

Hitachi Dynamic Link Manager Software User's Guide (for AIX(R))

3000-3-F01-50(E)

■ Relevant program products

Hitachi Dynamic Link Manager version 6.6

For details about applicable OSs, see the *Release Notes*.

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■ Edition history

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Summary of Amendments

The following table lists changes in this manual (3000-3-F01-50(E)) and product changes related to this manual.

Changes	Location in this manual
Virtual Storage Platform has been added as a storage system supported by HDLM.	1.1, 2.6.1, 2.7.1, 2.7.2, 3.1.1, 3.1.2, 3.10.2, 3.11, 3.12.1, 3.14.2, 3.14.5, 6.7.2, Appendix C
A logical device file name can now be changed by using the <code>rendev</code> command.	2.5, Appendix C
The utility for collecting HDLM installation error information (<code>dlngetrasinst</code>), which collects information about errors that occur during installation of HDLM, has been added.	2.10.4, 2.11.1, 7.1, 7.4
AIX V7.1 has been added as a supported OS.	3.1.1, 3.1.3
The utility for HDLM common installer (<code>installux.sh</code>) has been added. This utility determines what OS HDLM will be installed on.	3.5.3, 3.5.5, 3.5.8, 7.1, 7.13
Alternate disks can now be used for upgrade installations and re-installations of HDLM.	3.5.1, 3.5.5
The following messages have been added: KAPL09601-E, KAPL09602-E, KAPL09603-E, KAPL09604-E, KAPL15084-I, KAPL15085-I	8.9, 8.13
The following messages have been changed: KAPL10648-E	8.10

In addition to the above changes, minor editorial corrections have been made.

Preface

This manual describes the functions and use of the following program products.

- Hitachi Dynamic Link Manager

Intended Readers

This manual is intended for system administrators who use Hitachi Dynamic Link Manager (HDLM) to operate and manage storage systems. The readers of this manual must have a basic knowledge of the following areas:

- AIX and its management functionality
- Storage system management functionality
- Cluster software functionality
- Volume management software functionality

Organization of This Manual

This manual is organized as follows:

1. *Overview of HDLM*

Chapter 1 gives an overview of HDLM, and describes its features.

2. *HDLM Functions*

Chapter 2 describes management targets and the system configuration of HDLM, and the basic terms and functions for HDLM.

3. *Creating an HDLM Environment*

Chapter 3 describes the necessary preparations for installing HDLM, and then describes how to install HDLM and set up the various functions.

4. *HDLM Operation*

Chapter 4 describes procedures for operating HDLM by using the HDLM commands, and procedures for manually starting and stopping the HDLM manager. This chapter also describes how to configure the appropriate environment for operating HDLM, such as changing the HDLM management-target devices that connect paths or replacing the hardware that comprises a path.

5. *Troubleshooting*

Chapter 5 explains how to troubleshoot a path error, HDLM failure, or any other

problems that you might encounter.

6. *Command Reference*

Chapter 6 describes all the HDLM commands.

7. *Utility Reference*

Chapter 7 describes the HDLM utilities.

8. *Messages*

Chapter 8 provides information about viewing messages output by HDLM. It also lists and explains the HDLM messages and shows the actions to be taken in response to each message.

A. *Functional Differences Between Versions of HDLM*

Appendix A explains the differences in functionality between HDLM versions.

C. *Glossary*

This glossary explains terms used in this manual.

Related Publications

Manuals related to this manual are listed below. See these manuals when necessary:

- *Hitachi Global Link Manager Software Installation and Configuration Guide*
- *Hitachi Global Link Manager Software Messages*
- *Hitachi Adaptable Modular Storage Series User's Guide*
- *Hitachi Simple Modular Storage Series User's Guide*
- *Hitachi USP Series User's Guide*
- *Hitachi Workgroup Modular Storage Series User's Guide*
- *Thunder9580V Series Disk Array Subsystem User's Guide*
- *Reference Manual / File Conversion Utility & File Access Library*
- *Universal Storage Platform V User's Guide*
- *Universal Storage Platform VM User's Guide*
- *Virtual Storage Platform User's Guide*

Conventions: Abbreviations

This manual uses the following abbreviations for product names.

Abbreviation	Full name or meaning
Device Manager Agent	Device Manager Agent included in Hitachi Device Manager

Abbreviation	Full name or meaning
Global Link Manager	Hitachi Global Link Manager
GPFS	General Parallel File System
HACMP	High Availability Cluster Multi-Processing
	A generic term for: <ul style="list-style-type: none"> • HACMP 5.4 • HACMP 5.4.1 • PowerHA 5.5 • PowerHA 6.1 • PowerHA 7.1
HDLM	Hitachi Dynamic Link Manager
Hitachi AMS	A generic term for: <ul style="list-style-type: none"> • Hitachi Adaptable Modular Storage 1000 • Hitachi Adaptable Modular Storage 500 • Hitachi Adaptable Modular Storage 200
Hitachi AMS/WMS series	A generic term for: <ul style="list-style-type: none"> • Hitachi Adaptable Modular Storage 1000 • Hitachi Adaptable Modular Storage 500 • Hitachi Adaptable Modular Storage 200 • Hitachi Workgroup Modular Storage series
Hitachi AMS2000/AMS/WMS/SMS series	A generic term for: <ul style="list-style-type: none"> • Hitachi Adaptable Modular Storage 2000 series • Hitachi Adaptable Modular Storage 1000 • Hitachi Adaptable Modular Storage 500 • Hitachi Adaptable Modular Storage 200 • Hitachi Workgroup Modular Storage series • Hitachi Simple Modular Storage series
Hitachi AMS2000 series	Hitachi Adaptable Modular Storage 2000 series
Hitachi NSC55	Hitachi Network Storage Controller NSC55
Hitachi SMS	Hitachi Simple Modular Storage series
Hitachi USP	A generic term for: <ul style="list-style-type: none"> • Hitachi NSC55 • Hitachi Universal Storage Platform 100 • Hitachi Universal Storage Platform 600 • Hitachi Universal Storage Platform 1100 • SVS • HP XP10000 • HP XP12000

Abbreviation	Full name or meaning
Hitachi WMS	Hitachi Workgroup Modular Storage series
HP XP128	HP StorageWorks XP128 Disk Array
HP XP1024	HP StorageWorks XP1024 Disk Array
HP XP10000	HP StorageWorks XP10000 Disk Array
HP XP12000	HP StorageWorks XP12000 Disk Array
HP XP20000	HP StorageWorks XP20000 Disk Array
HP XP24000	HP StorageWorks XP24000 Disk Array
HP XP series	A generic term for: <ul style="list-style-type: none"> • HP XP128 • HP XP1024 • HP XP10000 • HP XP12000 • HP XP20000 • HP XP24000
JDK™	Java™ 2 SDK, Standard Edition
JRE	Java™ 2 Runtime Environment, Standard Edition
Lightning 9900V series	A generic term for: <ul style="list-style-type: none"> • HP XP128 • HP XP1024 • Lightning 9900V series
Oracle RAC	A generic term for: <ul style="list-style-type: none"> • Oracle Real Application Clusters 10g • Oracle Real Application Clusters 11g
Oracle RAC 10g	Oracle Real Application Clusters 10g
Oracle RAC 11g	Oracle Real Application Clusters 11g
P9500	HP StorageWorks P9500 Disk Array
PowerHA	PowerHA for AIX
RVSD	Recoverable Virtual Shared Disk
SVS	HP StorageWorks 200 Storage Virtualization System

Abbreviation	Full name or meaning
Universal Storage Platform V/VM	A generic term for: <ul style="list-style-type: none"> • Hitachi Universal Storage Platform V • Hitachi Universal Storage Platform VM • HP XP20000 • HP XP24000
UNIX	A generic term for: <ul style="list-style-type: none"> • AIX • HP-UX • Linux • Solaris
VCS	Veritas Cluster Server
Virtual Storage Platform	A generic term for: <ul style="list-style-type: none"> • Hitachi Virtual Storage Platform • HP StorageWorks P9500 Disk Array
VxVM	Veritas Volume Manager

This manual also uses the following abbreviations.

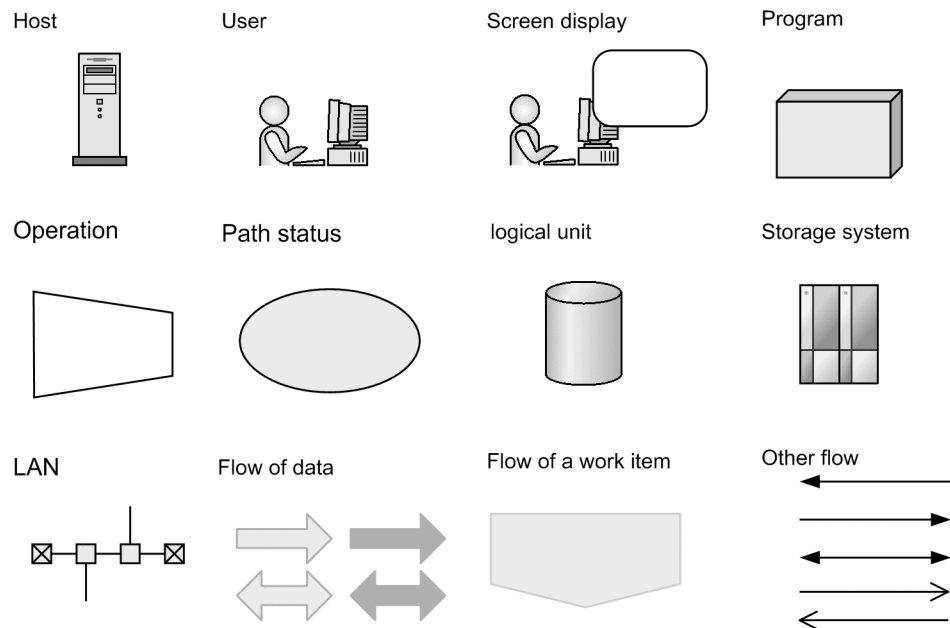
Abbreviation	Full name or meaning
AL	Arbitrated Loop
API	Application Programming Interface
ASM	Automatic Storage Management
CHA	Channel Adapter
CHRP	Common Hardware Reference Platform
CLPR	Cache Logical Partition
CPU	Central Processing Unit
CU	Control Unit
DBMS	Database Management System
Dev	Device
DNS	Domain Name Server
FC	Fibre Channel
FC-SP	Fibre Channel Security Protocol

Abbreviation	Full name or meaning
FO	Failover
GMT	Greenwich Mean Time
GUI	Graphical User Interface
HBA	Host Bus Adapter
HDev	Host Device
HLU	Host Logical Unit
HTTP	Hypertext Transfer Protocol
I/O	Input/Output
IP	Internet Protocol
iSCSI	Internet Small Computer System Interface
LAN	Local Area Network
LDAP	Lightweight Directory Access Protocol
LDEV	Logical Device
LPAR	Logical Partition
LU	Logical Unit
LUN	Logical Unit Number
LVM	Logical Volume Manager
MPIO	Multipath I/O
NAS	Network Attached Storage
NIM	Network Installation Management
NPIV	N-Port ID Virtualization
NTP	Network Time Protocol
ODM	Object Data Manager
OS	Operating System
P	Port
PCI	Peripheral Component Interconnect
PVID	Physical Volume Identifier

Abbreviation	Full name or meaning
RADIUS	Remote Authentication Dial in User Service
SAN	Storage Area Network
SCSI	Small Computer System Interface
SLPR	Storage Logical Partition
SMIT	System Management Interface Tool
SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
SP	Service Pack
SSL	Secure Sockets Layer
SVP	Service Processor
VG	Volume Group
WWN	World Wide Name

Conventions: Diagrams

This manual uses the following conventions in diagrams:



Conventions: Fonts and Symbols

Font and symbol conventions are classified as:

- General font conventions
- Conventions in syntax explanations

These conventions are described below.

General Font Conventions

The following table lists the general font conventions:

Font	Convention
Bold	<p>Bold type indicates text on a window, other than the window title. Such text includes menus, menu options, buttons, radio box options, or explanatory labels. For example, bold is used in sentences such as the following:</p> <ul style="list-style-type: none"> • From the File menu, choose Open. • Click the Cancel button. • In the Enter name entry box, type your name.
<i>Italics</i>	<p>Italics are used to indicate a placeholder for some actual text provided by the user or system. Italics are also used for emphasis. For example:</p> <ul style="list-style-type: none"> • Write the command as follows: <i>copy source-file target-file</i> • Do <i>not</i> delete the configuration file.

Font	Convention
Code font	<p>A code font indicates text that the user enters without change, or text (such as messages) output by the system. For example:</p> <ul style="list-style-type: none"> At the prompt, enter <code>dir</code>. Use the <code>send</code> command to send mail. The following message is displayed: The password is incorrect.

Code examples and messages appear as follows (though there may be some exceptions, such as when the code is part of a diagram):

```
MakeDatabase
...
StoreDatabase temp DB32
```

In examples of coding, an ellipsis (...) indicates that one or more lines of coding are not shown for purposes of brevity.

Conventions in Syntax Explanations

Syntax definitions appear as follows:

```
StoreDatabase [temp|perm] (database-name ...)
```

The following table lists the conventions used in syntax explanations:

Example font or symbol	Convention
<code>StoreDatabase</code>	Code-font characters must be entered exactly as shown.
<i>database-name</i>	This font style marks a placeholder that indicates where appropriate characters are to be entered in an actual command.
SD	Bold code-font characters indicate the abbreviation for a command.
<u>perm</u>	Underlined characters indicate the default value.
[]	Square brackets enclose an item or set of items whose specification is optional. An item that is underlined is specified when all items are omitted.
{ }	One of the options enclosed in { } must be specified.
	Only one of the options separated by a vertical bar can be specified at the same time.
...	An ellipsis (...) indicates that the item or items enclosed in () or [] immediately preceding the ellipsis may be specified as many times as necessary.
()	Parentheses indicate the range of items to which the vertical bar () or ellipsis (...) is applicable.
#	A prompt on a command-execution window when the OS is UNIX

Conventions: KB, MB, GB, and TB

This manual uses the following conventions:

- 1 KB (kilobyte) is 1,024 bytes.
- 1 MB (megabyte) is $1,024^2$ bytes.
- 1 GB (gigabyte) is $1,024^3$ bytes.
- 1 TB (terabyte) is $1,024^4$ bytes.

Contents

Preface	i
Intended Readers	i
Organization of This Manual	i
Related Publications	ii
Conventions: Abbreviations	ii
Conventions: Diagrams	vii
Conventions: Fonts and Symbols	viii
Conventions: KB, MB, GB, and TB	x
1. Overview of HDLM	1
1.1 What is HDLM?	2
1.2 HDLM Features	4
2. HDLM Functions	5
2.1 Devices Managed by HDLM	6
2.2 System Configuration	7
2.3 LU Configuration	10
2.4 Program Configuration	12
2.5 Position of the HDLM Driver and hdisk	14
2.6 Distributing a Load Using Load Balancing	15
2.6.1 Paths to which load balancing is applied	16
2.6.2 Load Balancing Algorithms	18
2.7 Performing Failovers and Failbacks Using Path Switching	21
2.7.1 Automatic path switching	21
2.7.2 Manual path switching	27
2.7.3 Path status transition	28
2.8 Monitoring intermittent errors (functionality when automatic failback is used)	32
2.8.1 Checking intermittent errors	32
2.8.2 Setting up intermittent error monitoring	32
2.8.3 Intermittent Error Monitoring Actions	33
2.8.4 When a User Changes the Intermittent Error Information	35
2.9 Detecting errors by using path health checking	38
2.10 Error management	39
2.10.1 Types of Collected Logs	41
2.10.2 Filtering of error information	42
2.10.3 Collecting error information using the utility for collecting HDLM error information (DLMgetras)	43

2.10.4 Collecting installation error information using the utility for collecting HDLM installation error information (dlmgetrasinst)	43
2.11 Collecting Audit Log Data.....	44
2.11.1 Categories and Audit Events that HDLM Can Output to the Audit Log....	45
2.11.2 Requirements for Outputting Audit Log Data	48
2.11.3 Destination and Filtering of Audit Log Data.....	49
2.11.4 Audit Log Data Formats	50
2.12 Integrated HDLM management using Global Link Manager.....	53
2.13 Cluster support.....	55
3. Creating an HDLM Environment	57
3.1 HDLM System Requirements.....	58
3.1.1 Host and OS Support for HDLM.....	58
3.1.2 Storage Systems Supported by HDLM.....	60
3.1.3 Cluster Software Supported by HDLM	62
3.1.4 Memory and Disk Capacity Requirements.....	65
3.1.5 Number of Paths Supported in HDLM.....	66
3.2 Flow for Creating an HDLM Environment	68
3.3 Types of HDLM Installation.....	69
3.4 Notes on Creating an HDLM Environment.....	70
3.4.1 Notes on Installing HDLM	70
3.4.2 Notes on an Upgrade Installation or Re-installation of HDLM	70
3.4.3 Notes on the Virtual I/O Server	71
3.4.4 Notes on a License Key	72
3.4.5 Notes on Trace Files	72
3.4.6 Notes on Storage Systems	73
3.4.7 Notes on the Cluster	73
3.4.8 Notes on the Automatic Failback	74
3.4.9 Notes on the queue_depth Parameter Value for an HDLM-Managed device	74
3.5 Installing HDLM.....	75
3.5.1 Available Installation Methods.....	75
3.5.2 Preparations for a New Installation of HDLM	79
3.5.3 Performing a New Installation of HDLM.....	82
3.5.4 Preparations for an Upgrade Installation or Re-installation of HDLM	95
3.5.5 Performing an Upgrade Installation or Re-installation of HDLM	97
3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later	117
3.5.7 Installing HDLM in an HACMP Environment	121
3.5.8 Performing an Unattended Installation of HDLM.....	125
3.6 Checking the Path Configuration.....	134
3.7 Setting up HDLM	136
3.7.1 Checking the Current Settings.....	136
3.7.2 Setting Up the HDLM Functions.....	136
3.7.3 Checking the Updated Settings.....	145

3.8	Setting up Integrated Traces	147
3.8.1	Notes on Using the Hitachi Network Objectplaza Trace Library	147
3.8.2	Displaying the Hitachi Network Objectplaza Trace Library setup menu ...	148
3.8.3	Changing the Size of Integrated Trace Files	148
3.8.4	Changing the Number of Integrated Trace Files	149
3.8.5	Changing the Buffer Size Per Monitoring Interval Duration	150
3.8.6	Adjusting the Number of Messages to be Output Per Monitoring Interval	151
3.8.7	Finishing the Hitachi Network Objectplaza Trace Library Settings	153
3.8.8	Applying the Hitachi Network Objectplaza Trace Library Settings	153
3.9	About the Reservation Policy	155
3.10	Settings for Using HACMP	156
3.10.1	Storage System Settings	156
3.10.2	Registering the HDLM Script for HACMP	156
3.10.3	Setting the Reservation Policy	158
3.11	Settings for Using GPFS	159
3.12	Settings for Using Oracle RAC 10g or Oracle RAC 11g	160
3.12.1	Settings for MISSCOUNT and DISKTIMEOUT	160
3.12.2	Settings for Reservation Policy	161
3.13	Settings for Using VCS	163
3.14	Uninstalling HDLM	165
3.14.1	Preparations for HDLM Uninstallation	165
3.14.2	Uninstalling HDLM	165
3.14.3	Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2) ..	174
3.14.4	Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib)	175
3.14.5	Canceling Cluster Software (HACMP) Settings	176
4.	HDLM Operation	177
4.1	Notes on Using HDLM	178
4.1.1	Displaying Path Information	178
4.1.2	When a Path Error Is Detected	178
4.1.3	Storage System	179
4.1.4	Notes on Shutting Down a Host	179
4.1.5	Notes on Errors in a Host	179
4.1.6	Notes on Enabling Both Primary and Secondary Volumes to Be Viewed From the Same Server	180
4.1.7	Notes on an LVM Mirror Configuration	180
4.1.8	Notes on When the OS Functionality in Not Available in a Boot Disk Environment	180
4.1.9	Notes on Replicating a System	181
4.2	HDLM Operations Using Commands	182
4.2.1	Notes on Using Commands	182
4.2.2	Viewing Path Information	182
4.2.3	Changing the Status of Paths	182
4.2.4	Viewing LU Information	185

4.2.5	Displaying the Correspondences Between hdisks, OS Management Path IDs, and LDEVs	185
4.2.6	Initializing Statistical Information for Paths.....	186
4.2.7	Viewing and Setting Up the Operating Environment.....	187
4.2.8	Viewing License Information	189
4.2.9	Updating the License	189
4.2.10	Viewing HDLM Version Information.....	190
4.2.11	Viewing HDLM Component Information	190
4.3	Starting and Stopping the HDLM Manager.....	192
4.3.1	Starting the HDLM Manager.....	192
4.3.2	Stopping the HDLM Manager	192
4.4	HDLM Resident Processes	194
4.5	Changing the Configuration of the HDLM Operating Environment.....	195
4.5.1	Changing an HDLM Management-Target Device	195
4.5.2	Changing hdisk attributes	196
4.5.3	Changing a Path.....	202
4.5.4	Replacing an HBA.....	205
4.5.5	Replacing a Fiber Cable	211
4.5.6	Replacing a Fibre Channel Switch	213
5.	Troubleshooting	217
5.1	Information Collected by the DLMgetras Utility for Collecting HDLM Error Information	218
5.2	Checking error information in messages	219
5.3	What To Do for a Path Error.....	221
5.3.1	Examining the messages.....	222
5.3.2	Obtain path information.....	222
5.3.3	Identifying the Error Path	223
5.3.4	Narrowing Down the Hardware That Might Have Caused the Error.....	223
5.3.5	Identifying the Error Location and Correcting any Hardware Errors	223
5.3.6	Placing the Path Online	223
5.4	What To Do for a Program Error	224
5.4.1	Examining the Messages	224
5.4.2	Obtaining Program Information	224
5.4.3	What To Do for the Program Error.....	225
5.4.4	Contacting your HDLM Vendor or Maintenance Company	225
5.5	What To Do for Other Errors	226
6.	Command Reference	227
6.1	Overview of the HDLM Command dlnkmgr	228
6.2	clear (Returns the Path Statistics to the Initial Value).....	230
6.2.1	Format.....	230
6.2.2	Parameters	230
6.3	help (Displays the Operation Format)	232

