Preface

This manual describes the "ETERNUS Multipath Driver" (hereinafter referred to as "Multipath Driver") software that manages the path control and connection status of the FUJITSU Storage ETERNUS Disk storage system, ETERNUS All Flash Array, and GR series (hereinafter referred to as "storage system" unless stated otherwise).

The functions, installation, management, and maintenance of the Multipath Driver are explained. This manual is intended for system administrators who are connecting the storage system to a Microsoft® Windows Server®.

You can view the product’s website for the latest information (supported models and operating systems, important notes, etc.).


Organization

This manual is composed of the following four chapters and five appendices:

- **Chapter 1  What is Multipath Driver?**
  This chapter explains the features, software configuration, functions, and connection patterns of the Multipath Driver.

- **Chapter 2  Installation/Uninstallation**
  This chapter explains how to install and uninstall the Multipath Driver.

- **Chapter 3  Operating Multipath Manager**
  This chapter explains how to use Multipath Manager.

- **Chapter 4  Notes About Using Multipath Driver**
  This chapter contains special considerations when using the Multipath Driver.

Appendices for the following items are also provided:

- Error Messages and Event Logs
- Creating a Maintenance Profile
- Persistent Reserve Clearing Tool (F3GLMiTIRsCl)
- Driver Information Verification Tool (F3GLMiTIDrCk)
- Troubleshooting Data
Related Manuals

For the related manuals for each storage system, refer to the following URL:

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Naming Conventions

■ Product names

■ Abbreviations used in this manual
  • "HBA" refers to a Host Bus Adapter, which is installed in a Windows® server for connecting a host to a storage system. It indicates a Fibre Channel card for Fibre Channel connections, Network Interface Card (NIC) or an iSCSI HBA for iSCSI connections, a SAS HBA for SAS connections, and Converged Network Adapter (CNA) for FCoE connections.
  • "CA" refers to a Channel Adapter for a storage system.
  • "LUN" refers to a Logical Unit Number, a term that is used to describe a logical drive number. A "LUN" is also used to describe a logical drive.
Symbols used in this manual

The following conventions are used in this guide.

**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

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.
# Updates

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

<table>
<thead>
<tr>
<th>Version</th>
<th>Modifications</th>
</tr>
</thead>
</table>
| V2.0L10     | First edition<br>
• Added Microsoft® MPIO framework<br>
• Added support for iSCSI<br>
• Added support for Storport Miniport |
| V2.0L11     | Added support for Windows Server® 2003 x64<br>
• Included the GR Multipath Driver V1.0L14 |
| V2.0L12     | Added support for the ETERNUS4000 and ETERNUS8000<br>
• Added support for the QLogic Storport Miniport driver<br>
• Added support for load balancing in the MSCS environment<br>
  (added a function to convert SCSI2 Reserve to Persistent Reserve)<br>
• Added a function to collect an event log for the following sense information: 06/fb80 (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x80) |
| V2.0L13     | Added support for the ETERNUS2000 |
| V2.0L14     | Added support for Windows Server® 2008<br>
• Added support for SAS<br>
• Added event log ID=305<br>
  (detection of no controller redundancy in the storage system) |
| V2.0L15     | Added support for the ETERNUS DX series<br>
• Discontinued the client version package that was included in the product<br>
• Discontinued the html version user’s guide |
| V2.0L16     | Added support for Windows Server® 2008 R2<br>
• Improved the path switching process when path failures occur<br>
• Added a function to collect an event log for the following sense information: 06/fb8x (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x8x) |
## Release Information

<table>
<thead>
<tr>
<th>Version</th>
<th>Modifications</th>
</tr>
</thead>
</table>
| V2.0L17 (October 2010) | • Added a function to set timeout information to the Emulex Storport Miniport driver  
• Added a function to monitor I/O response time  
• Added a function to monitor the recurrence of path reconnection errors  
• Added a function to scan devices  
• Changed some parts of character strings that are displayed in the description column of the following event logs: ID=201, 202, 301, 304, 401, 402, 403, 1010, 1020, 1030, 1040, 1050, 1051, 1100, and 1200 |
| V2.0L18 (June 2011) | • Added support for the ETERNUS DX80 S2/DX90 S2 and ETERNUS DX400 S2 series  
• Added a description about how the Warning status remains for six minutes |
| V2.0L19 (September 2012) | • Added support for Windows Server® 2012 |
| V2.0L20 (July 2013) | • Added support for the TPG Referrals function. For details, refer to "ETERNUS Web GUI User's Guide ETERNUS DX80 S2/DX90 S2, ETERNUS DX410 S2/ DX440 S2, ETERNUS DX8100 S2/ DX8700 S2" (tenth edition or later)  
• Added a function to set timeout information to the Emulex Storport Miniport driver that has the file name elxfc.sys  
• Added the following event logs: ID=312 and 313 |
| V2.0L21 (July 2014) | • Added support for the Storage Cluster function |
| V2.0L22 (July 2015) | • Added support for the ETERNUS DX8700 S3/DX8900 S3 |
Modification History

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

■ V2.0L12 Modifications

- Modification outline
  Added a function to the Multipath Driver that collects event logs.
  - Modification target
    Multipath Driver
  - Modification details
    - Modification effect
      When the storage system responds with sense information 06/fb80, event logs can be collected.

<table>
<thead>
<tr>
<th>Version</th>
<th>Modification details</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.0L11 or earlier</td>
<td>Event logs are not collected for sense information 06/fb80 (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x80).</td>
</tr>
<tr>
<td>V2.0L12</td>
<td>Event logs are collected for sense information 06/fb80 (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x80).</td>
</tr>
</tbody>
</table>

■ V2.0L14 Modifications

- Modification outline
  Added an event log ID to the Multipath Driver.
  - Modification target
    Multipath Driver
  - Modification details
    - Modification effect
      When a storage system without controller redundancy is connected, event logs can be collected.

<table>
<thead>
<tr>
<th>Version</th>
<th>Modification details</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.0L13 or earlier</td>
<td>A function to check controller redundancy in the storage system is not supported. The event log ID=305 is not collected.</td>
</tr>
<tr>
<td>V2.0L14</td>
<td>A function to check controller redundancy in the storage system is supported. The event log ID=305 is collected.</td>
</tr>
</tbody>
</table>
■ V2.0L16 Modifications

- Modification outline
  Added a function to the Multipath Driver that collects event logs.
  - Modification target
    Multipath Driver
  - Modification details

<table>
<thead>
<tr>
<th>Version</th>
<th>Modification details</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.0L15 or earlier</td>
<td>Event logs are not collected for sense information 06/fb81 to 06/fb8f (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x81 to 0x8f).</td>
</tr>
<tr>
<td>V2.0L16</td>
<td>Event logs are collected for sense information 06/fb81 to 06/fb8f (Sense Key = 0x06, ASC = 0xfb, ASCQ = 0x81 to 0x8f).</td>
</tr>
</tbody>
</table>

- Modification effect
  When the storage system responds with sense information 06/fb8x, event logs can be collected.

■ V2.0L17 Modifications

- Modification outline
  Added event log IDs to the Multipath Driver.
  - Modification target
    Multipath Driver
  - Modification details

<table>
<thead>
<tr>
<th>Version</th>
<th>Modification details</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.0L16 or earlier</td>
<td>—</td>
</tr>
</tbody>
</table>

- Modification effect
  New event logs can be collected.

- Modification outline
  Changed parts of the character strings in the description column for the event log IDs of the Multipath Driver.
  - Modification target
    Multipath Driver
  - Modification details
    Changed some parts of the character strings in the description column of ID=201, 202, 301, 304, 305, 401, 402, 403, 1010, 1020, 1030, 1040, 1050, 1051, 1100, and 1200.

<table>
<thead>
<tr>
<th>ID</th>
<th>V2.0L16 or earlier</th>
<th>V2.0L17</th>
</tr>
</thead>
<tbody>
<tr>
<td>201</td>
<td>An input/output error has occurred in the device below. Device:\Device\ScsiPortP</td>
<td>An input/output error has occurred in the device below. Device: ScsiPortP</td>
</tr>
<tr>
<td>202</td>
<td>An input/output error has occurred in the device below. Device:\Device\ScsiPortP(PathId=B, TargetId=T, Lun=L)</td>
<td>An input/output error has occurred in the device below. Device: ScsiPortP; PathId=B; TargetId=T; Lun=L</td>
</tr>
</tbody>
</table>
## Release Information

<table>
<thead>
<tr>
<th>ID</th>
<th>V2.0L16 or earlier</th>
<th>V2.0L17</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>Some paths could not be detected. Check to see if the paths are properly connected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of current paths: A</td>
<td>Number of previous paths: B</td>
</tr>
<tr>
<td></td>
<td>Some paths could not be detected. Check to see if the paths are properly connected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The information of the ports (CAID) that are not connected on the storage system-side can be checked with [Source=F3GLMiDr, ID=306 Event].</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T</td>
<td></td>
</tr>
<tr>
<td>304</td>
<td>Multipath operation has commenced for the following device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of paths: A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multipath operation has commenced for the following device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of paths : A</td>
<td></td>
</tr>
<tr>
<td>305</td>
<td>The device has an incorrect connection pattern. It is not the redundancy of the controller</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Since the connection between the server and the storage system is not configured correctly, there is no CM Redundancy. For example, this event occurs when only one CM in a storage system in which CM0 and CM1 are installed is connected to the server.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T</td>
<td></td>
</tr>
<tr>
<td>401</td>
<td>The following device was not able to be used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The following device was not able to be used.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T, Lun=L</td>
<td></td>
</tr>
<tr>
<td>402</td>
<td>The following device was removed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The following device was deleted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T, Lun=L</td>
<td></td>
</tr>
<tr>
<td>403</td>
<td>The following device was removed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId: <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The following device was deleted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ProductId : <code>DeviceProductId</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device : <code>ScsiPortP</code>, PathId=B, TargetId=T</td>
<td></td>
</tr>
<tr>
<td>1010</td>
<td>An input/output fault in the following device has caused the path to switch.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Re-examine the device connections.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>An input/output fault in the following device has caused the path to disconnect.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Re-examine the device connections.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>ScsiPortP</code>, PathId=B, TargetId=T, Lun=L</td>
<td></td>
</tr>
<tr>
<td>1020</td>
<td>The path was restored.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The path was restored.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>ScsiPortP</code>, PathId=B, TargetId=T, Lun=L</td>
<td></td>
</tr>
<tr>
<td>1030</td>
<td>Reset request was issued to the following device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: <code>0xA4A4A4A4</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reset request was issued to the following device.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>ScsiPortP</code>, PathId=B, TargetId=T, Lun=L</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: <code>0xA4A4A4A4</code></td>
<td></td>
</tr>
<tr>
<td>1040</td>
<td>The following path was invalidated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>\Device\ScsiPortP (PathId=B, TargetId=T)</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: <code>0xA4A4A4A4</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The following path was invalidated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Device: <code>ScsiPortP</code>, PathId=B, TargetId=T</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: <code>0xA4A4A4A4</code></td>
<td></td>
</tr>
</tbody>
</table>
Modification effect
Some parts of the character strings in the description column of event logs have been changed. If monitoring is affected by these character string modifications, the monitoring method needs to be changed. Note that the following software is not subject to these modifications:
- ETERNUS SF Storage Cruiser
- Systemwalker
- REMCS Agent
- PRIMEQUEST Server Agent (PSA)

V2.0L20 Modifications

Modification outline
Added event log IDs to the Multipath Driver.
- Modification target
  Multipath Driver
- Modification details

<table>
<thead>
<tr>
<th>ID</th>
<th>V2.0L16 or earlier</th>
<th>V2.0L17</th>
</tr>
</thead>
<tbody>
<tr>
<td>1050</td>
<td>The processing of Persistent Reserve was done.</td>
<td>The processing of Persistent Reserve was done.</td>
</tr>
<tr>
<td></td>
<td>Device: \Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</td>
<td>Device: ScsiPortP, PathId=B, TargetId=T, Lun=L</td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
</tr>
<tr>
<td>1051</td>
<td>The processing of Persistent Reserve was done.</td>
<td>The processing of Persistent Reserve was done.</td>
</tr>
<tr>
<td></td>
<td>Device: \Device\ScsiPortP (PathId=B, TargetId=T, Lun=L)</td>
<td>Device: ScsiPortP, PathId=B, TargetId=T, Lun=L</td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
</tr>
<tr>
<td>1100</td>
<td>Received the transition demands of the path status.</td>
<td>Received the transition demands of the path status.</td>
</tr>
<tr>
<td></td>
<td>Device: \Device\ScsiPortP (PathId=B, TargetId=T)</td>
<td>Device: ScsiPortP, PathId=B, TargetId=T</td>
</tr>
<tr>
<td></td>
<td>Command: 0xAAAAAAAA4</td>
<td>Command: 0xAAAAAAAA4</td>
</tr>
<tr>
<td>1200</td>
<td>Lack of adequate memory resources.</td>
<td>Lack of adequate memory resources.</td>
</tr>
<tr>
<td></td>
<td>Device: \Device\ScsiPortP</td>
<td>Device: ScsiPortP</td>
</tr>
<tr>
<td></td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
<td>Supplemental Code: 0xAAAAAAAA4</td>
</tr>
</tbody>
</table>

- Modification effect
New event logs can be collected.
# MPIO Version in the Multipath Driver

The following table shows versions of MPIO, a Microsoft module that is installed in every Multipath Driver.

<table>
<thead>
<tr>
<th>Multipath Driver version</th>
<th>MPIO version</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.0L10 (January 2005)</td>
<td>mpio 1.11</td>
</tr>
<tr>
<td>V2.0L11 (July 2005)</td>
<td>mpio 1.12</td>
</tr>
<tr>
<td>V2.0L12 (June 2006)</td>
<td>mpio 1.16</td>
</tr>
<tr>
<td>V2.0L13 (August 2007)</td>
<td>mpio 1.18</td>
</tr>
<tr>
<td>V2.0L14 (April 2008)</td>
<td>mpio 1.20</td>
</tr>
<tr>
<td>V2.0L15 (June 2009)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L16 (October 2009)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L17 (October 2010)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L18 (June 2011)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L19 (September 2012)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L20 (July 2013)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L21 (July 2014)</td>
<td>mpio 1.23</td>
</tr>
<tr>
<td>V2.0L22 (July 2015)</td>
<td>mpio 1.23</td>
</tr>
</tbody>
</table>

**Note**

MPIO that is installed in the Multipath Driver is used for Windows Server 2003. MPIO that is installed in the OS is used for Windows Server 2008 or Windows Server 2012.
# Table of Contents

## Chapter 1  What is Multipath Driver?  18

1.1 Features ............................................................................................................ 18
1.2 Components ...................................................................................................... 19
1.3 Connections ...................................................................................................... 20
1.4 Multipath Driver Functions .............................................................................. 23
1.5 Path Management ........................................................................................... 24
   1.5.1 Path Status ................................................................................................... 24
   1.5.2 Path Status Transitions ............................................................................... 26
1.6 Load Balancing/Failover Operation ................................................................. 27
1.7 Forcible Disconnection of Unstable Paths .................................................... 33

## Chapter 2  Installation/Uninstallation  35

2.1 Operating Systems Supported ........................................................................ 35
2.2 New Installation ............................................................................................... 36
2.3 Overwrite Installation ..................................................................................... 38
   2.3.1 Non-MSCS/Non-WSFC Clustering Environment ............................................. 39
   2.3.2 MSCS/WSFC Environment .......................................................................... 39
2.4 Installing the Driver ....................................................................................... 40
2.5 Uninstalling the Driver .................................................................................. 43
   2.5.1 Non-MSCS/Non-WSFC Environment ............................................................. 44
   2.5.2 MSCS/WSFC Environment .......................................................................... 45
   2.5.3 Multipath I/O for Windows Server 2008 and Windows Server 2012 ............... 46
2.6 Converting to/from Related Products ............................................................. 46
   2.6.1 Converting to Multipath Driver V2.0 from Related Products ......................... 46
   2.6.2 Converting from Multipath Driver V2.0 to a Related Product ....................... 47
2.7 Working in a MSCS/WSFC Environment ....................................................... 48
2.8 Notes for Installation/Uninstallation ............................................................... 49
   2.8.1 Notes When Installation has Failed .............................................................. 49
   2.8.2 Notes When Canceling the Uninstallation .................................................... 50
## Chapter 3  Operating Multipath Manager  51

