to either SynfinityCluster or the PRIMECLUSTER cluster system (hereafter called a "cluster system").

Respond to the following inquiry according to the environment of the server receiving the installation:

```
Do you want to use ETERNUS series as a shared disk of a Cluster System ?
** In case of installation of PRIMECLUSTER/SafeCLUSTER, you have to use
  facility of multipath setting offered by its product.
** Please conduct a review of maxthrottle.

  Yes          ---> hit the 'y' key
  No and Quit  ---> hit the 'n' key

Please input  [y,n] n  <--- Hit "y" if you have a cluster system, or hit "n" if
you do not have a cluster system.
```

y: Defers the setting to SynfinityCluster or PRIMECLUSTER (Not applicable for North America)

n: Does not defer the setting to SynfinityCluster or PRIMECLUSTER

(8) Create access special file.

Create an access special file.

An access special file creates a special file same with the existing LUs.

```
Path      : Action : Element path          :LUN: Storage      :
mplb0     : exist  : c2t16d0s2 c3t16d0s2 : 0 : E30004641- 130011 :
mplb1     : exist  : c2t16d1s2 c3t16d1s2 : 1 : E30004641- 130011 :
mplb2     : exist  : c2t16d2s2 c3t16d2s2 : 2 : E30004641- 130011 :
mplb3     : new    : c2t16d3s2 c3t16d3s2 : 3 : E30004641- 130011 :
mplb4     : new    : c2t16d4s2 c3t16d4s2 : 4 : E30004641- 130011 :
mplb5     : new    : c2t16d5s2 c3t16d5s2 : 5 : E30004641- 130011 :
mplb6     : new    : c2t16d6s2 c3t16d6s2 : 6 : E30004641- 130011 :
=== Reconfigure plan ===
Multi path          : 3
Create new multi path : 4 <-- Is the number of new paths correct?
Add path for multi path : 0 (instance)
Delete path from multi path : 0 (instance)
```

Multipaths with "new" displayed in the "Action" column are newly added.

 **Caution**

- When this procedure is performed, the following message may appear on the execution terminal or console, but this does not mean there is a problem.

Refer to "[Appendix B Miscellaneous Notes](#)" ([page 109](#)) for details of this message.

- Execution terminal

```
Cannot unload module: mplb
Will be unloaded upon reboot.
Forcing update of mplb.conf.
```

- Console

```
WARNING: Duplicate instance 4095 of node "mplb" ignored.
```

- When local resources are added to the cluster system, additional procedures may be required. For details, refer to "[D.7 Adding Local Resources to a Cluster System](#)" ([page 154](#)).

3.2 Adding a Path or Storage System Device

This section provides procedures for adding paths or storage system devices to a multipath configuration on a server.

An added path or a storage system device can be included in the multipath configuration upgraded by using the "grmpdautoconf" command without having to shut down the server.

 **Note**

These procedures cannot be used when adding an HBA to the server. For servers that support the Dynamic Reconfiguration function, find instructions in the following manuals:

- Enhanced Support Facility User's Guide For Dynamic Reconfiguration
- Enhanced Support Facility User's Guide Dynamic Reconfiguration I/O device

For servers that support the PCI Hot Plug function, find instructions in the following manuals:

- Enhanced Support Facility User's Guide For PCI Hot Plug (PRIMEPOWER)
- Enhanced Support Facility User's Guide for PCI Hot Plug I/O device (PRIMEPOWER)

For servers that do not support either function, determine the appropriate procedure.

- (1) Mount, connect, and configure the Channel Adapter card on the storage system.

Mount the Channel Adapter card in the storage system device and connect it to either a Fibre Channel switch or directly to an HBA.

Then configure the added Channel Adapter card. For details on how to perform Channel Adapter card settings, refer to the manual of the storage system device

(2) . Perform the server's HBA driver settings. (Non-Fujitsu HBAs)

When using Non-Fujitsu HBAs, follow the instructions in the driver manual to set the target ID of the Channel Adapter port that was added to the storage system device.

When using Fujitsu HBAs, skip to step (3).

(3) Initiate an interactive settings process with the "grmpdautoconf" command.

Execute the "grmpdautoconf" command to begin a process that will create a multipath configuration for the added path.

```
# /usr/sbin/grmpdautoconf
```

When using Non-Fujitsu HBAs, the "grmpdautoconf" process starts at step (7).

Note

The "grmpdautoconf" command is activated when the Multipath Driver is installed. The execution of this command initiates an interactive settings process. Respond to all prompts for successful use of this command.

(4) Confirm the added path and whether to set host affinity and switch zoning (Fujitsu HBAs Only).

A list of storage system devices that are connected to the server appears. Make sure the Adapter port of the added HBA has a WWN, and that its status is "Exist" or "AL." Also, make sure that all ports of any previously mounted Channel Adapter cards in the storage system device have WWNs and an "Exist" status.

```
Select and define access paths for system configuration.
Search devices ...display device and access paths list after searching.

switch                WWN                device            slot/port
-----
  1  100000000e244187  fjpfca5           -
  2  100000000e24418d  fjpfca3           -
  2  100000000e244543  fjpfca4           -
  2  210000e000a80236  E3000            CM0CA0P0
  2  230000e000a80236  E3000            CM0CA1P0
  1  270000e000a80236  E3000            CM1CA1P0

          Adapter          Switch          ETERNUS(GR)          Status
          instance        WWN            WWN            product
-----+-----+-----+-----+-----
  fjpfca3 100000000e24418d  2  230000e000a80236  E3000  CM0CA1P0  Exist
  fjpfca4 100000000e244543  2  210000e000a80236  E3000  CM0CA0P0  New
  fjpfca5 100000000e244187  1  270000e000a80236  E3000  CM1CA1P0  Exist

Do you want to set Host affinity & set a switch zoning?
Yes          ---> hit the 'y' key.
No & skip    ---> hit the 'n' key.
Quit         ---> hit the 'q' key.

Please input  [y,n,q] n <--- Enter
```

y: The Adapter port does not have a WWN. After entering "y," check the settings of the storage system device and the status of its connection to the server.

n: The Adapter port already has a WWN, as indicated in the example above.

q: Cancels the upgrade process.

(5) Set the environment of the HBA(Fujitsu HBAs Only).

```
Do you want to select access paths by automatic or by manual?
** If you select automatic selection, all paths which status is "New"
   are set as the object of multipath configuration.
** All paths which status is "Exist" are always set as the object of
   LUN addition.
** All devices connected by AL are always the target of LUN addition
   and the target of adding multipaths.

manual selection    ---> hit the 'm' key.
automatic selection ---> hit the 'a' key.
Quit                ---> hit the 'q' key.

Please input  [m,a,q] a  <--- Enter
```

m: The storage system device or access path added to the original storage system device is recognized differently by each of the server's HBAs.

a: The storage system device or access path added to the original storage system device is recognized by all of the server's HBAs, as indicated in the example above. Host affinity is set in the storage system device.

q: Cancels the upgrade process.

(6) Set the environment of the HBA (Fujitsu HBAs Only).

Refer to [\(4\) "Setup the HBA drivers" \(page 50\)](#) of ["2.2.1 Fujitsu HBA Driver Settings" \(page 45\)](#) for details on the procedure.

(7) Set the environment of the "multipath" drivers.

An environment settings message similar to the one shown below appears:

```
Please wait for update configuration of multipath driver ...
!!!!CAUTION: This process requires long time !!!!!
```

During this time, a label is being written for the LUN. A message such as the following may appear while the label is being written.

```
Please wait for check disklabels.
!!!!CAUTION: This process requires long time !!!!!
```

(8) Install or do not install the product to a cluster system.

When the setting is to use mplb access special file, the interactive settings process inquires about whether to install the product to either SynfinityCluster or the PRIMECLUSTER cluster system (hereafter called a "cluster system").

Respond to the following inquiry according to the environment of the server receiving the installation:

```
Do you want to use ETERNUS series as a shared disk of a Cluster System ?
** In case of installation of PRIMECLUSTER/SafeCLUSTER, you have to use
   facility of multipath setting offered by its product.
** Please conduct a review of maxthrottle.

Yes          ---> hit the 'y' key
No and Quit  ---> hit the 'n' key

Please input  [y,n] n  <--- Hit "y" if you have a cluster system, or hit "n" if
you do not have a cluster system.
```

y: Defers the setting to SynfinityCluster or PRIMECLUSTER (Not applicable for North America)

n: Does not defer the setting to SynfinityCluster or PRIMECLUSTER

(9) Create access special file.

Create an access special file.

An access special file creates a special file same with the existing LUs.

```
Path      : Action : Element path                :LUN: Storage      :
mplb0    : add     : c2t16d0s2 c3t16d0s2 c4t16d0s2 : 0 : E30004641- 130011 :
mplb1    : add     : c2t16d2s2 c3t16d1s2 c4t16d1s2 : 1 : E30004641- 130011 :
mplb2    : add     : c2t16d3s2 c3t16d2s2 c4t16d2s2 : 2 : E30004641- 130011 :
mplb3    : add     : c2t16d4s2 c3t16d3s2 c4t16d3s2 : 3 : E30004641- 130011 :
mplb4    : add     : c2t16d5s2 c3t16d4s2 c4t16d4s2 : 4 : E30004641- 130011 :
mplb5    : add     : c2t16d6s2 c3t16d5s2 c4t16d5s2 : 5 : E30004641- 130011 :
mplb6    : add     : c2t16d7s2 c3t16d6s2 c4t16d6s2 : 6 : E30004641- 130011 :
=== Reconfigure plan ===
Multi path                : 0
Create new multi path     : 0
Add path for multi path   : 7 (instance) <-- Is the number of added paths cor-
rect?
Delete path from multi path : 0 (instance)
```

y: The added storage system device or access path shows a multipath configuration.

n: The added storage system device or access path does not show a multipath configuration.

 **Caution**

When local resources are added to the cluster system, additional procedures may be required. For details, refer to ["D.7 Adding Local Resources to a Cluster System" \(page 154\)](#).

3.3 Removing a LUN

The "grmpdautoconf" command may be used to automatically recognize that a LUN should be removed from the multipath configuration. The LUN being removed does not need to be specified, however before executing the command the LUN must be rendered unrecognizable by the server.

Caution

If the LUN that is to be removed is being used as a PRIMECLUSTER or PRIMECLUSTER GDS resource, it must be deregistered as a resource before it is removed.

Use the following procedure when removing a LUN:

- (1) Stop applications.
Stop all applications that might access the LUN that is to be removed. If the LUN has been mounted, unmount it. Any /etc/vfstb entries must also be deleted.
- (2) Remove the LUN on the storage system device side.
Render the LUN being removed unrecognizable by the server. Remove the LUN on the storage system device side. Refer to the storage system device manual for details of how to remove a LUN.
- (3) Execute the "grmpdautoconf" command.
Execute the "grmpdautoconf" command with the "-d" option.

Example

```
# /usr/sbin/grmpdautoconf -d
Path   : Action   : Element path           : LUN : Storage
mplb20 : destroy  : c15t16d8s2 c17t16d8s2 :   8 : E4000- 6A0299
=== Reconfigure plan ===
  Destroy multi path           : 1
  Delete path from multi path : 0 (instance)

Do you want to continue the multipath remove?

Yes   ---> hit the 'y' key
No    ---> hit the 'n' key

Please input [y,n] y
Configuration was successfully.
```

Caution

Even after this procedure is performed, the special file names under /dev/[r]dsk/ will remain. Delete them, for example, by using the Solaris "devfsadm" command, if necessary.

3.4 Removing a Path

The "grmpdautoconf" command may be used to automatically recognize that a path should be removed from the multipath configuration. The path being removed does not need to be specified, however before executing the command the path must be rendered unrecognizable by the server.

Caution

The server must be rebooted after a path has been removed for the path to be removed from the active configuration.

Use the following procedure when removing a path:

- (1) Remove the path between the server and the storage system device.
Remove the path by using the zoning settings or by physically disconnecting the cable. Note that paths do not need to be switched to "Stop" status using the "iompadm change" command. Stopped paths are exempt from removal.
- (2) Execute the "grmpdautoconf" command.
Execute the "grmpdautoconf" command with the "-d" option. For Fibre Channel connections, a new Fibre Channel driver definition file is output that does not contain the removed path's information.

● Example

```
# /usr/sbin/grmpdautoconf -d
Path   : Action : Element path : LUN : Storage
mplb12 : del    : c17t17d0s2  : 0  : E4000- 6A0299
mplb13 : del    : c17t17d1s2  : 1  : E4000- 6A0299
mplb14 : del    : c17t17d2s2  : 2  : E4000- 6A0299
mplb15 : del    : c17t17d3s2  : 3  : E4000- 6A0299
=== Reconfigure plan ===
  Destroy multi path      : 0
  Delete path from multi path : 4 (instance)

Do you want to continue the multipath remove?

  Yes  ---> hit the 'y' key
  No   ---> hit the 'n' key

Please input [y,n] y
/tmp/grmpdautoconf/fjpfca.conf seems to be correct.

*****

*port definition*

instance      status  options
-----

*target definition*

instance      t-id    wwn                status  throt  alias
-----
fjpfca2       16      0x2040000b5d6a0299  detect  255    UNDEF
fjpfca6       16      0x2041000b5d6a0299  detect  255    UNDEF

check new target definition
-----

check new max throttle setting
-----

check new port definition
-----

Configuration was successfully.
```

(3) Reboot the server.

Execute the following command to reboot the server.

```
# shutdown -y -i6 -g0
```

 **Caution**

If the path redundancy is lost after a path is removed, a confirmation message appears.

```
# /usr/sbin/grmpdautoconf -d
Path   : Action : Element path : LUN : Storage
mplb12 : del     : c15t16d0s2   : 0   : E4000- 6A0299
mplb13 : del     : c15t16d1s2   : 1   : E4000- 6A0299
mplb14 : del     : c15t16d2s2   : 2   : E4000- 6A0299
mplb15 : del     : c15t16d3s2   : 3   : E4000- 6A0299
=== Reconfigure plan ===
  Destroy multi path           : 0
  Delete path from multi path : 4 (instance)

mplb12 : It will be a configuration without the redundancy.
mplb13 : It will be a configuration without the redundancy.
mplb14 : It will be a configuration without the redundancy.
mplb15 : It will be a configuration without the redundancy.

Do you want to continue the multipath remove?

  Yes  ---> hit the 'y' key
  No   ---> hit the 'n' key

Please input  [y,n] n
```

3.5 Removing a Storage System Device

The "grmpdautoconf" command may be used to automatically recognize that a storage system device should be removed from the multipath configuration. The storage system device being removed does not need to be specified, however before executing the command the storage system device must be rendered unrecognizable by the server.

Caution

- The server must be rebooted after a storage system device has been removed in order for the storage system device to be removed from the active configuration.
- If the LUN that is to be removed is being used as a PRIMECLUSTER or PRIMECLUSTER GDS resource, it must be deregistered as a resource before it is removed.

Use the following procedure when removing a storage system device:

(1) Stop applications.

Stop all applications that might access the storage system device that is to be removed. If the storage system device has been mounted, unmount it. Any /etc/vfstb entries must also be deleted.

(2) Disconnect the storage system device from the server.

Disconnect the storage system device from the server by using the zoning settings or by physically removing all cables connecting the storage system and the server. Note that paths do not need to be switched to "Stop" status using the "iompadm change" command. Stopped paths are exempt from removal.

(3) Execute the "grmpdautoconf" command.

Execute the "grmpdautoconf" command with the "-d" option. For Fibre Channel connections, a new Fibre Channel driver definition file is output that does not contain the removed storage system device's information.

● Example

```
# /usr/sbin/grmpdautoconf -d
Path   : Action : Element path           : LUN : Storage
mplb12 : destroy : c15t16d0s2 c17t16d0s2 : 0   : E4000- 6A0299
mplb13 : destroy : c15t16d1s2 c17t16d1s2 : 1   : E4000- 6A0299
mplb14 : destroy : c15t16d2s2 c17t16d2s2 : 2   : E4000- 6A0299
mplb15 : destroy : c15t16d3s2 c17t16d3s2 : 3   : E4000- 6A0299
=== Reconfigure plan ===
  Destroy multi path           : 4
  Delete path from multi path : 0 (instance)

Do you want to continue the multipath remove?

  Yes  ---> hit the 'y' key
  No   ---> hit the 'n' key

Please input [y,n] y
/tmp/grmpdautoconf/fjpfca.conf seems to be correct.

*****

*port definition*

instance      status  options
-----

*target definition*

instance      t-id   wwn                status  throt  alias
-----

check new target definition
-----

check new max throttle setting
-----


check new port definition
-----

Configuration was successfully.
```

(4) Reboot the server.

Execute the following command to reboot the server.

```
# shutdown -y -i6 -g0
```

 **Caution**

Even after this procedure is performed, the special file names under /dev/[r]dsk/ will remain. Delete them, for example, by using the Solaris "devfsadm" command, if necessary.

Chapter 4

Replacing Failed Components

This chapter describes how to replace failed components.

Before replacing a failed component, the multipath driver must be used to "set aside", any paths that will be disrupted by the replacement procedure. Placing the paths offline in this way provides the following benefits:

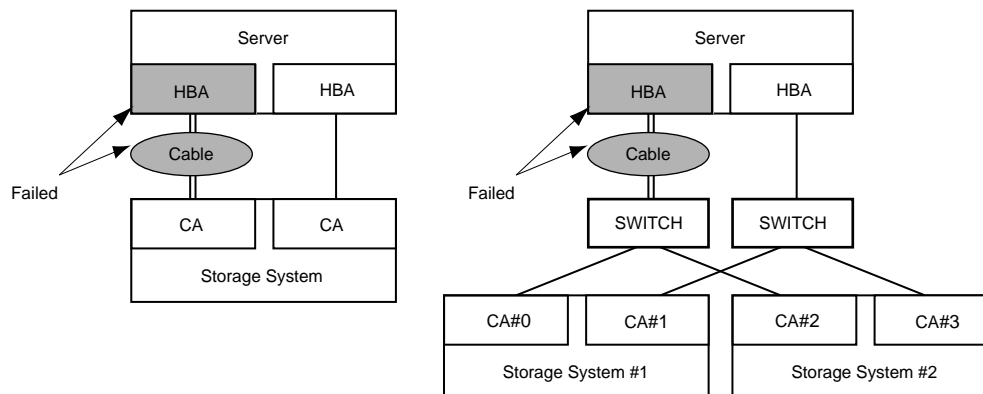
- Checks the path redundancy situation.
An immediate check is provided on whether the intended replacement paths are actually available and not blocked. This is particularly important in cluster configurations and for preventive maintenance.
- Reduces the number of console error messages.

Failed components must be replaced by a maintenance engineer. The customer should not be replacing failed components, but should contact their maintenance engineer instead.

4.1 Replacing a Server-side HBAs or Cable

4.1.1 Replacement Targets and the Setting Aside of Paths

The following diagrams and procedures described how to replace a failed server-side HBA or cable.