6.3.1	Format	232
6.3.2	Parameter	232
6.4	offline (Places Paths Offline).....	235
6.4.1	Format	235
6.4.2	Parameters	235
6.5	online (Places Paths Online).....	242
6.5.1	Format	242
6.5.2	Parameters	242
6.6	set (Sets Up the Operating Environment).....	249
6.6.1	Format	249
6.6.2	Parameters	249
6.7	view (Displays Information).....	266
6.7.1	Format	266
6.7.2	Parameters	267

7. Utility Reference 303

7.1	Overview of the Utilities	304
7.2	DLMgetras Utility for Collecting HDLM Error Information.....	308
7.2.1	Format	308
7.2.2	Parameters	308
7.2.3	List of Collected Error Information	310
7.3	dlnchpdattr Utility for Changing HDLM Default Settings	316
7.3.1	Format	316
7.3.2	Parameters	316
7.4	dlngetrasinst Utility for Collecting HDLM Installation Error Information	319
7.4.1	Format	319
7.4.2	Parameters	319
7.4.3	List of Collected Error Information	320
7.5	dlninstcomp Utility for HDLM Component Installation.....	323
7.5.1	Format	323
7.5.2	Parameter.....	323
7.6	dlnmigsts Utility for Assisting HDLM Migration.....	324
7.6.1	Format	324
7.6.2	Parameters	324
7.7	dlnmodmset Utility for Setting the HDLM Execution Environment ODM.....	326
7.7.1	Format	326
7.7.2	Parameters	326
7.8	dlnpostrestore Utility for HDLM Restoration Support	329
7.8.1	Format	329
7.8.2	Parameters	329
7.9	dlnmpr Utility for Clearing HDLM Persistent Reservation	330
7.9.1	Format	330
7.9.2	Parameters	330
7.10	dlnpreuninst Utility for Executed Before Uninstalling HDLM.....	333

7.10.1	Format.....	333
7.10.2	Parameters	333
7.11	dldrmdev Utility for Deleting HDLM Drivers.....	334
7.11.1	Format.....	334
7.11.2	Parameters.....	334
7.12	installhdldm Utility for Installing HDLM	336
7.12.1	Format.....	336
7.12.2	Parameters	336
7.12.3	Items To Be Defined in an installation-information Settings File	336
7.12.4	Log file	345
7.13	installlux.sh Utility for HDLM Common Installer	347
7.13.1	Format.....	347
7.13.2	Parameters	347
7.13.3	Log file	347
8.	Messages	349
8.1	Before Viewing the List of Messages	350
8.1.1	Format and Meaning of Message IDs.....	350
8.1.2	Terms Used in Messages and Message Explanations.....	350
8.1.3	Components that Output Messages to syslog.....	351
8.2	KAPL01001 to KAPL02000	352
8.3	KAPL03001 to KAPL04000	374
8.4	KAPL04001 to KAPL05000	377
8.5	KAPL05001 to KAPL06000	385
8.6	KAPL06001 to KAPL07000	389
8.7	KAPL07001 to KAPL08000	392
8.8	KAPL08001 to KAPL09000	393
8.9	KAPL09001 to KAPL10000	396
8.10	KAPL10001 to KAPL11000.....	420
8.11	KAPL11001 to KAPL12000.....	445
8.12	KAPL13001 to KAPL14000	449
8.13	KAPL15001 to KAPL16000	457
8.14	Return Codes for Hitachi Command Suite Common Agent Component.....	461
Appendixes		467
A.	Functional Differences Between Versions of HDLM	468
A.1	Functional Differences Between Version 6.2 and Versions Earlier than 6.2	468
A.2	Functional Differences Between Version 6.1 and Versions Earlier than 6.1	468
A.3	Functional Differences Between Version 6.0 or Later and Versions Earlier than 6.0	468
B.	Differences Between HDLM Version 5.9 or Later and Version 5.8.1 or Earlier	469
B.1	Add-in HDLM Driver Module.....	469
B.2	Simplifying the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files.....	470

B.3 Changing the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files.....	472
B.4 Migrating Reservation Control Settings	473
B.5 Support for a Boot Disk Environment.....	473
B.6 About Settings when Upgrading the OS.....	474
B.7 Changing a Virtual I/O Server's Method of Recognizing Virtual SCSI Disks.....	474
C. Glossary	475
Index	483

Chapter

1. Overview of HDLM

HDLM is a software package that manages paths between a host and a storage system. HDLM is designed to distribute loads across multiple paths and will switch a given load to another path if there is a failure in the path that is currently being used, thus improving system reliability.

This chapter gives an overview of HDLM and describes its features.

- 1.1 What is HDLM?
- 1.2 HDLM Features

1.1 What is HDLM?

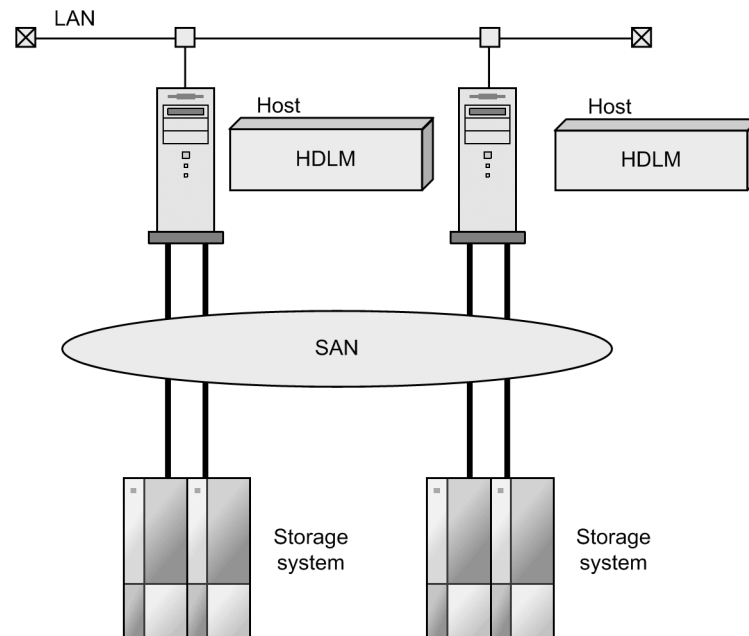
The widespread use of data warehousing and increasing use of multimedia data have increased the need for high-speed processing of large volumes of data on networks. To satisfy this need, networks dedicated to data transfer, such as a SAN, are now being used to provide access to storage systems.

The HDLM software manages access paths to storage systems. HDLM uses MPIO functionality supported by AIX 5L V5.2 or later.

HDLM, as an extended module of MPIO, provides functionality for distributing the load across paths and switching to another path if there is a failure in a path being used, thus improving system availability and reliability.

Figure 1-1: Connections between hosts and storage systems illustrates the connections between hosts and storage systems. A server on which HDLM is installed is called a *host*.

Figure 1-1: Connections between hosts and storage systems



HDLM supports the following storage systems.

- Hitachi AMS2000/AMS/WMS/SMS series
- Hitachi USP

- Thunder 9500V series
- Lightning 9900V series
- Universal Storage Platform V/VM
- Virtual Storage Platform

1.2 HDLM Features

HDLM features include the following:

The ability to distribute a load across multiple paths. This is also known as *load balancing*.

When a host is connected to a storage system via multiple paths, HDLM can distribute the load across all the paths. This prevents one, loaded down path from affecting the processing speed of the entire system.

For details on load balancing, see 2.6 *Distributing a Load Using Load Balancing*.

The ability to continue running operations between a host and storage system, even if there is a failure. This is also known as performing a *failover*.

When a host is connected to a storage system via multiple paths, HDLM can automatically switch to another path if there is some sort of failure in the path that is currently being used. This allows operations to continue between a host and a storage system.

For details on performing failovers, see 2.7 *Performing Failovers and Failbacks Using Path Switching*.

The ability to bring a path that has recovered from an error back online. This is also known as performing a *failback*.

If a path is recovered from an error, HDLM can bring that path back online. This enables the maximum possible number of paths to always be available and online, which in turn enables HDLM to better distribute the load across multiple paths.

Failbacks can be performed manually or automatically. In an automatic failback, HDLM will automatically restore the path to an active state after the user has corrected the problem that exists on the physical path.

For details on performing failbacks, see 2.7 *Performing Failovers and Failbacks Using Path Switching*.

The ability to automatically check the status of any given path at regular intervals. This is also known as *path health checking*.

HDLM can easily detect errors by checking the statuses of paths at user-defined time intervals. This allows you to check for any existing path errors and to resolve them promptly and efficiently.

For details on setting up and performing path health checking, see 2.9 *Detecting errors by using path health checking*.

Chapter

2. HDLM Functions

This chapter describes the various functions that are built into HDLM. Before the function specifications are explained though, this chapter will go into detail about the HDLM management targets, system configuration, and basic terms that are necessary to know to effectively operate HDLM. After that, the rest of the chapter focus on describing all the HDLM functions, including the main ones: load distribution across paths and path switching.

- 2.1 Devices Managed by HDLM
- 2.2 System Configuration
- 2.3 LU Configuration
- 2.4 Program Configuration
- 2.5 Position of the HDLM Driver and hdisk
- 2.6 Distributing a Load Using Load Balancing
- 2.7 Performing Failovers and Failbacks Using Path Switching
- 2.8 Monitoring intermittent errors (functionality when automatic failback is used)
- 2.9 Detecting errors by using path health checking
- 2.10 Error management
- 2.11 Collecting Audit Log Data
- 2.12 Integrated HDLM management using Global Link Manager
- 2.13 Cluster support

2.1 Devices Managed by HDLM

Below is a list of devices that can or cannot be managed by HDLM. The devices that can be managed by HDLM are called *HDLM management-target devices*.

HDLM management-target devices:

The following devices are from the storage systems listed in Section *1.1 What is HDLM?*:

- SCSI devices
- Boot disks (including boot disks on a client logical partition in a virtual I/O server environment)
- Command devices (such as Hitachi RAID Manager command devices)
- Dump devices
- Swap devices

Non-HDLM management-target devices:

- SCSI devices other than those that are in the storage systems listed in Section *1.1 What is HDLM?*
- Built-in disks on a host
- Non-disk devices (tape devices, etc.)

2.2 System Configuration

HDLM manages routes between a host and a storage system by using the SCSI driver. The host and storage systems are connected using SAN with fiber cables. The cable port on the host is a *host bus adapter* (HBA). The cable port on the storage system is a *port* (P) on a *channel adapter* (CHA).

A *logical unit* (LU) contained in a storage system is the target of input to, or output from, the host. An area in an LU is called a *Dev*. A route that connects a host and a *Dev* in an LU is called a *path*.

HDLM manages a path by assigning an ID to it. This ID is called the *AutoPATH_ID*. A path may also be called a *management target*. The ID that AIX assigns to a path is called the *OS management path ID*. The OS management path ID can be displayed by executing the AIX `lspath` command. Also, HDLM can display the OS management path ID that corresponds to the path management `PATH_ID` when you execute the HDLM command's `view` operation with the `-lu` or `-drv` parameter specified. For details about the `view` operation, see 6.7 *view (Displays Information)*.

Figure 2-1: HDLM System Configuration shows the HDLM system configuration.

Figure 2-1: HDLM System Configuration

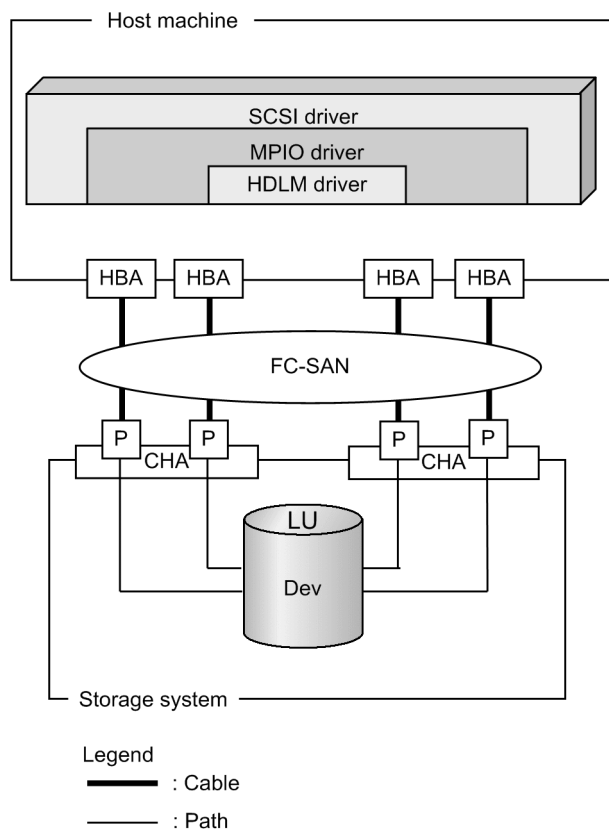


Table 2-1: HDLM System Components lists the HDLM system components.

Table 2-1: HDLM System Components

Components	Description
HBA	A host bus adapter. This serves as a cable port on the host.
SAN	A dedicated network that is used for data transfer between the host machine and storage systems.
CHA	A channel adapter.
P	A port on a CHA. This serves as a cable port on a storage system.
LU	A logical unit (a logical volume defined on the storage system). This serves as the target of input or output operations from the host.
Dev	An area in an LU.

Components	Description
Path	A route that connects a host and a Dev.

2.3 LU Configuration

On a system using HDLM, the logical device file for the HDLM management-target device is used to access the target LU.

An LU recognized by a host after HDLM installation, is called a *host LU* (HLU). The areas in a host LU that correspond to the Dev in a storage system LU are called *host devices* (HDev).

An LU in the storage system corresponds one-to-one with a host LU, a host device, or an hdisk.

Figure 2-2: LU configuration of the host where HDLM is installed and correspondence with an hdisk shows the LU configuration recognized by a host, after the installation of HDLM.

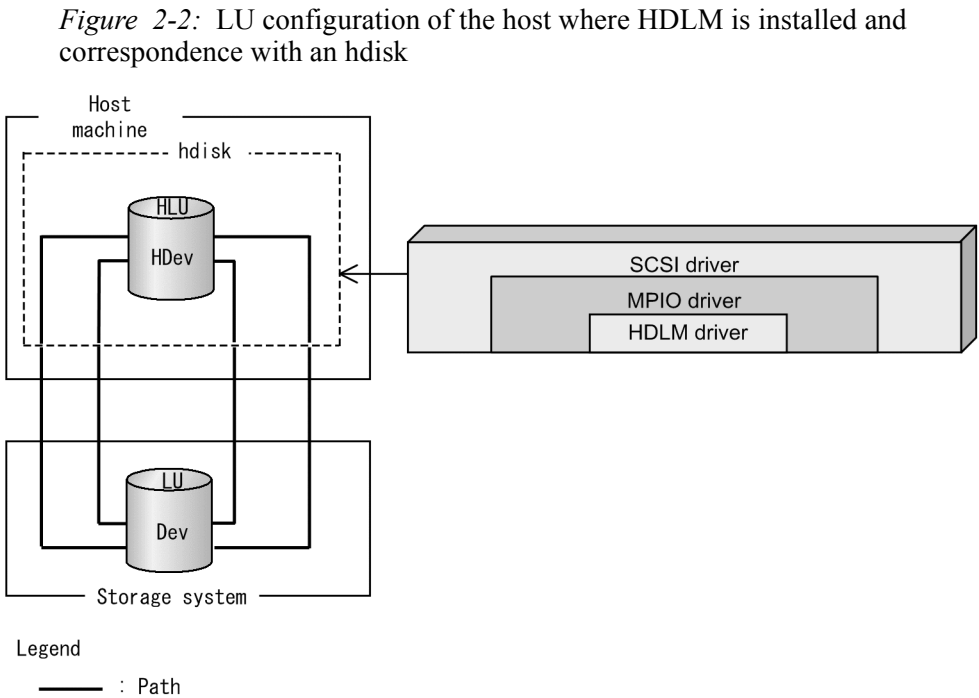


Table 2-2: Components recognized by the host lists the components recognized by the host.

Table 2-2: Components recognized by the host

Components	Description
HLU	An LU that the host recognizes via the HDLM driver. It is called a <i>host LU</i> . No matter how many paths exist, one host LU is recognized for one LU in the storage system.
HDev	A Dev in an LU that the host recognizes via the HDLM driver. It is called a <i>host device</i> . No matter how many paths exist, one host device is recognized for one Dev in the storage system.

2.4 Program Configuration

HDLM is actually a combination of several programs. Because each program corresponds to a specific HDLM operation, it is important to understand the name and purpose of each program, along with how they are all interrelated.

Figure 2-3: Configuration of the HDLM Programs configuration of the HDLM programs.

Figure 2-3: Configuration of the HDLM Programs

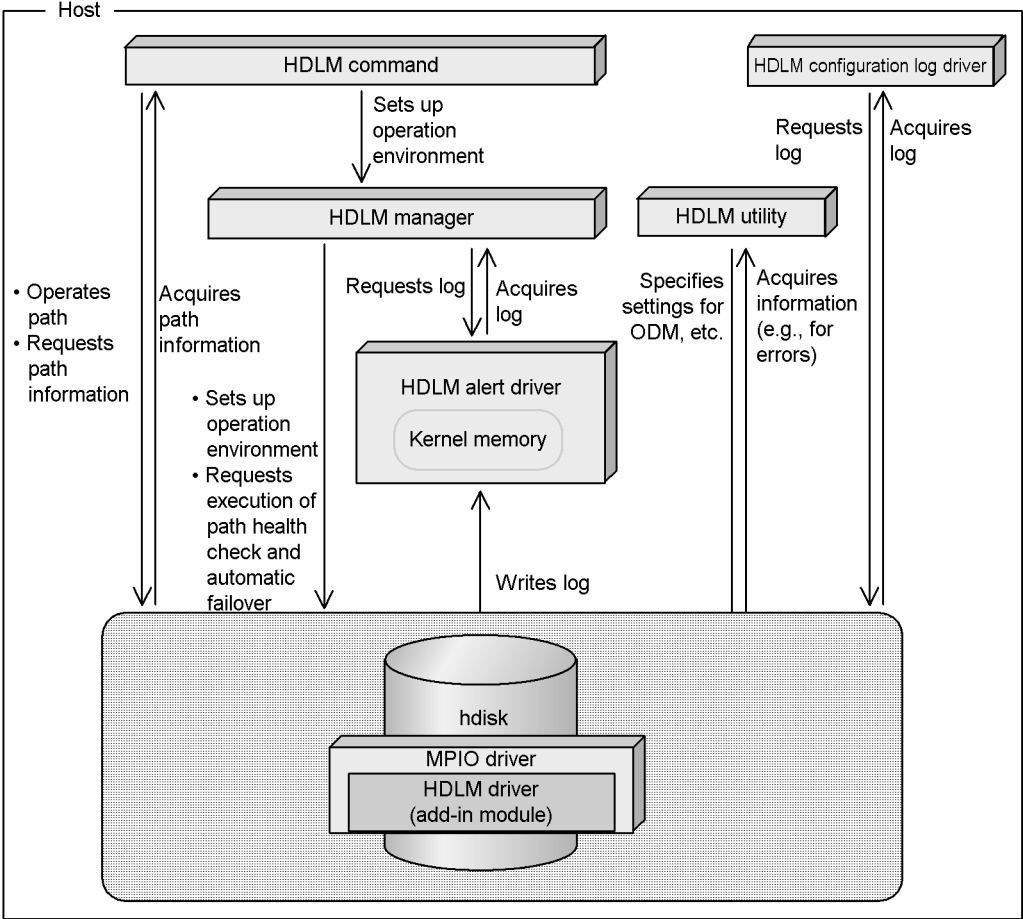


Table 2-3: Functionality of HDLM Programs lists and describes the functions of these programs.