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Selecting Local or Remote</td>
<td>51</td>
</tr>
<tr>
<td>3.2 Starting Multipath Manager</td>
<td>52</td>
</tr>
<tr>
<td>3.3 Multipath Manager Window</td>
<td>56</td>
</tr>
<tr>
<td>3.4 Check the Path Status</td>
<td>62</td>
</tr>
<tr>
<td>3.5 Start/Stop Maintenance Mode</td>
<td>65</td>
</tr>
<tr>
<td>3.6 Path Recovery</td>
<td>67</td>
</tr>
<tr>
<td>3.7 Paths Offline/Online (Path Switching During Maintenance)</td>
<td>68</td>
</tr>
<tr>
<td>3.8 Auto Path Check</td>
<td>70</td>
</tr>
<tr>
<td>3.9 Auto Path Recovery</td>
<td>71</td>
</tr>
<tr>
<td>3.10 I/O Response Time Monitoring and Path Reconnection Monitoring</td>
<td>72</td>
</tr>
<tr>
<td>3.11 Path Diagnosis</td>
<td>73</td>
</tr>
<tr>
<td>3.12 Multipath Reconfiguration</td>
<td>74</td>
</tr>
<tr>
<td>3.13 Device Scan</td>
<td>75</td>
</tr>
<tr>
<td>3.14 Refresh to the Latest Information</td>
<td>76</td>
</tr>
<tr>
<td>3.15 Local Mode/Remote Mode Setting</td>
<td>76</td>
</tr>
<tr>
<td>3.16 HBA Time Out Setting</td>
<td>78</td>
</tr>
</tbody>
</table>

## Chapter 4  Notes About Using Multipath Driver  80

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 During Installation/Uninstallation</td>
<td>80</td>
</tr>
<tr>
<td>4.2 Configuring a LUN</td>
<td>80</td>
</tr>
<tr>
<td>4.3 Windows Server 2008 and Windows Server 2012</td>
<td>81</td>
</tr>
<tr>
<td>4.3.1 MPIO Properties</td>
<td>81</td>
</tr>
<tr>
<td>4.3.2 Multi-Path Disk Device Properties</td>
<td>82</td>
</tr>
<tr>
<td>4.4 iSCSI Initiator</td>
<td>83</td>
</tr>
<tr>
<td>4.5 Operating in a MSCS Environment</td>
<td>84</td>
</tr>
<tr>
<td>4.5.1 Installation</td>
<td>84</td>
</tr>
<tr>
<td>4.5.2 Reset Groups</td>
<td>84</td>
</tr>
<tr>
<td>4.6 Unusable Disks</td>
<td>86</td>
</tr>
<tr>
<td>4.7 Notes When Using a Hyper-V Virtual Fibre Channel Environment</td>
<td>86</td>
</tr>
<tr>
<td>4.7.1 Live Migration</td>
<td>86</td>
</tr>
<tr>
<td>4.7.2 Uninstalling the Multipath Driver</td>
<td>87</td>
</tr>
</tbody>
</table>
4.8 Notes When Using a Storage Cluster Environment ............................................................ 87
4.9 Other Notes .................................................................................................................. 87
  4.9.1 Device Manager ........................................................................................................... 87
  4.9.2 Power on/off the Storage System ................................................................................ 87

Appendix A  Error Messages and Event Logs  88

A.1 Error Messages ........................................................................................................... 88
  A.1.1 Format of Error Messages .......................................................................................... 88
  A.1.2 Sample Error Messages ............................................................................................ 88
A.2 Event Logs .................................................................................................................. 89
  A.2.1 Event Log Type and Format ...................................................................................... 89
  A.2.2 Multipath Driver Event Log ....................................................................................... 90

Appendix B  Creating a Maintenance Profile  109

Appendix C  Persistent Reserve Clearing Tool (F3GLMiTIRsCl)  116

Appendix D  Driver Information Verification Tool (F3GLMiTIDrCk)  119

Appendix E  Troubleshooting Data  122
List of Figures

Figure 1.1 Multipath Driver Components ........................................................................... 19
Figure 1.2 Two-Path Connection Examples ........................................................................ 20
Figure 1.3 Four-Path Connection Examples ....................................................................... 20
Figure 1.4 Correctly Configured Zone Example ................................................................. 21
Figure 1.5 Incorrectly Configured Zone Example ............................................................... 21
Figure 1.6 Unsupported Configuration Example (without controller redundancy) .......... 22
Figure 1.7 Changes in Path Conditions .............................................................................. 26
Figure 1.8 Load Balancing on a Storage System with Assigned CMs ............................... 28
Figure 1.9 Multipath Load Balancing on a Storage System with CM not Assigned .......... 29
Figure 1.10 2-Path Failover on a Storage System with CM Assigned .................................. 30
Figure 1.11 4-Path or More Failover on a Storage System with CM Assigned, Example 1 ........................................................................................................... 31
Figure 1.12 4-Path or More Failover on a Storage System with CM Assigned, Example 2 ........................................................................................................... 31
Figure 1.13 Multipath Failover, a Storage System with CM not Assigned ......................... 32
Figure 1.14 Forcible Disconnection of Unstable Paths ....................................................... 33
Figure 2.1 Message Window that Appears During Overwrite Installation ...................... 38
Figure 2.2 Multipath Driver Installation Screen ................................................................. 41
Figure 2.3 Uninstalling ........................................................................................................ 43
Figure 2.4 Multipath Driver Uninstallation Screen ............................................................. 44
Figure 2.5 Multipath Driver Uninstallation Screen (exiting the application) ..................... 45
Figure 2.6 Multipath I/O for Windows Server 2008 or Windows Server 2012 .................. 46
Figure 2.7 Message Window When Installation Fails ......................................................... 49
Figure 2.8 Message Window When Uninstallation is Canceled ......................................... 50
Figure 3.1 User Account Control Confirmation Message Window ................................... 52
Figure 3.2 Starting Multipath Manager (for Windows Server 2003 or Windows Server 2008) ........................................................................................................... 53
Figure 3.3 Starting Multipath Manager (for Windows Server 2012) ................................... 53
Figure 3.4 Computer Name Input Window ......................................................................... 54
Figure 3.5 Multipath Manager Window ............................................................................. 56
Figure 3.6 Multipath Manager Fault List ........................................................................... 56
Figure 3.7 Unit Information Window Display Format ....................................................... 57
Figure 3.8 Storage System Information ............................................................................. 58
Figure 3.9 Storage System Information (ETERNUS Web GUI) .......................................... 58
Figure 3.10 Path Information ............................................................................................. 59
Figure 3.11 Multipath Manager Help .................................................................................. 59
Figure 3.12 CAIDs and Connection Locations ................................................................. 60
Figure 3.13 Path Display Order in the LU Information Window ....................................... 60
Figure 3.14 Path Display (when paths are normal) ............................................................. 62
Figure 3.15 Path Display (when some paths are deleted) .................................................. 62
Figure 3.16 Path Display (when errors occurred on all of the paths and the paths were deleted) ............................................................................................................... 63
Figure 3.17 Path Display (when the path failed) ................................................................. 64
Figure 3.18 Path Display (when the path forcibly failed) .................................................. 64
Figure 3.19 Start Maintenance Mode ................................................................................ 65
Figure 3.20 Maintenance Mode Display in Status Bar ....................................................... 65
Figure 3.21 Stop Maintenance Mode .................................................................................. 66
Figure 3.22 Recovering a Path ........................................................................................... 67
Figure 3.23 Setting a Path Offline ..................................................................................... 68
Figure 3.24 Setting a Path Online ...................................................................................... 69
Figure 3.25 Turning on Auto Path Checking ...................................................................... 70
Figure 3.26 Turning on Auto Path Recovery ...................................................................... 71
List of Figures

Figure 3.27 Turning on I/O Response Time Monitoring or Path Reconnection Monitoring ........................................ 72
Figure 3.28 Confirmation Message Window When a Path Error is Detected ................................................................. 74
Figure 3.29 Scanning the Device .................................................................................................................................. 75
Figure 3.30 Confirmation Message Window for Device Scan .......................................................................................... 75
Figure 3.32 Setting Local Mode/Remote Mode ........................................................................................................... 77
Figure 3.33 HBA Time Out Setting ........................................................................................................................... 78
Figure 3.34 HBA Time Out Setting Window ................................................................................................................ 78
Figure 4.1 Multipath Manager Help .......................................................................................................................... 81
Figure 4.2 DSM Details ............................................................................................................................................... 82
Figure 4.3 Multi-Path Disk Device Properties ........................................................................................................... 82
Figure 4.4 MPIO Properties ........................................................................................................................................ 82
Figure 4.5 MPIO Path Details .................................................................................................................................... 83
Figure 4.6 Windows Server 2003 ............................................................................................................................... 83
Figure 4.7 Windows Server 2008 .............................................................................................................................. 84
Figure 4.8 Windows Server 2008 R2 or Windows Server 2012 ................................................................................... 84
Figure 4.9 Setting Reset Groups .................................................................................................................................. 85
Figure A.1 Incorrect Connection Configuration between the Server and the Storage System Example ......... 96
Figure A.2 CAIDs and Connection Locations ........................................................................................................... 95
Figure A.3 Incorrect Storage System LUN Assignment Example (OLU number is different) ........................................ 98
Figure B.1 System Properties ..................................................................................................................................... 109
Figure B.2 Hardware Profiles ..................................................................................................................................... 110
Figure B.3 Copy Profile ............................................................................................................................................... 110
Figure B.4 Computer Management .......................................................................................................................... 111
Figure B.5 Cluster Service Properties ....................................................................................................................... 111
Figure B.6 Computer Management .......................................................................................................................... 112
Figure B.7 Cluster Network Driver Properties .......................................................................................................... 112
Figure B.8 Cluster Disk Driver Properties ................................................................................................................ 113
Figure B.9 System Settings Change .......................................................................................................................... 113
Figure B.10 Cluster Network Driver Properties ........................................................................................................ 114
Figure B.11 Cluster Disk Driver Properties ............................................................................................................... 114
Figure E.1 Information Required When a Problem Occurs ....................................................................................... 122
Figure E.2 Maintenance Information Collection (for Windows Server 2003 or Windows Server 2008) ....... 123
Figure E.3 Maintenance Information Collection (for Windows Server 2012) .............................................................. 124
Chapter 1

What is Multipath Driver?

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

1.1 Features

The ETERNUS Disk storage systems, ETERNUS All Flash Array, and GR series are designed to prevent loss of data and down time due to a disk failure, thus creating a high-speed, high-capacity system with high reliability.

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

By using redundant paths, data stored in the storage system is not only protected against a disk failure, but also against loss of access due to a path failure. In order to provide uninterrupted data access during a path failure, the Multipath Driver takes care of switching over to the redundant path.

The Multipath Driver provides the driver that connects the storage system and computer, the Multipath Manager software that manages connection status from GUI screens, and the Multipath Service that notifies Multipath Manager of the path status that is reported from the Multipath Driver.

The following table shows the maximum Multipath Driver support configuration:

| No. of paths between any given server and storage system pair | 8 |
| No. of storage systems that can be connected to a single server | 32 |
| No. of disks that can be connected to a single server (*1) | 8160 |
| Maximum capacity of each disk | No limit |

*1: Not the number of physical disks, but the number visible for disk management purposes. For example, in a configuration where a LUN is connected via two paths the number of disks is still only one, not two.

Caution

Various Windows and server software and hardware restrictions can render the maximum configuration shown above impossible.
1.2 Components

The Multipath Driver consists of the following elements:

- Driver, which connects the storage system to a Windows server and contains path control functions
- Multipath Manager, a GUI that sets and monitors path connection status
- Multipath Service, a service function that monitors paths for errors and notifies Multipath Manager when a path error occurs

Figure 1.1 shows the relationship between the Multipath Driver components.

Figure 1.1 Multipath Driver Components

Windows server

[Diagram of Multipath Driver components]

Application → Multipath Manager
Multipath Manager → Multipath Service
Multipath Service → Driver
Driver → HBA (x4)
HBA (x4) → Storage system
1.3 Connections

Connection Examples

A multipath connection consolidates multiple independent HBA-CA connections. Multipath connections provide greater system control and improve reliability.

- Supported Multipath Connection Examples

Figure 1.2 Two-Path Connection Examples

Figure 1.3 Four-Path Connection Examples

Dotted lines in switches show that the switches are set up in a zone configuration. Configurations with a single server port that is connected to multiple storage system ports are also supported (shown in the bottom diagram of Figure 1.3).
In a multipath connection, all HBAs must be of the same type.

Zone Configuration

Set up the Fibre Channel switches in a zone configuration. The number of ports in a zone configuration is two (connect the port on a one-on-one basis). The relation of ports can be specified with a port number or WWN. For details, refer to the manual provided with Fibre Channel switch.

Figure 1.4 Correctly Configured Zone Example

Figure 1.5 Incorrectly Configured Zone Example

In the incorrectly configured zone example above, the number of ports in the zone configuration is three. Set up a zone configuration with two ports as shown by the correctly configured zone example.
Unsupported Configuration Example

- Configurations with no controller redundancy

Configurations with no storage system controller redundancy are not allowed. Set a multipath configuration using CAs on different CMs to respond to a CM failure.
Use an even-numbered CM and an odd-numbered CM (for example, CM0 and CM1) for multipath configuration. If even-numbered CMs or odd-numbered CMs are used for multipath configuration, both of the paths are disconnected when the firmware is concurrently loaded.

Figure 1.6 Unsupported Configuration Example (without controller redundancy)
1.4 Multipath Driver Functions

The Multipath Driver performs the following functions.

- **Automatic multipath configuration**

  When the Multipath Driver is installed in a Windows server, and a storage system with multipath configuration is connected to the Windows server, there is no need to perform any settings during installation because the paths are automatically recognized and the multipath environment will be configured. In an automatically configured multipath environment, load balancing and path failover will be executed.

- **Load balancing**

  Load balancing (load distribution) acts on all available paths, improving accessibility. Load balancing operates differently for each storage system model. For details, refer to section "1.6 Load Balancing/Failover Operation" (page 27).

- **Failover**

  If a currently used path fails, the system automatically switches over to another path to access the storage system, allowing the host application to continue normal operation. Failover operates differently for each storage system model. For details, refer to section "1.6 Load Balancing/Failover Operation" (page 27).

- **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, it is disconnected from the system and its status is reported to Multipath Manager or recorded in the event log.

- **Auto path recovery**

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

- **Path disconnection**

  Using Multipath Manager, you can disconnect a specified path by setting it to "Offline" status. I/O to the path should be stopped to perform maintenance on the path. After maintenance work is complete, I/O can be issued to the path again by setting the path to "Online" status using Multipath Manager. For details, refer to "3.7 Paths Offline/Online (Path Switching During Maintenance)" (page 68).
1.5 Path Management

1.5.1 Path Status

The Multipath Driver automatically detects multiple paths that are connected to the same storage system from the host, and controls these paths as a redundant path set. When an error occurs during load balancing, failover is executed.

<table>
<thead>
<tr>
<th>Path Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td>This path status allows access to the storage system. In &quot;Online&quot; status, the path which is used to access the storage system (Active) and the path which is used for failover (Standby) are determined by LUN.</td>
</tr>
<tr>
<td>Offline</td>
<td>The &quot;Offline&quot; path is a path specified by Multipath Manager, and is not used for accessing the storage system from the host. When it is specified &quot;Online&quot; by the Multipath Driver, it returns to the original status &quot;Online&quot;. Being different from &quot;Active/Standby&quot; status, a path specified &quot;Offline&quot; is not used for accessing the storage system from the server. However, the Offline path can be used when a path error occurred and any Online path becomes unavailable.</td>
</tr>
<tr>
<td>Warning</td>
<td>When I/O errors (which may be considered as path errors) are detected, the status of these paths changes to &quot;Warning&quot; and a different path is used to access the storage system. When Windows cannot recognize the storage system connection, the path status immediately changes to &quot;Deleted&quot;. The &quot;Warning&quot; status remains for at least 6 minutes. If the path is diagnosed as normal during this period by the Multipath Driver internal diagnosis, the path status returns to &quot;Online&quot;. If the path is diagnosed as abnormal, the path status changes to &quot;Failed&quot;. When the path is restored using Multipath Manager, the path status changes to &quot;Online&quot;.</td>
</tr>
<tr>
<td>Deleted</td>
<td>When Windows cannot recognize the storage system, the connection between Windows and the storage system will be deleted. In this case, the path will not be displayed in Multipath Manager.</td>
</tr>
<tr>
<td>Failed</td>
<td>When a path with Warning status is diagnosed by the Multipath Driver, the path is diagnosed as unavailable. To recover the path, use Multipath Manager after performing maintenance such as replacing the failed parts. When the Auto Path Recovery function is enabled, the path status automatically changes to &quot;Online&quot; if the path is diagnosed as having no problems.</td>
</tr>
<tr>
<td>Forcibly Failed</td>
<td>When the status of the path is unstable (alternates between normal and error status), the path is diagnosed by the Multipath Driver as unavailable. To recover the path, use Multipath Manager after performing maintenance such as replacing the failed parts. Even if the Auto Path Recovery function is enabled, the path status does not automatically change to &quot;Online&quot;.</td>
</tr>
</tbody>
</table>
Online paths may have either Active or Standby status, depending on whether they are currently in use for input/output.