The preventive maintenance replacement procedure described below is for the right-hand configuration above, when the following message is output to the console. All paths that run through the failed HBA or cable must be set aside. In this example, this means that the I/O paths that run through CA#0 and CA#2 must be set offline.

■ Example console message

Instance name is underlined.

```
/pci@1f,0/pci@1/fibre-channel@1/mplbt@10,0(mplbt540)  
SCSI transport failed: reason'incomplete': retrying command
```

The offline command is as follows:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change "unit_being_replaced" "physical_device_node"
```

Use the (underlined) "instance_name" from the console message as the physical device node. Search for the same "instance_name" in the output of the "iompadm info" command. Specify the matching path names (shown underlined below) as the physical device nodes.

■ Example output for "iompadm info" command

```
# /usr/opt/FJSViomp/bin/iompadm info  
IOMP: /dev/FJSVmplb/fiomp/adm0  
Element:  
    /dev/rdisk/c10t16d0s2   online active block "good status with active  
                           [E30004641- 130011-CM01-CA01-PORT34] (mplbt540)"  
    /dev/rdisk/c17t16d0s2   online standby block "good status with standby  
                           [E30004641- 130011-CM00-CA00-PORT30] (mplbt15)"  
:  
IOMP: /dev/FJSVmplb/fiomp/adm8  
Element:  
    /dev/rdisk/c10t17d8s2   online active block "good status with active  
                           [E30004640- 130001-CM01-CA01-PORT34] (mplbt640)"  
    /dev/rdisk/c17t17d8s2   online standby block "good status with standby  
                           [E30004640- 130001-CM00-CA00-PORT30] (mplbt115)"
```

Specify "adapter" as the unit_being_replaced. When "adapter" is specified, as well as the paths that directly specify the physical device node, all paths that include the same controller number as that in the physical device node must be set aside. For our example, as well as the /dev/rdsk/c10t/16d0s2 path for adm0, the /dev/rdsk/c10t17d8s2 path for adm8 must also be set offline.

The following command is used to set aside a path:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change a /dev/rdsk/c10t16d0s2
```

4.1.2 Hot Swapping an HBA

The following functions are required if a server HBA is to be replaced without turning off the server:

- Dynamic Reconfiguration function
- PCI Hot Plug function

Refer to the following manuals when using these functions to perform a hot spare replacement.

- Dynamic Reconfiguration function
 - "Enhanced Support Facility User's Guide For Dynamic Reconfiguration"
 - "Enhanced Support Facility User's Guide Dynamic Reconfiguration I/O device"
- PCI Hot Plug function
 - "Enhanced Support Facility User's Guide For PCI Hot Plug (PRIMEPOWER)"
 - "Enhanced Support Facility User's Guide for PCI Hot Plug I/O device (PRIMEPOWER)"

Caution

The type (model) of the replacement HBA must be the same as that of the HBA being replaced. For example, a PW008FC2 type HBA cannot be replaced with a PW008FC3 type HBA.

4.1.3 Cold Swapping an HBA

The following procedure describes how to replace an HBA with the server turn off.

Procedure

- 1 Turn off the server.
- 2 Replace the HBA inside the server.
- 3 If host affinity is set for the storage system and WWN zoning for the Fibre Channel switch update the settings to use the new HBA's WWN. Refer to the individual device manuals for details.
- 4 Turn on the server.
- 5 Execute the following command to verify that all paths are now either Active or Standby.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

Caution

The type (model) of the replacement HBA must be the same as that of the HBA being replaced. For example, a PW008FC2 type HBA cannot be replaced with a PW008FC3 type HBA.

4.1.4 Hot Swapping a Server-side Cable

The following procedure describes how to replace a cable connected to the server without turning the server off.

Procedure

- 1 Execute the following command to set aside the affected path.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change a /dev/rdisk/c10t16d0s2
```

- 2 Replace the cable that is connected to the server.

- 3 Execute the following command to release the path that was set aside in step 1.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart a /dev/rdisk/c10t16d0s2
```

- 4 Execute the following command to verify that all paths are now either Active or Standby.

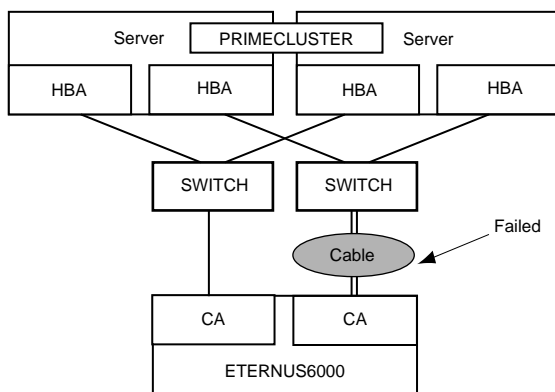
```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.2 Replacing a Switch to Storage System Cable

4.2.1 Replacement Targets and the Setting Aside of Paths

The following diagram and procedure described how to replace a failed cable between the storage system and switch.



The preventive maintenance replacement procedure described below is for the configuration above, when the following message is output to the main server console. All paths that run through the failed CA or cable must be set aside.

■ Example console message

Instance name is underlined.

```
/pci@1f,0/pci@1/fibre-channel@1/mplbt@10,0(mplbt0)  
SCSI transport failed: reason'incomplete': retrying command
```

The offline command is as follows:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change "unit_being_replaced" "physical_device_node"
```

Use the (underlined) "instance_name" from the console message as the physical device node. Search for the same "instance_name" in the output of the "iompadm info" command. Specify the matching path names (shown underlined below) as the physical device nodes.

■ Example output for "iompadm info" command

```
# /usr/opt/FJSViomp/bin/iompadm info (primary server)  
IOMP: /dev/FJSVmplb/fiomp/adm2048  
Element:  
    /dev/rdsk/c16t16d0s2    online active block "good status with active  
    [E6000- 000001-RT00-CA21-PORT87] (mplbt0)"  
    /dev/rdsk/c17t16d0s2    online active block "good status with active  
    [E6000- 000001-RT10-CA31-PORTc7] (mplbt826)"  
:  
# /usr/opt/FJSViomp/bin/iompadm info (secondary server)  
IOMP: /dev/FJSVmplb/fiomp/adm2048  
Element:  
    /dev/rdsk/c5t16d0s2    online active block "good status with active  
    [E6000- 000001-RT00-CA21-PORT87] (mplbt20)"  
    /dev/rdsk/c6t16d0s2    online active block "good status with active  
    [E6000- 000001-RT10-CA31-PORTc7] (mplbt811)"  
:
```

Specify "controller" as the unit_being_replaced. When "controller" is specified, as well as the paths that directly specify the physical device node, all paths that have the same controller identifier as that in the physical device node must be set aside. For our example, as well as the /dev/rdsk/c10t16d0s2 path for primary server adm2048, the /dev/rdsk/c10t17d8s2 path for secondary server adm2048 must also be set offline.

The following command is used to set aside a path:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change c /dev/rdsk/c16t16d0s2
```

4.2.2 Hot Swapping a Cable between the Storage System and Switch

The following procedure describes how to replace a cable between the storage system and switch without turning the server and storage system off.

Procedure

- 1 Execute the following command to set aside the affected path.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change c /dev/rdisk/c16t16d0s2
```

- 2 Replace the cable between the storage system and the switch.

- 3 Execute the following command to release the path that was set aside in step 1.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart c /dev/rdisk/c16t16d0s2
```

- 4 Execute the following command to verify that all paths are now either set to Active or Standby.

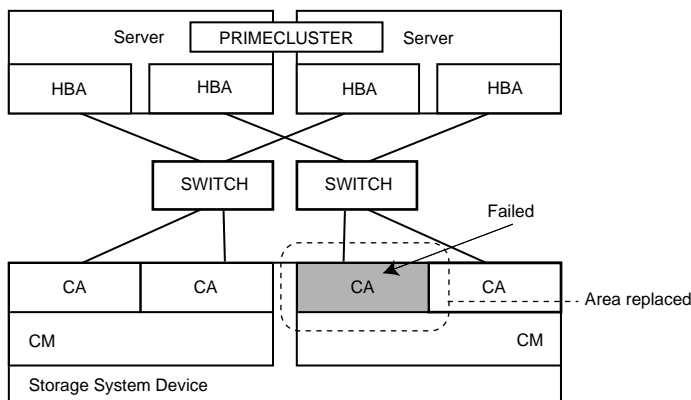
```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

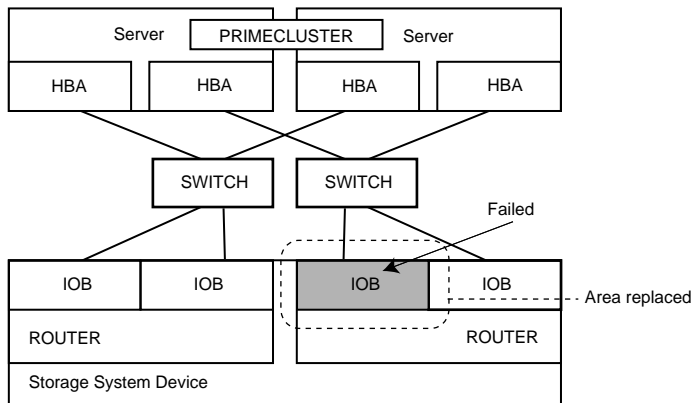
End of procedure

4.3 Replacing a CA or IOB

4.3.1 Replacement Targets and the Setting Aside of Paths

The following diagram and procedure describes how to replace a failed CA or IOB. Some storage systems require the CM to be removed to allow the CA to be replaced. In this case, refer to ["4.4 Replacing a CM or ROUTER" \(page 86\)](#).





The preventive maintenance replacement procedure described below is for the configuration above, when the following message is output only once to the main server console. All paths connected to the failed CA, or IOB must be set aside.

■ Example console message

Instance name is underlined.

```
/pci@1f,0/pci@1/fibre-channel@1/mplbt@10,0(mplbt540)  
SCSI transport failed: reason'incomplete': retrying command
```

The offline command is as follows:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change "unit_being_replaced" "physical_device_node"
```

Use the (underlined) "instance_name" from the console message as the physical device node. Search for the same "instance_name" in the output of the "iompadm info" command. Specify the matching path names (shown underlined below) as the physical device nodes.

■ Example output for "iompadm info" command

```
# /usr/opt/FJSViomp/bin/iompadm info (primary server)
IOMP: /dev/FJSVmplb/fiomp/adm2048
Element:
  /dev/rdisk/c4t16d0s2  online active block "good status with active
                        [E30004641- 130011-CM01-CA01-PORT34] (mplbt540)"
  /dev/rdisk/c5t16d0s2  online standby block "good status with standby
                        [E30004641- 130011-CM00-CA00-PORT30] (mplbt15)"
  :
# /usr/opt/FJSViomp/bin/iompadm info (secondary server)
IOMP: /dev/FJSVmplb/fiomp/adm2048
Element:
  /dev/rdisk/c8t16d0s2  online active block "good status with active
                        [E30004641- 130011-CM01-CA01-PORT36] (mplbt640)"
  /dev/rdisk/c9t16d0s2  online standby block "good status with standby
                        [E30004641- 130011-CM00-CA00-PORT32] (mplbt115)"
  :
```

Specify "controller unit" as the unit_being_replaced. When "controller unit" is specified, as well as the paths that directly specify the physical device node, all paths that have same value "number of unit_being_replaced in the controller identifier" as that in the physical device node must be set aside. For our example, as well as the /dev/rdisk/c4t16d0s2 path for primary server adm2048, the /dev/rdisk/c8t16d0s2 path for secondary server adm2048 must also be set offline.

The following command is used to set aside a path:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change cu /dev/rdisk/c4t16d0s2
```

4.3.2 Hot Swapping a CA or IOB

The following procedure describes how to replace a CA or IOB without turning off the server and storage system.

Procedure

- 1 Execute the following command to set aside the affected path.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change cu /dev/rdisk/c4t16d0s2
```

- 2 Replace the CA or IOB.

- 3 Execute the following command to release the path that was set aside in step 1.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart cu /dev/rdisk/c4t16d0s2
```

- 4 Execute the following command to verify that all paths are now either set to Active or Standby.

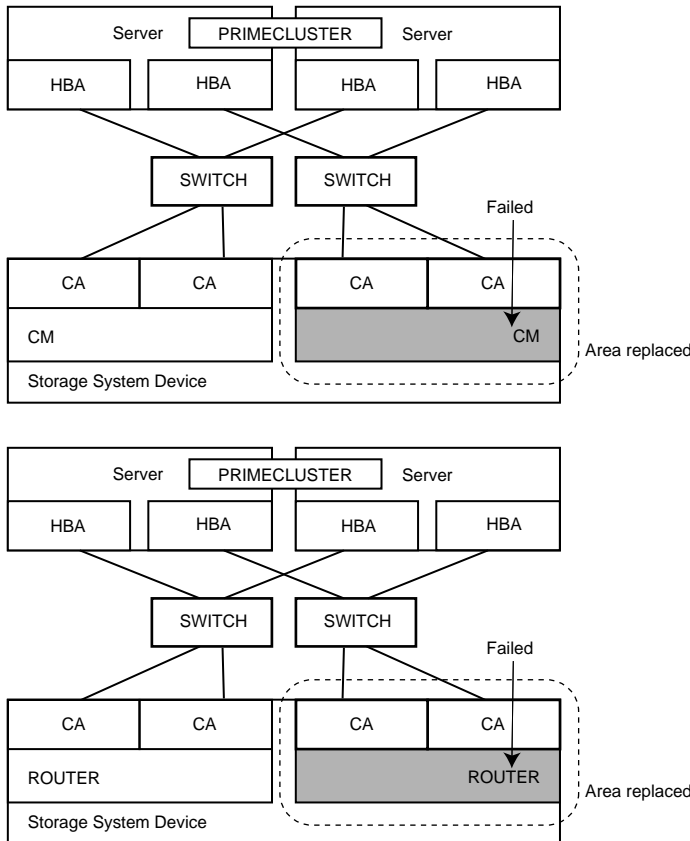
```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.4 Replacing a CM or ROUTER

4.4.1 Replacement Targets and the Setting Aside of Paths

The following diagram and procedure described how to replace a failed CM or ROUTER.



The preventive maintenance replacement procedure described below is for the configuration above, when the following message is output only once to the main server console. All paths that run through CAs that are attached to the failed CM or ROUTER must be set aside. However, the ETERNUS6000 does not require that paths be set aside when replacing a CM.

■ Example console message

Instance name is underlined.

```
WARNING: /pci@1f,0/pci@1/fibre-channel@1/mplbt@10,0(mplbt0)  
SCSI transport failed: reason'incomplete': retrying command
```

The offline command is as follows:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change "unit_being_replaced" "physical_device_node"
```

Use the (underlined) "instance_name" from the console message as the physical device node. Search for the same "instance_name" in the output of the "iompadm info" command. Specify the matching path names (shown underlined below) as the physical device nodes.

■ Example output for "iompadm info" command

```
# /usr/opt/FJSViomp/bin/iompadm info (primary server)  
IOMP: /dev/FJSVmplb/fiomp/adm2048  
Element:  
  /dev/rdisk/c16t16d0s2 online active block "good status with active  
    [E6000- 000001-RT00-CA21-PORT87] (mplbt0)"  
  /dev/rdisk/c17t16d0s2 online active block "good status with active  
    [E6000- 000001-RT10-CA31-PORTc7] (mplbt826)"  
:  
# /usr/opt/FJSViomp/bin/iompadm info (secondary server)  
IOMP: /dev/FJSVmplb/fiomp/adm2048  
Element:  
  /dev/rdisk/c5t16d0s2 online active block "good status with active  
    [E6000- 000001-RT00-CA21-PORT87] (mplbt20)"  
  /dev/rdisk/c6t16d0s2 online active block "good status with active  
    [E6000- 000001-RT10-CA31-PORTc7] (mplbt811)"  
:
```

Specify "groupmodule" as the unit_being_replaced. When "groupmodule" is specified, as well as the paths that directly specify the physical device node, all paths that have same value "number of unit_being_replaced in the controller identifier" as that in the physical device node must be set aside. For our example, as well as the /dev/rdisk/c16t16d0s2 path for primary server adm2048, the /dev/rdisk/c5t16d0s2 path for secondary server adm2048 must also be set offline.

The following command is used to set aside a path:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change g /dev/rdisk/c16t16d0s2
```

4.4.2 Hot Swapping a CM or ROUTER

The following procedure describes how to replace the CM or ROUTER without turning the server and storage system off.

Procedure

- 1 Execute the following command to set aside the affected path.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb change g /dev/rdisk/c16t16d0s2
```

- 2 Replace the CM or ROUTER.