Table 2-3: Functionality of HDLM Programs

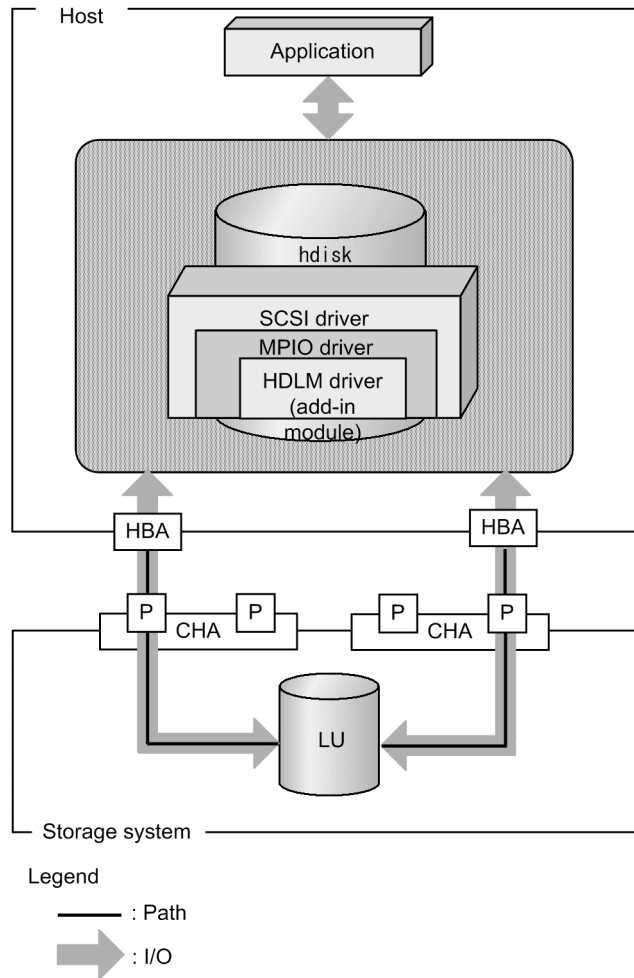
Program name	Functions
HDLM command	Provides the <code>dlmkmgr</code> command, which enables you to: <ul style="list-style-type: none"> • Manage paths • Display error information • Set up the HDLM operating environment
HDLM utility	Provides the HDLM utility, which enables you to: <ul style="list-style-type: none"> • Collect error information • Change the default value of the <code>hdisk</code> attribute • Migration of HDLM • Clear HDLM persistent reservation • Exclude the <code>hdisk</code> recognized as a boot disk from being an HDLM management target • Set ODM to define HDLM operations • Delete <code>hdisk</code>s according to the parameter settings • Install HDLM • The unattended installation of HDLM • Install Hitachi Command Suite Common Agent Component • Collect information about errors that occur during HDLM installation • Perform maintenance when HDLM-managed devices are restored
HDLM manager	Provides the HDLM manager, which enables you to: <ul style="list-style-type: none"> • Configures the HDLM operating environment • Request path health checks and automatic failbacks to be performed • Collects error log data
HDLM alert driver	Reports the log information collected by the HDLM driver to the HDLM manager. The driver name is <code>dlmadrv</code> .
HDLM driver	Controls HDLM functionality, manages paths, and detects errors. This is an add-in module of the AIX MPIO driver. The HDLM driver consists of the following: <ul style="list-style-type: none"> • Core logic component Controls the basic functionality of HDLM. • Filter component Sends and receives I/O data.
HDLM configuration log driver	Acquires operation logs of the configuration processing for the HDLM driver.

2.5 Position of the HDLM Driver and hdisk

The HDLM driver is positioned above the SCSI driver and is an add-in module of MPIIO driver located in the AIX standard hdisk. Each application on the host uses the hdisk (logical device file) created by HDLM, to access LUs in the storage system.

Figure 2-4: Position of the HDLM Driver and hdisk shows the position of the HDLM driver and hdisk. The logical device file name can be changed by using the `rendev` command. In this manual, the file name of a default logical device of the OS (`hdiskn`) or an hdisk name is used as the logical device file name.

Figure 2-4: Position of the HDLM Driver and hdisk

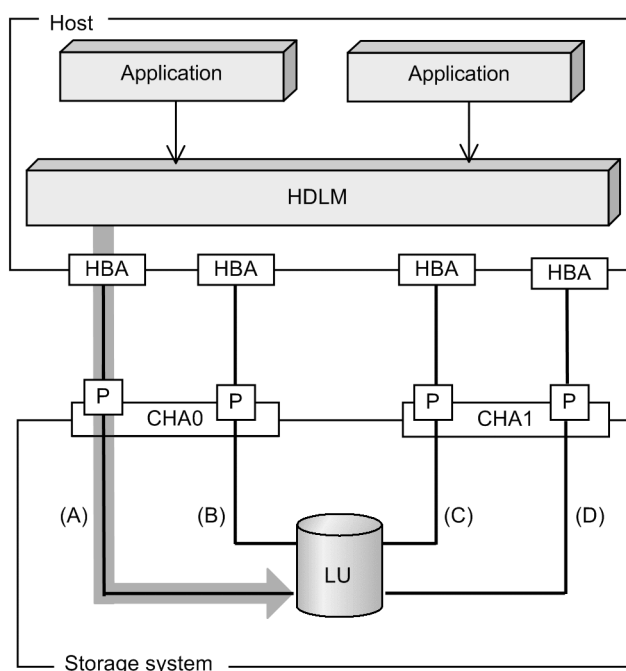


2.6 Distributing a Load Using Load Balancing

When the system contains multiple paths to a single LU, HDLM can distribute the load across the paths by using multiple paths to transfer the I/O data. This function is called *load balancing*, and it prevents a single, heavily loaded path from affecting the performance of the entire system.

Figure 2-5: Flow of I/O Data When the Load Balancing Function Is Not Used shows the flow of I/O data when the load balancing function is not used. *Figure 2-6: Flow of I/O Data When the Load Balancing Function Is Used* shows the flow of I/O data when the load balancing function is used. Both figures show examples of I/O operations being issued for the same LU by multiple applications.

Figure 2-5: Flow of I/O Data When the Load Balancing Function Is Not Used

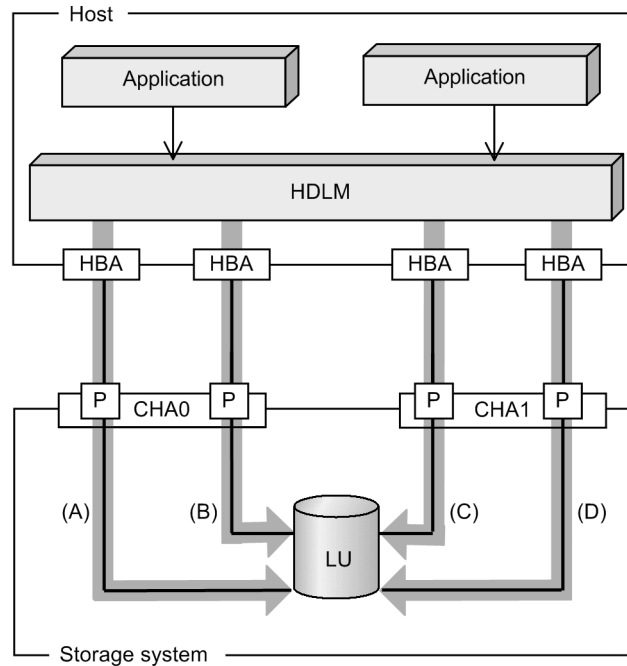


Legend

- : Path
- ➡ : Path where an I/O is issued
- : I/O request

When the load balancing function is not being used, I/O operations converge on one physical path (A). The load on the physical path (A) will cause a bottleneck, which might cause deterioration of the whole system's performance.

Figure 2-6: Flow of I/O Data When the Load Balancing Function Is Used



Legend

- : Path
- ➡ : Path where an I/O is issued
- ➞ : I/O request

When the load balancing function is being used, I/O operations are distributed via physical paths (A), (B), (C), and (D). This prevents deterioration of the whole system's performance from a bottleneck on one path.

2.6.1 Paths to which load balancing is applied

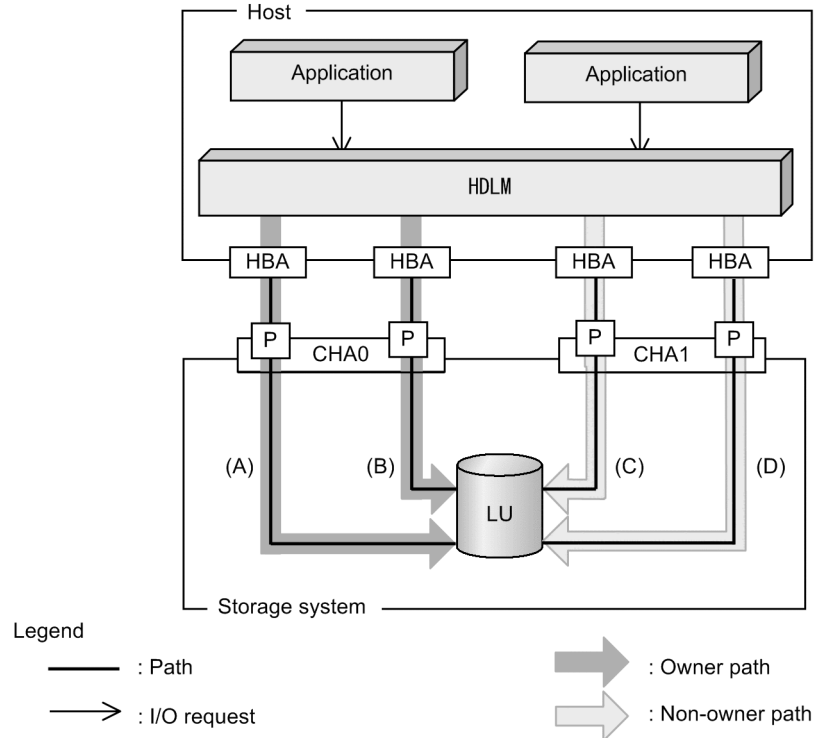
This subsection describes, for each type of storage system, the paths to which the load balancing function is applied.

(1) When Using the Thunder 9500V Series, or Hitachi AMS/WMS Series

When HDLM performs load balancing, it differentiates between load balancing among owner paths and among non-owner paths. An *owner path* is a path that passes through the *owner controller* for a target LU. When you set up an LU, you have to specify which CHA to be used as the owner controller for the LU. Because different LUs might have different owner controllers, different LUs might also have different owner paths. A *non-owner path* is a path that passes through a CHA other than the owner controller. This type of CHA is also known as a *non-owner controller*. An owner path is usually used in preference to a non-owner path. In order to prevent system performance from slowing down, HDLM does not perform load balancing between owner paths and non-owner paths. If failures occur across some of the owner paths, load balancing will be performed among the remaining, usable owner paths. It is only when absolutely no owner paths are available, that load balancing is then performed among the non-owner paths.

For the example in *Figure 2-7: Overview of load balancing*, suppose that in the owner controller of LU0 is CHA0. When the LU is accessed, the load is balanced between the two paths A and B, which are both owner paths. When one of the paths (A) cannot be used, then the LU is accessed from the only other owner path (B). When the physical paths (A) and (B) cannot be used, the load is balanced between the physical paths (C) and (D) (that is, between non-owner paths).

Figure 2-7: Overview of load balancing



(2) When Using the Lightning 9900V Series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 Series, or Hitachi SMS

All online paths are owner paths. Therefore, for the example in *Figure 2-6: Flow of I/O Data When the Load Balancing Function Is Used*, the load is balanced among the four paths A, B, C, and D. If one of the paths were to become unusable, the load would be balanced among the three, remaining paths.

2.6.2 Load Balancing Algorithms

HDLM has the following six load balancing algorithms:

- The Round Robin algorithm
- The Extended Round Robin algorithm
- The Least I/Os algorithm
- The Extended Least I/Os algorithm
- The Least Blocks algorithm

- The Extended Least Blocks algorithm

The above algorithms are divided into two categories, which differ in their processing method. The following describes both of these processing methods:

The Round Robin, Least I/Os, and Least Blocks algorithms

These algorithms select which path to use every time a certain number of I/Os are issued. The path that is used is determined by the following:

- Round Robin

The paths are simply selected in order from among all the connected paths.

- Least I/Os

The path that has the least number of I/Os being processed is selected from among all the connected paths.

- Least Blocks

The path that has the least number of I/O blocks being processed is selected from among all the connected paths.

The Extended Round Robin, Extended Least I/Os, and Extended Least Blocks algorithms

These algorithms determine which path to allocate based on whether the data of the I/O to be issued is sequential with the data of the I/O that was issued immediately beforehand.

If the data is sequential, the path used will be the one to which the data of the I/O that was issued immediately beforehand was distributed. However, if a specified number of I/Os has been issued to a path, processing switches to the next path.

If the data is not sequential, these algorithms select the path to be used each time an I/O request is issued.

- Extended Round Robin

The paths are simply is selected in order from among all the connected paths.

- Extended Least I/Os

The path that has the least number of I/Os being processed is selected from among all the connected paths.

- Extended Least Blocks

The path that has the least number of I/O blocks being processed is selected from among all the connected paths.

Table 2-4: Features of the Load Balancing Algorithms describes the features of the load balancing algorithms.

Table 2-4: Features of the Load Balancing Algorithms

Algorithm type	Algorithm features
<ul style="list-style-type: none"> • Round Robin[#] • Least I/Os • Least Blocks 	These types of algorithms are most effective when a lot of discontinuous, non-sequential I/Os are issued.
<ul style="list-style-type: none"> • Extended Round Robin • Extended Least I/Os • Extended Least Blocks 	If there is a read request for I/O data that is sequential with the data of the I/O that was issued immediately beforehand, an improvement in reading speed can be expected due to the storage system cache functionality. These types of algorithms are most effective when many continuous I/Os are issued (the I/O data is sequential).

#

Some I/O operations managed by HDLM can be distributed across all paths, and some cannot. Thus, you should be aware that even if you specify the Round Robin algorithm, I/O operations cannot always be allocated uniformly across all paths.

By default, the Extended Least I/Os algorithm is set when HDLM is first installed. When an upgrade installation of HDLM is performed, the existing setting is inherited.

Select the load balancing algorithm most suitable for the data access patterns in your system environment. If there are no recognizable data access patterns, we recommend applying the Extended Least I/Os algorithm.

You can specify the load balancing function by the `dlncmgr` command's `set` operation. For details on the `set` operation, see 6.6 *set (Sets Up the Operating Environment)*.

2.7 Performing Failovers and Failbacks Using Path Switching

When the system contains multiple paths to an LU and an error occurs on the path that is currently being used, HDLM can switch to another functional path, so that the system can continue operating. This is called a *failover*.

If a path in which an error has occurred recovers from the error, HDLM can then switch back to that path. This is called a *failback*.

Two types of failovers and failbacks are available:

- Automatic failovers and failbacks
- Manual failovers and failbacks

Failovers and failbacks switch which path is being used and also change the statuses of the paths. A path status is either *online* or *offline*. An online status means that the path can receive I/Os. On the other hand, an offline status means that the path cannot receive I/Os. A path will go into the offline status for the following reasons:

- An error occurred on the path.
- A user executed the HDLM command's `offline` operation.

For details on the `offline` operation, see 6.4 *offline (Places Paths Offline)*.

For details on path statuses and the transitions of those statuses, see 2.7.3 *Path status transition*.

2.7.1 Automatic path switching

The following describes the automatic failover and failback functions, which automatically switch a path.

(1) Automatic failovers

If you detect an error on the path that is currently being used, you can continue to use the system by having the status of that path automatically changed to offline, and then automatically have the system switch over to another online path. This functionality is called *automatic failover*. Automatic failovers can be used for the following levels of errors:

Critical

A fatal error that might stop the system.

Error

A high-risk error, which can be avoided by performing a failover or some other countermeasure.

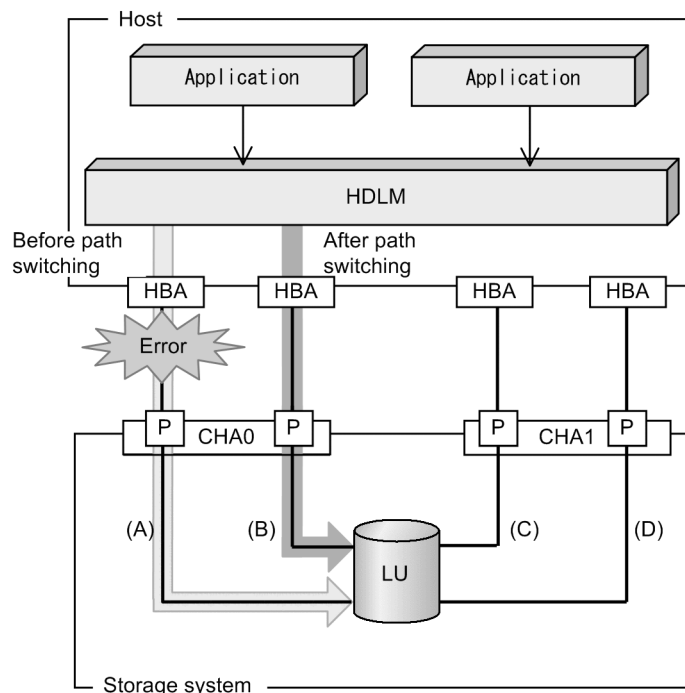
For details on error levels, see *2.10.2 Filtering of error information*.

When the Thunder 9500V series, or Hitachi AMS/WMS series is being used, HDLM will select the path to be used next from among the various paths that access the same LU, starting with owner paths, and then non-owner paths. For example, in *Figure 2-8: Path switching*, the owner controller of an LU is CHA0, and access to the LU is made via only one path (A). After that access path (A) is placed offline, the first choice for the switching destination is the other path connected to CHA0 (B). If an error also occurs on that path (B), then the next possibility for a path comes from one of the two paths (C or D) connected to CHA1.

When the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS is being used, all the paths are owner paths. This means all the paths accessing the same LU can be possible switching destinations. For example, in *Figure 2-8: Path switching*, the LU is accessed using only the path (A). After the access path is placed offline, the switching destination is one of the paths (B), (C), and (D).

For details on the priority for determining which of the paths to the same LU is used as the switching destination, see *(2) Priority of Switching Destination Paths*.

Figure 2-8: Path switching



Legend

— : Path
 → : I/O request

→ : Path before switching
 → : Path after switching

(2) Priority of Switching Destination Paths

Priority of paths varies depending on the architecture of the host machine.

If the architecture of the host is CHRP, the switching destination path is selected based on four keys. First, the path with the smallest path priority number (first key) is selected. If there are multiple paths with the smallest path priority number, the order for selecting a unique path is smallest slot number (second key), smallest CHA port number (third key), and smallest `PATH_ID` value (fourth key).

If the architecture of the host is not CHRP, the switching destination path is selected based on three keys. First, the path with the smallest path priority number (first key) is selected. If there are multiple paths with the smallest path priority number, the order for selecting a unique path is smallest CHA port number (second key) and then smallest `PATH_ID` value (third key).

This sub-section explains these keys.

Path priority number

This number indicates the priority level set for each path. Priority levels can be set from 1 to 255. The lower the number, the higher the priority. The default is 1. The priority level is set by using OS commands. The following shows an example of the procedure for setting the path priority number.

1. Execute a command that displays the path information for the LU:

```
# lspath -l hdisk4 -F"name parent path_id connection
path_status status"

hdisk4 fscsi0 0 50060e8005271720,31000000000000
Available Enabled

hdisk4 fscsi1 1 50060e8005271730,31000000000000
Available Enabled

hdisk4 fscsi2 2 50060e8005271740,31000000000000
Available Enabled

hdisk4 fscsi3 3 50060e8005271750,31000000000000
Available Enabled
```

2. Execute a command that displays the information for the path whose path priority number you want to set:

```
# lspath -l hdisk4 -p fscsi0 -w
50060e8005271720,31000000000000 -E

scsi_id    0x651400          SCSI ID      False
node_name  0x50060e8005271720 FC Node Name False
state      Enabled          N/A         True
priority   1                N/A         True
```

3. Execute a command that changes the path priority number:

```
# chpath -l hdisk4 -p fscsi0 -w
50060e8005271720,31000000000000 -a priority=5

path Changed
```

4. Execute a command that displays the information for the path for which a new path priority number has been set:

```
# lspath -l hdisk4 -p fscsi0 -w
50060e8005271720,31000000000000 -E

scsi_id    0x651400          SCSI ID      False
```

```

node_name 0x50060e8005271720 FC Node Name False
state      Enabled              N/A          True
priority   5                   N/A          True

```

Slot number

This number indicates the position of the slot where an HBA is mounted.

You can find the order of the slot numbers by comparing their physical location code.

The following describes how to obtain the physical location code.

1. Execute the following command to find `hdisk`, based on `AutoPATH_ID`.

```

# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName  OSPathID  LDEV
000000 hdisk0    00000    9500V.0051.0005
000001 hdisk1    00000    9500V.0051.0015
000002 hdisk2    00000    9500V.0051.0020
000003 hdisk0    00001    9500V.0051.0005
000004 hdisk1    00001    9500V.0051.0015
000005 hdisk2    00001    9500V.0051.0020

```

2. Execute the following command to find the parent device of `hdisk` (the HBA device instance).

```

# lsdev -C -l hdisk4 -F 'parent'
fscsi0

```

3. Execute the following command to find the physical location code, based on the HBA device instance.

```

# lscfg -vp -l fscsi0

```

DEVICE	LOCATION	DESCRIPTION
fscsi0	U1.1-P1-I1	FC SCSI I/O controller protocol device
PLATFORM SPECIFIC		
Name: fibre-channel		
Node: fibre-channel@1		
Physical Location: U1.1-P1-I1/Q1		

↑
physical location code

The obtained physical location code is in the *Uaa.bb-Pcc-Idd* format. The first letters, *Uaa.bb*, depend on the model of the host. HDLM selects the path with the lowest value for *aabbccdd*. When the physical location code is in another format, the priority of paths is not decided. Note that the top priority path does not change because of, for example, restarting a computer in the same environment.