<table>
<thead>
<tr>
<th>Path Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Path</td>
<td>The Active path is being used to access the storage system from the host. When there are two or more Active paths, load balancing is performed between the Active paths. For the storage system with CMs assigned, the path connected to a CM assigned on the LUN becomes &quot;Active&quot;.</td>
</tr>
<tr>
<td>Standby Path</td>
<td>This path is connected to a non-assigned CM on the device, and is a &quot;Normal&quot; path that is not being used for I/O (not &quot;Active&quot;). When Active paths become unavailable due to a path error or an offline operation, the Standby paths automatically change to Active paths and can be used.</td>
</tr>
</tbody>
</table>

The Active Path/Standby Path is decided by setting the assigned CM for each LU on the storage system. The Active Path/Standby Path of each LUN appears in the LU information window of Multipath Manager. (Refer to "3.3 Multipath Manager Window" (page 56).)

**Caution**

If all paths are in "Deleted" status, the storage system cannot be recognized from Windows. In this case, for example, the LUNs of the storage system will not be displayed as volumes in "Disk Management" of Windows.
1.5.2 Path Status Transitions

Path status transitions are shown in the following figure.

Figure 1.7 Changes in Path Conditions

(1) Startup → Online
Paths are automatically recognized 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) Standby ↔ Active
When an error in a path is detected during I/O, or the path status changes to Offline, the Standby path status automatically changes to Active.
When the original path has recovered and becomes active again, the Active path returns to Standby.

(3) Online ↔ Offline
When the "Offline" command is selected in Multipath Manager, the path status changes to Offline.
When the "Online" command is selected in Multipath Manager, the path status changes to Online. The Active/Standby status is the same as it was before going Offline.

(4) Online ↔ Warning
When an I/O error occurs on an Online path (either Active or Standby), the path status changes to Warning.
When the path is re-enabled by path checking and recovery, the path status returns to Online. The Active/Standby status is the same as it was before going into a Warning condition.
When the "Recover" command is selected in Multipath Manager, the path changes to Online.

(5) Any → Deleted
When the HBA driver notifies Windows that the LUNs cannot be found the LUNs become invisible to Windows and the Multipath Driver, and the status changes to Deleted.
(6) Deleted → Any
When the HBA driver notifies Windows that the LUNs have been recovered, the LUNs become visible to
Windows and the Multipath Driver, and the status changes to another state.

(7) Warning → Failed
When the path status changes to Warning, a background path diagnosis is performed by the Multipath
Driver every two minutes. If the path is diagnosed as unavailable, the path status changes to Failed.

(8) Failed → Warning
When the Auto Path Recovery function is enabled, background path diagnosis is performed for the Failed
status path by the Multipath Driver. If the path is diagnosed as available in the diagnosis performed by the
Auto Path Recovery function, the path status changes to Normal. The Active/Standby status is the same as
it was before the Failed condition.

(9) Failed/Forcibly Failed → Normal
When the “Recover” command is selected in Multipath Manager, the path status changes to Normal. The
Active/Standby status is the same as it was before the Failed condition.

(10) Any → Forcibly Failed
When the path status alternates between normal and error status and is diagnosed as unstable, the path
status changes to Forcibly Failed.

1.6 Load Balancing/Failover Operation

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

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

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

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

For storage system models that have assigned CMs and that do not have assigned CMs, refer to “Windows
version” found under “Downloads” at the following URL:

Load balancing

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

Storage system with assigned CMs

For storage systems with assigned CMs, each LUN in the storage system is assigned to either CM0 or CM1, and the Multipath Driver accesses each LUN via its assigned CM. In the Multipath Manager window, "Active" is displayed for the path connected to the assigned CM, and "Standby" is displayed for the path connected to the non-assigned CM.

Figure 1.8 Load Balancing on a Storage System with Assigned CMs
● Storage system with CM not assigned

For a storage system that does not have assigned CMs, there is no concept of an assigned CM. The Multipath Driver uses all paths to access the storage system. In the Multipath Manager window, "Active" is displayed for all paths.

Figure 1.9  Multipath Load Balancing on a Storage System with CM not Assigned

● Cluster environment

LUN exclusive control commands are issued to the storage system by the MSCS (Microsoft Cluster Service) or WSFC (Windows Server Failover Clustering) environment. LUN exclusive control commands include the old-type SCSI2 Reserve command and the new-type Persistent Reserve command.

Which type of command is issued depends on the combination of Windows type, the Multipath Driver version, and storage system type.

The old-type SCSI2 Reserve command allows only one path to be used for reads and writes. This restriction means that there can only be one active path and therefore, load balancing is not performed in SCSI2 Reserve command environments. The new-type Persistent Reserve command does not have this restriction and load balancing is performed normally, depending on the configuration.

<table>
<thead>
<tr>
<th>Windows type</th>
<th>Multipath Driver version</th>
<th>Storage system type</th>
<th>Exclusive control command to be issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Server 2003</td>
<td>From V2.0L10 to V2.0L11</td>
<td>Any storage system</td>
<td>SCSI2 Reserve</td>
</tr>
<tr>
<td></td>
<td>From V2.0L12</td>
<td>A GR series or ETERNUS3000 model 50</td>
<td>SCSI2 Reserve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any storage system other than a GR series or ETERNUS3000 model 50</td>
<td>Persistent Reserve</td>
</tr>
</tbody>
</table>
1.6 Load Balancing/Failover Operation

Failover

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

- **Storage system with CM assigned (2-path connections)**

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

  **Figure 1.10 2-Path Failover on a Storage System with CM Assigned**

<table>
<thead>
<tr>
<th>Windows type</th>
<th>Multipath Driver version</th>
<th>Storage system type</th>
<th>Exclusive control command to be issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Server 2008</td>
<td>From V2.0L10 V2.0L13</td>
<td>Any storage system</td>
<td>Unsupported configuration</td>
</tr>
<tr>
<td></td>
<td>From V2.0L14</td>
<td>A GR series or ETERNUS3000 model 50</td>
<td>Unsupported configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any storage system other than a GR series or ETERNUS3000 model 50</td>
<td>Persistent Reserve</td>
</tr>
<tr>
<td>Windows Server 2012</td>
<td>From V2.0L10 V2.0L18</td>
<td>Any storage system</td>
<td>Unsupported configuration</td>
</tr>
<tr>
<td></td>
<td>From V2.0L19</td>
<td>A GR series or ETERNUS3000 model 50</td>
<td>Unsupported configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Any storage system other than a GR series or ETERNUS3000 model 50</td>
<td>Persistent Reserve</td>
</tr>
</tbody>
</table>

**Caution**

- Load balancing is not performed in environments where the SCSI2 Reserve command may be issued.
- Load balancing may be performed in an environments where the Persistent Reserve command is used, depending on the configuration.
Storage system with CM assigned (4-path or more connections)

- **Example 1**
  Even if multiple path failures occur, I/O processing can still 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 path available.

Figure 1.11  4-Path or More Failover on a Storage System with CM Assigned, Example 1

Windows server

- **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 performed.

Figure 1.12  4-Path or More Failover on a Storage System with CM Assigned, Example 2

Windows server
● Storage system with CM not assigned

When an Active path becomes unavailable, efficiency is degraded, but the remaining Active paths continue operation as normal, including load balancing.

Figure 1.13  Multipath Failover, a Storage System with CM not Assigned
1.7 Forcible Disconnection of Unstable Paths

The Multipath Driver is equipped with functions that detect unstable paths that alternate between normal and error status. When a path is diagnosed as unstable, the path is forcibly disconnected and even if the path is available, the path is not used. The forcibly disconnected path changes to Forcibly Failed status.

The Multipath Driver monitors for the following three types of events to detect unstable paths:
- Occurrences of a specific status (such as a timeout) that is notified when paths are unstable
- I/O response time of the storage system
- Recurrence of path reconnection errors

Monitoring for "I/O response time of the storage system" and "Recurrence of path reconnection errors" can be enabled and disabled in Multipath Manager.

When these events occur, the Multipath Driver adds values to the internal counter that is managed for each path. When the value reaches a certain threshold value, the path status changes to Forcibly Failed. A Forcibly Failed path is not automatically restored even if the Auto Path Recovery function is enabled. The internal counter value and Forcibly Failed status are cleared when one of the following actions is performed:
- The "Recover" command is selected in Multipath Manager
- The "Start Maintenance Mode" command is selected in Multipath Manager
- Windows is restarted

Refer to "Chapter 3 Operating Multipath Manager" (page 51) for more details about how to operate Multipath Manager.
Note

The internal counter of a path that does not change to Forcibly Failed status is automatically cleared every 24 hours regardless of whether the Auto Path Recovery function is enabled or disabled.
Chapter 2

Installation/Uninstallation

This chapter explains how to install and uninstall the Multipath Driver in a Windows server. You must log on with Windows administrator's privileges to install/uninstall the Multipath Driver. Install the Multipath Driver in the computer that is to be connected to the storage system.

**Caution**

- To avoid data damage, do not make multipath connections from the storage system to the Windows server before installing the Multipath Driver.
- Do not connect the storage system to a Windows server while the Multipath Driver is being installed. Even if installation is successful, the Multipath Driver may not recognize the storage system due to incomplete registry configurations. If this happens, disconnect the storage system from the Windows server (reduce the number of paths to a single path in a SAN Boot configuration) and remove and reinstall the Multipath Driver. Re-installation of the Multipath Driver modifies registry configurations.

**Note**

For Windows Server 2008 or Windows Server 2012, if a confirmation message regarding User Access Control is displayed, click the [Continue] button or the [Yes] button to proceed.

2.1 Operating Systems Supported

The Multipath Driver supports the following operating systems:

- Microsoft® Windows Server® 2003 (32-bit, x64, ia64)
- Microsoft® Windows Server® 2003 R2 (32-bit, x64, ia64)
- Microsoft® Windows Server® 2008 (32-bit, x64, ia64)
- Microsoft® Windows Server® 2008 R2 (x64, ia64)
- Microsoft® Windows Server® 2012 (x64)
- Microsoft® Windows Server® 2012 R2 (x64)

**Caution**

For the latest information about supported operating systems, refer to "Environments" at the following URL: http://www.fujitsu.com/global/products/computing/storage/software/eternus-mpd/
2.2 New Installation

This section explains the procedure to configure Multipath by connecting the new storage system. The procedures differ in the following cases:

- When not starting Windows from the storage system
- When starting Windows from the storage system (SAN boot, etc.)

When not starting Windows from the storage system

Procedure

1. Check that the storage system is not connected to the computer.
   When the storage system is connected to the computer, shutdown the computer, disconnect the cables, and restart the computer.

2. Install the Multipath Driver.
   Refer to "2.4 Installing the Driver" (page 40) for the installation procedures.

3. Shutdown the computer.

4. Connect the storage system(s) to the computer.

5. Restart the computer. (The Multipath Driver recognizes the path connections during startup and constructs and loads the paths automatically.)

6. Check that the storage system is displayed in Multipath Manager, and restart the computer.

7. Confirm that the multipath status is normal.
   Activate Multipath Manager and the connected storage system will be displayed. Check the status from the icon display to make sure that it is normal. For details, refer to "Chapter 3 Operating Multipath Manager" (page 51).

End of procedure
When starting Windows from the storage system (SAN boot, etc.)

**Procedure**

1. Connect the computer and the storage system with a single path, and install Windows in the storage system.
2. Install the Multipath Driver, and follow the message that appears at the end of the installation procedure to restart the computer.
   For the installation procedures, refer to the "2.4 Installing the Driver" (page 40).
3. Restart the computer, and then shut it down.
4. Connect the storage system and the computer in a multipath connection.
5. Start the computer.
6. Check that the number of storage systems matches the number of multipaths that are displayed in Multipath Manager, and restart the computer.
7. Confirm that the multipath status is normal.
   Activate Multipath Manager and the connected storage system will be displayed. Check the status from the icon display to make sure that it is normal.
   For details, refer to "Chapter 3 Operating Multipath Manager" (page 51).

**End of procedure**

**Caution**

- **Multipath Connection of Storage Systems**
  - When a multipath connection is set up for a storage system after the Multipath Driver is installed or the existing Multipath Driver is overwritten, the configuration between the LU numbers and disk numbers may be disrupted (*1), or the recognition of the storage system may take some time after Windows is started (*2). This is due to Windows specifications that replace the driver that controls the storage system in Windows. These events are solved by restarting Windows.
    
    *1: For example, two LUNs (LUN0 and LUN1) are normally recognized as disk 0 and disk 1. However, LUN0 is recognized as disk 1 and LUN1 is recognized as disk 0.
    
    *2: Some middleware is affected because it does not operate normally if the storage system is not recognized during Windows startup. Since the driver for the storage system has been changed, the storage system is recognized from the next Windows startup.

- **Use with MSCS/WSFC**
  - The Multipath Driver V2.0L12 and later uses a different control method for MSCS/WSFC to previous versions.
    Therefore, the same version of the Multipath Driver must be installed on each node of the MSCS/WSFC configuration, otherwise problems such as failure of cluster failover may occur.
  - It is recommended that Multipath Driver be installed before setting up MSCS/WSFC.
    Refer to the instructions in "2.7 Working in a MSCS/WSFC Environment" (page 48) for details of how to install the Multipath Driver after setting up the MSCS/WSFC.
2.3 Overwrite Installation

Computers on which the Multipath Driver V2.0 or ETERNUS Device Driver V2.0 has already been installed can be overwrite installed without having to uninstall the current product (upgrade installation).

This only applies in the following cases:
• When converting from the Multipath Driver V2.0 to a higher level version
• When converting from the ETERNUS Device Driver V2.0 to Multipath Driver V2.0 or a higher level version

**Caution**

• For changes other than those listed above (reverting to a lower level version, etc.), the current product will need to be uninstalled first, before installing the desired product.
• If the currently installed product has been patched then it cannot be overwrite installed, and will need to be uninstalled first to allow the new product to be installed.
• If the current product is older than V2.0, refer to "2.6.1 Converting to Multipath Driver V2.0 from Related Products" (page 46).
• If the following conditions are satisfied, installing the Multipath Driver is recommended while the storage system is continuously connected.
   - OS
     Windows Server 2008 or later
   - Multipath Driver
     V2.0L10 to V2.0L20 (installed version)

If an overwrite installation is performed without connecting to the storage system, a storage system LUN that is connected after installation may become offline because information that identifies LUN in Windows server has changed. In this case, change the LUN to an online state with disk management according to the circumstance.

If none of the conditions above apply, connecting to the storage system is optional.

**Note**

During overwrite installation, the following message may be displayed several times. In this case, click the [Continue] button to continue the process.

Figure 2.1 Message Window that Appears During Overwrite Installation
2.3.1 Non-MSCS/Non-WSFC Clustering Environment

To overwrite install in a non-MSCS/non-WSFC clustering environment, follow the procedure below:

**Procedure**

1. Backup the data in the storage system.
2. Install the new product without uninstalling the currently installed product.
   
   For installation procedures, refer to "2.4 Installing the Driver" (page 40).

   
   **End of procedure**

**Caution**

- Multipath Connection of Storage Systems
  When a multipath connection is set up for a storage system after the Multipath Driver is installed or the existing Multipath Driver is overwritten, the configuration between the LU numbers and disk numbers may be disrupted (*1), or the recognition of the storage system may take some time after Windows is started (*2). This is due to Windows specifications that replace the driver that controls the storage system in Windows. These events are solved by restarting Windows.

  *1: For example, two LUNs (LUN0 and LUN1) are normally recognized as disk 0 and disk 1. However, LUN0 is recognized as disk 1 and LUN1 is recognized as disk 0.

  *2: Some middleware is affected because it does not operate normally if the storage system is not recognized during Windows startup. Since the driver for the storage system has been changed, the storage system is recognized from the next Windows startup.

2.3.2 MSCS/WSFC Environment

For MSCS/WSFC environment, refer to "2.7 Working in a MSCS/WSFC Environment" (page 48).
Chapter 2  Installation/Uninstallation

2.4 Installing the Driver

This section explains how to install the Multipath Driver in a Windows environment.

Procedure

1. Insert the CD-ROM, then use Explorer (or similar) to find and double-click the Setup.msi file in the [English] folder. For a Server Core installation, the setup screen is displayed by executing Setup.msi from the command prompt.

2. If there is a README file, read it first.

3. A window to confirm whether to start installation or not will appear. Click the [Next] button to proceed with the installation. Click the [Cancel] button to stop the installation.