- 3 Execute the following command to release the path that was set aside in step 1.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart g /dev/rdisk/c16t16d0s2
```

- 4 Execute the following command to verify that all paths are now either set to Active or Standby.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.5 Replacing a Storage System Device

The following procedure describes how to replace a failed storage system device.

Caution

The following must be considered before replacing a storage system device.

- When replacing a storage system, the cables must be re-connected to the same positions as before.
- The new storage system device must have LUNs created in the same configuration as used by the storage system device being replaced.
- Reuse the same loop ID as before when the server and storage system are connected without the use of a Fibre Channel switch.

Procedure

- 1 When connecting the server and storage system using a Fibre Channel switch, check the storage system's WWN.
- 2 Turn off the server, then set to single user mode.

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

- 3 When connecting a Fujitsu Fibre Channel card and storage system with a Fibre Channel switch, use the "chgfcctl" command or the "clchgfc" command, which are fjsvpc driver commands, to reattach the old targetID to all the WWNs of the new storage system device. If the WWNs of the new storage system device are the same as the old WWNs, this procedure is not necessary.

- For the "chgfcctl" command

```
# /usr/sbin/FJSVpfca/chgfcctl -d <target_disk_name> -p  
WWN_of_storage_system_device_after_replacement
```

(Example)

```
# /usr/sbin/FJSVpfca/chgfcctl -d /dev/rdisk/c2t16d0s2 -p 0x202400e000cb0001
```

- For the "clchgfc" command

```
# /usr/sbin/FJSVpfca/clchgfc -d <target_disk_name> -p  
WWN_of_storage_system_device_after_replacement
```

(Example)

```
# /usr/sbin/FJSVpfca/clchgfc -d /dev/rdisk/c2t16d0s2 -p 0x202400e000cb0001
```

- 4 Shut down the server.
- 5 Replace the storage system device.
- 6 Reboot the server

- 7 Execute the following command to confirm that all paths are Active or Standby status.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.6 Replacing a Server System Board

4.6.1 Hot Swapping a System Board

Replacing a system board without turning the server off is only possible if the server has the Dynamic Reconfiguration function. When hot swapping a system board by using this function, follow the procedures given in the following documents.

- "Enhanced Support Facility User's Guide For Dynamic Reconfiguration"
- "Enhanced Support Facility User's Guide Dynamic Reconfiguration I/O device"

4.6.2 Cold Swapping a System Board

The following procedure describes how to replace the system board with turning the server off.

Procedure

- 1 Turn off the server.
- 2 Replace the system board inside the server. Refer to the individual server manuals for details.
- 3 Turn on the server.
- 4 Execute the following command to verify that all paths are now either Active or Standby.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.7 Replacing a Fibre Channel Switch and SFP/GBIC

4.7.1 Hot Swapping a Fibre Channel Switch or SFP/GBIC

The following procedure describes how to replace a Fibre Channel switch or SFP/GBIC without needing to turn the server and storage system off.

Procedure

- 1 Use the following command to confirm that the paths which are not connected to the Fibre Channel switch or SFP/GBIC that is to be replaced are in "Online Active" or "Online Standby" status:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

- 2 Replace the Fibre Channel switch or SFP/GBIC. No multipath commands need be executed. Error messages (see below) may appear for paths connected to the Fibre Channel switch or SFP/GBIC that is being replaced. However, even if the path status changes to "Warning" or "Offline", the result will just be failover to the normal Standby path.

(Example 1)

```
WARNING: /pci@16,2000/fibre-channel@1/mplbt@11,0 (mplbt1792):  
disk not responding to selection
```

(Example 2)

```
WARNING: /pci@17,2000/fibre-channel@1/mplbt@11,0 (mplbt768):  
SCSI transport failed: reason 'tran_err': giving up
```

- 3 Use the following command to verify that all paths are back "Online".

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

Paths connected to the replaced Fibre Channel switch or SFP/GBIC may show as "Offline Fail" or "Online Warning" status for a while. If this is the case, specify the Offline Fail path or the Online Warning path and execute the following command:

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart a "physical_device_node"
```

(Example)

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb restart a /dev/rdisk/c16t16d0s2
```

End of procedure

4.7.2 Cold Swapping a Fibre Channel Switch or SFP/GBIC

The following procedure describes how to replace the Fibre Channel switch or SFP/GBIC with the server turned off.

Procedure

- 1 Turn off all the servers connected to the Fibre Channel switch or SFP/GBIC.
- 2 Replace the Fibre Channel switch or SFP/GBIC.
- 3 Turn the servers back on.
- 4 Use the following command to verify that all paths are now "Online Active" or "Online Standby" status.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

4.8 Replacing a Storage System Disk

The following procedure describes how to replace a failed storage system disk.

Procedure

- 1 Replace the failed disk, referring to the individual storage system device manuals.
- 2 If data has been lost, use the "format" command to recreate the disk label. Refer to the man pages for details of the "format" command.

```
# format /dev/FJSVmplb/rdisk/mplb0s2
```

End of procedure

Appendix A

Multipath Control Commands

This appendix explains the commands used for managing multipath configurations with the Multipath Driver. The commands in this chapter are grouped by function:

Table A.1 Multipath Commands

| Function | Command and Subcommand |
|---|--|
| Displaying path status | iompadm status ("A.1.1 "iompadm status" Command" (page 95)) |
| | iompadm info ("A.1.2 "iompadm info" Command" (page 100)) |
| | mpdinfo ("A.1.3 "mpdinfo" Command" (page 102)) |
| Performing concurrent upgrades | iompadm change ("A.2.1 "iompadm change" Command" (page 104)) |
| | iompadm restart ("A.2.2 "iompadm restart" Command" (page 106)) |
| Creating or changing multipath configurations | grmpdautoconf ("A.3.1 "grmpdautoconf" Command" (page 107)) |

Note

Command formats, usage, and arguments for "grmpdautoconf" and "mpdinfo" commands are presented in respective sections of this appendix. Command format and arguments for "iompadm" commands are summarized below.

■ "iompadm" command format

"iompadm" commands use the following syntax:

```
/path_to_command_directory class_of_device command required_argument \  
[optional_argument] subcommand /path_to_target
```

For example, in the following command line:

```
/usr/opt/FJSViomp/bin/iompadm -c mplb info /dev/FJSVmplb/fiomp/adm0
```

- "/usr/opt/FJSViomp/bin" is the path to the directory for the command.
- "iompadm" is the command.
- "-c" is the required option specifying the mplb type of SCSI device.
- "info" is the subcommand.
- "/dev/FJSVmplb/fiomp/adm0" is the path to the target on which the subcommand operates.

■ "iompadm" command arguments

The following table explains the various arguments that can be used with each "iompadm" command.

Table A.2 Arguments for Multipath Commands

| Argument | Description |
|------------|---|
| -c | Class of SCSI device; specify "mplb" (required) |
| -p | When the -p option is used, the physical device node name corresponding to the specified instance will be displayed. <i>(optional)</i> |
| subcommand | <p>One of the following subcommands is required. These are described in the following subsections of this appendix.</p> <ul style="list-style-type: none"> • status • info • change • restart <p>If the "change" or "restart" subcommand is specified for a cluster configuration node, the same command may be automatically executed in the other nodes. Refer to "A.2.1 "iompadm change" Command" (page 104) for details. The other subcommands are not automatically executed in the other nodes.</p> |
| path_name | <p>Path name can be any one of the following three types, and is an optional argument. If no path name is specified, information for all related paths will be shown.</p> <ol style="list-style-type: none"> 1. Instance administration device node, for example: <code>/dev/FJSVmplb/fiomp/adm*</code> This is a device node for controlling a multipath, generated when the multipath is created. 2. User access device node (= access special file), for example: <code>/dev/FJSVmplb/[r]dsk/mplb*s*</code> <code>/dev/[r]dsk/c*t*d*s*</code> This is a device node for transferring multipath data, generated when the multipaths are created, and used by applications. 3. Physical device node, for example <code>/dev/[r]dsk/c*t*d*s*</code>, <code>/devices/...</code> This is a device node for a disk device that is part of the multipath. |

A.1 Displaying Multipath Status

Use the "iompadm status", "iompadm info" and "mpdinfo" commands to display multipath status.

Caution

These commands display the internal status of the Multipath Driver path information. Current path connectivity is neither checked nor displayed by these commands.

For example, when the cable of a normal status path becomes disconnected, the relevant path status shown by these commands will stay "online" for as long as the path status information managed by Multipath Driver remains unchanged.

The path status information managed by Multipath Driver will be changed when an I/O error or path failure is detected by the auto-check function. Subsequent execution of these commands will then reveal the new status of the changed path information.

A.1.1 "iompadm status" Command

■ Command format

```
iompadm -c mplb [-p] status instance_administration_device_node  
[physical_device_node] [:event] [physical_device_node]
```

■ Function

This command shows the multipath status of a specified instance administration device node. It can also be used to isolate the status of a specified physical device node.

Note

If this command is issued in response to an "E:" output message, details of the event will appear as [:event] after instance_administration_device_node.

■ Usage

This command can be used to check the multipath status at any time. It should be used whenever a Multipath Driver error message is displayed, to obtain information for troubleshooting the error.

■ Output format

```
physical_device_node, status 1, status 2, status 3, "message,  
[disk_device_controller_id] (mplbt_instance)"  
[-> device_path]
```

The following table explains some of the values that may be displayed for each argument in the output.

Table A.3 Arguments for "iompadm status" Command

| Argument | Possible Values and Description |
|---|---|
| physical_device_node | Displays physical disk device name (/dev/rdisk/c*t*d*s) configuring multipath. The controller number of the device name (c*) cannot be changed, because it is automatically assigned by the OS |
| status 1 | online = path is active |
| | offline = path is not active, not in use |
| | unconfigured = path has been cut off from multipath control |
| status 2 | active = path is operating normally |
| | standby = path is on standby |
| | stop = path is temporarily stopped by a command |
| | fail = path has failed for some reason |
| | disconnected = path has been disconnected by the Dynamic Reconfiguration function |
| status 3 | block = external access of physical_device_nodes is prohibited For the ETERNUS Driver, status 3 is fixed at this value. |
| | unblock = blocked status has been released |
| message | This indicates the cause of the status, disconnected status (Warning), or that an error prevents the path status from changing ("E:"). "Warning" indicates that the online access path has been temporarily disconnected. "E:" indicates that an error prevents the previous path status from changing. The error details can be displayed using the ":event option" for the access path that appears after "E:". For the cause of the status, refer to "Message list" (page 98) . |
| mplbt_instance | Displays the instance number of mplbt. |
| device_path | If the -p option is used, the device path will be displayed in the "/devices" portion of the output. |
| disk_device_controller_id (see Note below) | This character string identifies the connected disk devices and their channel adapter ports (controllers), and is composed of the following elements: <ul style="list-style-type: none"> • Device name port = model name and magic code (for internal identification) • Device identification no. port = unique serial number assigned to each disk device • Group no. port = identifier for all paths of the same device name grouped through the same router. When replacing a group module, all paths in the group should be disabled first. Further information about group modules for storage system devices is available at the following website: http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/software/eternusmpd/ • Change unit port = identifier for elements in a path that may be replaced, depending on the specific parts and paths that need replacing. • Adapter port no. port = CA port number on the disk device side of the physical cable connection. |

Further information about the relationship between `disk_device_controller_id` and physical locations is available at the following website:

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

■ Examples

To display the multipath status, enter the following command:

```
# iompadm -c mplb status /dev/FJFSVmplb/fiomp/adm0
```

The system responds with information about the failed path(s) such as:

```
/dev/rdisk/c5t16d0s2 offline fail block "unspecified transport error
[E60004648- 000001-RT10-CA31-PORTc7] (mplbt42)"
/dev/rdisk/c6t16d0s2 online active block "good status with active
[E60004648- 000001-RT00-CA21-PORT87] (mplbt716)"
```

If the `-p` option is used (as in the following command), the affected physical device node(s) will also be displayed:

```
# iompadm -c mplb -p status /dev/FJFSVmplb/fiomp/adm0
```

The system outputs the following type of information about the physical device node, in response to the `-p` option (note the added `/devices` information).

```
/dev/rdisk/c5t16d0s2 offline fail block "unspecified transport error
[E60004648- 000001-RT10-CA31-PORTc7] (mplbt42)
-> /devices/pci@1f,4000/fibre-channel@1/mplbt@10,0:c,raw
```

Information about the physical device node can also be displayed by entering its specification in the command line:

```
# iompadm -c mplb status /dev/FJFSVmplb/fiomp/adm0 \
/devices/pci@1f,4000/fibre-channel@1/mplbt@10,0:c,raw
```

■ :event option

When "E:" appears at the beginning of the message argument in a status display, detailed information appears concerning the event and all physical nodes connected with the related instance. If "E:" appears following a physical device node identifier, only the information for that physical node will be displayed.

An "E:" message (indicating an event has occurred) appears in response to a status command for the instance "adm0" in the following example:

```
# iompadm -c mplb status /dev/FJFSVmplb/fiomp/adm0
/dev/rdisk/c5t16d0s2 online active block "good status with active
[E60004648- 000001-RT10-CA31-PORTc7] (mplbt42)"
/dev/rdisk/c6t16d0s2 online active block "E: good status with active"
[E60004648- 000001-RT00-CA21-PORT87] (mplbt716)"
```

To request the display of event information related to an instance, specify `:event` after the instance administration device node name, as in the following example.

```
# iompadm -c mplb status /dev/FJSSVmplb/fiomp/adm0:event
/dev/rdisk/c5t16d0s2 online active block ""
/dev/rdisk/c6t16d0s2 online active block "good, last event: I/O error"
```

Note

When the details of an event are requested using the ":event" option, the "E:" flag will not appear in the output display.

Message list

The following table shows the messages that are displayed and their meanings.

Table A.4 Message List

| | Displayed Message | Description |
|---|--------------------------------------|---|
| 1 | good status with active | The path is in Active status. |
| 2 | good status with standby | The path is in Standby status. |
| 3 | warning, last event: | The path is in Warning status and error contents are displayed. When nothing is displayed for "last event:", this means that the status has changed to Warning status due to an error detected by checks or other LUNs. |
| 4 | warning, status: | The path is in Warning status and the current detailed status is displayed. |
| 5 | forcible fail status | The path is changed to Forcible Fail status. |
| 6 | fail status of Oracle hardware error | The path is changed to Fail status on the Oracle hardware. |
| 7 | fail status by LUN degraded | The path is changed to Fail status due to a blocked LUN. |
| 8 | fail status by hardware trouble | The path is changed to Fail status due to an error detected by checks or other LUNs. |
| 9 | stop status by software indication | The path is in Stop status. |

| | Displayed Message | Description |
|----|---|--|
| 10 | no sense (0/???) recovered error (1/???) not ready (2/???) medium error (3/???) hardware error (4/???) illegal request (5/???) unit attention (6/???) data protect (7/???) blank check (8/???) vendor specific (9/???) copy aborted (a/???) aborted command (b/???) equal (c/???) volume overflow (d/???) mismatch (e/???) reserved (f/???) undefined sense key (???) transport stopped with not normal state dma direction error occurred unspecified transport error target completed hard reset sequence command transport aborted on request command timed out data overrun command overrun status overrun message not command complete target refused to go to message out phase extended identify message rejected initiator detected error message rejected abort message rejected reject message rejected no operation message rejected message parity error message rejected bus device reset message rejected identify message rejected unexpected bus free phase occurred target rejected our tag message command transport terminated on request undefined pkt_reason (??) | The error contents are displayed. These messages only indicate that an error occurred. They do not necessarily mean that the current I/O has failed or that the path status is Offline. |

| | Displayed Message | Description |
|----|---|--|
| 10 | device queue full status device busy status reservation conflict status condition met status intermediate status SCSI2 status intermediate condition met status command terminated status ACA active status undefined SCSI status (0x?) fatal error in transport layer adapter or device queue full status DMA size exceeded maximum value transport layer accepted packet undefined scsi_transport(9F) value (?) incomplete uscsi cdb=(0x?) | |
| 11 | recovered from fail status | The path is recovered by checks. |
| 12 | changing parts with power supply charged | For Dynamic Reconfiguration and PCI Hot Plug, this message is displayed when the path is disconnected. |
| 13 | no such device or address | The path is Offline at device start-up. |

 **Caution**

If the message is too long to display, [...] is displayed.
Example:

```
/dev/rdisk/c6t16d0s2 online active block "warning, last event: target completed hard
reset se... [E30004641- 130011-CM00-CA00-PORT30] (mplbt716) "
```

A.1.2 "iompadm info" Command

■ **Command format**

```
iompadm -c mplb info [instance_administration_device_node [:event]]
```

■ **Function**

Executing this command provides information on the specified instance_administration_device_nodes. If the instance_administration_device_node is omitted, information will be displayed for all instances in the order they were recognized by the OS, which is not necessarily ascending order instance number. If "E:" is displayed in the output message, add [:event] after the instance_administration_device_node to display its details. (See ":event option" under ["A.1.1 "iompadm status" Command" \(page 95\)](#))

■ Usage

This command is used to show information regarding the elements that constitute an instance administration node.

■ Output format

The following table explains some of the arguments that appear in the output for the "info" command.

Table A.5 Arguments for "iompadm info" Command

| Argument | Description |
|---|---|
| IOMP | instance_administration_device_node |
| Element | Displays the status of each configured physical_device_node for the instance_administration_device_node controlled by the multipath. This portion of the "info" display corresponds to the "status" display described previously. For details of each path display, refer to the prior section on the "iompadm status" command. |
| Node | All the device node names that access the controlling multipath for this instance_administration_device_node. |
| Function: MPmode=true AutoPath=true Block=true NeedSync=false | This argument is fixed for the Multipath Driver. |

■ Example

Use the following command to gather information on instance administration node adm0.

```
# iompadm -c mplb info /dev/FJSVmplb/fiomp/adm0
```

Information such as the following sample will be displayed.

● When Solaris standard special files are used:

```
IOMP: /dev/FJSVmplb/fiomp/adm0
Element:
/dev/rdisk/c0t16d0s2 offline fail "unspecified transport error
[E60004648- 000001-RT10-CA31-PORTc7] (mplbt42)"
/dev/rdisk/c1t16d0s2 online active "good status with active
[E60004648- 000001-RT00-CA21-PORT87] (mplbt716)"
Node:
/dev/rdisk/c5t0d0s0
/dev/rdisk/c5t0d0s1
:
Function:
MPmode=true
AutoPath=true
Block=true
NeedSync=false
```

- When mplb access special files are used:

```
IOMP: /dev/FJSVmplb/fiomp/adm0
Element:
/dev/rdsk/c0t16d0s2 offline fail "unspecified transport error
[E60004648- 000001-RT10-CA31-PORTc7] (mplbt42)"
/dev/rdsk/c1t16d0s2 online active "good status with active
[E60004648- 000001-RT00-CA21-PORT87] (mplbt716)"
Node:
/dev/FJSVmplb/dsk/mplb0s0
/dev/FJSVmplb/dsk/mplb0s1
:
Function:
MPmode=true
AutoPath=true
Block=true
NeedSync=false
```

A.1.3 "mpdinfo" Command

- Command format

```
/usr/sbin/FJSVmplb/mpdinfo [sd_instance_name | sd_device_node | mplb_instance_name
| mplb_device_node]
```

- Function

This command shows information for multipath managed sd devices and sd device-related mplb devices. For details of the relationship between mplb devices and sd devices, refer to ["D.1 Checking the Performance Information" \(page 141\)](#).

- Usage

This command is used to confirm which multipath device corresponds to the device information displayed by the "sar" or "iostat" command.

■ "mpdinfo" command arguments

The following table explains the various arguments that can be used with each "iompadm" command.

Table A.6 Arguments for "mpdinfo" Commands

| Argument | Possible Values and Description |
|--------------------|---|
| sd_instance_name | Specify the sd device managed by the Multipath Driver in "sd*" format. ("*" is the instance number.) |
| sd_device_node | Specify the sd device managed by the Multipath Driver in "/dev/rdisk/c*t*d*s*" format. ("/dev/rdisk/" can be omitted.) |
| mplb_instance_name | Specify the mplb device managed by the Multipath Driver in "mplb*" format. ("*" is the instance number.) This argument is disabled for Solaris standard special file format multipaths. |
| mplb_device_node | Specify the mplb device managed by the Multipath Driver in "/dev/FJSMplb/rdisk/mplb*s" format. ("/dev/FJSMplb/rdisk/" can be omitted.) This argument is disabled for Solaris standard special file format multipaths. |

■ How to use the command

Refer to ["D.1 Checking the Performance Information" \(page 141\)](#) for details.

■ Example

The displayed contents depend on the type of special file specified when the multipath was created.

● When mplb special files are used:

If no arguments are specified, information for all recognized multipath devices is displayed.