Note

Depending on the HBA, you need to repeat steps 2 and 3.

For details on the position of slots, see the manual of the host.

CHA port number

The port number of the CHA.

You can check this number by using the `dlmkmgr` command's `view` operation. For details on the `view` operation, see 6.7 *view (Displays Information)*.

AutoPATH_ID

The ID assigned to a path. This ID is re-assigned each time the host or the HDLM Manager is started.

You can check this ID by using the `dlmkmgr` command's `view` operation. For details on the `view` operation, see 6.7 *view (Displays Information)*.

(3) Automatic fallbacks

When a path recovers from an error, HDLM can automatically place the recovered path back online. This function is called the *automatic fallback* function.

In order to use the automatic fallback function, HDLM must already be monitoring error recovery on a regular basis.

When using the Thunder 9500V series, or Hitachi AMS/WMS series, HDLM will select the next path to be used first from among the online owner paths, and then from the online non-owner paths. As a result, if an owner path recovers from an error, and

then HDLM automatically places the recovered path online while a non-owner path is in use, the path will be automatically switched over from the non-owner path to the owner path that just recovered from the error.

When the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS is being used, all the paths are owner paths. Therefore, if an owner path recovers from an error and HDLM automatically places the recovered path online, the path to use is not switched.

When intermittent errors[#] occur on paths and you are using the automatic failback function, the path status might frequently alternate between the online and offline statuses. In such a case, because the performance of I/Os will most likely decrease, if there are particular paths in which intermittent errors might be occurring, we recommend that you set up intermittent error monitoring so you can detect these paths, and then remove them from those subject to automatic failbacks.

You can specify the automatic failback function or intermittent error by the `dlmkmgr` command's `set` operation. For details on the `set` operation, see 6.6 *set (Sets Up the Operating Environment)*.

#

An *intermittent error* means an error that occurs irregularly because of some reason such as a loose cable connection.

2.7.2 Manual path switching

You can switch the status of a path by manually placing the path online or offline. Manually switching a path is useful, for example, when system maintenance needs to be done.

You can manually place a path online or offline by doing the following:

- Execute the `dlmkmgr` command's `online` or `offline` operation.

For details on the `online` operation, see 6.5 *online (Places Paths Online)*. For details on the `offline` operation, see 6.4 *offline (Places Paths Offline)*.

However, if there is only one online path for a particular LU, that path cannot be manually switched offline. Also, a path with an error that has not been recovered from yet cannot be switched online.

HDLM uses the same algorithms to select the path that will be used next, regardless of whether automatic or manual path switching is used.

When using the Thunder 9500V series, or Hitachi AMS/WMS series, HDLM selects the switching destination path from owner paths and then from non-owner paths.

When the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS is being used, all paths that access the same LU are candidates for the switching destination path. All

other paths that run through the same physical path are switched.

Executing the `online` operation places the offline path online. For details on the `online` operation, see *6.5 online (Places Paths Online)*. After the path status is changed to online (by executing the `online` operation), HDLM selects the path to use in the same way as for automatic path switching. When using the Thunder 9500V series, or Hitachi AMS/WMS series, HDLM selects the path to use from online owner paths, and then from online non-owner paths. When the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS is being used, since all the paths are owner paths, the path to use is not switched even if you change the path status to online by using the `online` operation.

2.7.3 Path status transition

Each of the online and offline statuses described in *2.7 Performing Failovers and Failbacks Using Path Switching* is further subdivided into two statuses. The following explains the two online path statuses and the two offline statuses.

(1) The online path status

The online path statuses are as follows:

- `Online`

I/Os can be issued normally.

- `Online (E)`

An error has occurred on the path, but none of the other paths that access the same LU are in the `Online` status.

If none of the paths accessing a particular LU are in the `Online` status, one of the paths is changed to the `Online (E)` status. This ensures that the LU can be accessed through at least one path.

The (E) means *error*, which indicates that an error has occurred on the path from some previous operation.

(2) The offline path status

The offline path statuses are as follows:

- `Offline (C)`

The status in which I/O cannot be issued because the `offline` operation was executed. For details on the `offline` operation, see *6.4 offline (Places Paths Offline)*.

The (C) indicates the command attribute, which indicates that the path was placed offline by using the command.

- Offline (E)

The status indicating that an I/O could not be issued on a given path, because an error occurred on the path.

The (E) means *error*.

(3) Correspondence Between Path Statuses Displayed by the OS and by HDLM

Table 2-5: Correspondence Between Path Statuses Displayed by the OS and by HDLM shows the correspondence between the path statuses displayed when commands such as the AIX `lspath` command are executed and the path statuses displayed when the `dlmkmgr` command's `view` operation is executed.

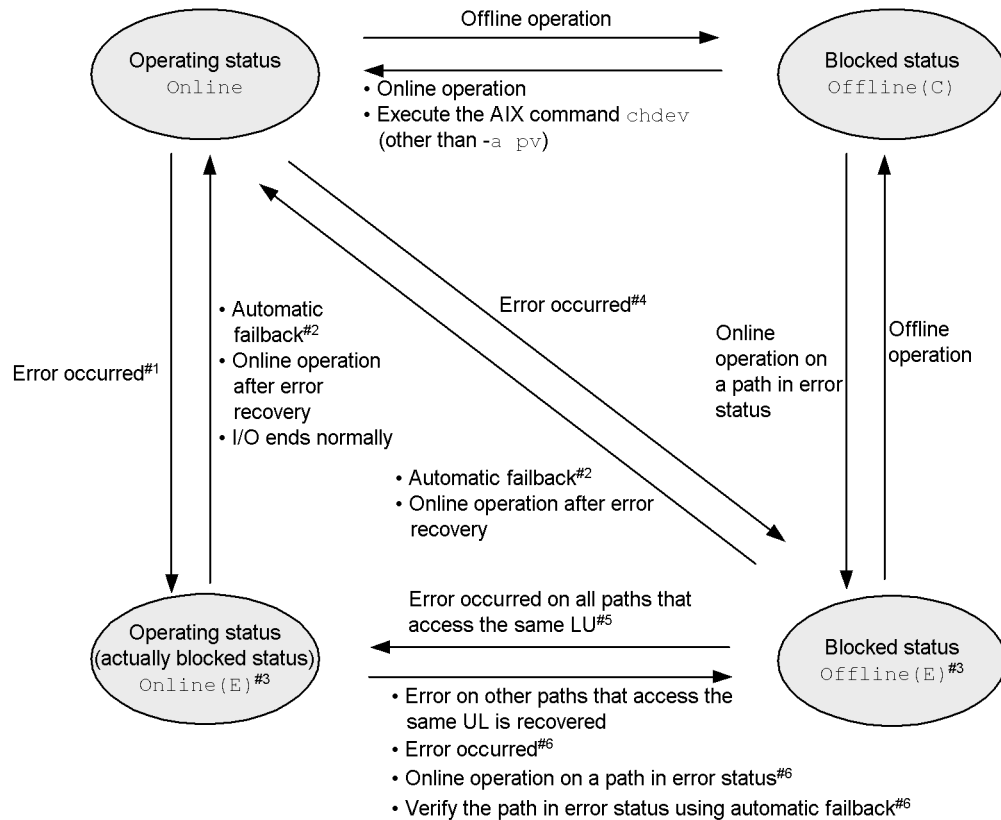
Table 2-5: Correspondence Between Path Statuses Displayed by the OS and by HDLM

Path status displayed by an AIX command	Path status displayed by the HDLM command
Can be used	Either Online or Online(E)
Cannot be used	Offline(C)
Error	Offline(E)

(4) Status transitions of a path

Figure 2-9: Path status transitions shows the status transitions of a path.

Figure 2-9: Path status transitions



Legend:

Online operation: Online operation performed by executing the `dlmkmgr` command's `online` operation.

Offline operation: Offline operation performed by executing the `dlmkmgr` command's `offline` operation.

#1

When no `Online` or `Offline(E)` paths exist among the paths that access the same LU.

#2

When the following conditions are satisfied, a path that has been determined to have an intermittent error also becomes subject to automatic failback:

- All the paths connected to an LU are `Online(E)`, `Offline(E)`, or

`Offline(C)`.

- All the paths connected to an LU have been determined to have an intermittent error.
- The processing of continuous I/O operations issued to an LU is successful.

#3

This path is deleted when the AIX `chdev` command is executed on an `hdisk` where an `Online` or `Offline(E)` path exists. To restore the deleted path, remove the cause of the error and then execute the AIX `mkdev -l hdisk-name` or `cfgmgr` command.

#4

When an `Online` or `Offline(E)` path exists among the paths that access the same LU.

#5

One of the `Offline(E)` paths is changed to the `Online(E)` path.

#6

When an `Offline(E)` path exists among the paths that access the same LU.

The last available online path for each LU cannot be placed offline by executing the `offline` operation. This ensures access to the LU. For details on the `offline` operation, see *6.4 offline (Places Paths Offline)*.

If an error occurs in the last available online path for each LU, the status of the path is changed to `Online(E)`.

If you are using automatic failback, when the path recovers from an error, HDLM automatically places the path online.

When you are using intermittent error monitoring, the path in which the intermittent error occurred is not automatically placed online when the path recovers from the error. In such a case, place the path online manually.

Note

If there is a path failure immediately after a path is taken offline by using either the an HDLM command, the status might change from `Offline(C)` to `Offline(E)`. If an offline operation was just performed, wait about 2 minutes, check the path status by using an HDLM command, and then make sure that the status has changed to `Offline(C)`. If it is still `Offline(E)`, retry the offline operation.

2.8 Monitoring intermittent errors (functionality when automatic failback is used)

An intermittent error refers to an error that occurs irregularly because of something like a loose cable. In such a case, I/O performance might decrease while an automatic failback is being performed to repair an intermittent error. This is because the automatic failback operation is being performed repeatedly (because the intermittent error keeps occurring). To prevent this from happening, HDLM can automatically remove the path where an intermittent error is occurring from the paths that are subject to automatic failbacks. This process is called *intermittent error monitoring*.

We recommend that you use intermittent error monitoring along with the automatic failback function.

A path in which an error occurs a specified number of times within a specified interval is determined to have an intermittent error. The path where an intermittent error occurs has an error status until the user chooses to place the path back online. Failbacks are not performed for such paths. This status is referred to as the *not subject to auto failback* status.

2.8.1 Checking intermittent errors

You can check the paths in which intermittent errors have occurred by viewing the execution results of the HDLM command's `view` operation.

For details on the `view` operation, see 6.7 *view (Displays Information)*.

2.8.2 Setting up intermittent error monitoring

When you enable the intermittent error monitoring function, specify the following monitoring conditions: the error monitoring interval, and the number of times that the error needs to occur. If an error occurs on a particular path the specified number of times within the specified error-monitoring interval, then an intermittent error will occur on the path. For example, if you specify 30 for the error monitoring interval and 3 for the number of times that the error needs to occur, the path is determined to have an intermittent error if an error occurs 3 or more times in 30 minutes.

You can set up intermittent error monitoring by executing the `dlnmgr` command's `set` operation.

Intermittent error monitoring can be used only when automatic failback has already been enabled. The values that can be specified for intermittent error monitoring depend on the values specified for automatic failbacks. For details on how to specify the settings, see 6.6 *set (Sets Up the Operating Environment)*.

2.8.3 Intermittent Error Monitoring Actions

Intermittent error monitoring is performed on each path, and it automatically starts as soon as a path is recovered from an error by using the automatic failback function.

This subsection describes the following intermittent error monitoring actions:

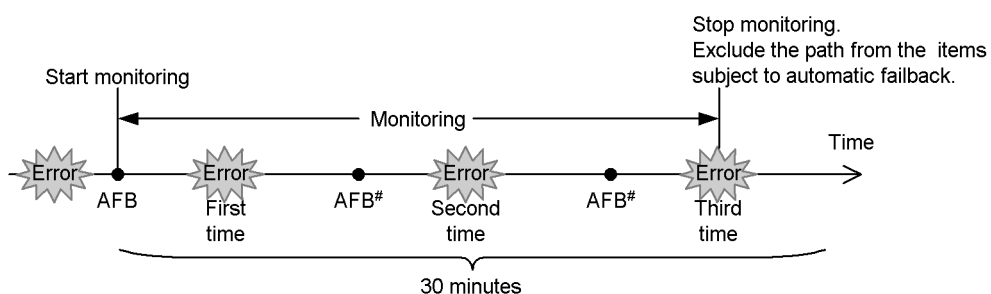
- When an intermittent error occurs
- When an intermittent error does not occur
- When the conditions for an intermittent error to occur are changed during error monitoring

(1) When an intermittent error occurs

When an error occurs on a path a specified number of times within a specified interval, the error monitoring will finish and the path is determined to have an intermittent error, upon which the path is removed from those subject to automatic failbacks. The path that is removed will remain in the error status until the online operation is performed. However, if the path satisfies certain conditions (see *Figure 2-9: Path status transitions*), it will be subject to automatic failbacks and change to the Online status.

Figure 2-10: Action What Will Happen When an Intermittent Error Occurs on a Path shows what will happen when an intermittent error occurs. For this example, the path is determined to have an intermittent error when the error occurs 3 or more times within 30 minutes. The events that occur are described by using the time arrows.

Figure 2-10: Action What Will Happen When an Intermittent Error Occurs on a Path



(Legend)

AFB: Indicates where the path was changed from error status to online status by automatic failback.

#

This includes online operation performed by a user.

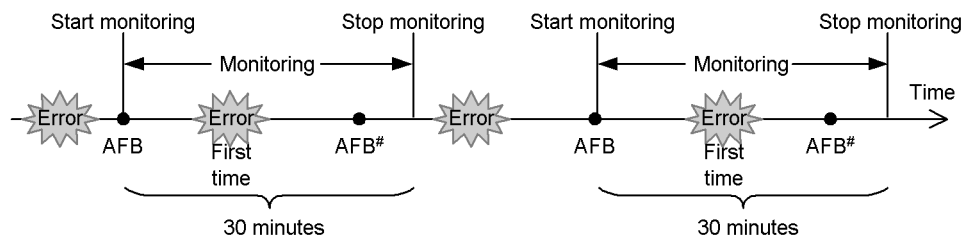
(2) When an intermittent error does not occur

If an error does not occur on a path a specified number of times within a specified interval, an intermittent error will not occur. In such a case, the error monitoring will finish when the specified error-monitoring interval finishes, upon which the number of errors is reset to 0. If an error occurs on the path again at a later time, error monitoring will resume when the path is recovered from the error via an automatic fallback.

If it takes a long time for an error to occur, an intermittent error can be more easily detected by increasing the error-monitoring interval or by decreasing the number of times that the error needs to occur.

Figure 2-11: What Will Happen When an Intermittent Error Does Not Occur on a Path shows what will happen when an intermittent error does not occur. For this example, the path is determined to have an intermittent error if the error occurs three or more times in 30 minutes. The events that occur are described by using the time arrows.

Figure 2-11: What Will Happen When an Intermittent Error Does Not Occur on a Path



(Legend)

AFB: Indicates where the path was changed from error status to online status by automatic fallback.

#

This includes online operation performed by a user.

As shown in *Figure 2-11: What Will Happen When an Intermittent Error Does Not Occur on a Path*, normally the count for the number of times that an error occurs is started after the path is first recovered from an error by using the automatic fallback function. However, if all the paths connected to the LU are in the `Offline(E)`, `Online(E)`, or `Offline(C)` status (which is due to the disconnection of the paths or some other reason), the paths will not be recovered and put back online by using the automatic fallback function. If I/O operations are continuously being issued to such an LU, the count for the number of times that the error occurs might be started even though the path will not be placed online. If the number of times that the error occurs reaches the specified value, the path is determined to have an intermittent error. In such a case, remove the cause of the error, and then manually place the path online.

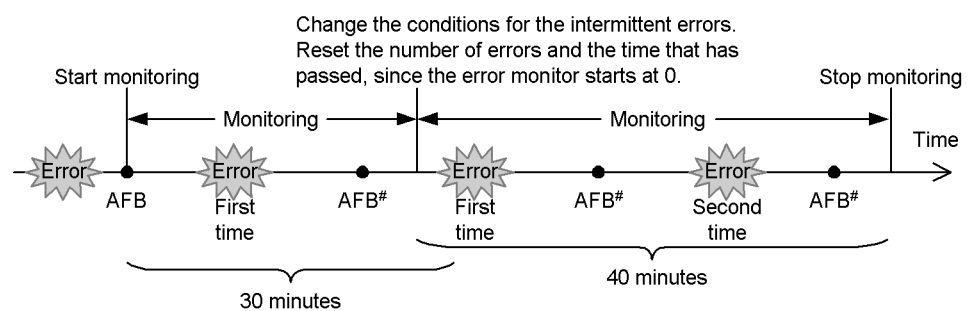
(3) When the conditions for an intermittent error are changed during error monitoring

When the conditions for an intermittent error are changed during error monitoring, the number of errors and the amount of time that has passed since the error monitoring started are both reset to 0. As such, the error monitoring will not finish, and it will start over by using the new conditions.

If the conditions are changed while error monitoring is not being performed, error monitoring will start up again and use the updated conditions after any given path is recovered from an error by performing an automatic fallback.

Figure 2-12: What Will Happen When Conditions Are Changed During Error Monitoring shows what will happen when the conditions for an intermittent error are changed during error monitoring. For this example, the conditions have been changed from 3 or more errors in 30 minutes, to 3 or more errors in 40 minutes. The events that occur are described by using the time arrows.

Figure 2-12: What Will Happen When Conditions Are Changed During Error Monitoring



(Legend)

AFB: Indicates where the path was changed from error status to online status by AFB.

#

This includes online operation performed by a user.

2.8.4 When a User Changes the Intermittent Error Information

The following might be reset when a user changes any of the values set for the intermittent error or the path status: the number of errors that have already been counted during error monitoring, the amount of time that has passed since error monitoring has started, and the information about whether an intermittent error has occurred. *Table 2-6: When Effects of a User Changing the Intermittent Error Information* lists whether the above items are reset.

If you want to check whether intermittent error monitoring is being performed for the

path, check the IEP item displayed when the `dlmkmgr` command's `view -path` operation is executed with the `-iem` parameter. If a numerical value of 0 or greater is displayed in the **Intermittent Error Path** item, then intermittent error monitoring is being performed.

Table 2-6: When Effects of a User Changing the Intermittent Error Information

User operation		Number of errors and time passed since error monitoring started	Information about paths not subject to automatic failback
Changing the intermittent error monitoring settings	Turning <code>off</code>	Reset	Reset ^{#1}
	Changing the conditions for an intermittent error while intermittent error monitoring is being performed	Reset ^{#2}	Inherited
	Turning intermittent error monitoring on by executing the <code>set</code> operation, (but not changing the conditions) while intermittent error monitoring is being performed		
	Changing the intermittent error monitoring conditions while intermittent error monitoring is not being performed	(Not applicable) (Not counted.)	Inherited
Changing the automatic failback settings	Turning <code>off</code>	Reset	Reset
Changing the path status	Taking the path <code>Offline(C)</code>	Reset	Reset
	Placing the path <code>Online</code> while intermittent error monitoring is not being performed	(Not applicable) (Not counted.)	Reset
	Placing the path <code>Online</code> while intermittent error monitoring is being performed	Inherited	(Not applicable) If a path has been removed from the paths subject to automatic monitoring, that path is no longer monitored.
Restarting the HDLM manager		Reset ^{#3}	Inherited
Restarting the host		Reset	Reset

#1

When you turn the intermittent error monitoring function off, information about paths not subject to automatic failback will be reset. If you do not want to reset the information about paths not subject to automatic failback when you turn the intermittent error monitoring function off, change the target paths to `Offline(C)`.

#2

The number of errors and the time passed since error monitoring had started are both reset to 0, and then monitoring restarts from the time the setting change is made in accordance with the changed monitoring conditions.

#3

The number of errors and the time passed since error monitoring had started are both reset to 0, and then monitoring restarts from the time the HDLM manager starts.

2.9 Detecting errors by using path health checking

HDLM can check the status of paths for which I/O operations are not being performed at regular intervals. This function is called *path health checking*.

Without path health checking, an error is not detected unless I/O is performed because the system only checks the path status when I/O is performed. With path health checking, however, the system checks the status of online paths at regular intervals regardless of whether I/O is performed. If an error is detected in a path, path health checking functionality switches the status of that path to `Offline(E)` or `Online(E)`, so you can use the `dlnmgr` command's `view` operation to check the path error.

For example, in a normal state, I/O operations are not performed on the paths coming from the standby host in the cluster configuration or on non-owner paths (that is, some of the paths that access a Thunder 9500V series and Hitachi AMS/WMS series storage system). Because of this, for the standby host or for a host connected to non-owner paths, we recommend that you use path health checking to detect errors. This enables the system to use the most up-to-date path-status information when selecting the next path to use.