4. Click the [Next] button.
A window appears in which the Multipath Driver installation directory and target user(s) may be specified.

5. When changing the installation directory, click the [Browse] button to select a directory to install.
Even though the target user selection has no effect on the use of the installed Multipath Driver, [Everyone] should normally be selected.

Note

Who is allowed to uninstall or overwrite install the Multipath Driver depends on the target user selected during the initial installation.
- If [Everyone] was selected:
  Any user with administrator authority can uninstall or overwrite install the Multipath Driver.
- If [Just me] was selected:
  Only the user who initially installed the Multipath Driver is allowed to uninstall or overwrite install. [Everyone] must be selected to ensure that the Multipath Driver will be uninstalled or overwrite installed by a different user from that of the initial installation.
2.4 Installing the Driver

Figure 2.2  Multipath Driver Installation Screen

A window to confirm the installation will appear. Clicking the [Next] button starts the installation. Clicking the [Back] button returns to the previous window. Clicking the [Cancel] button stops the installation.

When installation is complete, the message "Installation Complete" will appear. Click the [Close] button.

A message appears asking whether or not to restart the computer. Click the [OK] button. Clicking the [OK] button restarts the computer. When the computer is restarted, the installation is complete.

End of procedure

Different folders are used for 32-bit OS and 64-bit OS installations:
(The C drive is used in the following example)
- For 32-bit OSs
  C:\Program Files\ETERNUS Multipath Driver
- For 64-bit OSs
  C:\Program Files(x86)\ETERNUS Multipath Driver
2.4 Installing the Driver

• After the Multipath Driver has been installed a message prompting for Windows to be restarted appears, following which, paths and LUNs must not be added until Windows has shut down and restarted. Registry entries for paths or LUNs added in this period may be incomplete, leaving the Multipath Driver unable to recognize the storage system LUNs at the next startup. If this happens, disconnect the storage system from the computer (reduce the number of paths to a single path as in a SAN Boot configuration) and remove and re-install the Multipath Driver. Re-installation of the Multipath Driver modifies registry configurations.

• After the installation, connect the computer to the storage system, and restart. When referring to the status in Multipath Manager, the multipath may not be configured normally. In this case, restart the computer, and then check it again.

• The following event log may be saved, but it is not an error when normal multipath configuration is checked in Multipath Manager.
  - If the multipath has not been configured correctly, restart the computer and check it again.
    Event Type: Warning
    Event Source: PartMgr
    Event ID: 59
    Description: Disk x will not be used because it is a redundant path for disk y.

• The following event log may be saved in Windows Server 2012, but it is not an error that causes performance degradation for the current configuration.
  - When all the drivers that are related to disk access support extended STORAGE_REQUEST_BLOCKS (SRBs), this event suggests a performance improvement.
    Event Type: Warning
    Event Source: mpio
    Event ID: 44
    Description: One or more multipath adapters do not support extended SRBs. Performance of the device (\Device\MPIODisk n) may become degraded.

The driver can be installed in silent mode.
To install the driver in silent mode, enter the following using the command prompt:
msiexec /i Setup.msi /qn
After completion, restart the computer. The computer is automatically restarted by specifying the "/forcerestart" option.
2.5 Uninstalling the Driver

This section explains how to uninstall the Multipath Driver in a Windows environment.

**Caution**

- To avoid data damage, do not uninstall the Multipath Driver and restart the computer before reducing the number of paths to a single path, or undoing a multipath configuration in the storage system. Multipath connections do not allow uninstallation of the Multipath Driver.
- Until restarting of the computer is complete after the uninstallation, accessing the storage system will cause errors. Stop accessing of the storage system before executing the uninstallation. However, when starting Windows from a storage system, uninstallation should not cause a Windows error.
- When the message "Deleting drivers was not completed. Restart computer and use clean-up tool." is displayed during uninstallation, follow the procedure below to delete the driver using the cleanup tool.

1. Click the [OK] button to proceed with the uninstallation.
2. Follow the message which appears at the end of the installation procedure to restart the computer.
3. After restarting the computer, go to [Tools]-[Clearup] of the CD-ROM, and double click the "Clearup_32.exe", "Clearup_x64.exe" or "Clearup_ia64.exe" to execute.
   - Use "Clearup_32.exe" for a 32-bit OS.
   - Use "Clearup_x64.exe" for an x64 OS.
   - Use "Clearup_ia64.exe" for an ia64 OS.
   - When the cleanup completes normally, the following message will appear.
   "Cleanup has been done"
4. Click the [OK] button in the message to complete and restart the computer.

- When the number of LUNs involved is large, the uninstallation process can take several minutes to complete. During this interval the following dialog box can appear frozen at times, but even so, the uninstallation process has not hung and should complete normally if left alone. Do not attempt to forcibly terminate it via the task manager, as this can corrupt the registry.

**Figure 2.3 Uninstalling**

The driver can be uninstalled in silent mode.
To uninstall the driver in silent mode, enter the following using the command prompt:

```
msiexec /x Setup.msi /qn
```

After completion, restart the computer. The computer is automatically restarted by specifying the "/forcerestart" option.
2.5.1 Non-MSCS/Non-WSFC Environment

To uninstall in a non-MSCS/non-WSFC clustering environment, follow the procedure below:

**Procedure**

1. Shut down the computer, and disconnect the storage system.
2. Restart the computer, and click [Start] - [Settings] - [Control Panel] - [Add or Remove Programs], select the [ETERNUS Multipath Driver] and click the [Delete] button.
   For a Server Core installation, run the Setup.msi from the Command Prompt screen to display the following screen in a Server Core environment. Select the [Remove...] option and click the [Finish] button.

![Multipath Driver Uninstallation Screen](image)

Figure 2.4   Multipath Driver Uninstallation Screen
3  Follow the messages as they appear on screen. The following screen appears for Windows Server 2008 or Windows Server 2012. Select the [Automatically close applications and attempt to restart them after setup is complete.] option and click the [OK] button.

Figure 2.5  Multipath Driver Uninstallation Screen (exiting the application)

4  A window asking whether to restart the computer appears. Click the [OK] button. The computer is restarted. The uninstallation is complete after restarting.

End of procedure

2.5.2  MSCS/WSFC Environment

To uninstall the Multipath Driver while an MSCS/WSFC environment is configured, connect each storage system with a single path and follow "2.7 Working in a MSCS/WSFC Environment" (page 48) for uninstallation. After the Multipath Driver has been uninstalled from the last node and the computers have been restarted, use the Persistent Reserve Clearing Tool to check for any remaining Persistent Reserves. If any are discovered, they should be cleared as described in "Appendix C Persistent Reserve Clearing Tool (F3GLMiTlRsCl)" (page 116).
2.5.3 Multipath I/O for Windows Server 2008 and Windows Server 2012

The Multipath I/O function provided by Windows is still available even after the Multipath Driver is uninstalled from a computer running on Windows Server 2008 or Windows Server 2012.

Figure 2.6 Multipath I/O for Windows Server 2008 or Windows Server 2012

Click the [Remove Features] option on the [Server Manager] screen to disable multipath I/O if necessary. Multipath I/O can be left enabled.

2.6 Converting to/from Related Products

This section explains the conversion from the related products (MPHD, GR Multipath Driver V1.0, and GR Device Driver V1.0) to the Multipath Driver V2.0.

2.6.1 Converting to Multipath Driver V2.0 from Related Products

When installing the Multipath Driver V2.0 on a system in which MHPD, the GR Multipath Driver V1.0, and/or the GR Device Driver V1.0 have been installed, the current product will need to be uninstalled first, before installing the desired product.

The procedure to convert from the related products is as follows:

Procedure

1. Uninstall MHPD, the GR Multipath Driver V1.0, and the GR Device Driver V1.0.
   At the end of uninstallation, if the window asking whether to restart the computer or not appears, click the [Cancel] button to avoid restarting the computer.

2. Install the Multipath Driver V2.0.
   For the installation procedures, refer to "2.4 Installing the Driver" (page 40).
3 Follow the message that appears at the end of the installation procedure, and restart the computer.

4 After starting the computer, restart it again.

End of procedure

Caution

If a storage system is left in a multipath connection, and you restart your computer after uninstallation, there is a risk of data being lost or corrupted. After uninstall, do not restart, but continue directly to installation of the new product.

2.6.2 Converting from Multipath Driver V2.0 to a Related Product

When installing MPH, GR Multipath Driver V1.0, and the GR Device Driver V1.0 on a system in which the Multipath Driver V2.0 has been installed, the current product will need to be uninstalled first, before installing the desired product.

The procedure to convert to the related products is as follows:

Procedure

1 Uninstall the Multipath Driver V2.0.
   At the end of uninstallation, if the window asking whether to restart the computer or not appears, click the [Cancel] button to avoid restarting the computer.

2 Install the desired product.
   For the installing procedure, refer to the manual of each product.

End of procedure

Caution

- If a storage system is left in a multipath connection, and you restart your computer after uninstallation, there is a risk of data being lost or corrupted. After uninstall, do not restart, but continue directly to installation of the new product.
- When converting to/from the related product in the MSCS/WSFC environment, refer to the "2.7 Working in a MSCS/WSFC Environment" (page 48).
2.7 Working in a MSCS/WSFC Environment

When overwrite installing, uninstalling, or converting to/from related products in an MSCS/WSFC environment, use the following procedure with a maintenance profile (see "Appendix B Creating a Maintenance Profile" (page 109) for details):

**Procedure**

1. Backup all the data on the storage system.
2. Shutdown all the nodes.
3. Choose the node that is to be changed first.
4. Start that node using the maintenance profile.
5. Perform the normal operations for overwrite installation, uninstallation, or converting to/from related products.
   - If a procedure required a node restart, the node must be started using the maintenance profile.
6. After the operation is complete, shutdown the node.
7. Perform Step 4 to Step 6 on each of the other nodes in turn.
8. Start all the nodes using the normal profiles.

**End of procedure**

Driver versions V2.0L12 and higher may be overwrite installed using the following procedure:

**Procedure**

1. Choose the node that is to be overwrite installed first, and [Pause Node] it.
2. If this node has any groups, move these to another node.
3. Perform the normal overwrite installation operation, and restart the node.
4. After the node has restarted, [Resume Node] it.
5. Perform Step 1 to Step 4 on each of the other nodes in turn.

**End of procedure**
2.8 Notes for Installation/Uninstallation

This section explains the notes when installing or uninstalling the Multipath Driver V2.0.

2.8.1 Notes When Installation has Failed

The following window may appear even though you have closed the message window saying "Installation Complete".

Figure 2.7 Message Window When Installation Fails

In this case, it is necessary to reinstall the Multipath Driver, since the installation was unsuccessful. Follow the procedures shown below to reinstall.

Procedure

1. When the storage system is not connected, restart the computer.
   When the storage system is connected, shut down the computer and disconnect from the storage system, and then restart.

2. Install the Multipath Driver, and shut down the computer.

3. Connect the computer to the storage system, and start.

End of procedure
2.8.2 Notes When Canceling the Uninstallation

Even if an uninstallation is canceled before it completes, the driver may be deleted. In this case, the following window will appear at the end of the uninstallation.

Figure 2.8 Message Window When Uninstallation is Canceled

To connect the storage system, it is necessary to install the Multipath Driver V2.0. Before connecting the storage system, reinstall the Multipath Driver V2.0 following the installation shown below.

Procedure

1. Uninstall the Multipath Driver V2.0 again to complete the uninstallation.
2. Install the Multipath Driver V2.0 and shut down the computer.
3. Connect the storage system to the computer, and start the computer.
4. Check that the Multipath status is normal.

End of procedure
Chapter 3
Operating Multipath Manager

This chapter explains how to operate Multipath Manager. Confirm the storage system connection to the Windows server using the GUI for Multipath Manager. Multipath Manager GUI can also perform the following functions:

- Check the path status
- Start/Stop maintenance mode
- Recover path connections
- Set a path status to Offline or Online (path switching during maintenance)
- Control the Auto Path Check function
- Control the Auto Path Recovery function
- Monitor I/O response time and monitor the recurrence of path reconnection errors
- Path diagnosis
- Reconstruct path connections
- Device scanning
- Update information
- Set a machine's operational mode (Local mode/Remote mode)
- Set a HBA time out

3.1 Selecting Local or Remote

Multipath Manager can access a server connected to a storage system either locally or remotely through a network. Local mode is the default setting. Using Multipath Manager, you can change this default setting to Remote mode. Refer to "3.15 Local Mode/Remote Mode Setting" (page 76), for more information.

- Local Mode
  In Local mode, display and path operations are possible only for storage systems that are directly connected to the server on which Multipath Manager is running.

- Remote Mode
  In Remote mode, display and path operations are also possible for any storage system that may be network connected to the server on which Multipath Manager is running.
3.2 Starting Multipath Manager

To use Multipath Manager, you must log on under the following conditions:

- Administrator privileges for the Windows server
- Built-in account Administrator for the Multipath Manager's remote mode function in Windows Server 2008 or Windows Server 2012

**Note**

If the application is run with user-specific administrator privileges, a confirmation message may appear in Windows Server 2008 or Windows Server 2012. Operation related to multipath management or maintenance information collection may display the following message. Click the [Continue] button to proceed.

![User Account Control Confirmation Message Window](image)

Multipath Manager cannot be activated from different machines at the same time through a single Windows server - storage system connection.

To activate Multipath Manager, follow the procedure below:

**Procedure**

1. Start Multipath Manager.
   
   To start Multipath Manager, follow the procedure below that corresponds to the Windows version being used.
   
   - For Windows Server 2003 or Windows Server 2008
     
     Click [Start] - [Program] - [ETERNUS Multipath Driver] - [ETERNUS Multipath Manager].
3.2 Starting Multipath Manager

For Windows Server 2012
Click [ETERNUS Multipath Manager] on the [Start] screen.

Multipath Manager starts.
Chapter 3  Operating Multipath Manager
3.2  Starting Multipath Manager

The window that is displayed varies depending on the mode that is used.

- For Local mode
  The Multipath Manager window appears. The steps after Step 2 are not necessary. Refer to "3.3 Multipath Manager Window" (page 56) for details about the Multipath Manager window.

- For Remote mode
  The computer name input window appears. Proceed to Step 2. This window only appears when Remote mode is used.

**Figure 3.4  Computer Name Input Window**

[Image of the Computer Name Input Window]

---

**Note**

- [Maintenance Information Collection] is a tool used when maintaining the Multipath Driver.
- Multipath Manager can be started by double-clicking the F3GLMiMn.exe that is stored in the installation directory of the Multipath Driver.
- For a Server Core environment, change the directory to the installation directory of the Multipath Driver in the command prompt, and then run F3GLMiMn.exe.
2 In the computer name input window, enter a server name in the text box and click the [Add] button. The new server name will be added to the list.

The computer name input window consists of the following fields and buttons:

<table>
<thead>
<tr>
<th>No.</th>
<th>Field or Button</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input Computer Name</td>
<td>Enter the server name connected to the storage system. Specify a computer name which can be processed in Windows.</td>
</tr>
<tr>
<td></td>
<td>Name text box</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Computer List box</td>
<td>Displays a list of the connected servers. Up to eight names can be listed.</td>
</tr>
<tr>
<td>3</td>
<td>[Add] button</td>
<td>Adds the name entered in the text box to the list box. Only the names of properly connected servers can be added.</td>
</tr>
<tr>
<td>4</td>
<td>[Delete] button</td>
<td>Deletes the selected name (server) from the list box.</td>
</tr>
<tr>
<td>5</td>
<td>[OK] button</td>
<td>Displays the Multipath Manager window for the specified host computer. A dialog box is displayed if one of the servers in the list cannot make a connection. The messages as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;The specified host has already been connected.&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Cause] The specified host has already been connected to the multipath manager. (From the connection from another computer, etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Response] Close Multipath Manager which is connected to the specified host.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;You have no Account or Administrator authority in the specified Host.&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Cause] There is no logon account for the specified host or the account has no administrator's privileges.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Response] Logon with an account which has administrator's privileges.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• &quot;The specified host cannot be accessed.&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Cause] Caused by an error other than those listed above.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Response] Check that the host name and the network are O.K. Check that the service is running on the specified host.</td>
</tr>
<tr>
<td>6</td>
<td>[Cancel] button</td>
<td>Exits Multipath Manager</td>
</tr>
<tr>
<td>7</td>
<td>[Local] button</td>
<td>Connects only to the local server, and returns to the Multipath Manager window.</td>
</tr>
</tbody>
</table>

3 Click the [OK] button.
The Multipath Manager window will appear.

End of procedure
3.3 Multipath Manager Window

The Multipath Manager window consists of the following areas:

Figure 3.5 Multipath Manager Window

1. Menu
   Multipath Driver commands can be specified.

2. Fault List
   Displays a list of the connection failures.

Figure 3.6 Multipath Manager Fault List
Fault details are explained below:

a. Number of faults
b. Connection status - Describes the server path status of the connected storage system. Possible status values are described in the following table:

<table>
<thead>
<tr>
<th>Status Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrade</td>
<td>Path redundancy is decreasing for a reason; either a path is not recognized at startup or a path turned out to be unreadable during the operation. Otherwise, multipath configuration is not possible because a path is incorrectly configured.</td>
</tr>
<tr>
<td>Delete</td>
<td>All the paths of the storage system has been deleted.</td>
</tr>
<tr>
<td>Failed</td>
<td>A path failed.</td>
</tr>
<tr>
<td>False</td>
<td>The assigned CM information for the currently connected storage system cannot be reported.</td>
</tr>
<tr>
<td>Forcibly Failed</td>
<td>There is a path with Forcibly Failed status.</td>
</tr>
<tr>
<td>Warning</td>
<td>There is a path with Warning status.</td>
</tr>
</tbody>
</table>

Remedy
- Check the path connection status or the storage system settings.
- Check the path connection status, or setting condition of the storage systems. If there is an error, respond to it with appropriate measures.
- Perform the appropriate repair measures on the path, then use Multipath Manager to recover the path.
- Repeat the procedure to reconstruct the MSCS/WSFC environment.
- Perform the appropriate repair measures on the path, then use Multipath Manager to recover the path.
- Check the path connection status. If there is an error, respond to it with appropriate measures.