```
# /usr/sbin/FJSMplb/mpdinfo
mplb0(/dev/FJSMplb/rdisk/mplb0s2) --> sd30(/dev/rdisk/c5t0d0s2)
mplb1(/dev/FJSMplb/rdisk/mplb1s2) --> sd31(/dev/rdisk/c5t0d1s2)
mplb2(/dev/FJSMplb/rdisk/mplb2s2) --> sd32(/dev/rdisk/c5t0d2s2)
```

The instance number of a specific sd or special file name can be specified as an argument. In this case, only the information for the specified device is displayed.

```
# /usr/sbin/FJSMplb/mpdinfo sd30
mplb0(/dev/FJSMplb/rdisk/mplb0s2) --> sd30(/dev/rdisk/c5t0d0s2)
# /usr/sbin/FJSMplb/mpdinfo /dev/rdisk/c5t0d0s2
mplb0(/dev/FJSMplb/rdisk/mplb0s2) --> sd30(/dev/rdisk/c5t0d0s2)
```

The instance number of a specific mplb or special file name can be specified as an argument. In this case, only the information for the specified device is displayed.

```
# /usr/sbin/FJSMplb/mpdinfo mplb1
mplb1(/dev/FJSMplb/rdisk/mplb1s2) --> sd31(/dev/rdisk/c5t0d1s2)
# /usr/sbin/FJSMplb/mpdinfo /dev/FJSMplb/rdisk/mplb0s2
mplb0(/dev/FJSMplb/rdisk/mplb0s2) --> sd30(/dev/rdisk/c5t0d0s2)
```

- When Solaris standard special files are used:

If no arguments are specified, information for all recognized multipath devices is displayed.

```
# /usr/sbin/FJSMplb/mpdinfo  
/dev/rdisk/c5t0d0s2 --> sd30  
/dev/rdisk/c5t0d1s2 --> sd31  
/dev/rdisk/c5t0d2s2 --> sd32
```

The instance number of a specific sd or special file name can be specified as an argument. In this case, only the information for the specified device is displayed.

```
# /usr/sbin/FJSMplb/mpdinfo sd30  
/dev/rdisk/c5t0d0s2 --> sd30
```

A.2 Concurrently Upgrading a Multipath Configuration

A.2.1 "iompadm change" Command

- Command format

```
iompadm -c mplb change [change_unit] target_physical_device_node
```

- Function

This command is used to prepare the system for concurrently upgrading hardware. It disconnects the paths for the hardware to be replaced and stops all related I/O processes.

The `target_physical_device_node` is the physical path name of the element displayed by the "iompadm info" command, such as:

```
/dev/rdisk/c2t16d0s2
```

- Usage

Execute the "iompadm change" command to stop all I/O processing on paths used by hardware that is to be replaced.

After the hardware is upgraded, the "restart" command can be used to resume I/O processing on those paths.

■ Example

```
# iompadm -c mplb change c /dev/rdsd/c2t16d0s2
```

The letter(s) following the "change" command and preceding the device node specification ("c" in the preceding example) identify the type of hardware to be replaced. This hardware is referred to as the change unit.

Select the change unit for the hardware you are replacing from the following table. Note that the change unit parameters differ depending on the maintenance to be performed. If the change unit entry is omitted, the default setting is controller unit (cu).

Table A.7 Change Units

| To change: | Connecting between: | Specify change unit: | Attribute: |
|--------------|---|----------------------|-------------|
| Cables | Server and switch or Server and storage system device | Adapter | a |
| Cables | Switch and storage system device | Controller | c (default) |
| CA or CM | - | Controller unit | cu |
| Group module | In GR740 unit only | Group module | g |

When the replacement target hardware is used by multiple servers in a cluster configuration and the change unit is other than "a" (adapter), the cluster nodes talk to each other and then automatically transition the status of the paths between each node and the target hardware.

- For a cluster-sharing disk, this command only needs to be executed on one node of the cluster. Execution on all cluster nodes is not required.
- For a non-cluster-sharing disk in a cluster configuration, this command needs to be executed on all nodes.
- For a single (non-cluster) configuration, this command needs to be executed on all connected servers.

Further information about the relationship between the change units and ETERNUS hardware components is available at the following website:

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

▶ Caution

- When using SynfinityCluster, the "iompadm change" command does not need to be executed for each node.
- When using the Multipath Disk Control, you must stop I/O processing with the mphd driver command before exchanging the hardware.
- When the path status is transitioned to Stop by execution of this command, the Stop status is canceled after the server is restarted. Similar to a normal restart, the path status transitions to Online/Active/Standby if there are no path errors, or Offline Fail if a path error is found.
- When PRIMECLUSTER/SynfinityCluster is used, the regular diagnostic function may cause a Stop status path to be transitioned to Fail status. In this case, if the relevant path has no error, the path will recover automatically following Multipath Driver checks. This path status transition may be prevented by stopping the PRIMECLUSTER/SynfinityCluster diagnostic function until the maintenance work is complete. Refer to the PRIMECLUSTER/SynfinityCluster documentation for details.

A.2.2 "iompadm restart" Command

■ Command format

```
iompadm -c mpla restart [change_unit] target_physical_device_node
```

■ Function

This command reactivates I/O processing after hardware has been concurrently replaced. It also recovers the paths used by the new hardware. In addition, this command can be used when manually changing the path status from Warning to Online.

■ Usage

Execute the "iompadm restart" command to resume I/O processing on paths that have had hardware replacements. This command restarts I/O processes that have been stopped using the "iompadm change" command.

■ Example

```
# iompadm -c mpla restart c /dev/rdsk/c2t16d0s2
```

The letter(s) following the "restart" command and preceding the device node specification ("c" in the preceding example) identify the change unit. See the "iompadm change" command for more information on specifying change units.

Caution

When the path has a problem and the command is terminated with an error, the path status is changed to "Offline Fail".

A.3 Creating or Changing the Multipath Configuration

A.3.1 "grmpdautoconf" Command

■ Command format

```
/usr/sbin/grmpdautoconf [ -X | -d | -p ] [log_file]
```

The `log_file` attribute specifies the name of the log file output as a result of this command. The `log_file` attribute can be omitted, in which case `"/var/opt/FJSMplb/grmpdautoconf.log.$"` will be used to capture log file output (where `$` is 1 or 2).

-X

Allows the selection of paths that pass through multiple FC switches.

-d

Upgrades the multipath configuration to remove a path, logical unit (LU), or device.

-p

Enables an access path in the procedure of [\(5\) "Select the Disk Access Special File type" \(page 60\)](#) in ["2.3 Server Environment Validation" \(page 56\)](#) for a server on which the Dynamic Reconfiguration function is installed, which enables disk access special files to be created in the Solaris standard special files format. In this case, use of the Dynamic Reconfiguration function is not allowed.

■ Function

This command is used to automatically create a multipath when adding an LU to access a storage system device. It performs the same functions as interactive processing to create the environment settings:

- Defines or updates the environment for the `fjpfca` or `fjlsa` driver
- Creates a multipath

The `-X` option is required when configuring a multipath that passes through multiple Fibre Channel switches. The `-p` option is required when creating an access special file in the Solaris standard special file format for a server with the Dynamic Reconfiguration function installed. If this option is specified, the Dynamic Reconfiguration function cannot be used.

■ Note

When Fujitsu Fibre Channel cards or SAS cards are used to connect the server and the storage system device, this command sets up both the HBA driver and the multipath driver. If some other FC card is used, the FC driver must be setup before executing this command to setup the multipath driver.

■ Usage

The `"grmpdautoconf"` command can be used when:

- Creating a multipath during initial installation
- Creating a multipath after adding a path, or logical unit (LU)
- Removing a path, logical unit (LU), or device

■ **Caution**

- Data saved to the target logical units before the multipath is created will remain usable after the multipath has been created. Similarly, data on a logical unit is not lost even when the multipath configuration is changed or deleted.
- Disk labels are not destroyed by a multipath configuration being created, changed, or deleted.
- Other multipath device numbers are not changed by the multipath configuration being released. For example, when both mplb0 and mplb1 exist, releasing mplb0 should have no effect on mplb1.

Appendix B

Miscellaneous Notes

This appendix provides important notes and precautions that cover a range of topics concerning the Multipath Driver.

B.1 Formatting

When the setting is to use the mplb special file, execute the "format" command for a disk with a logical-path configuration as follows:

```
# format /dev/FJSVmplb/rdisk/mplb*s2
```

B.2 Logical Unit Size

Even though the LUN size has been changed, the "format" command persists in showing the old size. This is due to the old disk label information remaining. Perform the following procedure, typing the bold characters. The argument of the "format" command is the name of the special file for the target LUN.

```
# format /dev/rdsk/c2t0d27s2
format> type
AVAILABLE DRIVE TYPES:
    0. Auto configure
    :
    19. other
Specify disk type(enter its number)[18]: 0
/dev/rdsk/c2t0d27s2: configured with capacity of 1.98GB
<FUJITSU-GR730-1130 cyl 254 alt 2 hd 64 sec 256>
selecting /dev/rdsk/c2t0d27s2
[disk formatted]
format> label
Ready to label disk, continue? y
```

Note that because the partition configuration is changed, data retention is not guaranteed. Back up the data as necessary before changing the LUN size and then restore from the backup after changing the size and recreating the disk label.

B.3 Unknown Devices

In a Solaris 10 OS environment that uses mplb special files, the "format" command displays unused LUN paths as unknown devices.

(Example)

```
# format
  Searching for disks...done

  AVAILABLE DISK SELECTIONS:
      :
  2. c11t0d0 <FUJITSU-E6000-0000 ..
     /mplbx/mplbh@8/sd@0,0
  3. c11t0d1 <FUJITSU-E6000-0000 ..
     /mplbx/mplbh@8/sd@0,1
      :
```

- Action

Devices that are not in use or being accessed are recognized by Solaris 10 OS as unknown devices. When a device is accessed, the OS recognizes the device again.

Therefore, when using the "format" command, an unused path of an sd special file, controlled by a mplb special file, may be displayed. If the mplb special file is accessed, the path will not be displayed. Therefore, use the "iompadm info" command to access all mplb special files before executing the "format" command.

(Example)

```
# /usr/opt/FJSViomp/bin/iompadm info
```

B.4 Converting from Single Path to Multipath

The procedure to convert from a single path configuration to a multipath configuration is almost the same procedure as those shown in ["Chapter 2 Multipath Driver Settings" \(page 37\)](#). However, note the following points.

- It is not necessary to perform [\(1\) "Change the Partition Configuration" \(page 64\)](#) and [\(2\) "Create a File System" \(page 64\)](#) in ["2.4 Disk Settings \(Partitioning and File System\)" \(page 64\)](#).
- As the access path name to the disk will change, it is necessary to change the setting of applications such as /etc/vfstab.

B.5 HBA Driver Settings

Please refer to the Server Connection Guide for Solaris that was supplied with the storage system to determine the recommended target and/or LUN throttling, then follow the instructions in the HBA manuals for setting the driver parameters.

B.6 Geometry Messages

Messages such as below may appear during operation, however, they are geometry messages to be output when the geometry information has been read when starting the server or executing the "format" command, and do not indicate errors.

(Example)

```
[ID 365881 kern.info] <FUJITSU-GR740-0321 cyl 1954 alt 2 hd 64 sec 256>
```

B.7 "Corrupt label wrong magic number"

This message may appear if the disk label information has been lost during rebuilding of the RAID group or the volume after replacement of a failed disk, or a raw access that included cylinder 0. Use the following procedure to recover the information.

- Execute "format /dev/rdisk/c*t*d*s2" or "format /dev/FJSVmplb/rdisk/mplb*s2" to write the label information.

B.8 "sp diff:... "

The message "sp diff: name finddevice, nargs 1, nret 1, sp 0xf048c1b8 osp 0xf048c1a8oot" may appear many times.

This message indicates that the OS program sent a "finddevice" request to the Sun Fire OBP and the OBP outputs it. The message indicates normal status; however, the stack pointer (sp) in the message is different from that of original (osp). This is not an error because the control function was moved to the program for the OBP.

Since this is a notification message only, please ignore this message. It has no adverse effect on the system.

B.9 Devices

The message below may be output during a reconfiguration boot. Reconfiguration occurs when the /reconfigure file exists or the -r boot option was specified.

```
WARNING: add_spec: No major number for scsi@X  
WARNING: add_spec: No major number for fibre-channel@X  
X indicates an arbitrary value.
```

This is not a problem if all disk devices and storage system devices can be used after booting. Consult your Fujitsu maintenance engineer if optical disk devices and storage system devices cannot be used.

B.10 "Duplicate instance XX..."

The following message means that device XX has already been recognized by the OS, and an attempt to recognize it again is being ignored. This message has no effect on the system operation.

```
WARNING: Duplicate instance XX of node "mplb" ignored.
```

B.11 "SCSI transport failed:..."

The following message may be output to the console when the "restart" command is executed, when hardware is added/removed, or when the server is rebooted. No action is required since the driver is trying again.

```
SCSI transport failed: reason 'aborted': retrying command
```

B.12 "SUNW-MSG-ID:..."

For ZFS-managed Multipath Driver devices, the following message may be output to the console when the server is rebooted. No action is required since there is no effect on the system.

```
SUNW-MSG-ID: ZFS-8000-CS, TYPE: Fault, VER: 1, SEVERITY: Major EVENT-TIME: Mon Jun
25 14:43:42 JST 2007
PLATFORM: FJSV,GPUZC-M, CSN: -, HOSTNAME: raid-server2 SOURCE: zfs-diagnosis, REV:
1.0
EVENT-ID: ad895d1d-c04f-6686-88e8-bb23b276f467
DESC: A ZFS pool failed to open. Refer to http://sun.com/msg/ZFS-8000-CS for more
information.
AUTO-RESPONSE: No automated response will occur.
IMPACT: The pool data is unavailable
REC-ACTION: Run 'zpool status -x' and either attach the missing device or restore
from backup.
```

B.13 "Warning:..."

Messages such as below may appear during multipath driver setting.
The maximum number of instances allowed by the Solaris OS has been exceeded, and the configuration may need to be changed. Contact your Fujitsu maintenance engineer.

```
WARNING:mplbt33252:c, raw minor 0x40f22 too big for 32-bit applications
```


B.14 Power

If you turn on the power of the storage system device after you power on the server, the storage system device may not be recognized. Make sure to turn on the server after the storage system device. Use the "iompadm info" command to check status after turning the power on.
If "Fail" status is displayed, turn off both devices and reverse the power-on order.

B.15 Power 2

If you turn on the power of the storage system device after you power on the server, or if you power on the server with no cables connected between the server and the storage system device, it may take a very long time for the server to complete booting because it takes time for the multipath device to be recognized.

If any of the following messages do not appear after a HBA driver-related message has been output, the phenomenon described above may be the cause.

- Device configuration succeed
- Invalid Lun Mapping.
- Device configuration is without redundancy.
- Device is not found.

Wait until boot processing completes, or check the cable connections between the server and the storage system device, and then render the disks recognizable by the server. Use the "iompadm info" command to check status after turning the server on. If "Fail" status is displayed, reboot the server.

B.16 SynfinityCluster Message

The following messages are sometimes output to the console.
However, because it is output according to the timing of initialization operations during cluster activation it has no effect on the system operations.

```
"FJSVcluster:Error:/etc/opt/FSJVcluster/sys/acmaadproc.  
6212.The specified configuration change procedure is already registered.(/tmp/  
mplb/reqproc) "
```

B.17 SynfinityCluster Message 2

The following message may appear when all the cluster nodes are restarted for the first time after the initial cluster configuration has been setup. Restart the nodes once again and see whether or not the message reappears. If it does not, then no further action is required. If the message appears again, contact your Fujitsu maintenance engineer.

```
"mplbcl: error add procedure."
```

B.18 Non-identical Physical Device Nodes

When the "iompadm info/status" command is used to display the physical device nodes, the physical device nodes (/dev/rdisk/c*t*d*s*) may not be identical for all cluster nodes. This is not a problem. See the following example:

Example: For Server 1 and Server 2 in a cluster configuration, the device nodes for disk 0 may be c1 and c2 for Server 1, and c3 and c4 for Server 2.

- Result when the "iompadm" command is run on Server 1:

```
# iompadm -c mplb info /dev/FJSVmplb/fiomp/adm2048
IOMP: /dev/FJSVmplb/fiomp/adm2048
Element:
/dev/rdisk/c1t16d0s2 online active ..
/dev/rdisk/c2t16d0s2 online active ..
Node:
  /dev/FJSVmplb/dsk/mplb2048s0
  /dev/FJSVmplb/dsk/mplb2048s1
  :
```

- Result when the "iompadm" command is run on Server 2:

```
# iompadm -c mplb info /dev/FJSVmplb/fiomp/adm2048
IOMP: /dev/FJSVmplb/fiomp/adm2048
Element:
/dev/rdisk/c3t16d0s2 online active ..
/dev/rdisk/c4t16d0s2 online active ..
Node:
  /dev/FJSVmplb/dsk/mplb2048s0
  /dev/FJSVmplb/dsk/mplb2048s1
  :
```

B.19 Server and Storage System LUN Correspondence

When changing the correspondence between the server-side LUN and the storage system LUN_V, release the multipath before changing the correspondence. After changing the correspondence, setup the multipath again.

See the following example:

Example 1: Changing the LUN numbers recognized by the server from LUN0/LUN1/LUN2 to LUN3/LUN4/LUN5.
(Before change)

```
LUN0 ---> LUN_V # 0x200  
LUN1 ---> LUN_V # 0x201  
LUN2 ---> LUN_V # 0x202
```

(After change)

```
LUN3 ---> LUN_V # 0x200  
LUN4 ---> LUN_V # 0x201  
LUN5 ---> LUN_V # 0x202
```

Example 2: Changing the LUN_V numbers assigned to the server-side LUN numbers from 0x200/0x201/0x202 to 0x203/0x204/0x205, without changing the LUN numbers recognized by the server

(Before change)

```
LUN0 ---> LUN_V # 0x200  
LUN1 ---> LUN_V # 0x201  
LUN2 ---> LUN_V # 0x202
```

(After change)

```
LUN3 ---> LUN_V # 0x203  
LUN4 ---> LUN_V # 0x204  
LUN5 ---> LUN_V # 0x205
```

Refer to the individual storage system device manuals for details on changing the correspondence.

B.20 Changing or Deleting the Server and Storage System LUN Correspondence

To change the correspondence (LUN mapping or host affinity) between the LUNs recognized by the server and the volumes (LUN_V) in the storage system, the existing multipath will need to be released and then reconfigured.

For details, refer to ["D.4 Changing or Deleting a LUN Mapping or Host Affinity" \(page 147\)](#).

B.21 Changing Assigned CMs

After the "CM" of a RAID group has been changed, a server reboot is required for Multipath Driver configuration to update.

B.22 Multipath Driver Resident Processes

When the Multipath Driver starts, two "mplbstrtc" processes and two "mplbdaemon" processes also start. The main function of these resident processes is to collect and diagnosis I/O error information. They should appear as follows when the "ps" command is executed.