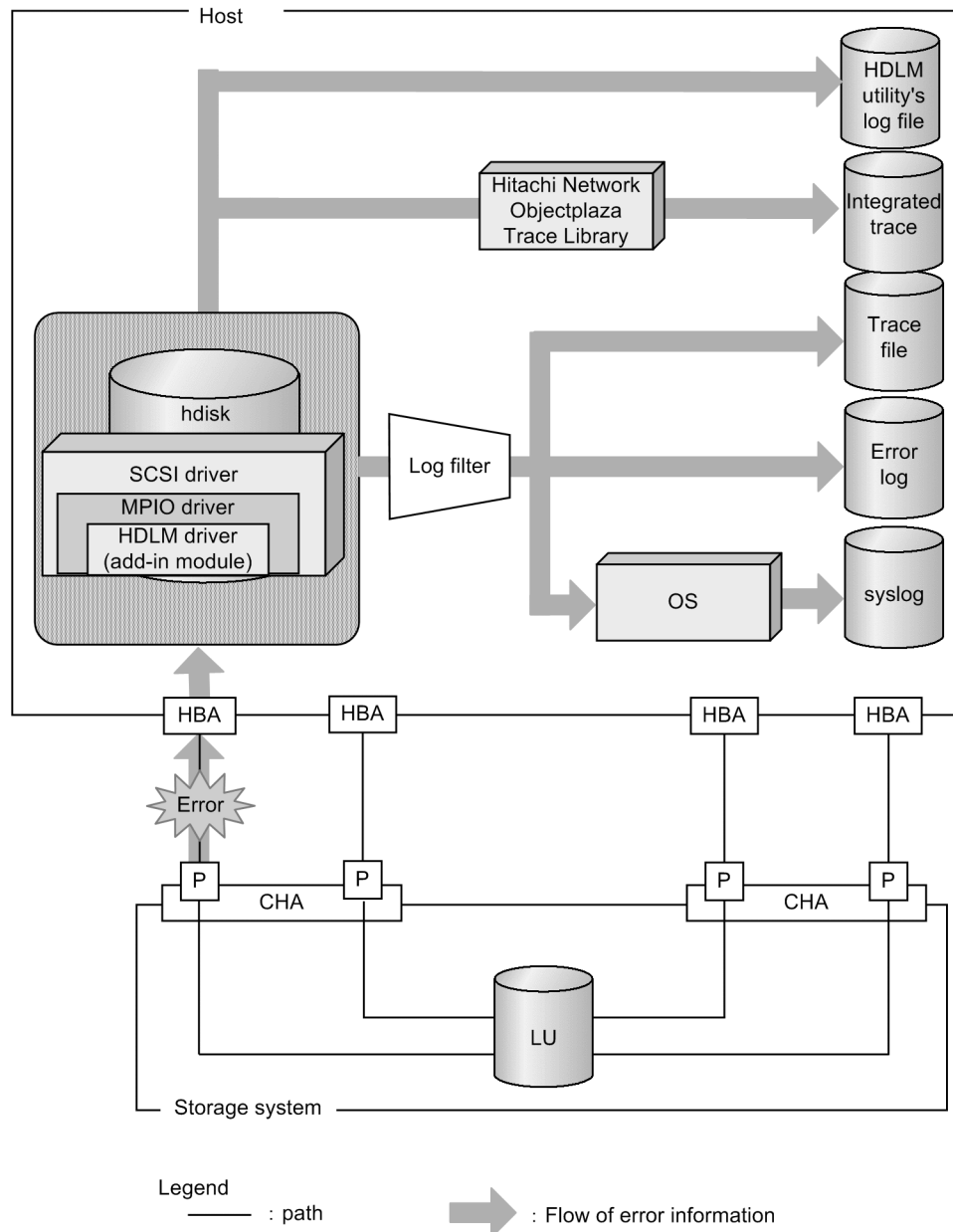
You can configure path health checking by executing the `dlnmgr` command's `set` operation. For details on the `set` operation, see 6.6 *set (Sets Up the Operating Environment)*.

2.10 Error management

For troubleshooting purposes, HDLM collects information and stores it into log files. The error information to be collected can be filtered out by error level, and then stored into the log files.

Figure 2-13: Flow of Data When Collecting Error Information shows the flow of data when collecting error information.

Figure 2-13: Flow of Data When Collecting Error Information



Logs might be collected in layers below HDLM, such as for the HBA driver. For more details, see the AIX documentation.

2.10.1 Types of Collected Logs

HDLM collects information on the detected error and trace information in the *integrated trace file*, *trace file*, *error logs*, *HDLM utility's log file*, and *syslog*. You can use the error information to examine the status of an error and analyze the cause of the error.

Table 2-7: *Types of error information* describes the types of error information.

Table 2-7: Types of error information

Log name	Description	Output destination
Integrated trace file	Operation logs of the HDLM command are collected.	The default file path is <code>/var/opt/hitachi/HNTRLib2/spool/hntr2[1-16].log</code> . To specify the output destination directory and the file prefix for the integrated trace file, use a Hitachi Network Objectplaza Trace Library (HNTRLib2) utility.
Trace file	Trace information on the HDLM manager is collected at the level specified by the user. If an error occurs, you might need to change the settings to collect trace information.	The trace file name is <code>/var/DynamicLinkManager/log/hdlmtr[1-64].log</code>
Error log	Error information is collected for the user-defined level. By default, HDLM collects all error information.	HDLM Manager logs: <code>/var/DynamicLinkManager/log/dlmmgr[1-16].log</code> Hitachi Command Suite Common Agent Component logs: <code>/var/DynamicLinkManager/log/dlmwebagent[1-N].log</code> The value <i>n</i> depends on the setting in the file <code>dlmwebagent.properties</code> .
<i>HDLM utility's log file</i>	Logs are collected when the <i>HDLM</i> utility is executed.	The following is the log file name: <code>/var/DynamicLinkManager/log/dlmutil[1-2].log</code>
Syslog	The HDLM messages on or above the level set by the user with <code>/etc/syslog.conf</code> are collected. [#] We recommend that you configure the system so that information at the Information level and higher is output. Syslogs can be checked using a text editor.	Syslog is not output by default. To output syslog, The syslog file path is specified in the file <code>/etc/syslog.conf</code> . For details, see the AIX documentation.
HDLM Inquiry log	An HDLM Inquiry log is a response log when the Inquiry command is issued to the hdisk.	<code>/var/DynamicLinkManager/log/dlminquiry[1-2].log</code>

Log name	Description	Output destination
HDLM configuration log	HDLM configuration log is an operation log of the configuration processing for the HDLM driver.	/var/DynamicLinkManager/log/dlmconfig[1-2].log

#

When you want to configure the system so that HDLM messages are output to syslog, specify `user` for the facility in the `/etc/syslog.conf` file. The following shows an example where the system function name is `user`, and messages at the `info` level or higher are output to the `/tmp/syslog.user.log` file:

```
user.info                /tmp/syslog.user.log
```

For details on error levels, see *2.10.2 Filtering of error information*.

2.10.2 Filtering of error information

Errors detected by HDLM are classified into various error levels. *Table 2-8: Error levels* lists the error levels, in the order of most to least severe.

Table 2-8: Error levels

Error level	Meaning	Level output in syslog
Critical	Fatal errors that may stop the system.	err
Error	Errors that adversely affect the system. This type of error can be avoided by performing a failover or other countermeasures.	err
Warning	Errors that enable the system to continue but, if left, might cause the system to improperly operate.	warning
Information	Information that simply indicates the operating history when the system is operating normally.	info

Error information is filtered according to the error level, and then collected.

In syslog, the HDLM messages on or above the level set by the user configured in `/etc/syslog.conf` are collected. It is recommended that you set the Information to be output at the `info` level or higher.

The error information in error logs and trace files are collected based on a user-defined collection level. The collection levels are as follows:

Collection levels for error logs

- Collects no error information.
- Collects error information at the Error level and higher.
- Collects error information at the Warning level and higher.
- Collects error information at the Information level and higher.
- Collects error information at the Information level and higher (including maintenance information).

Collection levels for log information in trace files:

- Outputs no trace information
- Outputs error information only
- Outputs trace information on program operation summaries
- Outputs trace information on program operation details
- Outputs all trace information

For details on how to set the collection level, see 3.7.2 *Setting Up the HDLM Functions*.

2.10.3 Collecting error information using the utility for collecting HDLM error information (DLMgetras)

HDLM has a utility for collecting HDLM error information (DLMgetras).

By executing this utility, you can simultaneously collect all the information required for analyzing errors: information such as error logs, integrated trace files, trace files, definition files, core files, system crash dump files, and libraries. You can use the collected information when you contact your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM).

For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

2.10.4 Collecting installation error information using the utility for collecting HDLM installation error information (dlmgetrasinst)

HDLM has a utility for collecting HDLM installation error information (dlmgetrasinst).

By executing the dlmgetrasinst utility, you can collect system information and log files needed to analyze errors that occurred during installation. You can use the collected information when you contact your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM).

For details on the dlmgetrasinst utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

2.11 Collecting Audit Log Data

HDLM and other Hitachi storage-related products provide an audit log function so that compliance with regulations, security evaluation standards, and industry-specific standards can be shown to auditors and evaluators. The following table describes the categories of audit log data that Hitachi storage-related products can collect.

Table 2-9: Categories of Audit Log Data that Can Be Collected

Category	Explanation
StartStop	An event indicating the startup or termination of hardware or software, including: <ul style="list-style-type: none"> • OS startup and termination • Startup and termination of hardware components (including micro-program) • Startup and termination of software running on storage systems, software running on SVPs (service processors), and Hitachi Command Suite products
Failure	An abnormal hardware or software event, including: <ul style="list-style-type: none"> • Hardware errors • Software errors (such as memory errors)
LinkStatus	An event indicating the linkage status between devices: <ul style="list-style-type: none"> • Link up or link down
ExternalService	An event indicating the result of communication between a Hitachi storage-related product and an external service, including: <ul style="list-style-type: none"> • Communication with a RADIUS server, LDAP server, NTP server, or DNS server, • Communication with the management server (SNMP)
Authentication	An event indicating that a connection or authentication attempt made by a device, administrator, or end-user has succeeded or failed, including: <ul style="list-style-type: none"> • FC login • Device authentication (FC-SP authentication, iSCSI login authentication, or SSL server/client authentication) • Administrator or end-user authentication
AccessControl	An event indicating that a resource access attempt made by a device, administrator, or end-user has succeeded or failed, including: <ul style="list-style-type: none"> • Device access control • Administrator or end-user access control

Category	Explanation
ContentAccess	An event indicating that an attempt to access critical data has succeeded or failed, including: <ul style="list-style-type: none"> Access to a critical file on a NAS or content access when HTTP is supported Access to the audit log file
ConfigurationAccess	An event indicating that a permitted operation performed by the administrator has terminated normally or failed, including: <ul style="list-style-type: none"> Viewing or updating configuration information Updating account settings, such as adding and deleting accounts Setting up security Viewing or updating audit log settings
Maintenance	An event indicating that a maintenance operation has terminated normally or failed, including: <ul style="list-style-type: none"> Adding or removing hardware components Adding or removing software components
AnomalyEvent	An event indicating an abnormal state such as exceeding a threshold, including: <ul style="list-style-type: none"> Exceeding a network traffic threshold Exceeding a CPU load threshold Reporting that the temporary audit log data saved internally is close to its maximum size limit or that the audit log files have wrapped back around to the beginning
	An event indicating an occurrence of abnormal communication, including: <ul style="list-style-type: none"> A SYN flood attack or protocol violation for a normally used port Access to an unused port (such as port scanning)

The categories of audit log data that can be collected differ depending on the product. The following sections explain only the categories of audit log data that can be collected by HDLM. For the categories of audit log data that can be collected by a product other than HDLM, see the corresponding product manual.

2.11.1 Categories and Audit Events that HDLM Can Output to the Audit Log

The following table lists and explains the categories and audit events that HDLM can output to the audit log. The severity is also indicated for each audit event.

Table 2-10: Categories and Audit Events that Can Be Output to the Audit Log

Category	Explanation	Audit event	Severity #1	Message ID
StartStop	Startup and termination of the software	Startup of the HDLM manager was successful.	6	KAPL15401-I
		Startup of the HDLM manager failed.	3	KAPL15402-E
		The HDLM manager stopped.	6	KAPL15403-I
		Startup of the DLMgetras utility	6	KAPL15060-I
		Termination of the DLMgetras utility ^{#2}	6	KAPL15061-I
		Startup of the dlmgetrasinst utility	6	KAPL15084-I
		Termination of the dlmgetrasinst utility ^{#3}	6	KAPL15085-I
Authentication	Administrator or end-user authentication	Permission has not been granted to execute the HDLM command.	4	KAPL15111-W
		Permission has not been granted to execute HDLM utilities.	4	KAPL15010-W
		Permission has not been granted to start or stop the HDLM manager.	4	KAPL15404-W
ConfigurationAccess	Viewing or updating configuration information	Initialization of path statistics was successful.	6	KAPL15101-I
		Initialization of path statistics failed.	3	KAPL15102-E
		An attempt to place a path online or offline was successful.	6	KAPL15103-I
		An attempt to place a path online or offline failed.	4	KAPL15104-W

Category	Explanation	Audit event	Severity #1	Message ID
		Setup of the operating environment was successful.	6	KAPL15105-I
		Setup of the operating environment failed.	3	KAPL15106-E
		An attempt to display program information was successful.	6	KAPL15107-I
		An attempt to display program information failed.	3	KAPL15108-E
		An attempt to display HDLM management-target information was successful.	6	KAPL15109-I
		An attempt to display HDLM management-target information failed.	3	KAPL15110-E
		Processing of the <code>d1mpr -k</code> command was successful.	6	KAPL15001-I
		Processing of the <code>d1mpr -k</code> command failed.	3	KAPL15002-E
		Processing of the <code>d1mpr -c</code> command was successful.	6	KAPL15008-I
		Processing of the <code>d1mpr -c</code> command failed.	3	KAPL15009-E
		Processing of the <code>d1modmset -o</code> command was successful.	6	KAPL15005-I
		Processing of the <code>d1mchpdatr -o</code> command was successful.	6	KAPL15080-I
		Processing of the <code>d1mchpdatr -o</code> command failed.	3	KAPL15081-E

Category	Explanation	Audit event	Severity #1	Message ID
		Processing of the <code>dlnchpdattr -a</code> command was successful.	6	KAPL15082-I
		Processing of the <code>dlnchpdattr -a</code> command failed.	3	KAPL15083-E

#1

The severity levels are as follows:

3: Error, 4: Warning, 6: Informational

#2

If you use **Ctrl + C** to cancel the `DLMgetras` utility for collecting HDLM error information, audit log data indicating that the `DLMgetras` utility has terminated will not be output.

#3

If you use **Ctrl + C** to cancel the `dlngetrasinst` utility for collecting HDLM installation error information, audit log data indicating that the `dlngetrasinst` utility has terminated will not be output.

2.11.2 Requirements for Outputting Audit Log Data

HDLM can output audit log data when all of the following conditions are satisfied:

- The `syslog` daemon is active.
- The output of audit log data has been enabled by using the HDLM command's `set` operation.

However, audit log data might still be output regardless of the above conditions if, for example, an HDLM utility is executed from external media.[#]

#:

The following audit log data is output:

- Categories: `StartStop`, `Authentication`, and `ConfigurationAccess`
- Severity: 6 (Critical, Error, Warning, or Informational)
- Destination: `syslog` (facility value: `user`)

Note:

- Enable `syslog` since `syslog` is disabled by default in AIX.

For details on how to enable `syslog`, see 2.11.3 *Destination and Filtering of Audit Log Data* or the AIX documentation.

- You might need to perform operations such as changing the log size and backing up and saving collected log data, because the amount of audit log data might be quite large.
- If the severity specified by the HDLM command's `set` operation differs from the severity specified by the configuration file `/etc/syslog.conf`, the higher severity level is used for outputting audit log data.

2.11.3 Destination and Filtering of Audit Log Data

Audit log data is output to `syslog`. Because HDLM messages other than audit log data are also output to `syslog`, we recommend that you specify the output destination that is used exclusively for audit log data.

For example, to change the output destination of audit log data to `/usr/local/audlog`, specify the following two settings:

- Specify the following setting in the `/etc/syslog.conf` file:

```
local0.info /usr/local/audlog
```

- Use the HDLM command's `set` operation to specify `local0` for the audit log facility:

You can also filter the audit log output by specifying a severity level and type for the HDLM command's `set` operation.

Filtering by severity:

The following table lists the severity levels that can be specified.

Table 2-11: Severity Levels That Can Be Specified

Severity	Audit log data to output	Correspondence with syslog severity levels
0	None	Emergency
1		Alert
2	Critical	Critical
3	Critical and Error	Error
4	Critical, Error, and Warning	Warning
5		Notice
6	Critical, Error, Warning, and Informational	Informational

Severity	Audit log data to output	Correspondence with syslog severity levels
7		Debug

Filtering by category:

The following categories can be specified:

- StartStop
- Authentication
- ConfigurationAccess
- All of the above

For details on how to specify audit log settings, see 3.7.2 *Setting Up the HDLM Functions*.

2.11.4 Audit Log Data Formats

The following describes the format of audit log data:

Format of audit log data output to syslog:

- *priority*
- *date-and-time*
- *host-name*
- *program-name*
- *[process-ID]*
- *message-section*

The following shows the format of *message-section* and explains its contents.

The format of message-section:

common-identifier, common-specification-revision-number, serial-number, message-ID, date-and-time, entity-affected, location-affected, audit-event-type, audit-event-result, subject-ID-for-audit-event-result, hardware-identification-information, location-information, location-identification-information, FQDN, redundancy-identification-information, agent-information, host-sending-request, port-number-sending-request, host-receiving-request, port-number-receiving-request, common-operation-ID, log-type-information, application-identification-information, reserved-area, message-text

Up to 950 bytes of text can be displayed for each *message-section*.

Table 2-12: Items Output in the Message Section

Item#	Explanation
Common identifier	Fixed to CELFSS
Common specification revision number	Fixed to 1.1
Serial number	Serial number of the audit log message
Message ID	Message ID in KAPL15nnn-l format
Date and time	The date and time when the message was output. This item is output in the following format: <i>yyyy-mm-ddThh:mm:ss.s time-zone</i>
Entity affected	Component or process name
Location affected	Host name
Audit event type	Event type
Audit event result	Event result
Subject ID for audit event result	Depending on the event, an account ID, process ID, or IP address is output.
Hardware identification information	Hardware model name or serial number
Location information	Hardware component identification information
Location identification information	Location identification information
FQDN	Fully qualified domain name
Redundancy identification information	Redundancy identification information
Agent information	Agent information
Host sending request	Name of the host sending a request
Port number sending request	Number of the port sending a request
Host receiving request	Name of the host receiving a request
Port number receiving request	Number of the port receiving a request
Common operation ID	Operation serial number in the program
Log type information	Fixed to BasicLog

Item#	Explanation
Application identification information	Program identification information
Reserved area	This field is reserved. No data is output here.
Message text	Data related to the audit event is output.

#: The output of this item depends on the audit event.

Example of the message section for the audit event *An attempt to display HDLM management-target information was successful*:

```
CELFSS,1.1,0,KAPL15109-I,2008-04-09T10:18:40.6+09:00,HDLMCo
mmand,hostname=moon,ConfigurationAccess,Success,uid=root,,,
,,,,,,,,,"Information about HDLM-management targets was
successfully displayed. Command Line = /usr/
DynamicLinkManager/bin/dlnkmgr view -path "
```

2.12 Integrated HDLM management using Global Link Manager

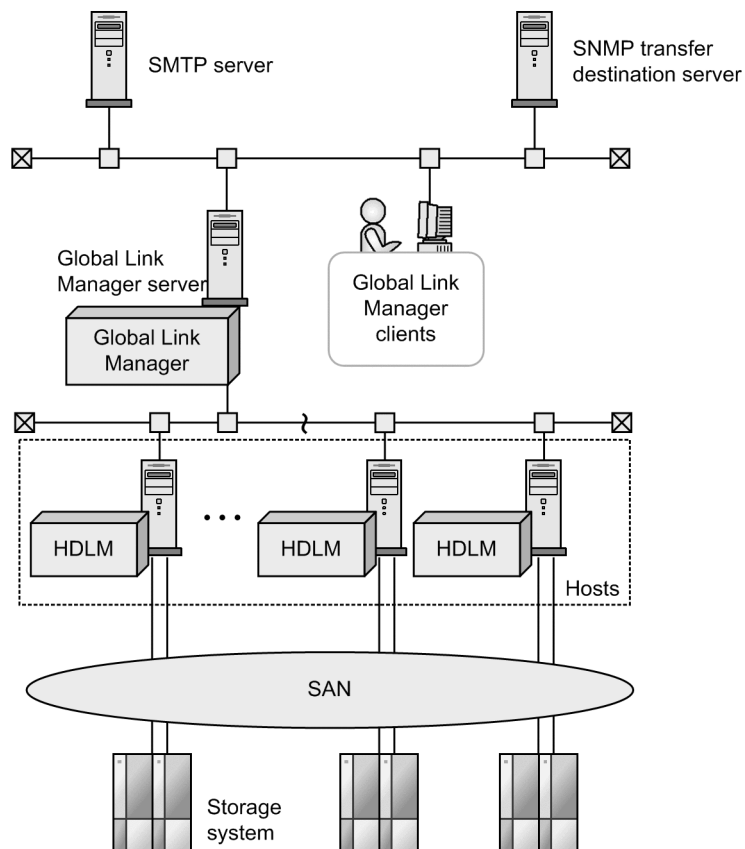
By using Global Link Manager, you can perform integrated path management on systems running multiple instances of HDLM.

For large-scale system configurations using many hosts running HDLM, the operational load for managing paths on individual hosts increases with the size of the configuration. By linking HDLM and Global Link Manager, you can centrally manage path information for multiple instances of HDLM and reduce operational load. In addition, you can switch the operational status of paths to perform system-wide load balancing, and centrally manage the system by collecting HDLM failure information in Global Link Manager.