Machine name - The name of the server in which the fault occurred.

Unit name - Information about the storage system enclosure. Product ID, Model Name and Device Identification Number (left-to-right).

(3) Unit information window
This section of the Multipath Manager window displays all monitored servers connected to storage systems, and their path information. The information is displayed in three hierarchical levels as follows:

Figure 3.7   Unit Information Window Display Format
3.3 Multipath Manager Window

- **Server**
  Server status is displayed by one of these icons, followed by the server name:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="ServerNormal" /></td>
<td>Normal</td>
<td>A server for which connection with Multipath Manager is normal.</td>
</tr>
<tr>
<td><img src="image" alt="Disconnected" /></td>
<td>Disconnected</td>
<td>A network error has occurred and the server has been taken offline; it is not available for access.</td>
</tr>
</tbody>
</table>

**Note**
To connect a server which has become disconnected, restart Multipath Manager.

- **Storage system**
  Connection status with the storage system is displayed by one of these icons:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="StorageNormal" /></td>
<td>Normal</td>
<td>Storage system is available</td>
</tr>
<tr>
<td><img src="image" alt="Warning" /></td>
<td>Warning</td>
<td>Either of the following storage systems:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The storage system that has a path with Failed status, a path with Forcibly Failed status, or a path with Warning status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The storage system has Degrade or False status</td>
</tr>
</tbody>
</table>

Information about the storage system enclosure is displayed; Product ID, Model Name and Device Identification Number appear (left-to-right).
The Model Name and Device Identification Number can be checked using ETERNUS Web GUI.

Figure 3.8  Storage System Information

![Storage System Information](image)

Figure 3.9  Storage System Information (ETERNUS Web GUI)

![Storage System Information](image)
### Path
Path status is displayed by one of these icons, followed by path identification information:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Online (Green)" /></td>
<td>Online (Green)</td>
<td>Path status is normal and path is available.</td>
</tr>
<tr>
<td><img src="image" alt="Warning (Yellow)" /></td>
<td>Warning (Yellow)</td>
<td>Path connection needs attention.</td>
</tr>
<tr>
<td><img src="image" alt="Failed (Red)" /></td>
<td>Failed (Red)</td>
<td>Path has failed.</td>
</tr>
<tr>
<td><img src="image" alt="Forcibly Failed" /></td>
<td>Forcibly Failed</td>
<td>Path that is diagnosed as unavailable due to its unstable status.</td>
</tr>
<tr>
<td><img src="image" alt="Offline" /></td>
<td>Offline</td>
<td>Path has been taken out of service.</td>
</tr>
</tbody>
</table>

Path identifier information includes the SCSIPort number, the Bus number, TargetID and CAID (Channel Adapter ID).

Figure 3.10   Path Information

- **SCSIPort number, Bus number, and TargetID**
  Values that are generated by HBA drivers and Windows and can be used to identify paths in Windows. These values are the same as the SCSI_ADDRESS structure values that are defined by Windows OS.


  The SCSIPort number corresponds to PortNumber, the Bus number corresponds to PathId, and TargetID corresponds to TargetId.

- **CAID**
  Information that shows a physical port location in the storage system. Refer to Multipath Manager Help for configurations between CAIDs and actual physical locations.

Figure 3.11   Multipath Manager Help
Figure 3.12  CAIDs and Connection Locations

The latest information is provided in "Windows version" found under "Downloads" at the following URL:


(4) Detailed path information
The LUN List (LUN No., Disk No., Path Information) for the storage system selected from
"(3) Unit information window" is shown.
A Disk Number is allocated by the computer for each LUN. The disk number is the same as the one that can
be checked with "Disk Management" or "diskpart" of Windows.
The "1st Path", "2nd Path", etc. shown in the Detailed path information are shown in the order they appear
in the Unit information window tree.

Figure 3.13  Path Display Order in the LU Information Window
Chapter 3 Operating Multipath Manager
3.3 Multipath Manager Window

The detailed path information is described below:

<table>
<thead>
<tr>
<th>Path Status</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>The path is currently used for I/O access.</td>
</tr>
<tr>
<td>Standby (Normal)</td>
<td>• The path is available but is not being used for I/O (connected to a non-assigned CM).</td>
</tr>
<tr>
<td></td>
<td>• The path is available but is not being used for I/O access, because Microsoft Cluster Server System has reserved another path for exclusive I/O use.</td>
</tr>
<tr>
<td>Standby (Warning)</td>
<td>An I/O error has been detected and is being checked.</td>
</tr>
<tr>
<td>Offline</td>
<td>The path is set to &quot;Offline&quot; and is not available for I/O access (its connection is disabled).</td>
</tr>
<tr>
<td>Failed</td>
<td>Failed I/O errors recur and the path is not available for I/O access (its connection is disabled).</td>
</tr>
<tr>
<td>Forcibly Failed</td>
<td>The path is unstable and is not available for I/O access (its connection is disabled).</td>
</tr>
</tbody>
</table>

(5) Status bar 1
Displays either "Auto Path Check" or "Auto Path Recovery" according to which one was selected from the path information in the tree display.

(6) Status bar 2
Displays other errors or non-path-related messages.
Examples of such messages are shown below:

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>A network error has occurred.</td>
<td>A communication error occurred between Multipath Manager and the server.</td>
<td>Check the network status.</td>
</tr>
<tr>
<td>The specified operation was canceled. All Other Path failure are detected.</td>
<td>When Offline was selected, all the paths except for the selected path had errors.</td>
<td>Check the path status.</td>
</tr>
<tr>
<td>Cannot perform the specified operation: Path failure is detected.</td>
<td>Due to a path error, the specified operation cannot be performed.</td>
<td>Check the path status.</td>
</tr>
<tr>
<td>Path status has change. Please try the operation again.</td>
<td>Path status has changed. Retry.</td>
<td>Check the path status and restart the server.</td>
</tr>
</tbody>
</table>

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3.4 Check the Path Status

The path error can be checked using Multipath Manager. The storage system with the path error is indicated by the device icon in the device information window (Tree).

The path display is different depending on whether the path has been deleted or the path has failed or forcibly failed.

■ When a path has been deleted

When a path has been deleted, the deleted path display disappears. "Degraded" or "Delete" will be displayed in the failure list.

The following displays an example when either path of a 2-path connection has been deleted.

- Normal path connection
  Displays 2 paths.

![Figure 3.14 Path Display (when paths are normal)]

- When some of the paths are deleted
  The deleted paths are not displayed anymore, only the normal paths are displayed.

![Figure 3.15 Path Display (when some paths are deleted)]
• When errors occurred on all of the paths and the paths were deleted
  The device icon disappears and the display is as follows:
  "Delete" will be displayed in the fault list.
  When the connection with the storage systems has not been recognized since starting the computer, the fault list does not appear.

Figure 3.16 Path Display (when errors occurred on all of the paths and the paths were deleted)

A path that was deleted due to an error automatically recovers and returns to normal status if the error is resolved and the path can be recognized again. In this case, it is not necessary to use Multipath Manager to restore the path.

However, if the path is unstable (the status of the path alternates between normal and error), the path is diagnosed as unstable by the Multipath Driver, and may change to Forcibly Failed after the path is recognized. In this case, the path status does not automatically recover and Multipath Manager must be used to recover the path.
When a path has failed or forcibly failed

When a path has failed or forcibly failed, the path traffic light icon turns from (Normal) to (Failed) or (Forcibly Failed).

- When the path has failed

Figure 3.17 Path Display (when the path failed)

- When the path has forcibly failed

Figure 3.18 Path Display (when the path forcibly failed)

In this case, please take the appropriate measures and "Recover" using Multipath Manager.
3.5 Start/Stop Maintenance Mode

When this mode is used, the Multipath Driver is notified if maintenance is being performed on the path and the Multipath Driver operation mode is changed to a mode other than normal operation mode. Select [Start Maintenance Mode] before performing maintenance on the path or the storage system. When maintenance is complete, select [Stop Maintenance Mode]. If maintenance is performed without selecting [Start Maintenance Mode], the path status may change to Forcibly Failed.

To start and stop maintenance mode, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the server to start maintenance mode with the cursor.
3. Click [Tools], and select [Start Maintenance Mode].

   **Figure 3.19   Start Maintenance Mode**

![Start Maintenance Mode](image)

4. A window to confirm starting the maintenance mode appears. Click the [OK] button to enter maintenance mode. Click the [Cancel] button to stop. After clicking the [OK] button, the [Maintenance Mode] display in the status bar 1 appears.

   **Figure 3.20   Maintenance Mode Display in Status Bar 1**

![Maintenance Mode](image)

5. Perform the maintenance operation on the storage system.
6. Select the server for which [Start Maintenance Mode] was specified in the main screen of Multipath Manager with the cursor.
7 Click [Tools], and select [Stop Maintenance Mode].

8 A window to confirm finishing maintenance appears. Click the [OK] button to stop maintenance. Click the [Cancel] button to continue maintenance.

After clicking the [OK] button, the [Maintenance Mode] display in the status bar 1 disappears.

End of procedure

---

Caution

After [Start Maintenance Mode] is selected, if Windows is restarted without selecting [Stop Maintenance Mode], the mode is returned to normal mode (maintenance mode is disabled). To continue maintenance after Windows is restarted, select [Start Maintenance Mode] again. If maintenance is complete, no action is required after Windows is restarted.

Note

- While [Start Maintenance Mode] is selected, all the unstable path monitoring functions such as "I/O Response Time Monitoring" and "Path Reconnection Monitoring" are unavailable. Path errors usually occur several times during maintenance. When the maintenance mode is selected, path status is prevented from accidentally changing to Forcibly Failed.
- The [Start Maintenance Mode] function checks whether controllers of the storage system are redundantly configured. If the controllers are not redundant, system event log [source=F3GLMiDr, Id=305] is recorded.
Chapter 3  Operating Multipath Manager

3.6  Path Recovery

When the (Warning), (Failed), or (Forcibly Failed) traffic light icon is displayed in the Multipath Manager window, Multipath Manager must be used to restore the path after the hardware failure has been resolved.

To recover a path connection, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Identify the failed path to be recovered.
   
   A failed path is indicated by the (Warning), (Failed), or (Forcibly Failed) traffic light icon.
   
   The path can be identified from the SCSIPort number, the Bus number, TargetID, and CAID that are displayed in the Manager Window.
   
   HBAs can usually be identified from SCSIPort numbers. The cables that are connected to the storage system and CAs in the storage system can usually be identified from CAIDs.
3. Perform the required maintenance (such as hardware replacement) for the path (HBAs, cables, CAs, etc.) to resolve the failure.
4. Select the failed storage system or the failed path with the cursor in the Manager window.
   
   When recovery is performed after a storage system is selected with the cursor, all the paths with Warning status, paths with Failed status, and paths with Forcibly Failed status in the storage system change to normal status.
   
   When recovery is performed after a path is selected with the cursor, only the selected path changes to normal status.
5. Click [Tools] - [Recovery], or right-click and select [Recovery].

Figure 3.22 Recovering a Path
The path(s) of the recovered paths will return to the states they were in prior to being disabled.

3.7 Paths Offline/Online (Path Switching During Maintenance)

A specified path can be forcibly changed to Offline (unavailable) or Online (available). I/O to the path can be stopped to perform preventive maintenance on the path. Use Multipath Manager to switch between Offline and Online.

To set a path offline or online, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the path to be taken offline with the cursor.
3. Click [Tools] - [Offline], or right-click and select [Offline].
4. A window to confirm going offline appears. Click the [OK] button to go offline, or the [Cancel] button to stop the operation.
5. Perform the necessary maintenance on the failed path.
6. Select the path to be taken online with the cursor.

The "Recover" command can be selected when the server and the storage system are connected with two or more paths. When a single path is used, the "Recovery" command cannot be selected.
7 Click [Tools] - [Online], or right-click and select [Online].

Figure 3.24 Setting a Path Online

8 A window to confirm going online appears. Click the [OK] button to go online, or the [Cancel] button to stop the operation.

9 Make sure that the path status has switched back to "Online" and the traffic light icon is green.

End of procedure

Note

- "Offline" operation
  Offline operation does not cause a path link down. The Multipath Driver only uses the work area for offline operation to prevent the relevant path from being selected when the Multipath Driver performs a path selection. Therefore, offline operation does not affect the status of the hardware that is connected to the relevant path.
3.8 Auto Path Check

This function performs diagnoses on all Online status paths. If an unusable path is detected, it is made unavailable for I/O. The default setting for the Auto Path Check function is ON (checked).

To set Auto Path Check, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the storage system with the cursor.
3. Click [Tools] - [Auto Path Check], or right-click and select [Auto Path Check].

![Turning on Auto Path Checking](image)

4. This enables the Auto Path Check function on all paths for the selected storage system.

**Caution**

For a single-path connection, Auto Path Check is never used, even if enabled.

**Note**

The Auto Path Recovery function monitors path status approximately every 10 minutes.
3.9 Auto Path Recovery

This function performs regular checks on all failed paths and reconnects them after a period of time if they have recovered from their failure. The default setting for Auto Path Recovery is ON (checked).

To set Auto Path Recovery, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the storage system the cursor.
3. Click [Tools] - [Auto Path Recovery], or right-click and select [Auto Path Recovery].

![Figure 3.26 Turning on Auto Path Recovery](image)

4. This procedure activates the Auto Path Recovery function on all paths for the selected storage system.

**End of procedure**

**Caution**

- For a single-path connection, the Auto Path Recovery function is never used, even if enabled.
- The Auto Path Recovery function is not performed on paths with Forcibly Failed status.
- The Auto Path Recovery function performs a diagnosis on LUNs that are recognized by Windows. This function does not automatically allow Windows to recognize the LUNs that it does not recognize.

**Note**

The Auto Path Recovery function monitors path status approximately every 10 minutes.
3.10 I/O Response Time Monitoring and Path Reconnection Monitoring

The Multipath Driver is equipped with functions that monitor I/O response time and the recurrence of path reconnection errors. These functions can be enabled and disabled using Multipath Manager.

To set I/O Response Time Monitoring or Path Reconnection Monitoring, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the storage system with the cursor.
3. Click [Tools] or right-click the mouse and select [I/O Response Time Monitoring] or [Path Reconnection Monitoring].

![Figure 3.27 Turning on I/O Response Time Monitoring or Path Reconnection Monitoring](image)

4. When a window to confirm the process appears, click the [OK] button to continue or the [Cancel] button to cancel the process.

**End of procedure**
3.11 Path Diagnosis

Path errors of the Multipath Driver are detected by access from applications or by the Auto Path Check function. Running the path diagnosis function enables diagnosing the current path status, and detecting a path error if there is one, even when there is no access from applications, or no error has been detected yet by the Auto Path Check function. This diagnosis is not normally required. Use this function only when instructed by your Fujitsu engineer.

To diagnose a path, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the server with the cursor.
3. Click [Tools], and select [Path Diagnosis].