```
# ps -aef
  UID    PID  PPID  C   STIME TTY      TIME CMD
  :
root    62    1    0 13:45:25 ?        0:00 /usr/sbin/mplbstrtc
root    63    62    0 13:45:25 ?        0:00 /usr/sbin/mplbstrtc
root    67    1    0 13:45:25 ?        0:00 /usr/sbin/mplbdaemon
root    68    67    0 13:45:25 ?        0:00 /usr/sbin/mplbdaemon
  :
```

B.23 Transport Errors for iostat -E

The "Transport Errors" value for iostat -E is not 0 even when the server is rebooted. This value is counted by a server reboot or the "grmpdautoconf" command, but it is not a problem.

B.24 Log File Size and Number of Generations

The log file size and the number of generations that can be stored are shown below.

| Log File Name | Size | Number of Generations |
|--|-------|-----------------------|
| /var/opt/FJSVmplb/grmpdautoconf.log* | 1MB | 2 |
| /var/opt/FJSVmplb/mplbdaemon.log* | 512KB | 2 |
| /var/opt/FJSVmplb/multi-path-config.log* | 2MB | 2 |
| /var/opt/FJSVmplb/mplbtrc* | 1MB | 3 |

Appendix C

Error Messages

This appendix describes the error messages generated by various functions of the Multipath Driver.

Each section explains the notification, degradation, and warning messages that may be displayed by a specific driver or command. These messages are displayed on the console and logged in the `/var/adm/messages` log file.

Refer to ["Appendix A Multipath Control Commands" \(page 93\)](#) for more information on the parameters and usage of the commands from which these error messages are generated.

C.1 Notification, Degradation, and Warning Messages

■ Transport related messages

Some of the messages are shown with an "XXXXXXXX" at the end. In practice, this part of the message will contain one of the following:

- retrying command:** Indicates that a retry will be performed. The initial "WARNING" will not be displayed.
- giving up:** Indicates that no more retries will be performed until after the paths have been switched.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed : reason 'incomplete' : retrying command

Cause:

A transport line error (CRC/framing error, etc.) occurred. Check all physical line connections (plug connections, etc.).

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

disk not responding to selection

Cause:

A transport line error (CRC/framing error, etc.) occurred. Check all physical line connections (plug connections, etc.). This message is displayed after all retries have failed on any path.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed : reason 'tran_err' : giving up

Cause:

A transport line error (adapter hardware/protocol error, etc.) occurred. Check all physical line connections (plug connections, etc.). This message is displayed after all retries have failed on any path.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed : reason 'reset' : XXXXXXXX

Cause:

I/O access was cut-off due to either a transport line link failure, or the issuance of a reset command by the SCSI protocol. If this frequently occurs, check all physical line connections (plug connections, etc.).

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed: reason 'aborted' : XXXXXXXX

Cause:

I/O access was cut-off due to either a transport line protocol error, or the issuance of an abort command by higher ranking software. If this frequently occurs, check all physical connections (plug connections, etc.).

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed : reason ' timeout' : XXXXXXXX

Cause:

I/O access was cut-off due to an I/O timeout in the storage system device. If this frequently occurs, check all physical connections (plug connections, etc.).

■ SCSI sense related messages

Each of these messages will include the initial "WARNING" after retry has failed.

At this time, the following message will also appear immediately following the message showing the cause of the error.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

information: giving up

Cause:

I/O failure occurred due to the reasons indicated in the preceding message.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 3, ASC :0xB, ASCQ : 0xC, FRU :0xD

information : Medium error

Cause:

The LUN has not been formatted in the storage system device. Format the LUN according to the instructions in the storage system device manual. To format the LUN, execute the label option from the server's format command menu. If the LUN is already properly formatted, consider there to be a failure in the storage system device. XXXXX represents the storage system device model which will be displayed. Refer to the displayed model's maintenance manual to locate the problem. The failure codes will be displayed for B, C, and D.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 4, ASC :0xf1, ASCQ : 0xC, FRU :0xD

information : FRU failed

Cause:

A failed part in the storage system device needs to be replaced. XXXXX represents the disk device model which will be displayed. Refer to the displayed model's maintenance manual to locate the problem. The failure codes will be displayed for C and D. This message is presented to the next LUN accessed after the failure. The LUN receiving the failed part notification may not be directly related to the failure.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK: 4,ASC: 0xf2,ASCQ: 0xC,FRU: 0xD

information : FRU failed

Cause:

A failed part in the storage system device needs to be replaced. XXXXX represents the disk device model which will be displayed. Refer to the displayed model's maintenance manual to locate the problem. The failure codes will be displayed for C and D. This message is presented to the next LUN accessed after the failure. The LUN receiving the failed part notification may not be directly related to the failure.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 4, ASC : 0xB, ASCQ, :0xC, FRU : 0xD

information : Hardware error

retry count = X, block no : Y

Cause:

The driver performs a retry after a hardware error has been detected in the device.

X, Y represents:

X : retry count : Number of retries

Y : block no : Block address (decimal value) of the slice resulting from the access request

When the same X (retry count) and Y (block no) is displayed twice in a row, it means that no more retries are allowed. XXXXX represents the storage system device model which will be displayed. Refer to the displayed model's maintenance manual to locate the problem. The failure codes will be displayed for B, C, and D.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 6,ASC : 0x11,ASCQ : 0x90,FRU : 0xA

While rebuild processing, fill the broken data into some sectors of disk.

Cause:

During the rebuild, data recovery failed because the source disk had a media error, and dummy file data was inserted. Contact your Fujitsu maintenance engineer and check data validity.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 6,ASC : 0xf2,ASCQ : 0x88,FRU : 0xA

Finish rebuild processing, but fill the broken data into some sectors of disk.

Cause:

Rebuild process has finished, but some data was unrecoverable. Contact your Fujitsu maintenance engineer and check data validity.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK: 6,ASC: 0xf2,ASCQ: 0x8x,FRU: 0xXX

information: Operating condition changed<Z=0xXX>

Cause:

Indicates that it is in the process of reconstructing or recovering the logical drive data, or that these processes were completed.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK: 6, ASC: 0xa9, ASCQ: 0x0, FRU: 0xXX

Cause:

Indicates that ETERNUS VD800 has taken time to access the tape device to read data and process.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

Error for Command : XXXX Error Level : A

Requested Block : B Error Block : C

Vendor : FUJITSU Serial Number : D

Sense Key : Illegal Request

ASC : 0xE (xxxxxx), ASCQ : 0xF, FRU : 0xG

Cause:

Received a command unsupported for this device. The CDB parameter specified during access is unsupported, or the LUN may be incorrectly specified. If using an application that directly generates SCSI commands to control the storage system device, make sure that it is supported. When using the OPC/EC function, make sure that the environment settings are correct. Also, confirm the ETERNUS SF AdvancedCopy Manager, or other storage management software settings, as well as all error messages. If none of the above conditions are responsible, consider a hardware failure. Refer to the respective storage system device's maintenance manual for details on how to locate the problem. The following information is contained in the error message:

XXXX: Type of command issued

A : Type of message (Information, Recovered, Retry, Fatal, etc.)

B : Block address (decimal value) of the disk heading resulting from the access request

C : Block address (decimal value) of the disk heading accessed by the storage system device

D : Device serial number

E, F, G, xxxxxx : Code number or message details

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

Error for Command : XXXX Error Level : A

Requested Block : B Error Block : C

Vendor : FUJITSU Serial Number : D

Sense Key : yyyyyy

ASC : 0xE (xxxxxx), ASCQ : 0xF, FRU : 0xG

Cause:

Received an unexpected error code from the storage system device. Refer to the maintenance manual of the storage system device to locate the problem. The following information is contained in the error message:

XXXX: Type of command issued

A : Type of message (Information, Recovered, Retry, Fatal, etc.)

B : Block address (decimal value) of the disk heading resulting from the access request

C : Block address (decimal value) of the disk heading accessed by the storage system device

D : Device serial number

E, F, G, xxxxxx : Code number or message details

yyyyyy : Corresponding Sense key message

The table below lists the Sense keys and their corresponding messages.

| Message | Sense Key |
|---------------------|-----------|
| No Additional Sense | 0x00 |
| Soft error | 0x01 |
| Not Ready | 0x02 |
| Write Protected | 0x07 |
| Blank Check | 0x08 |
| Volume Overflow | 0x0d |
| Miscompare Error | 0x0e |

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK : 0xb, ASC : 0xB, ASCQ : 0xC, FRU : 0xD

information : Aborted command

Cause:

The storage system device received the aborted command. If this message occurs frequently, and an error is notified to the application, consider the storage system device to be faulty. XXXXX represents the model of the storage system device. Refer to the displayed model's maintenance manual to locate the problem. The failure codes will be displayed for B, C, and D.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

device busy

Cause:

The device sends a BUSY response in succession (40 sec. - 1 min.) to the SCSI interface. If this message appears, consider reconfiguring the device and or applications to lessen the burden on the device. If this is not responsible for the problem, consider there to be a hardware failure. Refer to the device's maintenance manual to locate the problem.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

queue full

Cause:

The device sends a QFULL response in succession (40 sec. - 1 min.) to the SCSI interface. If this message appears, consider reconfiguring the device and or applications to lessen the burden on the device. If this is not responsible for the burden, consider the host bus adapter driver settings to be the problem. Refer to the storage system device manual to confirm the driver settings.

Confirm the following parameter:

When using the PFCA adapter: /kernel/drv/fjpfca.conf _max_throttle

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

unknown scsi status: scsi_status = A

Cause:

An unexpected SCSI STATUS code was received from the storage system device.

Refer to the maintenance manual of the storage system device to make sure there isn't a problem with the storage system device.

The driver will try another path.

A: SCSI STATUS

WARNING: Disk Pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

SCSI transport failed: reason 'timeout unit attention': giving up

Cause:

UNIT ATTENTION is the cause for a retry out to occur.

The load is probably too high for the storage system device to handle. Check the system configuration, applications, etc. If this is not the cause of the problem, a hardware failure may have occurred. Refer to the maintenance manual of the storage system device to troubleshoot the problem.

The driver will try another path.

WARNING: Disk Pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

information: can't get sense: giving up

Cause:

Failed to acquire the sense information.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

FUJITSU XXXXX SK: 6, ASC: 0xfb, ASCQ: 0x8x, FRU: 0xXX

Cause:

An error was detected in the disk's SMART information.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16))

incomplete uscsi cdb=0xXX - giving up

Cause:

uscsi transfer failed to complete.

C.2 Path Control Error Messages

NOTICE: mplbh*: I/O path failed. %s remaining online path number=%d

Cause:

The path is blocked due to a physical path error.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0").

%d indicates the number of remaining Online paths.

Action:

Replace the faulty component or perform the required maintenance.

NOTICE: mplbh*: I/O Lun degraded. %s remaining online path number of this lun=%d

Cause:

This message is output once for each LUN accessed via the specified path (%s) and indicates that a physical path error has blocked access to the LUN via this path.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0").

%d indicates the number of other paths to this LUN that remain Online.

Action:

Replace the faulty component or perform the required maintenance.

WARNING: mplbh*: I/O path failed, no more online paths available.

Cause:

A path was blocked due to a physical path error. Since this was the last Online path, all I/O processing has stopped.

Action:

Consult your Fujitsu maintenance engineer.

WARNING: mplbh*: I/O Lun degraded, no more online path of this lun.

Cause:

This message is output once for each LUN that has become unavailable and indicates that a physical path error has blocked the last remaining Online I/O access path to the LUN.

Action:

Consult your Fujitsu maintenance engineer.

NOTICE: mplbh*: Use of I/O path was restarted. %s

Cause:

The path has returned to a "Normal" status after recovering from its failure.

Note: "%s" represents the pathname (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0", etc.).

Action:

No action is required.

NOTICE: mplbh*: Use of I/O Lun was restarted. %s

Cause:

This message is output once for each LUN accessed via the specified path (%s) and indicates that the physical path error that was blocking access to the LUN via this path has been resolved and the paths have been reconfigured.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0").

Action:

No action is required.

NOTICE: mplbh*: Use of I/O path was restarted from STOP status. %s

Cause:

As there are no other paths available for use, the indicated path has been restored from the Stopped to the Online status.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0").

Action:

Check that you are not actually performing work on a different path to the path (%s) that was set offline by the "iompadm change" command.

NOTICE: mplbh*: disk controller connection is wrong. %s disk_controller_name= %d

Cause:

Since the path differs from the one established when the Multipath Driver path was created, the path of a storage system device or the controller connected to a physical path is blocked.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0").

%d indicates the storage system information.

Action:

Check the connections between the server and the storage system device and the device path configuration on the server side.

WARNING: storage system name (e.g.:E30004641 - E30004641) (mplbh*):

Invalid Lun Mapping.

Cause:

Multipath device recognition failed for the following causes:

- The multipath devices defined in the "storage system name" were found to access differing LUN configurations.
- For the multipath devices defined in the "storage system name", the LUN mapping for the smallest-number LUN was found to have changed or been deleted.

Action:

The storage system LUN mapping may have changed or been deleted following multipath configuration. Check the storage system's LUN configuration. If the LUN mapping has changed or been deleted, the multipath will need to be released and reconfigured. For details, refer to ["Appendix D Changing or Deleting a LUN Mapping or Host Affinity" \(page 147\)](#).

WARNING: storage system name (e.g.:E30004641- E30004641) (mplbh*):

Device configuration is without redundancy.

Cause:

During path recognition, a non-redundant path configuration was detected for the multipath device specified in "storage system name".

While the defined multipath configuration should have at least two independent paths, one of the following situations seems to apply:

- Only a single path was detected
- All detected paths connect to ports on the same ROUTER or CM

Action:

Check the connections between the server and the storage system.

WARNING: storage system name (e.g.:E30004641- E30004641) (mplbh*):

Device is not found.

Cause:

Multipath device specified in "storage system name" could not be found.

Action:

Check the status of the storage system and the connections between the server and the storage system.

WARNING: storage system name (e.g.:E30004641- E30004641) (mplbh*):

Operation of Lun addition : failed

Cause:

Extra LUNs could not be added to the (active) multipath device specified in "storage system name".

Action:

Check the LUN configuration defined in the storage system to see if all the paths access the same LUN configuration.

WARNING: storage system name (e.g.:E30004641- E30004641) (mplbh*):

Operation of Path addition : failed

Cause:

Extra paths could not be added for the (active) multipath device specified in "storage system name".

Action:

Check the LUN configuration defined in the storage system to see if all the paths access the same LUN configuration.

WARNING: mplbh*: forcible path degrade. %s

Cause:

Since the auto check results were found to unstably change between "normal" and "error", good results could not be obtained for the indicated path and it has been excluded from further checks.

%s indicates the physical path name (e.g. "/pci@1f,4000/fibrechannel@5,1/mplbt@4,0")

Action:

As checks are no longer being performed for it, this path cannot auto-recover.

Perform the required maintenance, then use the "iompadm" command to bring the path online.

WARNING: mplb*: %s slice %d is used by other process.

Cause:

Another process is using the physical path %s slice %d, so a multipath connection cannot be created or added.

%s indicates the disk path name (e.g. /pci@1f,4000/fibrechannel@5,1/mplbt@4,0).

%d indicates the slice number.

Action:

Release the physical path from other processes.

NOTICE: mplbh*: There is no redundancy of ETERNUS concurrent firmware loading.

All paths connect to (%s).

Cause:

The storage system redundancy was lost during the Concurrent Firmware Loading (CFL).

%s indicates the connected CM or ROUTER number.

For details of the relationship between CM or ROUTER numbers and physical locations in the storage system, refer to the following website.

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

Action:

The storage system configuration must be changed before performing the CFL. Remove the target devices, change the cable connections so that storage system redundancy will be maintained during the CFL, and then re-configure the multipath using the "gmpdautoconf" command.

NOTICE: Storage system name (e.g.:E30004641- E30004641) (mplbh*):

Device configuration succeed.

Description:

Multipath device indicated by "Storage system name" was recognized.

WARNING: Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0 (mplbt16)) this path was unrecognizable. -> (%s)

Cause:

The path indicated by "Disk pathname" could not be recognized at server startup. "%s" indicates the disk_device_controller_id of the target storage system. For details of this information, refer to ["Appendix A "iompadm status" Command" \(page 95\)](#).

Action:

Check the status of the storage system and of the connections between the path and the storage system.

mplbt* at fjpgca*: target * lun *

mplbt* is Disk pathname (e.g. /pci@1d,4000/fibre-channel@1/mplbt@10,0)

Description:

The path indicated by "Disk pathname" was recognized.

sd* at mplbh*: target * lun *

sd* is /mplbx/mplbh@*/sd@*,*

Description:

This message indicates that the driver was recognized.

pseudo-device: mplb*

mplb* is /pseudo/mplb@*

Description:

This message indicates that the driver was recognized.

C.3 iompadm Command Error Messages

iompadm: cannot initialize library: Permission Denied

Cause:

Initialization failed because a user other than a super user tried to use the command.

Action:

Log in as a super user and retry the command.

iompadm: cannot initialize library: No Memory

Cause:

Initialization failed due to lack of memory.

Action:

Exit all other applications and retry the command.

iompadm: Too many classes specified: Invalid Arguments

Cause:

A class was specified more than once.

Action:

Check the command format.

iompadm: invalid command: Invalid Arguments

Cause:

Subcommand name is incorrect.

Action:

Check the command format.

iompadm: -%s: Invalid Arguments

Cause:

An option other than -p or -c was specified.

Action:

Check the command format.

iompadm: cannot initialize library: Invalid Path

Cause:

No plug-in library could be found. There is no valid plug-in library.
All plug-in library initialization attempts failed.

Action:

Contact your Fujitsu maintenance engineer.

iompadm:<subcommand>: Invalid Arguments

Cause:
There is an incorrect subcommand argument.
Action:
Check the subcommand format.

iompadm:<subcommand>: No Memory

Cause:
The system ran out of memory while executing the subcommand.
Action:
Allocate sufficient memory and retry the command.

iompadm:<subcommand>: Invalid Path

Cause:
The argument specified in the device path name is invalid.
Action:
Specify a valid device path. Also, check the status of connections between the server and the storage system device and the hardware configuration of the storage system device.

iompadm:<subcommand>: Path Busy

Cause:
The argument specified in the device path is a path in use.
Or, a path under issue of a SCSI reserve command exists in the argument specified Instance.
Action:
Check that the device path is not being used.
Check whether or not a SCSI reserve command has been issued from the application for the argument specified Instance.

iompadm:<subcommand>: Too Many Paths

Cause:
The number of device paths specified by the argument exceeds the number that can be set for the class.
Action:
Reduce the number of paths.

iompadm:<subcommand>: Not Implemented

Cause:
A class cannot use the subcommand.
Action:
Use a subcommand that is supported.

iompadm:<subcommand>: Not Supported

Cause:
A transition not supported by the class was attempted.
Action:
Check the status.

iompadm:<subcommand>: IO Error

Cause:
A hardware failure was detected in a path that is part of Instance.
Action:
Check the hardware failure.

iompadm:encapsule: Not Supported

Cause:
This plug-in does not support the specified subcommand.
Action:
Use a supported subcommand.

iompadm:<subcommand>: Invalid Instance

Cause:
This plug-in does not support the specified subcommand.
Action:
Use a supported subcommand.

iompadm:<subcommand>: Internal Error

Cause:
The configuration information is corrupted.
Action:
Contact your Fujitsu maintenance engineer.

iompadm: <string> : Invalid Instance

Cause:
The character string is not a valid Instance name.
The class character string specified by -c does not control Instance.
Action:
Enter a valid Instance name that supports the class name.

iompadm: <string> : Busy