Global Link Manager collects and centrally manages information about paths from instances of HDLM installed on multiple hosts. Even if multiple users manage these hosts, they can control and view this centralized information from client computers.

For an example of a system configuration using HDLM and Global Link Manager, see *Figure 2-14: Example System Configuration Using HDLM and Global Link Manager*.

Figure 2-14: Example System Configuration Using HDLM and Global Link Manager



Legend:

_____ : Path

2.13 Cluster support

HDLM can also be used in cluster configurations.

HDLM supports the cluster software listed below.

- GPFS
- HACMP
- Oracle RAC 10g
- Oracle RAC 11g
- VCS

HDLM uses a path of the *active host* to access an LU.

The details of host switching depend on the application.

Chapter

3. Creating an HDLM Environment

This chapter describes the procedures for creating an HDLM environment and for canceling the setup.

Make sure that HDLM is installed and its functions have been set up. The volume groups and cluster software programs must be set up appropriately for your system environment.

Note that, in the required procedures and notes, there are differences between HDLM version 5.8.1 or earlier, and HDLM version 5.9 or later. For details, see *B. Differences Between HDLM Version 5.9 or Later and Version 5.8.1 or Earlier*.

- 3.1 HDLM System Requirements
- 3.2 Flow for Creating an HDLM Environment
- 3.3 Types of HDLM Installation
- 3.4 Notes on Creating an HDLM Environment
- 3.5 Installing HDLM
- 3.6 Checking the Path Configuration
- 3.7 Setting up HDLM
- 3.8 Setting up Integrated Traces
- 3.9 About the Reservation Policy
- 3.10 Settings for Using HACMP
- 3.11 Settings for Using GPFS
- 3.12 Settings for Using Oracle RAC 10g or Oracle RAC 11g
- 3.13 Settings for Using VCS
- 3.14 Uninstalling HDLM

3.1 HDLM System Requirements

Check the following before installing HDLM.

For OS patches and software provided by OS vendors, download them from the Web site of the appropriate OS vendor.

3.1.1 Host and OS Support for HDLM

You can install HDLM on hosts running the OSs shown in *Table 3-1: Applicable OSs for the Host*.

Table 3-1: Applicable OSs for the Host

OS	Kernel
AIX 5L V5.3 ^{#1}	For Technology Level 06: Apply SP9 or later For Technology Level 07: Apply SP6 or later For Technology Level 08: Apply APAR IZ43371 For Technology Level 09: Apply SP2 or later and APAR IZ42658 For Technology Level 10: Apply SP1 or later Technology Level 11 ^{#2} For Technology Level 12: Apply SP1 or later
AIX 5L V5.3 (Virtual I/O Server)	ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number)
AIX V6.1 ^{#1, #3}	If Technology Level is not installed: Apply SP1 or later and APAR IZ11722 For Technology Level 01: Apply APAR IZ42661 For Technology Level 02: Apply SP2 or later and APAR IZ42662 For Technology Level 03: Apply SP1 or later Technology Level 04 ^{#4} For Technology Level 05: Apply SP1 or later Technology Level 06
AIX V6.1 (Virtual I/O Server) ^{#3}	ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number)
AIX V7.1 ^{#1, #3}	No Technology Level

OS	Kernel
AIX V7.1 (Virtual I/O Server) ^{#3}	ioslevel 2.1.0.xx to 2.2.0.xx (where xx is a number)

#1

Every SP is applicable, unless otherwise specified.

#2

To set up a boot disk environment that uses Thunder 9500V series, Hitachi AMS/TMS/WMS series, or Hitachi SMS, use SP2 or a later service pack.

#3

An environment in which the Secure by Default functionality is enabled during installation of the OS is not supported.

#4

To set up a boot disk environment that uses a storage system of the Thunder 9500V series or the Hitachi AMS2000/AMS/WMS/SMS series, apply SP2 or a later service pack.

Prerequisite Programs for HDLM

Before you install HDLM, confirm that the required programs written below have been installed. For details about HTC_ODM and XP_ODM, contact the storage system vendor.

- VisualAge C++ Runtime 5.0.0.0 or later, IBM XL C/C++ V7 Runtime 7.0.0.0 to IBM XL C/C++ V8 Runtime 8.0.0.0 or 8.0.0.6 or later (8.0.0.1 to 8.0.0.5 are not supported), IBM XL C/C++ V9 Runtime 9.0.0.1 or later, or IBM XL C/C++ V10 Runtime 10.0.0.1 or later, or IBM XL C/C++ V11 Runtime 11.1.0.1 or later

Execute the following command, as applicable, to check the runtime version:

For AIX 5L V5.3:

```
# lslpp -L x1C.aix50.rte
```

For AIX V6.1

```
# lslpp -L x1C.aix61.rte
```

For AIX V7.1

```
# lslpp -L x1C.aix61.rte
```

■ HTC_ODM 5.0.52.1 or later

If you are using the following storage systems, use HTC_ODM 5.0.52.1 or later:

- Hitachi AMS2000/AMS/WMS/SMS series
- Hitachi USP (excluding the HP XP series)
- Lightning 9900V series (excluding the HP XP series)
- Thunder 9500V series
- Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000)
- Hitachi Virtual Storage Platform

Note:

When you install HTC_ODM in an HDLM environment where XP_ODM has already been installed, install HTC_ODM, and then re-install HDLM.

■ XP_ODM 5.0.52.1 or later

If you are using the following storage systems, use XP_ODM 5.0.52.1 or later:

- HP XP series
- P9500

Note:

When you install XP_ODM in an HDLM environment where HTC_ODM has already been installed, install XP_ODM, and then re-install HDLM.

■ JDK required for linkage with Global Link Manager

To link with Global Link Manager, make sure that JDK package 1.4.2 (32-bit version) or later, JDK package 5.0 (32-bit version) or later, or JDK package 6.0 (32-bit version) or later is already installed on the host. The JDK does not need to be installed if linkage with Global Link Manager is not used. When HDLM is installed in an environment in which the JDK has not been installed, the KAPL09241-W message is displayed. If linkage with Global Link Manager is not used, this message requires no action. Note that the display of the KAPL09241-W message does not affect HDLM operation.

3.1.2 Storage Systems Supported by HDLM

(1) Storage Systems

HDLM supports the following storage systems:

- Hitachi Universal Storage Platform V
- Hitachi Universal Storage Platform VM

- HP XP128/HP XP1024/HP XP10000/HP XP12000/HP XP20000/HP XP24000
- Thunder 9500V series
- Lightning 9900V series
- Hitachi AMS2000/AMS/WMS/SMS series
- Hitachi NSC55
- Hitachi Universal Storage Platform 100
- Hitachi Universal Storage Platform 600
- Hitachi Universal Storage Platform 1100
- Hitachi Virtual Storage Platform
- P9500
- SVS

The applicable storage systems require a dual controller configuration. If you use the system in a hub-connected environment, you must set unique loop IDs for all connected hosts and storage systems.

For details about microprograms, see the *HDLM Release Notes*.

(2) HBA

For applicable HBAs, see the *HDLM Release Notes*.

(3) When Handling Intermediate Volumes Managed by Hitachi RapidXchange

The HDLM-related programs that are required when you convert data with intermediate volumes managed by Hitachi RapidXchange are listed in *Table 3-2: HDLM-Related Programs Required When Handling Intermediate Volumes Managed by Hitachi RapidXchange*. For details about Hitachi RapidXchange, see the *Reference Manual / File Conversion Utility & File Access Library*.

Table 3-2: HDLM-Related Programs Required When Handling Intermediate Volumes Managed by Hitachi RapidXchange

OS	Related Programs
AIX 5L V5.3	File Access Library and File Conversion Utility (FAL/FCU) 01-03-56/20 or later
	File Access Library and File Conversion Utility (FAL/FCU) 01-04-64/21 or later

3.1.3 Cluster Software Supported by HDLM

The HDLM-related programs required when you combine cluster configurations are listed in *Table 3-3: HDLM-Related Programs When Combining Cluster Configurations*.

Table 3-3: HDLM-Related Programs When Combining Cluster Configurations

OS	Related Programs
AIX 5L V5.3	<ul style="list-style-type: none"> HACMP 5.4 IY84920 HACMP 5.4.1 PowerHA 5.5 PowerHA 6.1
	<ul style="list-style-type: none"> Oracle RAC 10g 10.1.0.5.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1} Oracle RAC 10g 10.2.0.2.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1}, or raw devices^{#1} Oracle RAC 10g 10.2.0.3.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1#2} When a logical volume is used: HACMP 5.4.1^{#1, #2} Oracle RAC 10g 10.2.0.4.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1} Oracle RAC 11g 11.1.0.6.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1}, or raw devices^{#1} Oracle RAC 11g 11.1.0.7.0 If the HDLM device is specified for direct access: ASM + raw devices^{#1}
	<ul style="list-style-type: none"> GPFS 3.2^{#3} GPFS 3.3^{#3#7}
	<ul style="list-style-type: none"> VCS 5.0^{#4} VCS 5.0.1^{#4} VCS 5.0.3^{#4, #6} VCS 5.1^{#4}

OS	Related Programs
AIX 5L V5.3 (Virtual I/O Server) ^{#5}	<ul style="list-style-type: none"> • HACMP 5.4 Client APAR: IY84920 Client: Technology Level 05 or later Server: ioslevel 1.5.1.1 to 1.5.2.1 • HACMP 5.4.1 Client: Technology Level 05 or later Server: ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number) • PowerHA 5.5 Client: Technology Level 07 or later Server: ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number) • PowerHA 6.1 Client: Technology Level 07 or later Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number)
AIX V6.1	<ul style="list-style-type: none"> • HACMP 5.4.1 • PowerHA 5.5 • PowerHA 6.1 • PowerHA 7.1
	<ul style="list-style-type: none"> • VCS 5.0.1^{#4} • VCS 5.0.3^{#4, #6} • VCS 5.1^{#4} • Oracle RAC 10g 10.2.0.4.0 If the HDLM device is specified for direct access: ASM + raw devices When a logical volume is used: HACMP 5.4.1^{#2} • Oracle RAC 11g 11.1.0.7.0 When a logical volume is used: HACMP 5.4.1^{#2} • Oracle RAC 11g 11.2.0.2.0 If the HDLM device is specified for direct access: ASM + raw devices
	<ul style="list-style-type: none"> • GPFS 3.2^{#3} • GPFS 3.3^{#3#7}

OS	Related Programs
AIX V6.1 (Virtual I/O Server) ^{#5}	<ul style="list-style-type: none"> HACMP 5.4.1 Client: Apply SP1 or later without using a Technology Level or with Technology Level 01 or later Server: ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number) PowerHA 5.5 Client: Technology Level 02 or later Server: ioslevel 1.5.1.1 to 2.2.0.xx (where xx is a number) PowerHA 6.1 Client: Technology Level 02 or later Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number) PowerHA 7.1 Client: Technology Level 06 or later Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number)
	<ul style="list-style-type: none"> VCS 5.1^{#4}
AIX V7.1	<ul style="list-style-type: none"> HACMP 5.4.1 PowerHA 5.5 PowerHA 6.1 PowerHA 7.1
AIX V7.1 (Virtual I/O Server) ^{#5}	<ul style="list-style-type: none"> HACMP 5.4.1 Client: No Technology Level Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number) PowerHA 5.5 Client: No Technology Level Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number) PowerHA 6.1 Client: No Technology Level Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number) PowerHA 7.1 Client: No Technology Level Server: ioslevel 2.1.0.0 to 2.2.0.xx (where xx is a number)

#1

When using Technology Level 05, apply IY92037.

#2

If you have updated the host environment by, for example, applying Oracle-specific patches, the Oracle I/O timeout threshold (MISSCOUNT) might have been changed. Therefore, when you update an environment, you need to review the MISSCOUNT value.

#3

Only the NSD (Network Shared Disk) configuration is supported. Set the

usePersistentReserve option to no in the GPFS cluster configuration information.

#4

VxVM is not supported.

#5

PowerVM Live Partition Mobility is supported only in an environment that uses the HDLM device as a virtual SCSI device. However, PowerVM Live Partition Mobility is not supported if the HDLM device used is an NPIV-based virtual HBA.

#6

Sometimes, if JFS2 is being used and a crash (`halt -q`) fails over a node, the resource to be mounted on the failover-destination node is not properly mounted. This problem occurs regardless of whether HDLM is installed.

#7

Apply fix pack 3.3.0.3 or later.

3.1.4 Memory and Disk Capacity Requirements

This subsection explains the memory and disk capacity requirements.

(1) Memory Requirements

Table 3-4: Memory Requirements for the Host shows the memory requirements for the host.

Table 3-4: Memory Requirements for the Host

OS	Required memory
AIX	$5000 \text{ KB} + 0.256 \text{ KB} \times \text{number-of-LUs} + 1.28 \text{ KB} \times \text{number-of-paths}$

(2) Disk Capacity Requirements

Table 3-5: Disk Capacity Requirements for the Host lists the disk capacity requirements for the host.

Table 3-5: Disk Capacity Requirements for the Host

Directory	Disk capacity requirement
/etc	150 KB
/opt	2 MB
/usr	220 MB

Directory	Disk capacity requirement
/var	$p \text{ MB}^{\#1} + 4\text{MB} + 2 \text{ MB} + q \text{ MB}^{\#2} + 19 \text{ MB} + 200 \text{ KB}^{\#3}$

#1

This value depends on the error log file settings. The maximum is 30,000 MB.

$$p = (s \times m) / 1024 \text{ (in MB)},$$

where:

s is the size of the error log file (units: KB, default is 9,900), and

m is the number of error log files (default is 2). The resulting fraction will be rounded up.

#2

This value depends on the trace file settings. The maximum is 1000 MB.

$$q = (t \times n) / 1024 \text{ (in MB)},$$

where:

t is the size of the trace file (units: KB, default is 1,000), and

n is the number of trace files (default is 4). The resulting fraction will be rounded up.

#3

This is the amount of unused capacity required to use the `installhdlm` utility. For details on this utility, see 7.12 *installhdlm Utility for Installing HDLM*.

3.1.5 Number of Paths Supported in HDLM

Table 3-6: Number of LUs and Paths Supported in HDLM lists the number of LUs, the number of paths for an individual LU, and the total number of paths supported in HDLM.

Table 3-6: Number of LUs and Paths Supported in HDLM

Item	Supported number
Number of LUs	1 to 4,096 ^{#1}
Number of paths available to connect to an LU	1 to 64 ^{#2}
Number of paths for a boot disk	1 to 4
Total number of paths	1 to 8,192

#1

The maximum number of LUs that can be recognized by a CHA port is 256.

#2

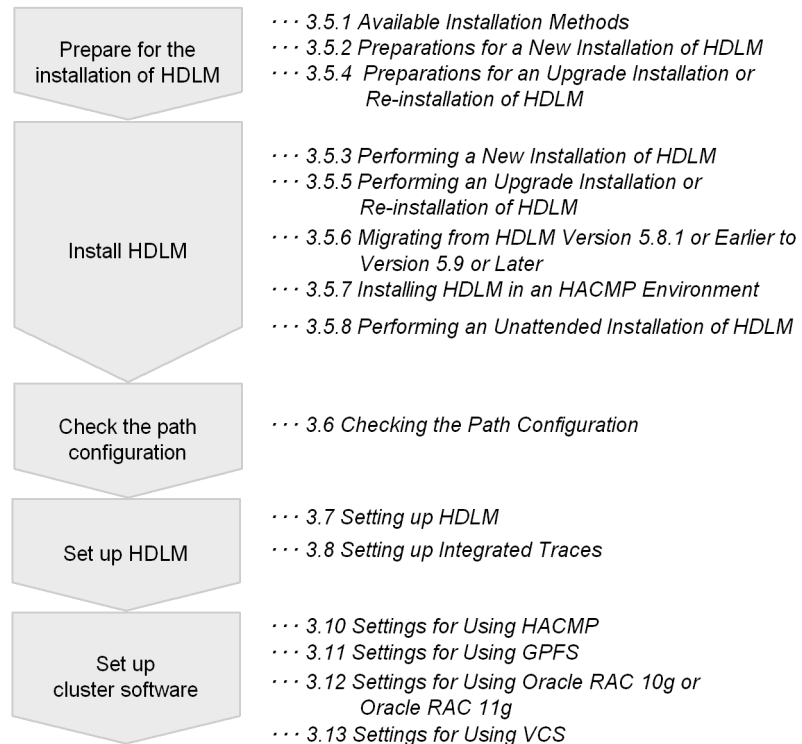
If the reservation policy is `PR_exclusive`, and the Thunder 9500V series, or Hitachi AMS2000/AMS/WMS/SMS series is used, the number of supported paths to an LU is 1 to 32.

For details on reservation policy, see *3.9 About the Reservation Policy*.

3.2 Flow for Creating an HDLM Environment

Set up the environment to use HDLM as follows.

Figure 3-1: Flow of HDLM Environment Setup



3.3 Types of HDLM Installation

This section describes the following HDLM installation types: new installation, upgrade installation, migration, and re-installation.

New installation of HDLM

Installing HDLM on a server where HDLM has not yet been installed is called a *new installation*.

Upgrade installation of HDLM

Installing a new version of HDLM over an already installed, earlier version of HDLM without first uninstalling the earlier version is called an *upgrade installation*.

You can perform an upgrade installation only for HDLM version 5.9 or later.

Migration of HDLM

Uninstalling HDLM version 5.8.1 or earlier, and then performing a new installation of HDLM 5.9 or later is called a *migration*. During a migration, you can inherit the earlier ODM settings and the HDLM functionality settings.

Migration is necessary because HDLM version 5.8.1 or earlier cannot be upgraded to HDLM version 5.9 or later. By performing the procedure described in *3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later*, you can inherit only the ODM settings and the HDLM functionality settings.

Re-installation of HDLM

Installing the same version of HDLM for repair purposes without uninstalling the existing instance of HDLM is called *re-installation* of HDLM.

3.4 Notes on Creating an HDLM Environment

This section provides notes on creating an HDLM environment.

For notes on operating HDLM, see *4.1 Notes on Using HDLM*.

3.4.1 Notes on Installing HDLM

- Install HDLM on the boot disk.
- To install HDLM, a license key is required. For more details, see the Notification of Software License Key provided with this package.
- Install HDLM in a multi-user mode environment.
- The HDLM-dedicated device files below are created when HDLM is installed. Do not use these device files.

`/dev/dlmdrv`

`/dev/rdlmdrvio`

`/dev/rdlmcldrv`

- HDLM version 5.9 or later cannot coexist with Auto-Path, Auto Path XP, Hitachi Path Manager, or HDLM version 5.8.1 or earlier. Before installing HDLM version 5.9 or later, you must uninstall any installed copies of these products. For details on migrating from HDLM version 5.8.1 or earlier, see *3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later*.
- When HDLM is installed, all devices shown under *Devices that HDLM can manage* in *2.1 Devices Managed by HDLM* are set to be targets for HDLM management.
- When installing HDLM on a host where version 5.0 or later of a Device Manager agent is installed, do not execute any of the following Device Manager agent commands during the installation:

`hbsasrv, HiScan, hdvmagt_account, hdvmagt_schedule, hldutil, TIC`

3.4.2 Notes on an Upgrade Installation or Re-installation of HDLM

When you upgrade or re-install HDLM, note the following:

- Information, such as the driver configuration, HDLM functionality settings, and log files will be inherited without being initialized when the upgrade installation or re-installation is complete. For details on the information to be inherited, see *Table 3-11: List of Files Inherited During an Upgrade Installation or*

Re-installation in 3.5.5 Performing an Upgrade Installation or Re-installation of HDLM.

- If you upgrade or re-install HDLM before you resolve a path failure, LU reservations might persist without being released. In such a case, use the utility for clearing HDLM persistent reservations (`dlmpr`) to release the LU reservation, if necessary.
- Performing an upgrade installation or re-installation might change the physical volume (hdisk name). For this reason, you must check and, if necessary, revise relevant settings, such as the settings for applications that directly access a hard disk recognized as an HDLM management-target device. Use the output information of the `view` operation (with the `-drv` parameter) to check the correspondence between the hdisk and the LU.

3.4.3 Notes on the Virtual I/O Server

- Before you install HDLM, change the `ioslevel` version of the virtual I/O server to a version supported by HDLM. For details about the `ioslevel` versions supported by HDLM, see 3.1.3 *Cluster Software Supported by HDLM*.
- If you want to apply a virtual SCSI disk to a client partition in a virtual I/O server environment, install HDLM into the virtual I/O server partition. If you want to apply a virtual HBA to a client partition, install HDLM into the client partition.
- Specify an hdisk, or a logical volume configured for HDLM, as the virtual target device. For details about how to configure a virtual target device, see the installation procedure in 3.5.3 *Performing a New Installation of HDLM* and 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*.
- To set up a virtual SCSI disk MPIO configuration in a client partition, or to use HACMP in a client partition, set the hdisk reservation policy in the virtual I/O server partition to `no_reserve`.
- If you want to use HDLM in a client partition to which a virtual HBA is applied by using the virtual I/O server NPIV functionality, set the NPIV option to `on`. If the option is not set to `on`, HDLM might not be able to recognize a path that goes through the virtual HBA.

To set the NPIV option, execute the `dlmodmset` utility. For details on this utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

If the HDLM device has already been configured, and NPIV option settings are changed, stop and restart the host. For a local boot disk environment, instead of stopping and restarting the host, you can also perform the following procedure:

1. Execute the `dlmrmddev` utility for deleting HDLM drivers to change the HDLM device status to `Defined`, or delete the HDLM driver.