---

**Caution**

- The I/O Response Time Monitoring function monitors whether it takes 10 seconds or longer for a normal response to return after I/O is issued to the HBA driver. If I/O response time delay occurs more than the specified number of times, the path is changed to Forcibly Failed status. When the I/O response time delays, [source=F3GLMiDr, Id=2100] system event log is recorded. Depending on the system environment, it may take 10 seconds or longer even when there is no hardware failure. When [Id=2100] system event log is recorded but hardware failure does not occur, disable the I/O Response Time Monitoring function and continue operation.
- The Path Reconnection Monitoring function monitors the recurrence rate of path reconnection errors. When the rate exceeds a specified number, the path status changes to Forcibly Failed. Disable the Path Reconnection Monitoring function for a system in which storage system LUN mapping settings are changed while Windows is running.

**Note**

- The I/O Response Time Monitoring function is disabled for iSCSI and enabled for host interfaces other than iSCSI as default.
- The Path Reconnection Monitoring function is enabled for all the host interfaces as default.
- Settings (enabled or disabled) are statically recorded in the Multipath Driver and are maintained after Windows is restarted.
When a path error is detected, the following message appears. Click the [OK] button to continue to diagnose the rest of the paths. Click the [Cancel] button to stop the operation.

![Figure 3.28 Confirmation Message Window When a Path Error is Detected](image)

**End of procedure**

### 3.12 Multipath Reconfiguration

When a multipath connection has been degraded, "Degrade" will appear in the Fault list. To reconstruct a multipath connection, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the server with the cursor.
3. Clicking [Reconfiguration] from the [Tools] menu recognizes the currently connected paths as the normal configuration, and both "Delete" and "Degrade" disappear from the failure list.

**End of procedure**

**Note**

The Multipath Driver statically records the maximum number of paths that were connected between the storage system and the server. When reconfiguration is performed, the previous maximum number of paths that were recorded is initialized and overwritten by the number of paths that are currently connected. Reconfiguration does not impact the recognition of the storage system by Windows OS. In addition, paths are not added or reduced during reconfiguration. For details about how to allow Windows OS to recognize the connection status of the storage system, perform device scanning as described in "3.13 Device Scan" (page 75).
3.13 Device Scan

This function instructs Windows OS to scan devices and allows Windows OS to recognize storage system status. To scan a device or devices, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the server with the cursor.
3. Click the [Tools] menu, and select [Device Scan].

![Figure 3.29 Scanning the Device](image)

4. When the following message appears, click the [OK] button to continue or the [Cancel] button to cancel the process.

![Figure 3.30 Confirmation Message Window for Device Scan](image)

End of procedure

- All the storage devices in the local server are scanned. Storage devices other than storage systems may be recognized by Windows OS.
- The target devices may not be recognized in the first device scanning operation. In this case, perform the device scanning operation once again.
3.14 Refresh to the Latest Information

Refresh to display the latest status of Multipath Manager. After a path restoration transition, some disk numbers in the LU information window may display "???". In such a case, use this function.

To display the latest information, follow the procedure below:

**Procedure**

1. Click the [Tools] menu, and select [Refresh].

    **End of procedure**

3.15 Local Mode/Remote Mode Setting

In Local mode, only the storage systems which are connected to the computer executing Multipath Manager can be viewed from the Multipath Manager window.

In Remote mode, multiple servers running the Multipath Driver and their connected storage systems can be viewed from the main Multipath Manager window.

After Multipath Manager starts, Remote mode can be changed to Local mode in the computer name input window (see Figure 3.4).

Remote mode and Local mode can be set using the [File] menu.

When [Local] is checked in the [File menu], Local mode is enabled. When [Local] is unchecked, Remote mode is enabled.
To set Local mode/Remote mode, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Click [File], and select [Local].

**Figure 3.32 Setting Local Mode/Remote Mode**

Remote mode and Local mode are switched.

3. Perform the following steps to change Local mode to Remote mode when the computer name input window (see **Figure 3.4**) is displayed.
   3-1. To add a server, enter the server name in the text box and click the [Add] button.
   3-2. Click the [OK] button.

**End of procedure**
3.16  HBA Time Out Setting

The Multipath Driver automatically sets the time out value of HBAs that are connected to the storage system. This function can be disabled and the value can be changed. This setting is not normally required. Set this function only when instructed by your Fujitsu engineer.

To set the HBA Time Out Setting, follow the procedure below:

**Procedure**

1. Activate Multipath Manager to display the Multipath Manager window.
2. Select the server with the cursor.
4. Click the [Tools] menu, and select [HBA Time Out Setting].

![HBA Time Out Setting](image)

The [HBA Time Out Setting] window appears.

5. Set the value specified by your Fujitsu engineer, and click the [OK] button.
6. Restart the computer.

End of procedure
• The HBA drivers that require this setting are Emulex elxstor.sys (version 1.20a3 or later), elxfc.sys (all versions), and elxcna.sys (all versions). This setting is not necessary for other HBA drivers.

• The following table explains about the HBA Time Out Setting window:

Figure 3.35  HBA Time Out Setting Window

<table>
<thead>
<tr>
<th>No.</th>
<th>Text box/Check box/Button</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ENABLE</td>
<td>This check box shows whether the automatic HBA time out setting function is enabled.</td>
</tr>
<tr>
<td>2</td>
<td>LinkTimeOut</td>
<td>These text boxes shows time out values that are set for the HBA driver. Input a value from 0 to 255 (secs).</td>
</tr>
<tr>
<td></td>
<td>NodeTimeOut</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>[OK] button</td>
<td>This button sets LinkTimeOut and NodeTimeOut.</td>
</tr>
<tr>
<td>4</td>
<td>[Defaults] button</td>
<td>This button displays the window for setting initial values of the Multipath Driver. LinkTimeOut and NodeTimeOut are 15 (sec.).</td>
</tr>
<tr>
<td>5</td>
<td>[CANCEL] button</td>
<td>This button cancels a setting change.</td>
</tr>
</tbody>
</table>
Chapter 4

Notes About Using Multipath Driver

This chapter provides important additional information for using the Multipath Driver. For the latest information, refer to the product’s URL listed in the readme text (readme_english.txt) on the Multipath Driver CD-ROM.

4.1 During Installation/Uninstallation

- To avoid data loss or corruption, set up a multipath connection only after installing the Multipath Driver.
- Before uninstalling, disconnect all the paths to the storage systems.
- Do not start the event viewer during installation/uninstallation.

4.2 Configuring a LUN

- For the GR series and ETERNUS3000 model 50, configurations from LUN 0 to LUN 7 are supported. Configurations with LUN numbers that are 8 or higher are not supported.
- If LUN mapping information is not identical for all paths, errors will occur during Multipath Manager startup. Set the storage system LUN mapping with LUN 0 as the first LUN (as seen from the server).
- Set the same LUN number for all the paths that are used in a multipath configuration. Perform LUN mapping so that each path recognizes the same LUN number, as shown in the diagram on the left below.

Figure 4.1 Configuring LUNs

- For the GR series and ETERNUS3000 model 50, configurations from LUN 0 to LUN 7 are supported. Configurations with LUN numbers that are 8 or higher are not supported.
- If LUN mapping information is not identical for all paths, errors will occur during Multipath Manager startup. Set the storage system LUN mapping with LUN 0 as the first LUN (as seen from the server).
- Set the same LUN number for all the paths that are used in a multipath configuration. Perform LUN mapping so that each path recognizes the same LUN number, as shown in the diagram on the left below.
4.3 Windows Server 2008 and Windows Server 2012

4.3.1 MPIO Properties

The [MPIO Devices] tab in the [MPIO Properties] screen lists devices that support MPIO. Do not add or delete information to or from the list. The device is automatically added to the list after the Multipath Driver is installed, and automatically deleted after the Multipath Driver is removed.

Figure 4.2 MPIO Properties
4.3.2 Multi-Path Disk Device Properties

Information such as type of load balancing policy, or details of DSM, is displayed on the [Multi-Path Disk Device Properties] screen. Load balancing policy cannot be changed in the Multipath Driver.

Figure 4.3 Multi-Path Disk Device Properties

The number of retries can be changed on the [DSM Details] screen, however changing this setting is not permitted.

Figure 4.4 DSM Details
Path status can be changed on the [MPIO Path Details] screen, however changing this setting is not permitted.

Figure 4.5  MPIO Path Details

Make sure the [Enable multi-path] checkbox is clear on the logon screen of the iSCSI initiator.

Figure 4.6  Windows Server 2003
4.5 Operating in a MSCS Environment

4.5.1 Installation

When using the Multipath Driver in a MSCS environment, the same version must be installed on all nodes.

4.5.2 Reset Groups

In environments where the SCSI2 Reserve command may be issued to the storage systems, set the CAs of different Windows server nodes (node A and node B in the following diagram) to the same reset group.

However, depending on the version of the Multipath Driver and storage system type, some MSCS may not issue the SCSI2 Reserve command making reset group setting unnecessary.
The following table shows environments where the reset group setting is required.

<table>
<thead>
<tr>
<th>Windows type</th>
<th>Multipath Driver version</th>
<th>Storage system type</th>
<th>Rest group setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Server 2003 MSCS</td>
<td>From V2.0L10 to V2.0L11</td>
<td>Any storage system</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td>From V2.0L12</td>
<td>A GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anything other than a GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Not required</td>
</tr>
<tr>
<td>Windows Server 2008 WSFC</td>
<td>From V2.0L10 to V2.0L13</td>
<td>Any storage system</td>
<td>Unsupported</td>
</tr>
<tr>
<td></td>
<td>From V2.0L14</td>
<td>A GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Unsupported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anything other than a GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Not required</td>
</tr>
<tr>
<td>Windows Server 2012 WSFC</td>
<td>From V2.0L10 to V2.0L18</td>
<td>Any storage system</td>
<td>Unsupported</td>
</tr>
<tr>
<td></td>
<td>From V2.0L19</td>
<td>A GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Unsupported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anything other than a GR series or ETERNUS3000 model 50 Disk storage system</td>
<td>Not required</td>
</tr>
</tbody>
</table>

In environments where the SCSI2 Reserve command may be issued to the storage systems, set the CAs to the same reset group. Failure to do so will prevent path switching and/or cluster failover.

**Figure 4.9** shows a cluster with node A connecting to CA-A and CA-C, and node B connecting to CA-B and CA-D. Thus, all four of these CAs would be in the same reset group.

**Figure 4.9 Setting Reset Groups**

For details on setting the reset group, refer to the manual provided with ETERNUSmgr/GRmgr.

**Note**

An environment where the SCSI2 Reserve command is issued requires a reset group setting. Even in MSCS, if the environment allows issuance of Persistent Reserve command the reset group does not need to be set. Refer to “Cluster environment” (page 29) in “Load balancing” (page 28) for more about environments which may issue the SCSI2 Reserve command.
4.6 Unusable Disks

In a MSCS/WSFC environment the Persistent Reserve command is issued to the storage system in order to obtain exclusive control for shared disks. When a LUN of the storage system that was being used by a MSCS/WSFC system is converted for use by a different environment, the LUN of the storage system may not initially be accessible to the new environment. This is because Persistent Reserve exclusive status locks are sometimes left in place when the storage system is switched over. The "Disk Management" status will be shown as "unreadable" in such cases. Turning off and on the storage system initializes Persistent Reserve locks and the LUN becomes available. Any remaining Persistent Reserve locks can also be checked and cleared using the supplied tool. Refer to "Appendix C Persistent Reserve Clearing Tool (F3GLMiTIRsCl)" (page 116) for details. If this tool does not detect any Persistent Reserve locks, other possible causes should be considered.

4.7 Notes When Using a Hyper-V Virtual Fibre Channel Environment

When using the Multipath Driver in a guest OS with FC ports that are assigned using the Hyper-V Virtual Fiber Channel function (vFC) for Windows Server 2012, the following notes should be taken into consideration.

4.7.1 Live Migration

Even though the port locations for the connected storage systems are changed by a live migration of a guest OS, the path information in Multipath Manager displays the pre-migration CAID connection destination port locations. Once the guest OS is restarted, the post-migration CAID connection destination port locations are displayed.
4.7.2 Uninstalling the Multipath Driver

Before uninstalling the Multipath Driver, perform the following procedure to change the connection type to a single path connection.

Procedure

1. Shut down the guest OS.
2. Delete the virtual FC adapters until only one virtual FC adapter is assigned to the guest OS.
3. Start the guest OS.
4. Start Multipath Manager in the guest OS.
   Make sure that a single path connection is being used.

End of procedure

4.8 Notes When Using a Storage Cluster Environment

When failover occurs, the path may temporarily be displayed as "Warning".

4.9 Other Notes

4.9.1 Device Manager

Do not disable or delete any devices (disks, HBAs, etc.) that are related to the storage system.

4.9.2 Power on/off the Storage System

Power on the storage system, and start the computer after checking that it is in "Ready" status.
Do not power off the storage systems while operating the computer.
Appendix A

Error Messages and Event Logs

If an error or event occurs in the Multipath Driver, the user will be notified by an error message and/or an entry in the event log.

A.1 Error Messages

A.1.1 Format of Error Messages

Error messages are provided in the following format in the Multipath Driver.

_XXXXXXXXXXXXXXXXXXXXX (Error message)_

**Description:**
- Explains the cause of the error.

**Action:**
- Gives the user instructions on how to solve the problem.

A.1.2 Sample Error Messages

**This user account does not have administrator privileges.**

**Description:**
- A username without administrator privileges logged on and attempted to activate Multipath Manager.

**Action:**
- Logon with a username that has administrator privileges.

**Failed to acquire sufficient memory.**

**Description:**
- Lack of adequate memory resources.

**Action:**
- Exit all other applications and restart.
A.2 Event Logs

Event logs can be viewed in the Event Viewer on a Windows server. To display the Event Viewer, click [Start] - [Programs] - [Management Tool (common)] - [Event Viewer].

A.2.1 Event Log Type and Format

The Event Log of the Multipath Driver appears as follows on the Event Viewer screen.

- **Log Type:** System Log
- **Message Type:**
  - One of the following message types will appear describing the nature of the event:
    - Information
    - Warning
    - Error
- **Description:**
  - Event
- **Source:** F3GLMiDr
- **User:** N/A
- **Computer:** The name of the computer on which the event occurred

---

**The specified host cannot be accessed.**

- **Description:**
  - The specified host name does not exist on the network, or
  - There is a network error
- **Action:**
  - Enter the correct host name.
  - Check for a network error.

**The specified host has already been connected.**

- **Description:**
  - The specified host is currently in use by another user.
- **Action:**
  - Wait until the user has logged off and try again later.
Multipath Driver Event Log entries are formatted as follows:

**Event ID:XXXX**

- **Type:**
  - One of the following message types will appear describing the nature of the event:
    - Information
    - Warning
    - Error

- **Description:**
  - The character string is displayed in the Event Viewer. Variable character strings are indicated in italics.

- **Details:**
  - If there are any device(s) or other information in the [Description], the details will be described here.

- **Cause:**
  - This describes the cause of the event.

- **Action:**
  - Notifies the user on how to deal with the Event Log.

### A.2.2 Multipath Driver Event Log

**Event ID:101**

- **Type:** Error
- **Description:** The detection of a fatal error caused a driver failure at startup.
- **Cause:** Since the Multipath Driver failed to acquire sufficient memory for normal operation, further driver processing is discontinued.
- **Action:** Re-examine the system and its memory. This event log may be collected during the Multipath Driver installation, however, this is normal.

**Event ID:102**

- **Type:** Error
- **Description:** Failed to access the Registry information.
- **Cause:** For some reason, the Multipath Driver-related registry information may be corrupted.
- **Action:** Re-examine the system and its memory. This event log may be collected during the Multipath Driver installation, however, this is normal.
Event ID: 103

Type: Error

Description:
Lack of adequate memory resources.

Cause:
Failed to acquire sufficient memory.

Action:
Re-examine the system and memory.
This event log may be collected during the Multipath Driver installation, however, this is normal.

Event ID: 104

Type: Error

Description:
Due to a lack of memory resources, some driver functions are unusable.

Cause:
Failed to acquire adequate memory.

Action:
Re-examine the system and its memory.

Event ID: 105

Type: Information

Description:
Reconstructed the path management information.

Cause:
This log is added after using Multipath Manager to execute "Reconfiguration", upon restarting the Windows server.

Action:
Since this event log message is not an error, no response is necessary.

Event ID: 201

Type: Error

Description:
An input/output error has occurred in the device below.
Device: ScsiPortP

Details:
Displays the device with the input/output error.