Cause:
The device referred to in this character string is used by another process. The device specified by -c is used elsewhere. If the above is not the case and <string> is <change>, stopping the path where a Concurrent Upgrade is to be made closes all paths; and because Instance is present, a Concurrent Upgrade cannot occur.
Or Instance specified by an argument contains a path issued by the SCSI reserve command.
Action:
Execute the command for the device specified by the character string when the other process ends.
Or do not perform Concurrent Upgrade in the change case, but perform a non-Concurrent Upgrade.
Check whether or not a SCSI reserve command has been issued for an Instance specified by an argument from the application.

iompadm: <string> : Class not Found

Cause:
The character string specified by c is not supported.
Action:
Specify the correct "class" name.

iompadm: <string> : Invalid Path

Cause:
The character string is not a valid device.
The device does not support the class character string.
Action:
Check the device name and specify a character string supported by the class.

iompadm: <string> : No Memory

Cause:

The system ran out of memory while checking the character string "device".

Action:

Allocate sufficient memory and retry the command.

iompadm: <string> : Invalid Arguments

Cause:

The argument character string is not valid.

Action:

Check the command format.

iompadm: <string>: IO Error

Cause:

A failure was detected in a device.

Action:

Check for a hardware failure.

iompadm: no more online path. continue(yes/no)?

Cause:

If the path specified by the `iompadm -c mplb change` command is cut-off, there will be no more online paths available.

Action:

Enter "yes" to continue, or "no" to cancel.

C.4 Cluster Error Messages

mplbclexec: invalid arg

Cause:

Parameter specification is incorrect.

Action:

Consult with your Fujitsu maintenance engineer if this error message is displayed during execution of the "iompadm" command.

mplbclexec: cannot get self node: %d

Cause:

Self-node information could not be obtained.
There may be a problem in the PRIMECLUSTER/SynfinityCluster environment.
%d indicates an error code.

Action:

Consult your Fujitsu maintenance engineer.

mplbclexec: cannot get all nodes: %d

Cause:

Information on node configuration could not be obtained.
There may be a problem in the PRIMECLUSTER/SynfinityCluster environment.
%d indicates an error code.

Action:

Contact your Fujitsu maintenance engineer.

mplbclexec: cannot create request: %d

Cause:

Check for empty areas in the /tmp directory and see if there is anything in the /tmp/mplb path.
%d indicates an error code.

Action:

Provide free space in the /tmp directory or delete data in the /tmp/mplb path and retry the command.

mplbclexec: cannot execute other nodes: %d

Cause:

Request for command execution could not be extended to other nodes.
There may be a problem in the PRIMECLUSTER/SynfinityCluster environment.
%d indicates an error code.

Action:

Contact your Fujitsu maintenance engineer.

mplbclexec: invalid response info: %node

Cause:

An error was detected in the response to the execution of a command from another node.
%node indicates the node where the error occurred.

Action:

Contact your Fujitsu maintenance engineer.

mplbclexec: detected error: %node

Cause:

The execution of a command failed in another node.
%node indicates the node where command execution failed.

Action:

Observe the instructions given in the error message for the executed command following this message.

mplbclexec: response timeout: %node

Cause:

Time-out occurred while waiting for a response from the execution of the command in another node.
The node has stopped.
%node indicates the node where the error occurred.

Action:

Node stoppage does not affect the execution of "iompadm" command change/restart.
If the node is running, check the system status of the node and consult our maintenance personnel if required.

mplbcl: not add procedure.

Cause:

The MPLB procedure could not be registered because the cluster system was busy.

Action:

This is not a problem if the cluster system is being reconfigured.
If this message is displayed after cluster system reconfiguration, contact your Fujitsu maintenance engineer.

mplbcl: cannot add procedure.

Cause:

The cluster MPLB procedure could not be registered because the commands or procedures required for registering it could not be found.
There may be a problem in the system environment.

Action:

Contact your Fujitsu maintenance engineer.

mplbcl: error add procedure.

Cause:

Registration of the cluster MPLB procedure failed. There may be a problem in the PRIMECLUSTER/SynfinityCluster environment.

Action:

This message may appear when all the cluster nodes are restarted for the first time after the initial cluster configuration has been setup. Restart the nodes once again and see whether or not the message reappears. If it does not, then no further action is required. If the message appears again, contact your Fujitsu maintenance engineer.

mplbclproc: cannot get self node: %d

Cause:

Remote execution of the node failed because self-node information could not be obtained.
There may be a problem in the PRIMECLUSTER/SynfinityCluster environment. %d indicates an error code.

Action:

Contact your Fujitsu maintenance engineer.

mplbclproc: invalid request proc.

Cause:

An error was detected in information from the source of request for remote execution between nodes.

Action:

Contact your Fujitsu maintenance engineer.

mplbclproc: cannot send response: %d

Cause:

The response to execution result could not be returned to source requesting remote execution between nodes. There may be a problem in the PRIMECLUSTER/SynfinityCluster environment.
%d indicates an error code.

Action:

Contact your Fujitsu maintenance engineer.

C.5 DR Script Error Messages

The following describes the error messages that are displayed relative to the DR Script. The DR script is a script that is provided by the Multipath Driver to work together with Dynamic Reconfiguration.

MPLB iompadm %s1 command was abnormal end. INSTANCE=%s2 device=%s3

Cause:

The "iompadm" subcommand (%s) aborted. The specified parameters were: Instance administration node %s2 and physical device node %s3.

Action:

Check the status of the physical device node that configures the Instance device node.
Check if the symbol link file on the /dev side for each device node exists.

MPLB all path become offline. Do you continue?

Cause:

The path you wish to disconnect is the last access path.

Action:

Select "yes" to continue and "no" to stop. Note that if "yes" is selected, all paths will be closed and it will no longer be possible to access the storage system device.

MPLB all path is in same SB. Do you continue?

Cause:

The access path in this system uses a redundant configuration.

Action:

Select "yes" to continue and "no" to stop.

Note that if "yes" is selected, all paths will be closed and it will no longer be possible to access the storage system device.

C.6 "grmpdautoconf" Command Error Messages

grmpdautoconf:ERROR 001:package FJSVmplb is not installed !!

Cause:

A required package (FJSVmplb) is not installed.

Action:

Install the required package to the system.

grmpdautoconf:ERROR 002:There is no Host bus adapter.

grmpdautoconf:ERROR 022:There is no Host bus adapter.

Cause:

Fibre Channel card is not installed.

For a SAS connection, this message indicates that no SAS adapter cards are installed.

Action:

The "grmpdautoconf" command cannot be executed in the present environment.

If a Fibre Channel card is installed, check to see if there is a problem with the Fibre Channel card.

If a SAS card is installed, check to see if there is a problem with the SAS card.

grmpdautoconf:ERROR 003:There is no Host Bus Adapter.

Cause:

An Emulex Fibre Channel card is not installed.

Action:

The "grmpdautoconf" command cannot be executed in the present environment.

If an Emulex Fibre Channel card is installed, check to see if there is a problem with the Fibre Channel card.

grmpdautoconf:ERROR 004:There is no ETERNUS devices.

Please deal as follows.

- **Please confirm the state and the power supply of the device.**
- **Please confirm the FC cable on the host bus adapter side.**
- **Please confirm the setting of the disk array device (Fabric connection / FC-AL connection).**
- **Please confirm the setting of lpfc.conf when you use the host bus adapter made by Emulex.**

Please reboot when you correct lpfc.conf.

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, Fibre Channel cable, fabric switch and host bus adapter card connections.

Follow any directions given in the error message.

grmpdautoconf:ERROR 005:There is no ETERNUS devices.

Please deal as follows.

- **Please confirm the state and the power supply of the device.**
- **Please confirm the cable on the host bus adapter side.**
- **Please confirm whether the host bus adapter of the FC-AL connection is defined by the Fabric form in fjpgca.conf (Is not port="fjpgca#:nport" described?).**

Please reboot when you correct fjpgca.conf.

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, cable, fabric switch and host bus adapter card connections.

Follow any directions given in the error message.

grmpdautoconf:ERROR 006:There is no ETERNUS devices.

Please deal as follows.

- **Please confirm the state and the power supply of the device.**
- **Please confirm the FC cable between the FC switch and the disk array device.**
- **Please confirm the zone setting of the FC switch.**

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, Fibre Channel cable, fabric switch and host bus adapter card connections.
Follow any directions given in the error message.

grmpdautoconf:ERROR 007:There is no ETERNUS devices.

Please deal as follows.

- **Please confirm the state and the power supply of the device.**
- **Please confirm the FC cable between the FC switch and the disk array device.**
- **Please confirm the zone setting of the FC switch.**
- **Please confirm whether the disk array device to be supported is connected.**

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, Fibre Channel cable, fabric switch and host bus adapter card connections.
Follow any directions given in the error message.

grmpdautoconf:ERROR 008:In the host affinity setting of the disk array device, the mistake is found in the host world wide name. Please confirm the host affinity setting.

Cause:

Host World Wide Name provided for the storage system's host-affinity setting is incorrect.

Action:

Check the host-affinity settings.

grmpdautoconf:ERROR 009: LUN Mapping is not defined. Please define LUN Mapping of the host affinity setting when you set the host affinity of the disk array device. Please define LUN Mapping of the disk array device, except for the abovementioned.

Cause:

LUN Mapping has not been defined for the storage system.

Action:

If the storage system uses host-affinity settings, define a LUN Mapping for the host-affinity settings.
Otherwise, define a LUN Mapping for the storage system.

grmpdautoconf:ERROR 010: The mistake is found in the setting of the disk array device.

Please deal as follows.

- **Please confirm whether the host world wide name is correct when you set the host affinity of the disk array device.**
- **Please confirm whether LUN Mapping of the host affinity setting is defined when you set the host affinity of the disk array device.**
- Please define LUN Mapping of the disk array device, except for the abovementioned.**

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, Fibre Channel cable, fabric switch and host bus adapter card connections.
Follow any directions given in the error message.

grmpdautoconf:ERROR 011: Only the device not supported is found.

grmpdautoconf:ERROR 012: Only the device not supported is found.

Cause:

None of the connected storage systems are supported.

Action:

Connect a supported storage system.

grmpdautoconf:ERROR 013: Only the device under the control of hddv is found.

grmpdautoconf:ERROR 014: Only the device under the control of hddv is found.

Cause:

For FC-AL connection, the storage system Loop-ID values are described in the hddv.conf file. For fabric connection, hddv.conf contains the target ID values described in the fcp-bind-target section of the fjpfca.conf file. The Multipath Driver is required to use values other than those used by hddv.

Action:

Change the Loop-ID or target ID value.

grmpdautoconf:ERROR 015: Only the device under the control of hddv is found.

Please deal as follows when you connect the device that is not under the control of hddv.

- **Please change Loop-ID to the one not defined in hddv.conf after the FC cable is pulled out for the FC-AL device. Moreover, please describe changed Loop-ID in lpfc.conf and reboot.**
- **Please describe the target ID not defined in hddv.conf in lpfc.conf and reboot for the Fabric device.**

Cause:

Only hddv managed devices were found. For FC-AL connection, the storage system Loop-ID values may already be used by hddv. For fabric connection, the target ID value used by hddv may be described in lpfc.conf.

Action:

For FC-AL connection, disconnect the Fibre Channel cable and change to a Loop-ID not already defined in the hddv.conf file. For fabric connection, lpfc.conf should contain target ID values that are not already defined in the hddv.conf file, and reboot the server.

grmpdautoconf:ERROR 016: Only the device not supported is found. Because a necessary package is not installed, the host bus adapter cannot be used. Please install the PFCA package when you use the host bus adapter made by Fujitsu. Please install the lpfc package and the HBAnyware package when you use the host bus adapter made by Emulex.

Cause:

Host Bus Adapter cannot be used because a required package is missing.

Action:

If using Fujitsu Host Bus Adapters, install the PFCA package. If using Emulex Host Bus Adapters, install the lpfc and HBAnyware packages.

grmpdautoconf:ERROR 017: The mistake is found in the connection or the setting of the disk array device.

Please deal as follows.

- **When all paths to the disk array device are connected with the same CM or RT, the multipath cannot be configured. Please connect them with the different CM or RT.**
- **When LUN Mappings of all paths are not matched, the multipath cannot be configured.**

Please match LUN mappings of all paths.

Cause:

All the paths to the storage system may be connected to a single CM or ROUTER (RT), or the LUN Mappings for each path in a multipath configuration may not match.

Action:

Ensure that all the paths to the storage system do not connect to a single CM or ROUTER (RT) (change the path configuration if necessary). For a multipath configuration, ensure that the LUN Mappings for all paths are identical.

grmpdautoconf:ERROR 018: The object to be removed is still connected or the path is in the stop status.

At removing the LUN, first of all, please remove the LUN on the disk array device.

At removing the path or removing the device, first of all, please deal as follows.

- 1. Please change the path status by the restart command when the path is in the stop status.**
- 2. Please remove the path by the methods such as setting the zoning or physically pulling out the cable.**

Cause:

The logical unit or path to be deleted is still connected or the path status is "Stop". Logical units and paths may not be deleted if it still possible for the server to recognize them. Neither may "Stop" status paths be targeted for deletion.

Action:

Logical units should be deleted on the storage system side. Before deleting a "Stop" status path or storage system with "Stop" status paths, use the "restart" command to change the path status, then perform the deletion by changing the Zoning settings or disconnecting all the cables between storage system being deleted and the server.

grmpdautoconf:ERROR 019: %s of the FC-AL connection is described in fcp-bind-target of fjpgca.conf. Please delete this description and reboot.

grmpdautoconf:ERROR 020: %s of the FC-AL connection is described in fcp-bind-target of fjpgca.conf. Please delete this description and reboot.

Cause:

For FC-AL connection, fjpgca.conf contains a %s description in the fcp-bind-target entry.

Action:

For FC-AL connection, the fcp-bind-target entry description is not required. Delete the description and reboot the server.

grmpdautoconf:ERROR 021:There is no ETERNUS devices.

Please deal as follows.

- **Please confirm the state and the power supply of the device.**
- **Please confirm the cable on the host bus adapter side.**
- **Please confirm fcp-bind-WWPN of lpfc.conf when you use lpfc.**

Please reboot when you correct lpfc.conf.

Cause:

The storage system may not be connected correctly.

Action:

Check the storage system, cable, Fibre Channel switch and host bus adapter card connections.
Follow any directions given in the error message.

grmpdautoconf:ERROR 104:The host bus adapters from different vendors cannot be used at the same time.

Cause:

Different types of host bus adapters cannot be mixed.

Action:

Decide on a single type of host bus adapter and use only that type.

grmpdautoconf:ERROR 201:An operation of fjpfca driver is failed(fc_info -a).

grmpdautoconf:ERROR 206:An operation of fjpfca driver is failed(fc_info -c).

grmpdautoconf:ERROR 207:An operation of fjpfca driver is failed(ns_show -n).

Cause:

The fjpfca driver command (fc_info, ns_show, alpa) failed.

Action:

Refer to the fjpfca driver manual.

grmpdautoconf:ERROR 202:An operation of fjpfca driver is failed(fc_info ?p %s).

Cause:

For FC-AL connection, the "fc_info" command failed against the %s Host Bus Adapter.

Action:

Refer to the fjpfca driver manual.

grmpdautoconf:ERROR 203:The FC-AL disk array device is set as Fabric connection. Please confirm the setting of the disk array device (Fabric Connection / FC-AL Connection).

Cause:

FC-AL connection is used between the server and the storage system, but the storage system has been set to use fabric connection.

Action:

Check the storage system settings.

grmpdautoconf:ERROR 204:An operation of fjpfca driver is failed(chk_conf -v).

grmpdautoconf:ERROR 205:An operation of fjpfca driver is failed(fc_config -v).

Cause:

The fjpfca driver command (chk_conf, fc_config) failed.
There is a problem with the definition file of the fjpfca driver.

Action:

Refer to the fjpfca driver manual to correct the definition file.

grmpdautoconf:ERROR 211:Only the cascade connection exists as the path for processing.

Please use the -X option when you select the cascade connection.

Cause:

All the paths between the server and storage system are cascade connected.

Action:

Execute the "grmpdautoconf" command with the -X option, to configure the multipath with cascade connection.

grmpdautoconf:ERROR 220:An operation of SAS driver is failed (sas_info -a).

Cause:

The "sas_info" command failed.

Action:

Contact your Fujitsu maintenance engineer.

grmpdautoconf:ERROR 251:There is no target ID which can be used.

Cause:

The target IDs in the sd.conf file from 0-255 are all in use.

Action:

The "grmpdautoconf" command cannot be used. Manually define the configuration definition.

grmpdautoconf:ERROR 252:An allocation of the target ID is failed. Please delete an unnecessary definition with fjpfca.conf, and prepare the target ID (16-254) that can be used.

Cause:

All target IDs between 16 and 254 are already used in fjpfca.conf, so new target IDs cannot be allocated.

Action:

Delete unnecessary target definitions from fjpfca.conf to free up target IDs for use by the "grmpdautoconf" command.

grmpdautoconf:ERROR 256:invalid fjpfca.conf. Please correct fjpfca.conf.

grmpdautoconf:ERROR 257:invalid fjpfca.conf. Please correct fjpfca.conf.

Cause:

The existing fjpfca driver that has been defined has a problem.

Action:

Refer to the fjpfca driver manual to correct the problem.

grmpdautoconf:ERROR 259:mplb.conf doesn't exist.

grmpdautoconf:ERROR 260:mplb.conf doesn't exist.

Cause:

The mplb.conf file is missing.

Action:

Contact your Fujitsu maintenance engineer.

grmpdautoconf:ERROR 261:There is erroneous definitions in fcp-bind-WWPN of lpfc.conf. Please correct lpfc.conf and reboot.

Cause:

The fcp-bind-WWPN definition in lpfc.conf is incorrect.

Action:

Fix the lpfc.conf definition and reboot the server.

grmpdautoconf:ERROR 262:The lpfc driver version 6.2x is not supported. Please use the driver before 6.11cx2 or newer 6.30g.

Cause:

LPFC 6.2x is being used. This version is not supported.

Action:

Replace the current LPFC driver with a version 6.11cx2-or-earlier driver, or a version 6.30g-or-later driver.

grmpdautoconf:ERROR 401:An operation of mplb driver is failed(mplbconfig).

Cause:

The "mplbconfig" command failed. Since the mplbconfig error message output simultaneously, refer to the message to find the cause.

Action:

Refer to the mplbconfig error message and take appropriate action to troubleshoot the problem.

grmpdautoconf:ERROR 402:An operation of mplb driver is failed (mplbconfig).

Cause:

If an error occurred or the "grmpdautoconf" command was canceled during execution, the multipath that was created up until that time cannot be deleted.

Action:

Execute the "iompadm" command, and delete manually.

grmpdautoconf:ERROR 901:System command error(cp).

grmpdautoconf:ERROR 902:System command error(mv).

grmpdautoconf:ERROR 904:System command error(mkdir).

grmpdautoconf:ERROR 913:System command error(disks).

grmpdautoconf:ERROR 914:System command error(update_drv).

Cause:

The user command in the parentheses (), or maintenance command failed.

Since the error message of the respective command will be output, refer to the Solaris manual.

Action:

Refer to the Solaris manual to troubleshoot the problem.

Because Loop-ID overlapped with the target ID of the device under the control of hddv as for the following FC-AL device, processing was skipped. (wwn=%s,target-id=%d) Please change Loop-ID to the one not defined in hddv.conf after the FC cable is pulled out when this device is not a device under the control of hddv.

Cause:

Because its target ID is identical to that of an hddv controlled device, the AL connected device indicated by the parenthesized WWN and target ID is not subject to control by the Multipath Driver.

Action:

Set the target ID to 16 or above and not identical to any hddv device ID to allow this device to be controlled by the Multipath Driver.

Appendix D

Additional Information

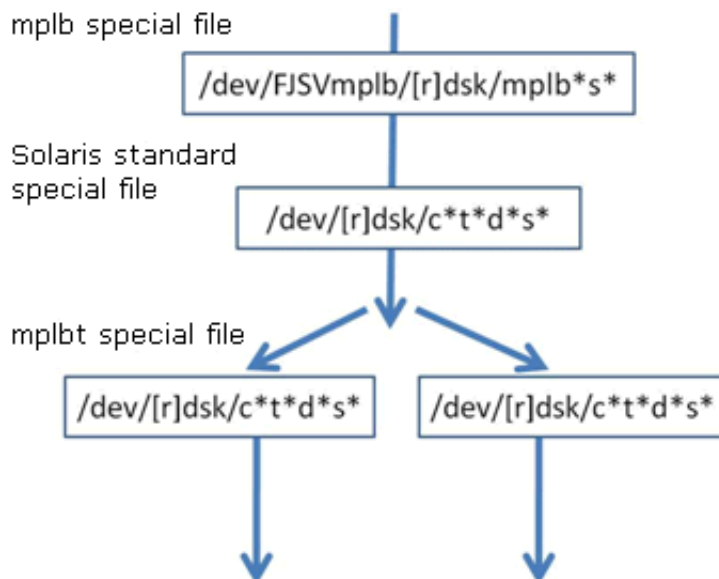
This appendix describes additional information about how the Multipath Driver works.

D.1 Checking the Performance Information

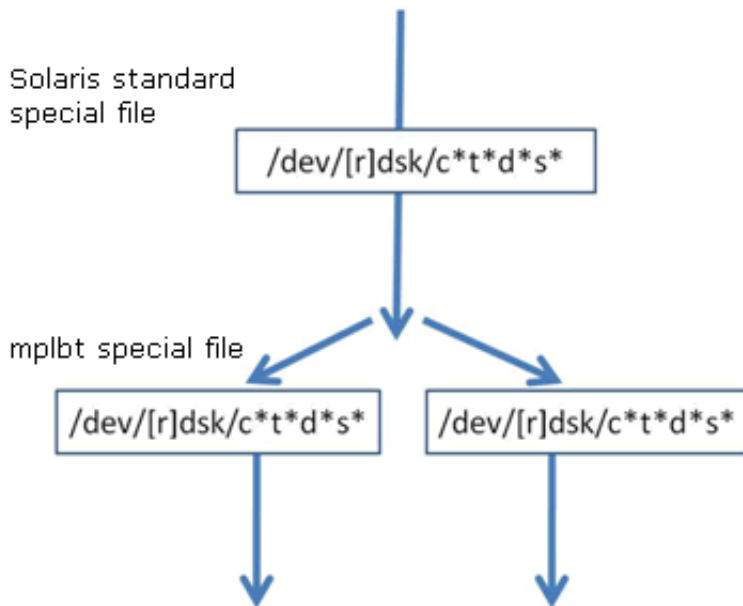
The way that the Multipath Driver is structured to handle accessed should be understood when checking the performance information.

Firstly, access is performed via access special files, of which there are three types; the mplb special file, Solaris standard special file, and mplbt special file. The access path structure used will depend on the type of access special file specified when the multipath was created.

If the mplb special file format is selected, the multipath access path structure for disk accesses is as follows, with the mplb special file, Solaris standard special file, and mplbt special files being accessed in the order shown.



If the Solaris standard special file format is selected, the multipath access path structure for disk accesses is as follows, with the Solaris standard special file, and mplbt special files being accessed in the order shown.



When a command such as sar or iostat is executed in a multipath configuration to check the performance information, only sd device information is displayed, as shown below. This allows the performance information of the Solaris standard special file (as shown in the above figures) to be confirmed. However, performance information cannot be confirmed on a per-path basis.