For details on the `dlmrmddev` utility, see 7.11 *dlmrmddev Utility for Deleting*

HDLM Drivers.

2. Execute the following command to reconfigure the HDLM device:

```
# cfgmgr
```

When the NPIV option is set to *on*, *HBA adapter number* and *bus number* for *PathName*, which are output by HDLM command *view* operations, are changed to *adapter type* and *adapter number* respectively.

The *view* operation parameters for which the above changes are to be applied are as follows:

- *-path* parameter (displays path information)
- *-lu* parameter (displays LU information)
- *-hba* parameter (displays HBA port information)

For details on the *view* operations, see 6.7 *view (Displays Information)*.

3.4.4 Notes on a License Key

- A license key is required when performing any of the following types of installation:
 - Performing a new installation of HDLM.
 - Migrating from HDLM version 5.8.1 or earlier to version 5.9 or later.
 - Upgrading or re-installing HDLM after the valid license period has expired.
- To update the HDLM license, specify the *-lic* parameter in the HDLM command's *set* operation, and then execute this command. The license key type determines the expiration of the license key. For details about license key types and the *set* operation, see 6.6 *set (Sets Up the Operating Environment)*.

3.4.5 Notes on Trace Files

In HDLM 5.6 or later, trace files for versions of HDLM earlier than 5.6 are divided into integrated trace files and trace files. The logs for the HDLM command are output to integrated trace files. Trace information for an HDLM manager is output to trace files. The output destinations for the files are changed as follows:

When you migrate from HDLM 04-00 or earlier

Trace files before the migration: */opt/hitachi/HNTRLlib/spool/hntrn.log* (*n* indicates a file number)

Integrated trace files after the migration: */var/opt/hitachi/HNTRLlib2/spool/hntr2n.log* (*n* indicates a file number)

Trace files after the migration: */var/DynamicLinkManager/log/hdlmtrn.log* (*n* indicates a file number)

When you migrate from HDLM 05-00 or later

Trace files before the migration: `/var/opt/hitachi/HNTRLib2/spool/hntr2n.log` (*n* indicates a file number)

Integrated trace files after the migration: `/var/opt/hitachi/HNTRLib2/spool/hntr2n.log` (*n* indicates a file number)

Trace files after the migration: `/var/DynamicLinkManager/log/hdlmtrn.log` (*n* indicates a file number)

3.4.6 Notes on Storage Systems

- Do not change the vendor ID or product ID of a storage system. If you do, HDLM will not be able to recognize the storage system.
- Before you connect multiple storage systems to the same host, make sure that the storage systems have unique serial numbers. If there is a duplication of serial numbers, use a tool such as Disk Array Management Program to assign a unique serial number to each device.
- If you restart a storage system when using an hdisk that meets both of the following conditions, the persistent reservation of the LU registered in this volume group will be cancelled:
 - The `reserve_policy` attribute has been set to `PR_exclusive`.
 - The volume group has been activated.

Perform the procedure below to inactivate the volume group, and then re-activate it. Also, when you perform a planned restart of a storage system, make sure you perform the operation while the volume group is inactive.

1. Execute the following command to inactivate the volume group:


```
# varyoffvg volume-group-name
```
2. Execute the following command to make sure that the inactivated volume group is no longer displayed:


```
# lsvg -o
```
3. Execute the following command to activate the volume group:


```
# varyonvg volume-group-name
```

3.4.7 Notes on the Cluster

- When you use HDLM in a cluster configuration, you must install the same version of HDLM on all the nodes that comprise the cluster. If different versions of HDLM are installed, the cluster system may not operate correctly. If the HDLM Version and Service Pack Version, which are displayed by executing the following command, are the same, the versions of HDLM are the same:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
```

- When you use HACMP, GPFS, Oracle RAC 10g, Oracle RAC 11g, or VCS, settings such as script registration or the reservation policy setting are required. For details about the settings used for each cluster, see the following:

For HACMP: *3.10 Settings for Using HACMP*.

For GPFS: *3.11 Settings for Using GPFS*.

For Oracle RAC 10g or Oracle RAC 11g: *3.12 Settings for Using Oracle RAC 10g or Oracle RAC 11g*.

For VCS: *3.13 Settings for Using VCS*.

- If you are using HACMP, note that HDLM does not support non-concurrent volume groups due to limitations in HACMP. For details, contact IBM.
- If all of the following conditions are met, HDLM can be migrated without stopping HACMP services:
 - The shared volume groups used by HACMP are concurrent volume groups.
 - A custom disk method is specified in the HACMP script.
 - A virtual I/O server environment is not used on the host.

3.4.8 Notes on the Automatic Failback

If the automatic failback processing starts before a path failure has been recovered from, the cluster system switchover time might become longer. To prevent this, for the automatic failback checking interval, specify a value that is greater than the value obtained from the following formula:

checking-interval (minutes)

$= \text{maximum-number-of-paths-among-the-LUs} \times$
 $\text{number-of-connected-storage-devices}$

3.4.9 Notes on the queue_depth Parameter Value for an HDLM-Managed device

Hitachi recommends that you set the `queue_depth` parameter of an `hdisk` for an HDLM-managed device to a value greater than or equal to the number of paths that are connected to the `hdisk`. For details on how to specify the `queue_depth` parameter, see the AIX documentation.

3.5 Installing HDLM

When you install HDLM, Hitachi Network Objectplaza Trace Library will also be installed. The file path of the integrated trace information file of Hitachi Network Objectplaza Trace Library is `/var/opt/hitachi/HNTRLib2/spool/hntr2n.log`, where *n* is the number of the integrated trace information file.

3.5.1 Available Installation Methods

To install HDLM, use one of the following procedures:

■ Use `installux.sh`.

By using `installux.sh`, you can install HDLM from the DVD-ROM or the directory to which the contents of the DVD-ROM have been copied without needing to consider the location in which the files to be installed are stored. You can use the `installux.sh` command to perform the following installations:

- New installation
- Upgrade installation
- Re-installation
- Unattended installation

■ Use SMIT or the `installp` command.

You can also copy the contents of the HDLM DVD-ROM to a desired directory, and then perform installation from that directory.

Copy the following files from the installation DVD-ROM to the same directory:

- `DLManager.bff`
- `.toc`

To use SMIT, in *software-input-device/directory* specify the directory in which the contents of the DVD-ROM have been copied.

■ Unattended installation

An unattended installation enables a user to install HDLM without entering information. For details about how to perform an unattended installation of HDLM, see 3.5.8 *Performing an Unattended Installation of HDLM*.

■ Installation on alternate disks

By using the `alt_disk_copy` or `nim` command of AIX, you can replicate the running system (clone) on an alternate disk, and then perform an upgrade installation or re-installation of HDLM in AIX on the alternate disk. The `hdisk`

where the replication is created is called an alternate disk.

In addition to installing HDLM on a typical host, you can install it in the following environments:

- Boot disk
- You can install HDLM on a virtual I/O server.

A virtual I/O server is a system that enables multiple client logical partitions to share one resource.

- HACMP environments

HACMP is IBM's HA cluster software that runs on AIX.

(1) When Performing a New Installation, Upgrade Installation, or Re-installation of HDLM

Table 3-7: Combination of Available Installation Methods and Installation Environments lists the combinations of available installation methods and installation environments. *Table 3-8: Combination of Installation Methods that Are Available in an HACMP Environment and the Supported Installation Environments* lists the combinations of installation methods that are available in an HACMP environment versus the supported installation environments.

Table 3-7: Combination of Available Installation Methods and Installation Environments

Installation method	Installation environment			
	Host		Virtual I/O server	
	Local boot disk environment	Boot disk environment	Local boot disk environment	Boot disk environment
<code>installux.sh</code> or <code>installp</code> command	Yes	Yes	Yes	Yes
SMIT	Yes	Yes	Yes	Yes
Unattended installation	Yes	Yes	Yes	Yes
Installation on alternate disks	Yes [#]	Yes [#]	Yes [#]	Yes [#]

Legend:

Yes: Can be executed

No: Cannot be executed

#

Only upgrade installations and re-installations are supported.

Table 3-8: Combination of Installation Methods that Are Available in an HACMP Environment and the Supported Installation Environments

Installation method	Installation environment			
	Host		Virtual I/O server	
	Local boot disk environment	Boot disk environment	Local boot disk environment	Boot disk environment
<code>installux.sh</code> ^{#1} or <code>installp</code> command	Yes	Yes	Yes	Yes
SMIT	Yes	Yes	Yes	Yes
Unattended installation	No	No	No	No
Installation on alternate disks	Yes ^{#2}	Yes ^{#2}	Yes ^{#2}	Yes ^{#2}

Legend:

Yes: Can be executed

No: Cannot be executed

#1

Only new installations, upgrade installations, and re-installations are supported.

#2

Only upgrade installations and re-installations are supported.

The installation procedures are explained in this manual in the locations shown below.

`installux.sh` or `installp` command

3.5.3 Performing a New Installation of HDLM, 3.5.5 Performing an Upgrade Installation or Re-installation of HDLM, (1) Upgrading or Re-installing HDLM in an HACMP Environment (in a Local Boot Disk Environment) in 3.5.7 Installing HDLM in an HACMP Environment, and (2) Upgrading or Re-installing HDLM in an HACMP Environment (in a Boot Disk Environment) in 3.5.7 Installing HDLM in an HACMP Environment.

Unattended installation

3.5.8 Performing an Unattended Installation of HDLM

Installation on alternate disks

(3) *When Installing HDLM on Alternate Disks* in 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*

To use SMIT, see the AIX documentation.

(2) When Performing a Migration of HDLM

Table 3-9: Combination of Available Migration Methods and Migration Environments lists the combinations of available migration methods and target environments. *Table 3-10: Combinations of Migration Methods Available in an HACMP Environment and the Migration Environments* lists the combinations of migration methods that are available in an HACMP environment and the migration destinations.

Table 3-9: Combination of Available Migration Methods and Migration Environments

Migration method	Migration environment			
	Host		Virtual I/O server	
	Local boot disk environment	Boot disk environment	Local boot disk environment	Boot disk environment
<code>installlux.sh</code> [#] or <code>installp</code> command	Yes	N/A	Yes	N/A
SMIT	Yes	N/A	Yes	N/A
Unattended installation	No	N/A	No	N/A
Installation on alternate disks	No	No	No	No

Legend:

Yes: Can be executed

No: Cannot be executed

N/A: Not applicable

#

Only new installations, upgrade installations, and re-installations are supported.

Table 3-10: Combinations of Migration Methods Available in an HACMP Environment and the Migration Environments

Migration method	Migration environment			
	Host		Virtual I/O server	
	Local boot disk environment	Boot disk environment	Local boot disk environment #1	Boot disk environment
<code>installux.sh</code> ^{#2} or <code>installp</code> command	Yes	N/A	No	N/A
SMIT	Yes	N/A	No	N/A
Unattended installation	No	N/A	No	N/A
Installation on alternate disks	No	No	No	No

Legend:

Yes: Can be executed

No: Cannot be executed

N/A: Not applicable

#1

Before you migrate HDLM to an environment that uses HACMP and a virtual I/O server, cancel the virtual disk definitions of the virtual I/O server. After you have migrated HDLM, redefine these virtual disk definitions.

#2

Only new installations, upgrade installations, and re-installations are supported.

For details about how to migrate, see each location shown below.

`installux.sh` or `installp` command

3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later, and (3) Migrating HDLM in an HACMP Environment in 3.5.7 Installing HDLM in an HACMP Environment.

To use SMIT, see the AIX documentation.

3.5.2 Preparations for a New Installation of HDLM

In this subsection, you will perform such preparations as backing up the HDLM management-target devices, applying AIX patches, and performing hardware setup.

When using HDLM in a cluster configuration, make sure to perform the operations

described in the following sub-sections on all hosts that comprise the cluster.

(1) Perform Operations for HDLM Management-Target Devices

If you have already defined physical volumes and have been running the HDLM management-target devices, perform the following procedure:

1. Terminate the processes of all applications that are accessing the HDLM management-target devices.
2. If necessary, back up all HDLM management-target devices to a medium such as tape.
3. Unmount the disks.

If the HDLM management-target devices are mounted, unmount them as follows:

- First, execute the command below to check the current settings.

```
# mount -p
```

The current settings will be output as shown in *Figure 3-2: Execution Result Example of the Mount -p Command (Preparations for a New Installation of HDLM)*.

Figure 3-2: Execution Result Example of the Mount -p Command (Preparations for a New Installation of HDLM)

# mount -p	node	mounted	mounted over	vfs	date	options
		/dev/hd4	/	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/dev/hd2	/usr	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/dev/hd9var	/var	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/dev/hd3	/tmp	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/dev/hd1	/home	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/proc	/proc	procfs	mmmm dd hh:mm	rw
		/dev/hd10opt	/opt	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
		/dev/lv02	/mntpt	jfs	mmmm dd hh:mm	rw,log=/dev/loglv01
#						

The following example manages the device, which is shown in the shaded portion of *Figure 3-2: Execution Result Example of the Mount -p Command (Preparations for a New Installation of HDLM)*, by using HDLM.

- Execute the following command to unmount the disk.

```
# umount /mntpt
```

4. Execute the following command to inactivate the applicable volume group:

```
# varyoffvg volume-group-name
```

(2) Set Up the Hardware

Check the topology (Fabric, AL, etc.) and perform setup as appropriate.

1. Set up the storage system.

For details on how to set up the storage system, see the maintenance documentation for the storage system. If you are using HACMP, see also *3.10.1 Storage System Settings* of *3.10 Settings for Using HACMP*.

2. Set up the Fibre Channel switches.

For details on how to set up a Fibre Channel switch, see the documentation for the Fibre Channel switch. If you do not use Fibre Channel switches, this setup is not necessary.

3. Set up the HBA.

For details on how to set up an HBA, see the documentation for the HBA.

Make sure that all HBAs that are on a single host and connected to HDLM-managed disks are of the same type and have the same microprogram version. If you are using more than one type of HBA, paths will not be able to be switched when an error occurs. Set the SCSI target ID according to the HBA settings. For details on checking the target ID, see the HBA documentation.

4. Make sure the OS recognizes the LU.

Execute the `cfgmgr` command to configure the device, and then execute the `lsdev` command to make sure that the physical volume has been recognized as `hdisk`.

```
# cfgmgr
# lsdev -Cc disk
```

(3) Switch the Kernel Mode

Before installing HDLM, decide which kernel mode you will use to operate AIX, and change to the desired kernel mode if necessary.

The following shows how to switch the kernel mode.

1. Check the kernel mode currently being used.

Execute the following command.

```
# bootinfo -K
```

32 will be displayed when the 32-bit kernel is being used, and 64 will be displayed when the 64-bit kernel is being used.

2. Switch the kernel mode.

When AIX is running, change the symbolic link for `/usr/lib/boot/unix` and `/unix` to switch the current kernel mode to the desired mode.

- The path for the 64-bit kernel mode

`/usr/lib/boot/unix_64`

- The path for the 32-bit kernel mode

`/usr/lib/boot/unix_up` (for a uni-processor)

`/usr/lib/boot/unix_mp` (for a multi-processor)

3. Execute the `bosboot` command.

```
# bosboot -ad /dev/ipldevice
```

4. Restart the system.

```
# shutdown -Fr
```

5. Execute the following command to confirm that the kernel mode has been changed properly.

```
# bootinfo -K
```

(4) Set Up Cluster Software

To use HDLM in a cluster configuration, you need to perform the following setup for the cluster software.

To set up cluster software:

1. Install the cluster software on all of the hosts in the cluster.

For details on the installation, see the documentation of the corresponding cluster software.

2. Stop the cluster software services.

For details on how to stop the services, see the documentation of the corresponding cluster software.

3.5.3 Performing a New Installation of HDLM

(1) When Installing HDLM in a Local Boot Disk Environment

To perform a new installation of HDLM:

1. Log in to AIX as the root user.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

2. If there is no directory for mounting the DVD-ROM, make the directory.

```
# mkdir /cdrom
```

cdrom is the desired directory name. Hereafter, *cdrom* is used for purposes of explanation.

3. Mount the DVD-ROM.

```
# mount -r -v cdrfs /dev/cd0 /cdrom
```

The */dev/cd0* part depends on the system.

4. Execute the following command to check that the devices to be managed by HDLM have been recognized by the system:

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0  16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0  16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

In this example, *hdisk3* and *hdisk4* are recognized as devices to be managed by HDLM. If all devices to be managed by HDLM are recognized, proceed to step 5.

If any devices to be managed by HDLM are not recognized, proceed to step 7.

5. Execute the following utility to remove, from the running kernel, the HDLM management-target device:

```
# /cdrom/HDLM_AIX/hdlmtool/dlrmdev -f
```

The KAPL10529-I message is displayed.

If the KAPL10529-I message is not displayed, the HDLM management-target device has not been deleted. Make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the above utility.

6. Execute the following command to make sure that the hdisk recognized as the device to be managed by HDLM has been deleted:

```
# lsdev -Cc disk
```

7. Prepare the license key or license key file.

- When only the license key has been provided

Create the `/var/DLM` directory, and then, in this directory, create the license key file (`d1m.lic_key`). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
```

```
# echo "123456789ABCDEF" > /var/DLM/d1m.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

Note that the `hdlm_license` and `d1m.lic_key` files are deleted after installation finishes successfully.

8. Execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installux.sh
```

or

```
# installp -aXgd /directory-in-which-the-DVD-ROM-is-mounted/  
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installux.sh
```

or

```
# installp -aXgd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If the KAPL09172-E message is displayed, the hdisk for the device that is managed by HDLM still remains. Re-execute the procedure starting from step 5.

During installation, the KAPL09241-W message might be output. In this case,

installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

9. Execute the following command to make sure that the package is installed.

```
# lspp -la DLManager.mpio.rte
```

Make sure that the fileset item in the output listing contains `DLManager.mpio.rte`, and all the displayed statuses are `COMMITTED`.

If one or more of the displayed statuses are `BROKEN`, uninstall and then re-install HDLM.

10. Unmount the DVD-ROM.

```
# umount /cdrom
```

11. Delete the created mount directory.

```
# rm -r /cdrom
```

12. As required, execute the `dlmodmset` utility for setting the HDLM execution environment ODM.

For details, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

13. Execute the following command to configure the hdisk:

```
# cfgmgr
```

If the hosts and storage systems are connected by a Fibre Channel switch, perform steps 14 to 18. If the hosts and storage systems are not connected by a Fibre Channel switch, go to step 19.

14. Finish defining the parent device (`fscsin`).

```
# rmdev -l fscsin -R
```

Note that you can use the following command to check the parent device:

```
# lsdev -C -l hdisk-name -F 'parent'
```

15. Change the `fc_err_recov` setting of the parent device (`fscsin`) to `fast_fail`.

```
# chdev -l fscsin -a fc_err_recov=fast_fail
```

16. Verify that the settings for the parent device (`fscsin`) are enabled.
Also, verify that the `fc_err_recov` setting has been changed to `fast_fail`.

```
# lsattr -El fscsin
fc_err_recov fast_fail FC Fabric Event Error RECOVERY Policy
TRUE
```

17. Repeat steps 14 to 16 for each parent device (`fscsin`) being used.

18. Enable the defined parent device (`fscsin`).

```
# cfgmgr
```

19. Execute the `chdev` command, as required, to change the attributes of the `hdisk`:

```
# chdev -l hdisk-name -a queue_depth=8 -a rw_timeout=60
```

20. Execute one of the following commands, as required, to add `/usr/DynamicLinkManager/bin` to the `PATH` environment variable.

When using a Bourne shell or Korn shell:

```
# PATH=$PATH:/usr/DynamicLinkManager/bin
# export PATH
```

When using a C shell:

```
# set path=( $path /usr/DynamicLinkManager/bin )
```

To simplify command execution, you can temporarily add the `PATH` environment variable. To execute HDLM commands or the HDLM utility without setting the `PATH` environment variable, specify an absolute path to execute the commands.

21. Make sure that `hdisk`s are available:

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0  16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0  16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
```

```

hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...

```

Make sure that the status of all displayed hdisks is Available.

hdisks 0 to 2 are the physical device file names for the host's internal disks.

hdisk 3 and the following are the logical device file names that correspond to physical volumes in the storage system.

22. Execute the `dlmkmgr` command's `view` operation to check the status of each program:


```

# /usr/DynamicLinkManager/bin/dlmkmgr view -sys
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)         : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)         : 1000
Number Of Trace Files       : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver            WakeupTime
Alive      x.x.x-xx        yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver       WakeupTime      ElogMem Size
Alive      x.x.x-xx        yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver            WakeupTime
Alive      x.x.x-xx        yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss

```

Even if cluster software is used, the name of the cluster software is not displayed in Support Cluster. However, the cluster support function is operating normally.

23. From the execution result of the `view` operation, check that the correct version of HDLM is installed.

If HDLM Version is `x.x.x-xx`, the installed version of HDLM is correct.

x.x.x-xx is the installed version of HDLM.

24. From the execution result of the `view` operation, check that the programs are running properly.

If HDLM Manager, HDLM Alert Driver, and HDLM Driver are all Alive, all programs are running correctly.

If you are not using a virtual I/O server, go to step 28.