Cause:
An input/output error was detected in ScsiPortP

Action:
Inspect the device displayed in ScsiPortP
## Event ID: 202

**Type:**
- Error

**Description:**
An input/output error has occurred in the device below.
- Device: ScsiPortP, PathId=B, TargetId=T, Lun=L

**Details:**
- Displays the device with the input/output error.

**Cause:**
An input/output error was detected in [ScsiPortP, PathId=B, TargetId=T, Lun=L].

**Action:**
Inspect the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].

## Event ID: 203

**Type:**
- Warning

**Description:**
Sense information was reported from the following device.
- Device: ScsiPortP, PathId=B, TargetId=T, Lun=L
- Sense Information: 0xAA-0xBB-0xCC

**Details:**
- Device: Displays the device from which sense information was recorded.
- Supplemental Information: Displays sense information. Sense Key, Additional Sense Code (ASC), and Additional Sense Code Qualifier (ASQC) are displayed from left to right. Sense information is generated by the storage system.

**Cause:**
Sense information was received from the device.

**Action:**
Inspect the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].

## Event ID: 204

**Type:**
- Warning

**Description:**
I/O status was reported from the following device.
- Device: ScsiPortP, PathId=B, TargetId=T, Lun=L
- Supplemental Information: 0xAA-0xBB

**Details:**
- Device: Displays the device from which input/output status was recorded.
- Supplemental Information: Displays input/output status. SrbStatus and ScsiStatus are displayed from left to right. SrbStatus is information that is generated by the HBA driver and ScsiStatus is information that is generated the HBA driver or the storage system.

**Cause:**
Input/output status from the device was received.

**Action:**
Inspect the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].
Appendix A  Error Messages and Event Logs
A.2  Event Logs

Event ID: 301

Type:
Error

Description:
Some paths could not be detected. Check to see if the paths are properly connected. The information of the ports (CAID) that are not connected on the storage system-side can be checked with [Source=F3GLMiDr, ID=306 Event].

ProductID : DeviceProductId
Device : ScsiPortP, PathId=B, TargetId=T
Number of current paths : A
Number of previous paths : B

Details:
ProductID: Displays the ProductID of the device that could not commence multipath operation.
Device: Displays the device that could not commence multipath operation.
Number of current paths: The number of paths that are currently recognized.
Number of previous paths: The previous maximum number of paths that were recognized.

Cause:
The ScsiPortP, PathId=B, TargetId=T prompt for the device could not commence multipath operation due to a hardware malfunction or improper cable connection.

Action:
Inspect the device displayed in ScsiPortP, PathId=B, TargetId=T.
The information of the ports (CAID) that are not connected on the storage system-side can be checked with [Source=F3GLMiDr, ID=306 Event].
Perform a multipath reconfiguration when starting a multipath operation with the current configuration. For details, refer to "3.12 Multipath Reconfiguration" (page 74).

Event ID: 304

Type:
Information

Description:
Multipath operation has commenced for the following device.

ProductID : DeviceProductId
Device : ScsiPortP, PathId=B, TargetId=T
Number of paths : A

Details:
ProductID: Displays the ProductID for the device that commenced multipath operation.
Device: Displays the device that commenced multipath operation.
Number of paths: Displays the number of path redundancies.

Cause:
Displays a message informing ScsiPortP, PathId=B, TargetId=T that multipath operation has commenced.

Action:
Since this event log is not an error, no action is necessary.
The event log is notified when multipath operation for ScsiPortP, PathId=B, TargetId=T commences.
**Event ID: 305**

Type: Error

Description:
Since the connection between the server and the storage system is not configured correctly, there is no CM Redundancy. For example, this event occurs when only one CM in a storage system in which CM0 and CM1 are installed is connected to the server.

ProductID: DeviceProductId
Device: ScsiPortP, PathId=B, TargetId=T

Details:
ProductID: Displays the ProductID of an incorrectly connected device.
Device: Displays the incorrectly connected device.

Cause:
Connection pattern that does not configure controller redundancy was detected. For example, a two-path connection configuration with both paths connected to CM0 notifies this event log.

Action:
Re-examine the connection pattern for ScsiPortP, PathId=B, TargetId=T.

**Event ID: 306**

Type: Error

Description:
The path between the server and the storage system port (CAID) shown below is not connected. Check the settings and the hardware.

ProductID: DeviceProductId
CAID: A

Check the following settings:
- HBA Driver settings: topology setting, etc.
- iSCSI Software Initiator settings (when set): logon setting, etc.
- Fibre Channel switch settings (when set): zoning setting, etc.
- Storage system settings: Host I/F setting, LUN mapping setting, etc.

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

Details:
ProductID: Displays the device ProductID that cannot be detected.
Device: Displays the CAID that cannot be detected.

Cause:
Connection to CAID: A could not be detected due to a hardware malfunction, improper cable connection, or setting changes.
Action:

Inspect the connection with CAID: A.
CAID: A shows the physical location of a storage system port.
Refer to Multipath Manager Help for configurations between CAIDs and actual physical locations.

Event ID: 308

Type: Error

Description:
The connection between the server and the storage system is not configured correctly.
Multiple ports on the server-side are only connected to one port on the storage system-side. For example, this event occurs when the zoning setting of the Fibre Channel switch is incorrect or when no zoning settings are set at all.

ProductID: DeviceProductId
Device: ScsiPortP1, PathId=B1, TargetId=T1, CAID=A1
            : ScsiPortP2, PathId=B2, TargetId=T2, CAID=A2

Details:
ProductID: Displays the ProductID of an incorrectly connected device.
Device: Displays the incorrectly connected device.
Appendix A  Error Messages and Event Logs
A.2  Event Logs

Cause:
An incorrect connection configuration between the server and the storage system was detected. Example: Multiple server ports are connected to a single storage system port.

Figure A.3  Incorrect Connection Configuration between the Server and the Storage System

Action:
Inspect the device displayed in ScsiPortP, PathId=B, TargetId=T to check whether the Fibre Channel switch was set or was correctly set up in a zone configuration.

Note
This event log is not output for V2.0L21 or later.

Event ID:310
Type:
Error
Description:
The LUN Mapping configuration in the storage system is incorrect. The LUN number for OLU=0xAAAA is not the same for the paths. Set the same value for the OLU LUN number of the paths.
OLU : 0xAAAA
Device : ScsiPortP1, PathId=B1, TargetId=T1, CAID=B1, LUN=L1
: ScsiPortP2, PathId=B2, TargetId=T2, CAID=B2, LUN=L2

Details:
OLU: Displays the incorrectly assigned OLU number for the LUN.
Device: Displays the device with improper LUN assignment.
OLU is the information that identifies LUs in the storage system. OLU is also referred to as "Logical Volume" in storage system manuals.
Cause:
The LUN number for OLU=0x4444 is not the same for the paths.
Example: The same OLU numbers (OLU=0) have different LUN numbers for the paths.

Figure A.4 Incorrect Storage System LUN Assignment Example (OLU number is identical)

Action:
Set the same value for the OLU LUN number of the paths.

Event ID:311
Type:
Error
Description:
The LUN Mapping configuration in the storage system is incorrect.
The set OLU is different to both of the LUN=L paths shown below.
Set the same OLU for both paths of the LUN.
LUN : L
Device : ScsiPortP1, PathId=B1, TargetId=T2, CAID=A1, OLU=0xBBB1
ScsiPortP2, PathId=B2, TargetId=T2, CAID=A2, OLU=0xBBB2

Details:
LUN: Displays the LUN number with improper LUN assignment.
Device: Displays the device with improper LUN assignment.
OLU is the information that identifies LUs in the storage system. OLU is also referred to as "Logical Volume" in storage system manuals.
Cause:
OLU numbers for the same LUN differ between paths.
Example: Actual LUN of the same LUN number (LUN=1) for different paths has different OLU.

Figure A.5 Incorrect Storage System LUN Assignment Example (OLU number is different)

Action:
Correct the LUN assignment for LUN: L.

Event ID:312
Type:
Warning
Description:
The host response setting for the storage system is incorrect.
Set the same parameter for the host response of VPD83 Type3 between the ports.

Product Id : DeviceProductId
Device : ScsiPortP1, PathId=B1, TargetId=T1, CAID=A1
ScsiPortP2, PathId=B2, TargetId=T2, CAID=A2

Details:
Product Id: Displays the ProductId of the device that has an incorrect host response setting.
Device: Displays a device that has an incorrect host response setting. CAID indicates a storage system port.

Cause:
Different host response settings for VPD83 Type3 between the ports were detected.

Action:
Set the same parameter for the host response of VPD83 Type3 between the ports by using ETERNUS Web GUI.
Event ID: 313

Type:
Warning
Description:
The host response setting for the storage system is incorrect.
Set the same parameter for the host response of the Referrals function or VPD83 Type5 between the ports.

ProductID: DeviceProductId
Device: ScsiPortP1, PathId=B1, TargetId=T1, CAID=A1
ScsiPortP2, PathId=B2, TargetId=T2, CAID=A2

Details:

ProductID: Displays the ProductID of the device that has an incorrect host response setting.
Device: Displays a device that has an incorrect host response setting. CAID indicates a storage system port.

Cause:
Different host response settings for the Referrals function or VPD83 Type5 between the ports were detected.

Action:
Set the same parameter for the host response of the Referrals function or VPD83 Type5 between the ports by using ETERNUS Web GUI.

Event ID: 401

Type:
Warning
Description:
The following device was not able to be used.

ProductID: DeviceProductId
Device: ScsiPortP, PathId=B, TargetId=T, Lun=L

Details:

ProductID: Displays the ProductID for the device that cannot be used.
Device: Displays the device that cannot be used.

Cause:
Informs that the Multipath Driver has received an instruction from the Windows to stop [ScsiPortP, PathId=B, TargetId=T, Lun=L].

Action:
When the event log ID=403 has been collected, check the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].
When the event log ID=403 has not been collected, there is no need to respond since the status is normal.
The event log ID=401 is collected when an error occurred in the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L], or when Windows has installed a device internally. When connecting a device to the Windows for the first time, the event log ID=401 for [ScsiPortP, PathId=B, TargetId=T, Lun=L] may be collected several times temporarily, but this is not a device failure.
Appendix A  Error Messages and Event Logs

A.2  Event Logs

Event ID: 402

Type:  Warning
Description:
The following device was deleted.
  ProductId : DeviceProductId
  Device : ScsiPortP, PathId=B, TargetId=T, Lun=L
Details:
  ProductID: Displays the ProductID which has been deleted.
  Device: Displays the device which has been deleted.
Cause:
  Informs that the Multipath Driver received an instruction from the Windows to delete [ScsiPortP, PathId=B, TargetId=T, Lun=L].
Action:
  When the event log ID=403 has been collected, check the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].
  When the event log ID=403 has not been collected, there is no need to respond since the status is normal.
  The event log ID=402 is collected when an error occurred in the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L], or when Windows has installed a device internally. When connecting a device to the Windows for the first time, the event log ID=402 for [ScsiPortP, PathId=B, TargetId=T, Lun=L] may be collected several times temporarily, but this is not a device failure.

Event ID: 403

Type:  Error
Description:
The following device was deleted.
  ProductId : DeviceProductId
  Device : ScsiPortP, PathId=B, TargetId=T
Details:
  ProductID: Displays the ProductID which has been deleted.
  Device: Displays the device which has been deleted.
Cause:
  ScsiPortP, PathId=B, TargetId=T cannot be used because of cable disconnection or device failure.
Action:
  If one LUN is allocated from the storage system to the server, the event log ID=403 is collected when an error occurred in the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L], or when Windows has installed a device internally. When connecting a device to the Windows for the first time, the event log ID=403 for [ScsiPortP, PathId=B, TargetId=T, Lun=L] may be collected several times temporarily, but this is not a device failure.
  If the above situation does not apply (if two or more LUNs are allocated and this is not the first connection), check the device displayed in ScsiPortP, PathId=B, TargetId=T.
Appendix A  Error Messages and Event Logs
A.2  Event Logs

**Event ID: 1010**
Type: Error
Description:
An input/output fault in the following device has caused the path to disconnect. Re-examine the device connections.
Device: ScsiPortP, PathId=B, TargetId=T, Lun=L
Details:
Device: Displays the device connected through the failed path.
Cause:
Since input/output errors recurred in the path, the path has been disconnected.
Action:
Inspect the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].

**Event ID: 1014**
Type: Error
Description:
Due to an error in which the status of the path listed below repeatedly alternates between normal and error, the path is forcibly disconnected. Connectors may not be connected properly or a hardware malfunction may have occurred. Check the hardware. Even if the automatic path restore function is set in Multipath Manager, the setting will not automatically restore the device path listed below. A path can be restored by restarting the OS or by using Multipath Manager to restore the path.
Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system
Details:
Device: Displays the path of the device that was forcibly disconnected.
Cause:
Since the path alternates between normal and error status and is abnormal, the path was disconnected.
Action:
Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, Lun=L].
Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system
**Event ID: 1020**
Type: Information
Description:
The path was restored.
Device: `ScsiPortP PathId=B, TargetId=T, Lun=L`
Details:
Displays the device connected to the restored path.
Cause:
The path was restored by Auto Path Recovery.
Action:
Since this event log is not an error, no response is necessary.

**Event ID: 1030**
Type: Information
Description:
Reset request was issued to the following device.
Device: `ScsiPortP PathId=B, TargetId=T, Lun=L`
Supplemental Code: `0xffffffff`
Details:
Device: Displays the device which has issued the reset request.
Supplemental Code: Displays the program's internal supplemental code value
Cause:
A reset request has been issued to release the Reservation status.
Action:
Since this event log is not an error, no response is necessary.

**Event ID: 1040**
Type: Warning
Description:
The following path was invalidated.
Device: `ScsiPortP PathId=B, TargetId=T`
Supplemental Code: `0xffffffff`
Details:
Device: Displays the device which has become invalid.
Supplemental Code: Displays the program's internal supplemental code value.
Cause:
`ScsiPortP PathId=B, TargetId=T` may not be able to be used due to a cable disconnection or a device failure.
Action:
Inspect the device displayed in `ScsiPortP PathId=B, TargetId=T`. 
Appendix A  Error Messages and Event Logs
A.2  Event Logs

Event ID:1050

Type: Information
Description:
The processing of Persistent Reserve was done.
Device: ScsiPortP, PathId=B, TargetId=T, Lun=L
Supplemental Code: 0xAAAAAAAA
Details:
Device: Displays the device for which Persistent Reserve control was performed.
Supplemental Code: Displays the program's internal supplemental code value.
Cause:
LUN exclusive control related processing was performed.
Action:
Since this event log is not an error, no response is necessary.

Event ID:1051

Type: Warning
Description:
The processing of Persistent Reserve was done.
Device: ScsiPortP, PathId=B, TargetId=T, Lun=L
Supplemental Code: 0xAAAAAAAA
Details:
Device: Displays the device for which Persistent Reserve control was performed.
Supplemental Code: Displays the program's internal supplemental code value.
Cause:
LUN exclusive control related processing was performed.
Action:
Since this event log is not an error, no response is necessary.

Event ID:1100

Type: Information
Description:
Received the transition demands of the path status.
Device: ScsiPortP, PathId=B, TargetId=T
Command: 0xAAAAAAAA
Details:
Displays the device whose path status has been changed.
Displays different types of status change requests.
Cause:
The operation was executed on the appropriate path by Multipath Manager.
Action:
Since this event log is not an error, no response is necessary.
**Event ID: 1200**

**Type:** Error  
**Description:** Lack of adequate memory resources.  
Device: ScsiPortP  
Supplemental Code: 0xAAAAAAAA  
**Details:**  
Device: Displays the device that was involved in the request.  
Supplemental Code: Displays the Supplemental Code which is in the internal program.  
**Cause:** Failed to acquire sufficient memory.  
**Action:** Re-examine the system and its memory.

**Event ID: 2000**

**Type:** Information  
**Description:** SCSI Sense information was received from the storage system. Since this information is not necessary for maintenance, ignore this event.  
Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L  
Sense: AA/BBCC  
**Details:**  
Device: Displays the device from which sense information was recorded.  
Sense: Displays sense information. Sense Key, Additional Sense Code (ASC), and Additional Sense Code Qualifier (ASCQ) are displayed from left to right. Sense information is generated by the storage system.  
**Cause:** SCSI sense information was received from the storage system.  
**Action:** Since this event log is not an error, no response is necessary.

**Event ID: 2002**

**Type:** Warning  
**Description:** SCSI Sense information was received from the storage system. If this event occurs repeatedly over an extended period of time, check the hardware.  
Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L  
Sense: AA/BBCC  
**Details:**  
Check the following hardware:  
- HBA(s), NIC(s), or CNA(s) on the server-side  
- Cable(s) connecting the server and the storage system  
- Fibre Channel switch(es) (when used)  
- Fibre Channel switch SFP Module(s) (when used)  
- Storage system
Details:
Device: Displays the device from which sense information was recorded.
Sense: Displays sense information. Sense Key, Additional Sense Code (ASC), and Additional Sense Code Qualifier (ASQC) are displayed from left to right. Sense information is generated by the storage system.

Cause:
SCSI sense information was received from the storage system.