```
# iostat -x
```

| extended device statistics | | | | | | | | | |
|----------------------------|-----|-----|------|------|------|------|-------|----|----|
| device | r/s | w/s | kr/s | kw/s | wait | actv | svc_t | %w | %b |
| fd0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |
| sd0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |
| sd1 | 1.2 | 0.2 | 6.2 | 1.2 | 0.0 | 0.0 | 11.9 | 0 | 1 |
| sd4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |
| sd30 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |
| sd31 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |
| sd32 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 0 |

The "mpdinfo" command may be used to check which /dev/FJFSVmplb/[r]dsk/mplb*s* or /dev/[r]dsk/c*t*d*s* corresponds to each *sd displayed by the "sar" or "iostat" command.

For example, if the multipath was created using the Solaris standard special file format, the "mpdinfo" command might output the following information, allowing the correspondence between device sd30 and access path /dev/rdsk/c5t0d0s2 to be confirmed.

```
# /opt/FJFSVmplb/bin/mpdinfo
/dev/rdsk/c5t0d0s2 --> sd30
/dev/rdsk/c5t0d1s2 --> sd31
/dev/rdsk/c5t0d2s2 --> sd32
```

Alternatively, if the multipath was created using the mplb special file format, the "mpdinfo" command might output the following information, allowing the correspondence between device sd30 and access path /dev/FJSVmplb/rdisk/mplb0s2 to be confirmed.

```
# /opt/FJSVmplb/bin/mpdinfo
mplb0(/dev/FJSVmplb/rdisk/mplb0s2) --> sd30(/dev/rdsk/c5t0d0s2)
mplb1(/dev/FJSVmplb/rdisk/mplb1s2) --> sd31(/dev/rdsk/c5t0d1s2)
mplb2(/dev/FJSVmplb/rdisk/mplb2s2) --> sd32(/dev/rdsk/c5t0d2s2)
```

D.2 How to Change mplb Instance Number

If the multipath was created using the mplb special file format, a mplb instance number is included in the mplb special file name. The mplb instance number is the "mplb*" part of the "/dev/FJSVmplb/[r]disk/mplb*s*" special file name format.

This section describes how to change the instance numbers of an existing mplb special file to an arbitrary number. To change the instance numbers, the -o and -f options of the "mplbconfig" command are used, to specify the mplb special file hereafter referred to as a "configuration file". The configuration file is then edited to change the instance numbers. The procedure is as follows:

Caution

The mplb instance numbers of mplb instances registered as PRIMECLUSTER/SynfinityCluster resources must not be changed, or PRIMECLUSTER/SynfinityCluster may not operate normally.

Procedure

- 1 Stop all applications that might access the mplb special file whose instance number is to be changed. If the mplb special file has been mounted, unmount it. Any /etc/vfstab entries must also be deleted.
- 2 Execute the "mplbconfig" command with the -o option to output the current configuration information to a configuration file. The configuration file is created with whatever name is specified.
(Example) Outputting the current configuration information to /tmp/mplb_def

```
# /usr/sbin/mplbconfig -o /tmp/mplb_def
*** Phase 1: read mplb.conf ***
*** Phase 2: read /dev ***
*** Phase 3: read /devices ***
*** Phase 4: compare mplb.conf and /devices ***
=== Reconfigure plan ===
Multi path:                2
Create new multi path:     0
Add path for multi path:   0 (instance)
Delete path from multi path: 0 (instance)
#
```

- 3 Edit the configuration file. Change the existing mplb instance numbers as desired.
(Example) Changing existing instance numbers mplb0 and mplb1 to mplb10 and mplb11 (respectively). Edit the strings of the "Path" column in the configuration file, as there indicate the instance numbers.

```
# vi /tmp/mplb_def

*** mplb config file ***
Path   : Action : Element path                               : LUN :Storage
mplb0  : exist  : c13t16d0s2 c14t16d0s2 c14t17d0s2 :    0 :E6000- 000001 :
mplb1  : exist  : c13t16d1s2 c14t16d1s2 c14t17d1s2 :    1 :E6000- 000001 :

↓

*** mplb config file ***
Path   : Action : Element path                               : LUN :Storage
mplb10 : exist  : c13t16d0s2 c14t16d0s2 c14t17d0s2 :    0 :E6000- 000001 :
mplb11 : exist  : c13t16d1s2 c14t16d1s2 c14t17d1s2 :    1 :E6000- 000001 :
```

- 4 Execute the "mplbconfig" command with the -f option specifying the edited configuration file in order to change the mplb instance numbers. The mplb instance numbers change according to the configuration file that is specified by -f option.

(Example) Changing the mplb instance numbers using the /tmp/mplb_def file

```
# /usr/sbin/mplbconfig -f /tmp/mplb_def
*** Phase 1: read mplb.conf ***
*** Phase 2: read /dev ***
*** Phase 3: read /devices ***
*** Phase 4: compare mplb.conf and /devices ***
*** Phase 5: update mplb.conf ***
=== Reconfigure plan ===
Multi path:                2
Create new multi path:     0
Add path for multi path:   0 (instance)
Delete path from multi path: 0 (instance)
#
```

- 5 Execute the "iompadm info" command to confirm that the instance numbers have changed as specified.

```
# /usr/opt/FJSViomp/bin/iompadm -c mplb info
```

End of procedure

Caution

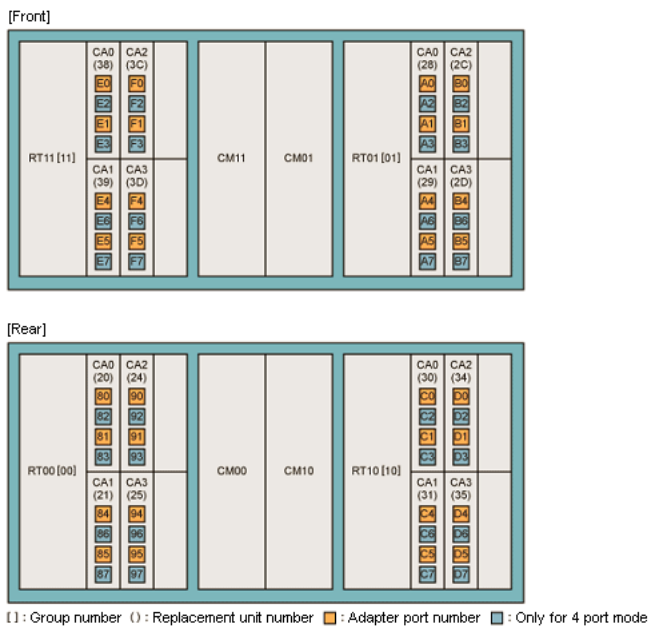
The "mplbconfig" command should only be used to change the mplb instance numbers or as instructed by your Fujitsu maintenance engineer.

D.3 Storage System Redundancy during Concurrent Firmware Loading

This section explains about system redundancy during a concurrent firmware load (CFL) operation, using the ETERNUS6000 as an example.

D.3.1 Redundancy during CFL

The ETERNUS6000 has the following configuration, with up to four ROUTERS (RT) installed.



In this section, RT00 and RT10 are defined as Group 1, and RT11 and RT10 defined as Group 2. The CFL process for the storage system is as follows:

- The firmware installed in Group 1 (RT00 and RT10) is to be updated. Note that server access via Group 1 is disabled while the firmware is being updated.
- After the firmware update for Group 1 has completed, the firmware installed in Group 2 (RT11 and RT10) is updated. Note that server access via Group 2 is disabled while the firmware is being updated.

Caution

In some cases, the Group 2 firmware may be updated before the Group 1 firmware.

Therefore, when the server and the ETERNUS6000 are connected in one of the following multipath configurations, application access will be blocked during CFL:

- (1) All cables connected to Group 1 only
- (2) All cables connected to Group 2 only

Since they are not redundant against CFL, if one of the above configurations is set up using the "grmpdautoconf" command, the warning message described in [\(6\) "Create the Disk Access Special Files" \(page 60\)](#) in ["2.3 Server Environment Validation" \(page 56\)](#) will be output during CFL.

To prevent this, the connections between the server and the ETERNUS6000 should be shifted to ensure the paths are redundant against CFL. This means that each Group must have at least one cable connected to it. ["D.3.2 Reconfiguration for CFL Path Redundancy" \(page 146\)](#) describes the necessary steps.

 **Caution**

- The steps described in ["D.3.2 Reconfiguration for CFL Path Redundancy" \(page 146\)](#) are not required if the firmware is cold swapped.
- Which connection configurations provide CFL path redundancy varies depending on the storage system model. For details of each storage system model, refer to its manuals.

D.3.2 Reconfiguration for CFL Path Redundancy

Use the following procedure to change the connections between the server and storage system:

Procedure

- 1 Take the target storage system offline, using the procedure described in ["3.5 Removing a Storage System Device" \(page 76\)](#), then shut down the server.
- 2 Change the connections between the server and storage system to ensure CFL path redundancy.
- 3 Restart the server.
- 4 Execute the "grmpdautoconf" command to configure the multipath.

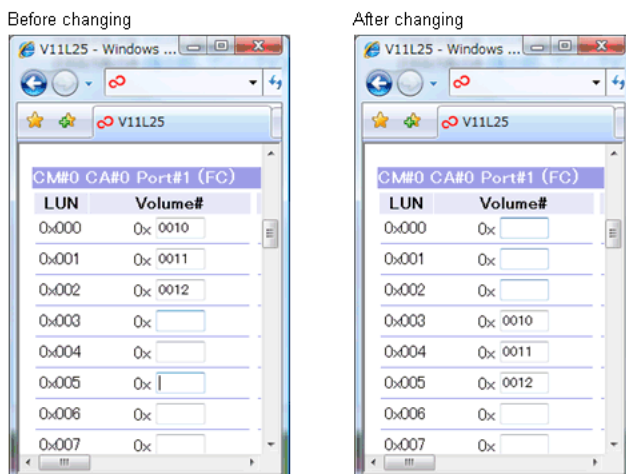
End of procedure

D.4 Changing or Deleting a LUN Mapping or Host Affinity

To change or delete the mapping or host affinity for the recognized LUNs after the multipath environment has been configured, the multipaths will need to be released and reconfigured. This section explains how to change or delete ETERNUS4000 LUN mapping as an example. For situations other than this example, the same procedure is also required to change or delete the LUN mappings. Refer to the storage system device manuals for details on how to change a LUN mapping or host affinity.

■ Changing the LUN numbers of the LUNs recognized by the server

Example: Changing the LUN number from LUN0x000 – LUN0x002 to LUN0x003 – LUN0x005



The storage system device must be removed from the configuration and the multipaths be reconfigured. Perform the following procedure:

Procedure

- 1 Remove the storage system device from the configuration, as described in ["3.5 Removing a Storage System Device" \(page 76\)](#).
- 2 Change the LUN mappings or host affinity settings of the target paths.
- 3 Execute the "grmpdautoconf" command to reconfigure the multipaths.

End of procedure

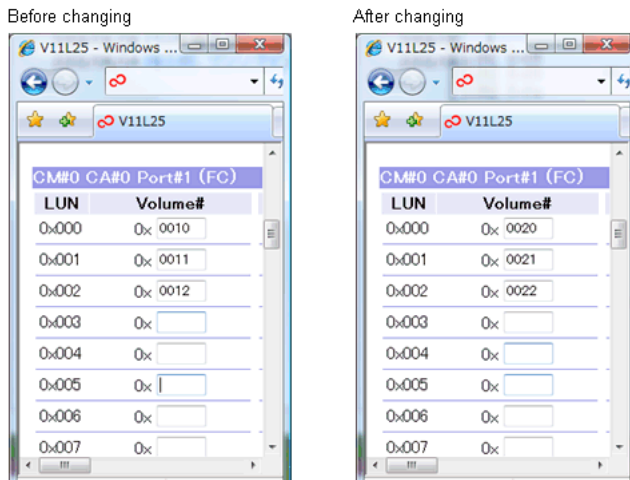
Caution

If the server is restarted after the multipaths are reconfigured but before the storage system device is removed, paths whose settings have changed will be set to "Offline Fail" status. If the settings for all paths connected to the storage system are changed, the following message is output:

```
WARNING: storage system name (mplbh*):  
Device is not found.
```

■ Changing the LUN_V mappings for the LUNs recognized by the server

Example: Changing the mapping for LUN0x000 – LUN0x002 from 0x0010 – 0x0012 to 0x0020 – 0x0022



The storage system device must be removed from the configuration and the multipath be reconfigured. Perform the following procedure:

Procedure

- 1 Remove the storage system device from the configuration, as described in ["3.5 Removing a Storage System Device" \(page 76\)](#).
- 2 Change the LUN mappings or host affinity settings of the target paths.
- 3 Execute the "grmpdautoconf" command to configure the multipaths.

End of procedure

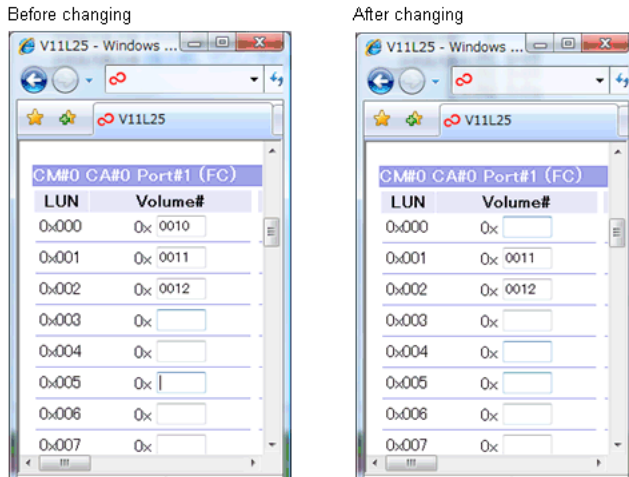
Caution

If the server is restarted after the multipaths are reconfigured but before the storage system device is removed, paths whose settings have changed will be set to "Offline Fail" status. If the settings for all paths connected to the storage system are changed, the following message is output:

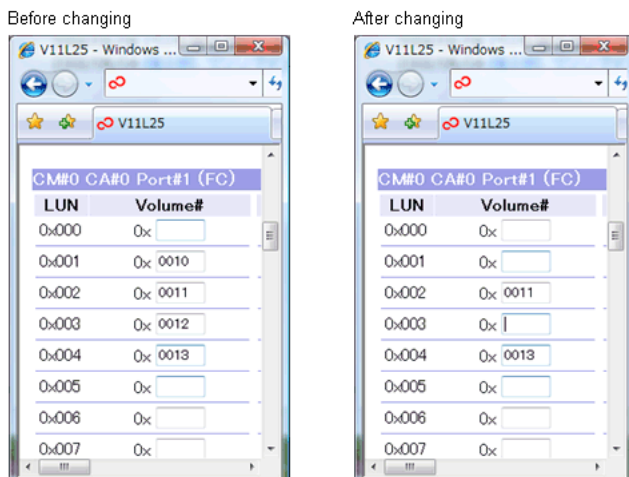
```
WARNING: storage system name (mplbh*):  
Invalid Lun Mapping.
```

■ Deleting the LUN_V mapping for the LUN with the smallest LUN number recognized by the server

Example: Deleting LUN_V 0x0010, which is mapped to the smallest LUN number LUN0x000



Example: Deleting LUN_V 0x0010, which is mapped to the smallest LUN number LUN0x000 and LUN_V 0x0012, which is mapped to LUN0x003



After deleting any LUN_V mappings, the logical units whose settings were deleted must be removed from the configuration. For details, refer to ["3.3 Removing a LUN" \(page 72\)](#).

Caution

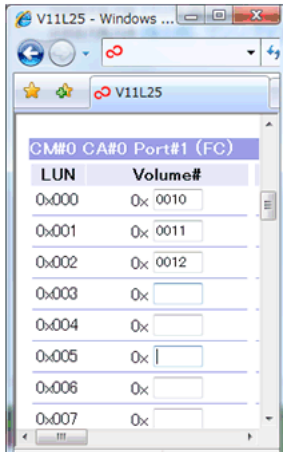
If the server is restarted after the multipaths are reconfigured but before the storage system device is removed, all the paths will be set to "Offline Fail" status and the following message output. If the settings for all paths connected to the storage system are changed, the following message is also output:

```
WARNING: storage system name (mplbh*):  
        Invalid Lun Mapping.
```

- Deleting the LUN_V mappings for LUNs other than that with the smallest LUN number recognized by the server

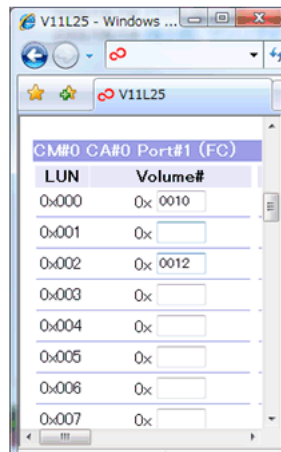
Example: Deleting LUN_V 0x0011, which is mapped to LUN0x001

Before changing



| CM#0 | CA#0 | Port#1 (FC) |
|-------|---------|-------------|
| LUN | Volume# | |
| 0x000 | 0x | 0010 |
| 0x001 | 0x | 0011 |
| 0x002 | 0x | 0012 |
| 0x003 | 0x | |
| 0x004 | 0x | |
| 0x005 | 0x | |
| 0x006 | 0x | |
| 0x007 | 0x | |

After changing



| CM#0 | CA#0 | Port#1 (FC) |
|-------|---------|-------------|
| LUN | Volume# | |
| 0x000 | 0x | 0010 |
| 0x001 | 0x | |
| 0x002 | 0x | 0012 |
| 0x003 | 0x | |
| 0x004 | 0x | |
| 0x005 | 0x | |
| 0x006 | 0x | |
| 0x007 | 0x | |

After deleting any LUN_V mappings, the logical units whose settings were deleted must be removed from the configuration. For details, refer to ["3.3 Removing a LUN" \(page 72\)](#).

Caution

If the server is restarted after the multipaths are reconfigured but before the storage system device is removed, LUNs whose settings have changed will be set to "Offline Fail" status.

D.5 Troubleshooting

This section explains how to acquire troubleshooting information after occurrence of a Multipath Driver error.

If a Multipath Driver error occurs, collect the required diagnostic information, then contact your customer support representative. For a cluster system, collect the necessary information for all nodes in the cluster. The following two procedures can be used to collect this information:

- "mplbsnap" command
- "fjsnap" command

■ mplbsnap command

Only Multipath Driver related information is collected with this command. Use the following procedure to collect the information.

Procedure

- 1 Execute the "mplbsnap.sh" command with the -a option.

```
#/opt/FJSVmplb/bin/mplbsnap.sh -a
```

An output directory can be specified for the collected information.

```
#/opt/FJSVmplb/bin/mplbsnap.sh -a -d /export/home/
```

End of procedure

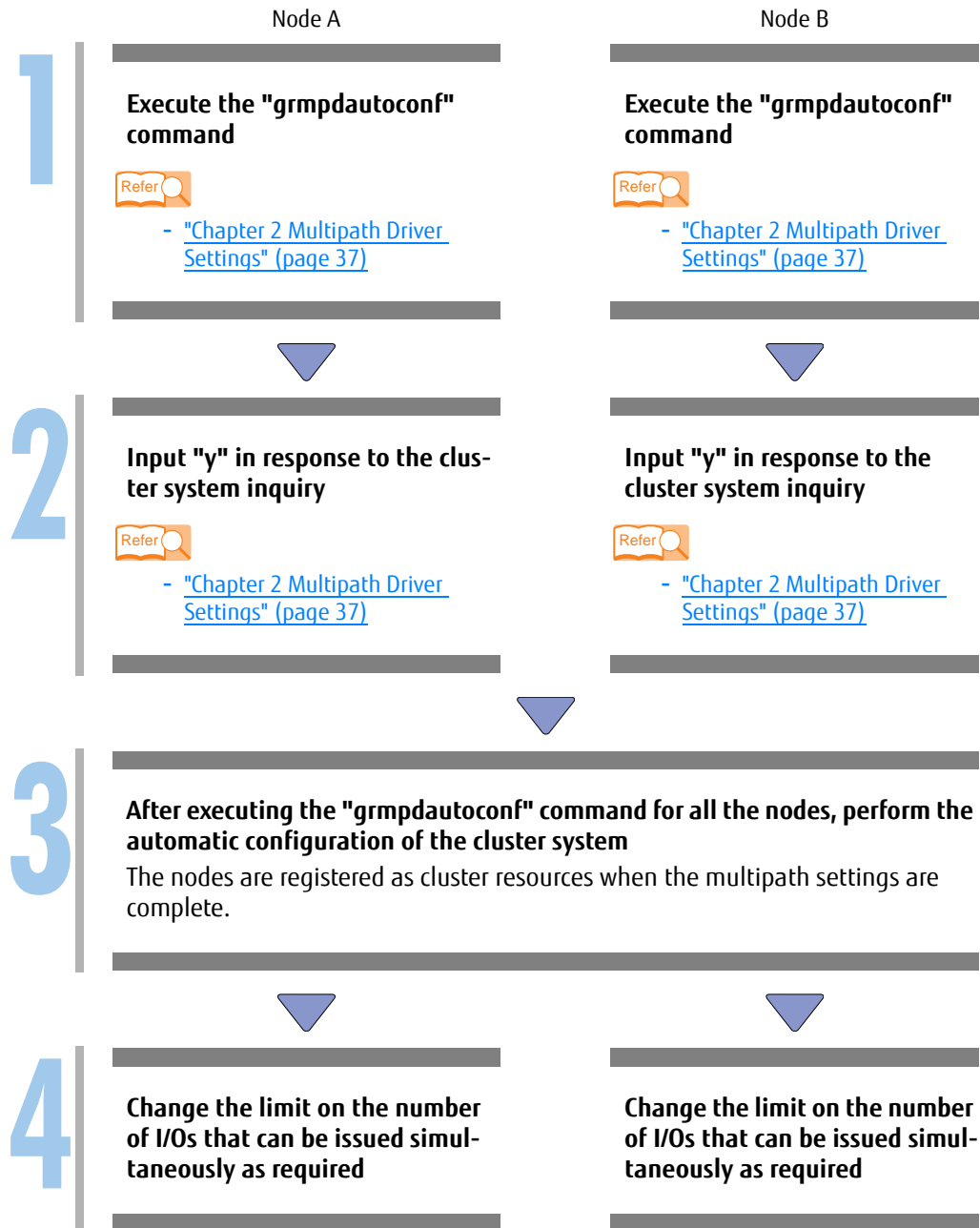
■ fjsnap command

The "fjsnap" command is a Solaris system information tool that is included with the FJSVsnap extended support function package. This command collects both Multipath Driver related information and unrelated information. For details of the "fjsnap" command, refer to the documentation provided with the FJSVsnap package.

D.6 Cluster System

This section provides a workflow and cautions when using a multipath configuration in a cluster system.

Workflow



 **Caution**

- If "y" is input in response to a cluster system inquiry, do not add or remove LUNs, paths, or storage system devices using the "grmpdautoconf" command before the automatic configuration of the cluster system. Do not connect or disconnect the cables, change the paths, or change the configuration of the storage system. Since multipath settings have not been completed, the "grmpdautoconf" command cannot be executed normally.
- The interactive configuration process automatically sets a limit on the number of I/Os that can be issued simultaneously. However, because the storage system device is accessed by multiple servers in a cluster system, you must manually set the fjpfc driver settings. Follow the instructions in the manual of your storage system device. Also refer to the instructions in the "FUJITSU PCI Fibre Channel User's Guide", or the manual provided with the storage system device, as necessary.
- If "y" is input in response to the cluster system inquiry, and then the "format" command is executed before the automatic configuration of the cluster system, then Solaris standard disk access special files (/dev/[r]dsk/c*t*d*s*) for the Multipath Driver that have been converted to multipath configuration files will appear. The links of these special files are shown as "/devices/mplbx/mplbh@...". After automatic configuration of the cluster system, these files will no longer appear.
- The controller number (c*) of the Solaris standard disk access special files name is automatically assigned by Solaris OS and "0" is assigned as the target number (t*). Therefore, even if under a cluster configuration, the Solaris standard disk access special files names may differ between the nodes. These numbers cannot be changed. When PRIMECLUSTER/SynfinityCluster is used, it is not an error that the "c*t*d*s*" part of the Solaris standard disk access special files names are different for different nodes, because automatic resource registration is used to convert the Solaris standard disk access special files to mplb special files.
- If "y" is input in response to the cluster system inquiry, the LUN mapping or host affinity setting needs to be changed or deleted, first allow the automatic configuration of the cluster system, to complete the multipath settings. Then release and reconfigure the multipath as described in ["D.4 Changing or Deleting a LUN Mapping or Host Affinity" \(page 147\)](#).
- Delete any resources that are registered in the cluster system before removing a device or a LUN.
- If "y" is mistakenly input for a non-cluster system, the "grmpdautoconf" command will terminate with the multipath settings incomplete. In this case, execute the "grmpdautoconf" command again to start the interactive multipath configuration process, and then input "n" for the cluster system inquiry.
- If "n" is mistakenly input for a cluster system, the multipath settings are completed in a malconfigured (non-cluster) status. In this case, cancel the incorrectly set multipath as detailed in ["3.3 Removing a LUN" \(page 72\)](#) and ["3.5 Removing a Storage System Device" \(page 76\)](#) set the target logical unit to allow it to be recognized by the server, and then execute the "grmpdautoconf" command again to redo the multipath settings.
- when local resources (unshared disks) are added to the cluster system, refer to ["D.7 Adding Local Resources to a Cluster System" \(page 154\)](#).

D.7 Adding Local Resources to a Cluster System

When local devices are added to the nodes of a PRIMECLUSTER or SynfinityCluster cluster system, make sure that each node uses unique mplb instance numbers for its local resources.

For example, in the following configuration both nodes (A and B) have a "mplb0" local resource.

| Cluster node A | Cluster node B |
|---------------------------|---------------------------|
| mplb2048 ---> LUN_V 0x000 | mplb2048 ---> LUN_V 0x000 |
| mplb2049 ---> LUN_V 0x001 | mplb2049 ---> LUN_V 0x001 |
| mplb0 ---> LUN_V 0x002 | mplb0 ---> LUN_V 0x003 |

This type of configuration is not supported, so the instance number "mplb0" must be changed on one of the nodes.

| Cluster node A | Cluster node B |
|---------------------------|---------------------------|
| mplb2048 ---> LUN_V 0x000 | mplb2048 ---> LUN_V 0x000 |
| mplb2049 ---> LUN_V 0x001 | mplb2049 ---> LUN_V 0x001 |
| mplb0 ---> LUN_V 0x002 | mplb1 ---> LUN_V 0x003 |

Use the following procedure to change the instance number:

Procedure

- 1 Add the local resources according to the procedure in ["Chapter 3 Adding or Removing Paths Between Storage Systems, LUNs, and Servers" \(page 65\)](#).
- 2 Execute the "iompadm info" command on each cluster node, and check the local resource mplb instance numbers used by each cluster node.
If each node uses a different set of instance numbers, no further action is required (skip Step 3).
- 3 If the same mplb instance number is used by multiple cluster nodes, refer to ["D.2 How to Change mplb Instance Number" \(page 143\)](#) and assign new, unique mplb instance numbers to negate any number overlaps.

End of procedure

D.8 Performing "add device" for mplb Special Files in Non-Global Zones

Perform the following procedure to "add device" for the mplb special files in a non-global zone.

Procedure

- 1 Create a non-global zone (example: test-zone).
- 2 Create a directory for mplb under /dev/ in the non-global zone.

```
# mkdir /export/test-zone/dev/FJSMplb
# mkdir /export/test-zone/dev/FJSMplb/dsk
# mkdir /export/test-zone/dev/FJSMplb/rdsk
```

- 3 Select the target multipath device from the test-zone, and check the device major and minor numbers.

The following example is for when "mplb0s0" is added:

```
# ls -l /dev/FJSMplb/rdsk/mplb0s0
lrwxrwxrwx 1 root root 36 Aug 28 20:28 /dev/FJSMplb/rdsk/mplb0s0
-> ../../../../devices/pseudo/mplb@0:a,raw
# ls -l /devices/pseudo/mplb@0:a,raw
crw-r----- 1 root sys 253, 0 Aug 30 04:19 /devices/pseudo/mplb@0:a,raw
# ls -l /devices/pseudo/mplb@0:a
brw-r----- 1 root sys 253, 0 Aug 30 04:19 /devices/pseudo/mplb@0:a
```

The underlined parts are the major and minor numbers.

- 4 Create a special file under /export/test-zone/dev/FJSMplb using the "mknod" command.

```
# mknod /export/test-zone/dev/FJSMplb/rdsk/mplb0s0 c 253 0
# mknod /export/test-zone/dev/FJSMplb/dsk/mplb0s0 b 253 0
```

- 5 Log in to the non-global zone and then access the mplb device.

End of procedure

A



Assigned CM

The control module that has primary control of the LUs in a storage system with CM assigned. Going through the assigned CM provides faster LU access.

C



CA

Channel Adapter. A storage system device I/O adapter connected to the server device, the CA controls transmission and reception of data.

CM

Controller Module in the storage system device. The main module for controlling the storage system device.

Concurrent Upgrade function

Adding a component into the system without affecting tasks. LUs and storage system devices can be added dynamically.

D



Device node

Device nodes are indicated by the following types of special files. Instance management device node: (/dev/FJSVmplb/fiomp/adm*)

User access device node: (/dev/[r]dsk/c*t*d*s*, /dev/FJSVmplb/[r]dsk/mplb*s*)

Physical device node: (/dev/[r]dsk/c*t*d*s*, /devices/*..)

F



Fabric connection

One of the formats for connecting between the server and the storage, using Fibre Channel interface. Fabric connection allows simultaneous transmission between multiple nodes, by going through the Fibre Channel switch.

G



GBIC

Gigabit Interface Converter. I/O module used to connect the port to the network, which is connected to the switch port. Dynamic exchange is possible.

H**HBA**

Host Bus Adapter. I/O adapter installed on the server. Connected to the storage system device, controls transmission and reception of data.

Hub

Cable intermediary device used when configuring a network.

I**Instance (No.)**

Units managed by the driver. For example, LU unit number indicates instance in the MPLB driver.

L**LU**

Logical Unit. Unit representing logical disks that are recognized from the server.

LUN

Logical Unit Number. Number attached to logical units.

M**MPHD Driver**

Multipath driver that has the failover function provided by multipath disk control. Accessed from special file `/dev/FJSMphd/[r]dsk/mphd*s*`.

MPLB Driver

It is accessed from the special file `/dev/FJSMplb/[r]dsk/mplb*s*`.

Note that both the Multipath disk load balance option and the GR Multipath Driver use the same name for their drivers.

P**Path**

A physical path is controlling that path when instructed to use the path from the server HBA to the storage system device.

A logical path indicates multiple bundles of logical paths for multipath above. In the same way, it may indicate the special file name of the MPLB driver.

**PRIMECLUSTER
SynfinityCluster**

Fujitsu's cluster system product. Can be used at the same time as the Multipath Driver. Configures a high availability system of multiple nodes that are connected in a dedicated network. High availability is achieved by taking over tasks through automatically switching from nodes that are down to other nodes.

R**Router**

The module that controls the transmission interface between each of the modules (between CM-CA, for example) in a storage system with CM not assigned.

S**SAN**

Storage Area Network. High-speed network that is connected to the server and storage system device. It is independent from the LAN, prevents degradation of LAN functions when large volumes of data are being handled.

sd driver

Standard Solaris SCSI disk driver.

Special file

`/dev/FJSVmplb/[r]dsk/mplb*s*`, `/dev/[r]dsk/c*t*d*s2`, `/devices/...`
Interface to access the driver:

Switch

An intermediary device that is necessary when configuring a network using Fibre Channel. In contrast to a hub, it has a function that selectively sends clumps of data to specified destination terminals. It can run multiple clusters of data transmission simultaneously.

ETERNUS SF AdvancedCopy Manager

Back-up for storage system device, Fujitsu's SAN administration software product.

U**Unassigned CM**

The control module that has secondary control of the LUs in a storage system with CM assigned. Compared to an assigned CM, access to the LUs is slower.

Z**Zoning Function**

Zones are divided according to their Fibre Channel switch port name and WWN (World Wide Name). This function limits access between a zone and separate zones.

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