Action:
Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].
Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

Event ID: 2004
Type: Error
Description:
SCSI Sense information was received from the storage system.
A storage system malfunction may have occurred.
Check the components of the storage system.
Note that this event may occur after the storage system has been repaired.
Contact your Fujitsu engineer to confirm the meaning of the SCSI Sense information.
Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
Sense: AA/BBCC
Check the following hardware:
- Storage system
Details:
Device: Displays the device from which sense information was recorded.
Sense: Displays sense information. Sense Key, Additional Sense Code (ASC), and Additional Sense Code Qualifier (ASQC) are displayed from left to right. Sense information is generated by the storage system.

Cause:
SCSI sense information was received from the storage system.

Action:
Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].
Check the following hardware:
- Storage system
**Event ID: 2012**

**Type:** Warning

**Description:**
An error notification was received from the HBA driver.
If this event occurs repeatedly over an extended period of time, check the hardware.

- **Device:** ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
- **SrbStatus:** 0xAA

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

**Details:**
- **Device:** Displays the device from which SrbStatus was recorded.
- **SrbStatus:** Displays SrbStatus.

**Cause:**
SrbStatus was received from the HBA driver.

**Action:**
Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

---

**Event ID: 2022**

**Type:** Warning

**Description:**
A SCSI Status notification was received from the storage system.
If this event occurs repeatedly over an extended period of time, check the hardware.

- **Device:** ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
- **SCSI Status:** 0xBB

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

**Details:**
- **Device:** Displays the device from which SCSI Status was recorded.
- **SrbStatus:** Displays SCSI Status.

**Cause:**
SCSI Status was received from the storage system.
Action:

Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].

Check the hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

Event ID: 2032

Type:
Warning

Description:

An error notification was received from the HBA driver.
If this event occurs repeatedly over an extended period of time, check the hardware.

Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
NTSTATUS: 0xbbbbbbbb

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system

Details:

Device: Displays the device from which NTSTATUS was recorded.
SrbStatus: Displays NTSTATUS.

Cause:

NTSTATUS was received from the HBA driver.

Action:

Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L].

Check the following hardware:
- HBA(s), NIC(s), or CNA(s) on the server-side
- Cable(s) connecting the server and the storage system
- Fibre Channel switch(es) (when used)
- Fibre Channel switch SFP Module(s) (when used)
- Storage system
Event ID: 2100

Type:
Warning

Description:
The storage system requires time to respond to the command.
If this event occurs repeatedly over an extended period of time, check the hardware.
Device: ScsiPortP, PathId=B, TargetId=T, CAID=A, LUN=L
Response Time: 5 seconds (decimal)
Check the following hardware:
  HBA(s), NIC(s), or CNA(s) on the server-side
  Cable(s) connecting the server and the storage system
  Fibre Channel switch(es) (when used)
  Fibre Channel switch SFP Module(s) (when used)
  Storage system

Details:
Device: Displays the device that required time to respond to the command.
Response Time: Displays the time that was required to respond in seconds.

Cause:
The storage system required time to respond to the command.

Action:
Check the following hardware that corresponds to the device displayed in [ScsiPortP, PathId=B, TargetId=T, CAID=A, Lun=L],
Check the following hardware:
  HBA(s), NIC(s), or CNA(s) on the server-side
  Cable(s) connecting the server and the storage system
  Fibre Channel switch(es) (when used)
  Fibre Channel switch SFP Module(s) (when used)
  Storage system
Appendix B
Creating a Maintenance Profile

In some cases, special functions on a Cluster Software shared disk should be disabled in order to install or maintain the Multipath Driver. For this purpose, the following Hardware Profiles must be created.

- Do not let Cluster Service start automatically when Windows Server 2003 starts
- Disable filter drivers related to Cluster (Cluster Disk Driver and Cluster Network Driver)

The following procedure explains how to create a Hardware Profile.
Refer to Windows Server 2003 online help for details of how to use the Hardware Profile.

Procedure

1. Power on the storage system while all nodes are shut down.
2. Power on only one node, and boot the computer.
3. Select Control Panel and start [System].
4. When [System Properties] appears on the screen, select the [Hardware] tab and click the [Hardware Profiles] button.

Figure B.1 System Properties
Appendix B  Creating a Maintenance Profile

5 Make sure that "Profile 1" is selected, then click the [Copy] button.

![Figure B.2 Hardware Profiles](image)

6 Enter Maintenance in [To], and click the [OK] button.

![Figure B.3 Copy Profile](image)

7 From Control Panel, start [Administrative Tools]-[Computer Management].

8 When [Computer Management] appears on the screen, select [Services and Applications] and select [Services].
9. Right-click [Cluster Service], and select [Properties].

Figure B.4  Computer Management


Figure B.5  Cluster Service Properties

11. Reboot the node using the newly-created Maintenance Hardware Profile (Maintenance).

12. From Control Panel, start [Administrative Tools]-[Computer Management].
13 Right-click [Device Manager], and select [View]-[Show hidden devices].

Figure B.6 Computer Management

14 Right-click [Cluster Network Driver] under [Non-Plug and Play Drivers], and select [Properties].

15 When [Cluster Network Driver Properties] appears on the screen, select the [General] tab. Select "Do not use this device in the current hardware profile (disable)" from [Device usage], and click the [OK] button.

Figure B.7 Cluster Network Driver Properties

16 When a message asking if you want to restart the computer appears, click the [No] button.
17 Right-click [Cluster Disk Driver] under [Non-Plug and Play Drivers], and select [Properties].

18 When [Cluster Disk Driver Properties] screen appears, select the [General] tab. Select "Do not use this device in the current hardware profile (disable)" from [Device usage], and click the [OK] button.

![Figure B.8 Cluster Disk Driver Properties](image)

19 When a message asking if you want to restart the computer appears, click the [Yes] button.

![Figure B.9 System Settings Change](image)

20 Restart the computer using "Maintenance" Hardware Profile.

21 From Control Panel, start [Administrative Tools]-[Computer Management].

22 Right-click [Device Manager], and select [View]-[Show hidden devices].

23 Right-click [Cluster Network Driver] under [Non-Plug and Play Drivers], and select [Properties].
24 When [Cluster Network Driver Properties] appears on the screen, select the [Driver] tab. Make sure that [Current status] is "Stopped", then click the [OK] button.

Figure B.10  Cluster Network Driver Properties

25 Right-click [Cluster Disk Driver] under [Non-Plug and Play Drivers], and select [Properties].

26 When [Cluster Disk Driver Properties] appears on the screen, select the [Driver] tab. Make sure that [Current status] is "Stopped", then click the [OK] button.

Figure B.11  Cluster Disk Driver Properties
27 Stop the node.

28 Execute the above procedure for each node.

End of procedure
Appendix C

Persistent Reserve Clearing Tool (F3GLMiTlRsCl)

The Persistent Reserve Clearing Tool (hereafter, "this tool") is used to clear Persistent Reserves from the storage system. This tool can be used even if the Multipath Driver is not installed.

Caution

This tool should not be used in an MSCS/WSFC environment. Before running this tool, confirm that no LUNs of the connected storage system are being used by an MSCS/WSFC system.

To use the Persistent Reserve Clearing Tool (F3GLMiTlRsCl), follow the procedure below:

Procedure

1. Log on to the computer.
   An administrator-level account must be used.

2. Make sure that there is only one online path.
   For multipath connections with the Multipath Driver installed, use the Multipath Manager's online/offline function (refer to "3.7 Paths Offline/Online (Path Switching During Maintenance)" (page 68)) to ensure that only one path is online.
   Note that any paths put offline at this time must be returned to an online state after using this tool.

3. Start F3GLMiTlRsCl.
   "F3GLMiTlRsCl.exe" may be found in the product installation folder and on the product CD:
   
   <Install_folder>\Tools\F3GLMiTlRsCl.exe
   <CD_drive>\Tools\RsCl\F3GLMiTlRsCl.exe

   Type the following at the command prompt to start the tool:
   > F3GLMiTlRsCl.exe

4. Device reserve status list appears.
   When the tool is run on a server, the status of Persistent Reserves on all storage systems connected to that server is displayed in list format:

<table>
<thead>
<tr>
<th>Disk No</th>
<th>LUN No</th>
<th>Product Id</th>
<th>Serial No</th>
<th>REG Key</th>
<th>RSV Key</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>000</td>
<td>E3000</td>
<td>012345</td>
<td>6356a9958a54c646</td>
<td>Not reserved</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>001</td>
<td>E3000</td>
<td>012345</td>
<td>6356a9958a54c646...</td>
<td>Not reserved</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>002</td>
<td>E3000</td>
<td>012345</td>
<td>52d50b9c8b54c646</td>
<td>52d50b9c8b54c646</td>
<td>06</td>
</tr>
<tr>
<td>4</td>
<td>003</td>
<td>E3000</td>
<td>012345</td>
<td>Not Registered</td>
<td>Not reserved</td>
<td>B</td>
</tr>
<tr>
<td>5</td>
<td>004</td>
<td>E3000</td>
<td>012345</td>
<td>SCSI-2 Reserved</td>
<td>Not reserved</td>
<td>C</td>
</tr>
<tr>
<td>6</td>
<td>005</td>
<td>E3000</td>
<td>012345</td>
<td>?</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>
Appendix C Persistent Reserve Clearing Tool (F3GLMiTlRsCl)

FUJITSU Storage ETERNUS Multipath Driver V2 User's Guide for Microsoft® Windows®

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- Disk No
  Assigned by Windows to each storage system LUN.
- LUN
  Storage system-side Logical Unit Number.
- Product ID
  Type of storage system.
- Serial No
  ID code for each storage system.
- REG Key
  An 8-byte hexadecimal key registered to a storage system LUN for Persistent Reserve use.
  If multiple keys are registered, only the first key is displayed, but with a trailing "..." to indicate that more keys exist (case "A" in the example).
  If no keys are registered, then "Not Registered" is displayed (case "B" in the example).
  When SCSI-2 type reservations are made, then "SCSI-2 Reserved" is displayed. (case "C" in the example)
  As a final, "?" is displayed (case "D" in the example) when:
  - An error has made judgment impossible.
  - A SCSI-2 reservation has been made, but the HBA driver cannot display correctly.
  - In a MSCS/WSFC environment, the disk (LUN) is not assigned to this node.
- RSV Key
  Another 8-byte hexadecimal key for LUN Persistent Reserve use.
  This key is displayed the same as for the "REG Key". LUNs that are not reserved show "Not Reserved".
- Type
  Indicates the Persistent Reserve type when a LUN is reserved.

**Note**

This tool will clear the registered keys of the target LUN, irrespective of whether a Persistent Reserve (RSV key) exists or not.

- When no connected devices support Persistent Reserve
  Persistent Reserves do not need to be cleared if none of the connected devices support them, in which case the following message should appear:
  
  A device that supports Persistent Reserve cannot be detected.

- When Persistent Reserves are not detected
  Even if a device that supports Persistent Reserves is connected, they do not need to be cleared if they do not currently exist, in which case the following message should appear:
  
  Persistent Reserves not detected.

- When more than one online path is set
  If more than one online path is currently set, the following message should appear:
  
  Set only one path online via Multipath Manager.
  
  Reduce the number of online paths to one, as described in Step 2, above.
When Persistent Reserve is used in MSCS/WSFC

If the server that is running this tool itself has Persistent Reserves on some LUNs, the following message will appear, and the Persistent Reserves will not be cleared:

This server issues Persistent Reserves. Persistent Reserves cannot be cleared.

Clearing the Persistent Reserves.

The storage system LUNs are checked, and if any Persistent Reserves are detected, the following message appears:

Do you want to clear Persistent Reserves?
Clear all disks: yes
Clear only one disk: Disk No
Exit: x

Type "yes" to clear all detected Persistent Reserves.
Specify a "Disk No" (from the list) to clear the Persistent Reserve from that LUN only.

The following message should appear, indicating that the process was successful:

Persistent Reserves successfully cleared.
Press the [Enter] key to exit.

End of procedure
Appendix D

Driver Information Verification Tool (F3GLMiTlDrCk)

The Multipath Driver changes the SCSI-2 Reserve command that is issued by MSCS, into the Persistent Reserve (PR) command in a Windows Server 2003 MSCS environment. Therefore, either of the following will cause an error in an MSCS environment.

- If any MSCS node is installed with a version of the Multipath Driver that does not issue the PR command.
- If another MSCS node uses the same Multipath Driver key when issuing the PR command.

In either of the above cases, this tool may be used to check if all installed Multipath Drivers can issue the PR command and if any nodes are sharing the same key. If identical keys are detected, they should be reinitialized. As each reinitialized node is restarted the Multipath Driver will create a unique key for it.

Caution

Do not reinitialize the Reservation Keys if they are already unique. Reinitializing unique keys will cause a MSCS error.

Note


To use the Driver Information Verification Tool (F3GLMiTlDrCk), follow the procedure below:

Procedure

1. Log on to the computer.
   An administrator-level account must be used.

2. Start F3GLMiTlDrCk.
   "F3GLMiTlDrCk.exe" may be found in the product installation folder and on the product CD:
   <Install_folder>\Tools\F3GLMiTlDrCk.exe
   <CD drive>\Tools\DrCk\F3GLMiTlDrCk.exe
   Type the following at the command prompt to start the tool.
   > F3GLMiTlDrCk.exe
3 PR Support Level and Reservation Key are displayed.
When the tool is run, the following information is displayed:

<table>
<thead>
<tr>
<th>Level</th>
<th>RSV Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0x6356a9958a54c646</td>
</tr>
</tbody>
</table>

- **Level**: Level of support for the PR command. The same level must be displayed for all nodes. If "0" is displayed, the installed driver version cannot issue the PR command.
- **RSV Key**: 8-byte key value required to support the use of Persistent Reserves. Initial value is "0x0000000000000000". Either all nodes must possess the same initial (zero) key value, or each node must possess a different (unique) key value.

Run this tool on all nodes to verify the PR command support level is the same and that all Reservation Keys are unique.

4 Initializing a Reservation Key.
For anything other than the default Reservation Key value (0x0000000000000000), the following options are shown after the PR support level and Reservation key information:

<table>
<thead>
<tr>
<th>Level</th>
<th>RSV Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0x6356a9958a54c646</td>
</tr>
</tbody>
</table>

Reinitialize this Reservation Key?
Yes: yes
Exit: x

If a non-unique Reservation Key is discovered, enter "yes" to reinitialize the Reservation Keys of all nodes that possess this key.

After reinitializing the Reservation Key, wait for the following message to be displayed, then restart the node:

Reservation key has been initialized.
Restart the computer.

End of procedure
Error display

- **When the Multipath Driver is not installed**
The following message appears if the Multipath Driver is not installed on the node on which this tool is being run:

```
ETERNUS Multipath Driver is not installed.
```
Installing the latest version of the Multipath Driver on the specified computer should resolve this problem.

- **When the services cannot be accessed**
The following message appears if ETERNUS-related services are not available on the node on which this tool is being run, because it is already connected to Multipath Manager:

```
Services are not available. Stop the Multipath Manager.
```
Stopping Multipath Manager to which this node is connected should resolve the problem.

- **When administrator access is not granted**
The following message appears if administrator-level access is not available for the node on which this tool is being run:

```
No administrator privileges.
```
Make sure that the login account has administrator-level privileges and run this tool again.
The following information is required when a problem occurs or is investigated:

- Information that should be provided
  - Details of phenomenon (as specific as possible)
  - Time of occurrence
  - Repeatability

- Information that must be collected
  - ETERNUS Multipath Driver maintenance information
  - dsnap information
  - Fibre Channel switch log
  - Storage system log

Figure E.1  Information Required When a Problem Occurs
The details for collecting data are described below.

- **Multipath Driver maintenance information**
  
  - **For Windows Server 2003 or Windows Server 2008**
    
    Click [Start] - [Programs] - [ETERNUS Multipath Driver] - [Maintenance Information Collection] and collect the information according to the on-screen instructions that follow.

*Figure E.2  Maintenance Information Collection (for Windows Server 2003 or Windows Server 2008)*
• For Windows Server 2012
  Click [Maintenance Information Collection] on the [Start] screen and collect the information according to the on-screen instructions that follow.

Figure E.3  Maintenance Information Collection (for Windows Server 2012)

Information is usually saved in a "MPDxxxxxxxxxxxxxx" file in the "C:\Program Files\ETERNUS Multipath Driver\snap" folder.

- dsnap information
  dsnap information is collected using the dsnap command.
  Check with your Fujitsu engineer for the dsnap command.
- Fibre Channel log
  Usually information that is displayed by the supportshow command is collected.
  Check with your Fujitsu engineer for details.
- Storage system log
  Collect the log on the storage system side.
  Check with your Fujitsu engineer for details.
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