25. If you are using a virtual I/O server, define an `hdisk` as a virtual target device.

Execute the following command on the virtual I/O server:

When creating the `hdisk` as a virtual target device:

```
$ mkvdev -vdev hdisk-name -vadapter virtual-SCSI-server-adapter-name
```

When creating the logical volume as a virtual target device:

```
$ mkvdev -vdev logical-volume-name -vadapter  
virtual-SCSI-server-adapter-name
```

26. Execute the following command in the client logical partition to reconfigure the device:

```
# cfmgr
```

27. Execute the following command in the client logical partition to confirm that the physical volume has been recognized as `hdisk`.

If the following message is displayed, then the physical volume (`hdisk`) was recognized correctly:

```
# lsdev -Cc disk  
hdisk1 Available Virtual SCSI Disk Drive
```

28. Activate the volume group used by HDLM.

```
# varyonvg volume-group-name
```

29. Mount the file system used by HDLM.

```
# mount file-system-mount-point
```

30. Check the path configuration according to the procedure described in 3.6 *Checking the Path Configuration*.

(2) When Installing HDLM in a Boot Disk Environment

To perform a new installation of HDLM:

1. Use a single-path configuration for host and storage systems.
2. Log in to AIX as the root user.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

3. If there is no directory for mounting the DVD-ROM, make the directory.

```
# mkdir /cdrom
```

cdrom is the desired directory name. Hereafter, *cdrom* is used for purposes of explanation.

4. Mount the DVD-ROM.

```
# mount -r -v cdrfs /dev/cd0 /cdrom
```

The */dev/cd0* part depends on the system.

5. Execute the following command to check that the devices to be managed by HDLM have been recognized by the system:

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0  16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0  16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

In this example, *hdisk3* and *hdisk4* are recognized as devices to be managed by HDLM. If all devices to be managed by HDLM are recognized, proceed to step 6.

If any devices to be managed by HDLM are not recognized, proceed to step 8.

6. Execute the following utility to remove, from the running kernel, the HDLM management-target device:

```
# /cdrom/HDLM_AIX/hdlmtool/dlrmdev -f
```

The KAPL10529-I message is displayed.

If the KAPL10529-I message is not displayed, the HDLM management-target device has not been deleted. Make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the above utility.

Note that an hdisk recognized as a boot disk will not be deleted.

7. Execute the following command to make sure that the hdisks recognized as the devices to be managed by HDLM have been deleted:

```
# lsdev -Cc disk
```

8. Prepare the license key or license key file.

- When only the license key has been provided

Create the /var/DLM directory, and then, in this directory, create the license key file (d1m.lic_key). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
```

```
# echo "123456789ABCDEF" > /var/DLM/d1m.lic_key
```

- When the license key file has been provided

Store the license key file directly under the /var/tmp/ directory by using the hdlm_license name.

```
/var/tmp/hdlm_license
```

Note that the hdlm_license and d1m.lic_key files are deleted after installation finishes successfully.

9. Execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installux.sh
```

or

```
# installp -aXgd /directory-in-which-the-DVD-ROM-is-mounted/  
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installux.sh
```


or

```
# installp -aXgd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If the KAPL09172-E message is displayed, the hdisk for the device that is managed by HDLM still remains. Re-execute the procedure starting from step 6.

During installation, the KAPL09241-W message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

10. Execute the following command to make sure that the package is installed.

```
# lslpp -la DLManager.mpio.rte
```

Make sure that the fileset item in the output listing contains `DLManager.mpio.rte`, and all the displayed statuses are COMMITTED.

If one or more of the displayed statuses are BROKEN, uninstall and then re-install HDLM.

11. Unmount the DVD-ROM.

```
# umount /cdrom
```

12. Delete the created mount directory.

```
# rm -r /cdrom
```

13. Connect cables to all HBAs to change the configuration to a multi-path configuration.

Do not execute the `cfgmgr` command.

14. Execute the following command to restart the host:

```
# shutdown -Fr
```

15. Make sure that the boot disk is in a multi-path configuration:

```
# lspath -l hdisk10 -s available
Available hdisk10 fscsi0
Available hdisk10 fscsi1
...
```

The following procedure assumes that `hdisk10` is recognized as a boot disk:

16. Check the current boot disk list:

```
# bootlist -m normal -o
hdisk10 blv=hd5
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

17. Specify boot disks that are suitable for your host environment:

```
# bootlist -m normal hdisk10 hdisk0 hdisk1
```

18. Make sure that the number of configured boot disks is the same as the number of paths that you checked in step 15:

```
# bootlist -m normal -o
hdisk10 blv=hd5
hdisk10 blv=hd5
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

If the hosts and storage systems are connected by a Fibre Channel switch, perform steps 19 to 23. If the hosts and storage systems are not connected by a Fibre Channel switch, go to step 24.

19. Finish defining the parent device (`fscsin`).

```
# rmdev -l fscsin -R
```

Note that you can use the following command to check the parent device:

```
# lsdev -C -l hdisk-name -F 'parent'
```

20. Change the `fc_err_recov` setting of the parent device (`fscsin`) to `fast_fail`.

```
# chdev -l fscsin -a fc_err_recov=fast_fail
```

21. Verify that the settings for the parent device (*fscsin*) are enabled.

Also, verify that the *fc_err_recov* setting has been changed to *fast_fail*.

```
# lsattr -El fscsin
fc_err_recov fast_fail FC Fabric Event Error RECOVERY Policy
TRUE
```

22. Enable the defined parent device (*fscsin*).

```
# cfgmgr -l fscsin
```

23. Repeat steps 19 to 22 for each parent device (*fscsin*) being used.

24. Execute the *chdev* command, as required, to change the attributes of the *hdisk*:

```
# chdev -l hdisk-name -a queue_depth=8 -a rw_timeout=60
```

25. Execute one of the following commands, as required, to add */usr/DynamicLinkManager/bin* to the *PATH* environment variable.

When using a Bourne shell or Korn shell:

```
# PATH=$PATH:/usr/DynamicLinkManager/bin
# export PATH
```

When using a C shell:

```
# set path=( $path /usr/DynamicLinkManager/bin )
```

To simplify command execution, you can temporarily add the *PATH* environment variable. To execute HDLM commands or the HDLM utility without setting the *PATH* environment variable, specify an absolute path to execute the commands.

26. Make sure that *hdisk*s are available:

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0   16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0   16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

Make sure that the status of all displayed hdisks is Available.

hdisks 0 to 2 are the physical device file names for the host's internal disks.

hdisk 3 and the following are the logical device file names that correspond to physical volumes in the storage system.

After executing the `lspv` command, if there is no hdisk other than the one that constitutes `rootvg`, re-execute the procedure starting from step 14.

27. Execute the `dlnmgr` command's view operation to check the status of each program:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)          : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver            WakeupTime
Alive      x.x.x-xx         yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver        WakeupTime      ElogMem Size
Alive      x.x.x-xx         yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver              WakeupTime
Alive      x.x.x-xx         yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

Even if cluster software is used, the name of the cluster software is not displayed in Support Cluster. However, the cluster support function is operating normally.

28. From the execution result of the view operation, check that the correct version of HDLM is installed.

If HDLM Version is `x.x.x-xx`, the installed version of HDLM is correct.

x.x.x-xx is the installed version of HDLM.

29. From the execution result of the `view` operation, check that the programs are running properly.

If HDLM Manager, HDLM Alert Driver, and HDLM Driver are all Alive, all programs are running correctly.

If you are not using a virtual I/O server, go to step 33.

30. If you are using a virtual I/O server, define an `hdisk` as a virtual target device.

Execute the following command on the virtual I/O server:

When creating the `hdisk` as a virtual target device:

```
$ mkvdev -vdev hdisk-name -vadapter virtual-SCSI-server-adapter-name
```

When creating the logical volume as a virtual target device:

```
$ mkvdev -vdev logical-volume-name -vadapter  
virtual-SCSI-server-adapter-name
```

31. Execute the following command in the client logical partition to reconfigure the device:

```
# cfmgr
```

32. Execute the following command in the client logical partition to confirm that the physical volume has been recognized as `hdisk`.

If the following message is displayed, then the physical volume (`hdisk`) was recognized correctly:

```
# lsdev -Cc disk  
hdisk1 Available Virtual SCSI Disk Drive
```

33. Check the path configuration according to the procedure described in *3.6 Checking the Path Configuration*.

3.5.4 Preparations for an Upgrade Installation or Re-installation of HDLM

Make necessary preparations, such as backing up the HDLM management-target devices.

When using HDLM in a cluster configuration, make sure to perform the operations described in the following sub-sections on all hosts that comprise the cluster.

(1) Stop Applications

HDLM manager stops during an upgrade installation or re-installation, so stop any applications that require HDLM manager operations before you start the upgrade installation or re-installation.

(2) Perform Operations for HDLM Management-Target Device

1. Terminate the processes of all applications that are accessing the HDLM management-target devices.
2. If necessary, back up all HDLM management-target devices to a medium such as tape.
3. Unmount the disks.

If the HDLM management-target devices are mounted, unmount them as follows:

- First, execute the command below to check the current settings.

```
# mount -p
```

The current settings will be output as shown in *Figure 3-3: Example of Results from Executing the Mount -p Command (Preparations for an Upgrade Installation or Re-installation of HDLM)*.

Figure 3-3: Example of Results from Executing the Mount -p Command (Preparations for an Upgrade Installation or Re-installation of HDLM)

```
# mount -p
```

node	mounted	mounted over	vfs	date	options
	/dev/hd4	/	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/dev/hd2	/usr	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/dev/hd9var	/var	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/dev/hd3	/tmp	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/dev/hd1	/home	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/proc	/proc	procfs	mmmm dd hh:mm	rw
	/dev/hd10opt	/opt	jfs	mmmm dd hh:mm	rw,log=/dev/hd8
	/dev/lv02	/mntpt	jfs	mmmm dd hh:mm	rw,log=/dev/loglv01

```
#
```

This example uses HDLM to manage the devices that are shaded in *Figure 3-3: Example of Results from Executing the Mount -p Command (Preparations for an Upgrade Installation or Re-installation of HDLM)*.

- Execute the following command to unmount the disk.

```
# umount /mntpt
```

4. Execute the following command to inactivate the applicable volume group:

```
# varyoffvg volume-group-name
```

3.5.5 Performing an Upgrade Installation or Re-installation of HDLM

This subsection explains how to perform an upgrade installation from an earlier version, or how to re-install HDLM.

Because HDLM version 5.8.1 or earlier cannot be upgraded to HDLM version 5.9 or later, migration is necessary. For details about migration, see 3.5.6 *Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later*.

(1) When Installing HDLM in a Local Boot Disk Environment

1. Log in to AIX as a user with root permissions.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

2. Back up the HDLM settings.

If an upgrade installation or re-installation fails, AIX automatically uninstalls HDLM, and the HDLM settings are deleted.

Perform this step so that a copy of the HDLM settings is available in this case.

If an upgrade installation or re-installation fails, perform a new installation, and then re-execute setup to reflect the settings that have been backed up.

- Save the HDLM environment settings information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys >
any-file-name
```

Make sure that the license has not expired.

- Save the HDLM execution environment ODM settings.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o > any-file-name
```

Reconfigure the HDLM device. To automatically perform processes required for the reconfiguration, such as unmounting the file system and changing the volume group statuses, go to step 3. To manually perform these processes, go to step 4.

3. Execute the utility for removing HDLM devices (`dlmrmddev`) with the `-A` parameter specified.

To inherit the existing hdisk configuration, execute the `dlmrmddev` utility with the `-e` parameter specified. If you execute the `dlmrmddev` utility without the `-e` parameter specified, the existing HDLM device is deleted.

Note that if you want to inherit the existing hdisk configuration when the installed HDLM version is earlier than 6.2, use the `dlmrmddev` utility included in the installation DVD-ROM of the HDLM version to be installed.

When `dlmrmddev` is executed, a message is displayed asking you to continue processing. Enter `y` to continue processing.

To inherit the existing `hdisk` configuration when the version of the installed HDLM is earlier than 6.2:

```
# /directory-in-which-the-DVD-ROM-is-mounted/HDLM_AIX/hdlmtool/  
dlmrmddev -e -A  
KAPL10528-I The volume group will be made inactive, and the  
file system that is using HDLM will be unmounted. Is this OK?  
[y/n]:y  
KAPL10526-I An attempt to unmount the file system has  
succeeded. (file system = /mnt/fs01)  
KAPL10527-I An attempt to inactivate the volume group has  
succeeded. (volume group = vg01)  
hdisk7 Defined  
hdisk8 Defined  
hdisk9 Defined  
hdisk10 Defined  
KAPL10531-I The status of all of the HDLM drivers was changed  
to "Defined".
```

To inherit the existing `hdisk` configuration when the version of the installed HDLM is 6.2 or later:

```
# /usr/DynamicLinkManager/bin/dlmrmdev -e -A  
KAPL10528-I The volume group will be made inactive, and the  
file system that is using HDLM will be unmounted. Is this OK?  
[y/n]:y  
KAPL10526-I An attempt to unmount the file system has  
succeeded. (file system = /mnt/fs01)  
KAPL10527-I An attempt to inactivate the volume group has  
succeeded. (volume group = vg01)  
hdisk7 Defined  
hdisk8 Defined  
hdisk9 Defined  
hdisk10 Defined  
KAPL10531-I The status of all of the HDLM drivers was changed  
to "Defined".
```

To avoid inheriting the existing `hdisk` configuration:

```
# /usr/DynamicLinkManager/bin/dlmrmdev -A  
KAPL10528-I The volume group will be made inactive, and the  
file system that is using HDLM will be unmounted. Is this OK?  
[y/n]:y
```



```
hdisk7 deleted
hdisk8 deleted
hdisk9 deleted
hdisk10 deleted
KAPL09012-I All HDLM drivers were removed.
```

- When the existing hdisk configuration has been successfully inherited, the KAPL10531-I message is displayed.

If the KAPL10531-I message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then perform step 3 again.

- When an existing hdisk has been successfully deleted, the KAPL09012-I message is displayed.

If the KAPL09012-I message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then perform step 3 again.

After the `dlmrmdev` utility successfully finishes, go to step 8.

4. Execute the following command to unmount the file system used by HDLM.

```
# umount file-system-mount-point
```

5. Execute the following command to display all the activated volume groups.

```
# lsvg -o
```

6. Among the displayed volume groups, inactivate the volume groups used by HDLM.

```
# varyoffvg volume-group-name
```

7. Execute the `dlmrmdev` utility to change the status of the hdisks recognized as HDLM management-target devices by the active kernel, and then stop the HDLM manager.

To inherit the existing hdisk configuration, execute the `dlmrmdev` utility, with the `-e` parameter specified, that is included in the installation DVD-ROM of the HDLM version to be installed. If you execute the `dlmrmdev` utility without the `-e` parameter specified, the existing HDLM device is deleted.

/DVD-ROM-mounted-directory/HDLM_AIX/hdlmtool/dlrmdev

- Deleting an existing hdisk

When an existing hdisk is successfully deleted, the KAPL09012-I message is displayed. If the KAPL09012-I message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the procedure of step 7.

- Inheriting the existing hdisk configuration

When the existing hdisk configuration is successfully inherited, the KAPL10531-I message is displayed.

If the KAPL10531-I message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the procedure of step 7.

8. Execute the following command and verify the status of the hdisks recognized as HDLM-managed devices:

```
# lsdev -Cc disk
```

- If you attempted to delete an existing hdisk by executing the dlrmdev utility, verify that the hdisk has been deleted.
- If you attempted to inherit the existing hdisk configuration by executing the dlrmdev utility, verify that the status of the hdisks recognized as HDLM-managed devices is Defined.

```
hdisk0 Available 1S-08-00-8,0      16 Bit LVD SCSI Disk Drive
hdisk1 Available 1S-08-00-9,0      16 Bit LVD SCSI Disk Drive
hdisk2 Available 1S-08-00-10,0     16 Bit LVD SCSI Disk Drive
hdisk3 Defined 1H-08-02           Hitachi Disk Array (Fibre)
hdisk4 Defined 1H-08-02           Hitachi Disk Array (Fibre)
...
```

9. If the license has expired, prepare the license key or license key file.

If the license has not expired, proceed to step 10.

- When only the license key has been provided

Create the /var/DLM directory, and then, in this directory, create the license key file (d1m.lic_key). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
```

```
# echo "123456789ABCDEF" > /var/DLM/dlm.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

Note that the `hdlm_license` and `dlm.lic_key` files are deleted after installation finishes successfully.

10. Insert the HDLM DVD-ROM into the DVD-ROM drive.

If you install HDLM by using a directory to which the DVD-ROM is copied, you do not have to perform this step.

11. For an upgrade installation, execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installlux.sh
```

or

```
# installp -aXgd /directory-in-which-the-DVD-ROM-is-mounted/  
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installlux.sh
```

or

```
# installp -aXgd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If you execute the `dlmrmddev` utility without the `-e` parameter specified at step 3 or 7 and then the `KAPL09048-E` message is displayed, the `hdisk` for the device that is managed by HDLM still remains.

If you execute the `dlmrmddev` utility with the `-e` parameter specified at step 3 or 7 and then the `KAPL09048-E` message is displayed, the `hdisk` for the device that is managed by HDLM still remains, and its status is `Available`. Re-execute the procedure in step 3.

During installation, the `KAPL09241-W` message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the `KAPL09241-W` message if necessary.

12. For a re-installation, execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installlux.sh
```

or

```
# installp -aXfd /directory-in-which-the-DVD-ROM-is-mounted/  
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installlux.sh
```

or

```
# installp -aXfd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If you execute the `dlmrmdev` utility without the `-e` parameter specified at step 3 or 7 and then the KAPL09048-E message is displayed, the hdisk for the device that is managed by HDLM still remains.

If you execute the `dlmrmdev` utility with the `-e` parameter specified at step 3 or 7 and then the KAPL09048-E message is displayed, the hdisk for the device that is managed by HDLM still remains, and its status is Available. Re-execute the procedure in step 3.

During installation, the KAPL09241-W message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

13. Execute the following command to make sure that the package is installed.

```
# lsllp -la DLManager.mpio.rte
```

Make sure that the fileset item in the output listing contains `DLManager.mpio.rte`, and all the displayed statuses are COMMITTED.

If one or more of the displayed statuses are BROKEN, uninstall and then re-install HDLM.

14. Execute the following command to make sure that the hdisk.

```
# cfgmgr
```

15. Execute the following command and verify that the status of the hdisks is

Available:

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0  16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0  16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

Make sure that all the displayed HDLM-related devices are Available.

hdisk0 to 2 are the physical device file names of the host's internal disks.

hdisk3 and the following are the logical device file names that correspond to physical volumes in the storage system.

16. Activate the volume group used by HDLM.

```
# varyonvg volume-group-name
```

17. Mount the file system used by HDLM.

```
# mount file-system-mount-point
```

18. Execute the dlnkmgr command's view operation to check the status of each program:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version           : x.x.x-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 9900
Number Of Elog Files    : 2
Trace Level            : 0
Trace File Size (KB)   : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : on(60)
Intermittent Error Monitor : off
HDLM Manager Ver       WakeupTime
Alive                  x.x.x-xx  yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver  WakeupTime      ElogMem Size
```

3. Creating an HDLM Environment

```
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver      WakeupTime
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

Even when cluster software is being used, the name of the cluster software is not displayed in Support Cluster. However, the cluster support function is operating normally.

19. From the execution result of the `view` operation, check that the correct version of HDLM is installed.

If HDLM Version is `x.x.x-xx`, the installed version of HDLM is correct. `x.x.x-xx` is the installed version of HDLM.

20. From the execution result of the `view` operation, check that the programs are running properly.

If HDLM Manager, HDLM Alert Driver, and HDLM Driver are all Alive, all programs are running correctly.

If you are not using a virtual I/O server, the upgrade installation or re-installation of HDLM is complete.

For details about the files to be inherited after the upgrade installation or re-installation of HDLM, see *Table 3-11: List of Files Inherited During an Upgrade Installation or Re-installation*.

21. If you are using a virtual I/O server, define an `hdisk` as a virtual target device.

Execute the following command on the virtual I/O server:

When creating an `hdisk` as a virtual target device:

```
$ mkvdev -vdev hdisk-name -vadapter virtual-SCSI-server-adapter-name
```

When creating a logical device as a virtual target device:

```
$ mkvdev -vdev logical-volume-name -vadapter
virtual-SCSI-server-adapter-name
```

22. Execute the following command in the client logical partition to reconfigure the device:

```
# cfmgr
```

23. Execute the following command in the client logical partition to confirm that the physical volume has been recognized as hdisk.

If the following message is displayed, then the physical volume (hdisk) was recognized correctly.

```
# lsdev -Cc disk
```

```
hdisk1 Available Virtual SCSI Disk Drive
```

Table 3-11: List of Files Inherited During an Upgrade Installation or Re-installation lists and describes the files that are inherited during an upgrade installation or re-installation of HDLM.

Table 3-11: List of Files Inherited During an Upgrade Installation or Re-installation

File	Description
/usr/DynamicLinkManager/config/dlmmgr.xml	File for setting up HDLM functionality
/var/DynamicLinkManager/log/dlmmgr[1-16].log	Log files of HDLM Manager
/var/DynamicLinkManager/log/dlminquiry[1-2].log	Log files of HDLM Inquiry information
/usr/DynamicLinkManager/config/dlmwebagent.properties	Hitachi Command Suite Common Agent Component settings file
/var/DynamicLinkManager/log/hdlmtr[1-64].log	Trace files
/var/DynamicLinkManager/log/dlmconfig[1-2].log	Configuration log file
/var/DynamicLinkManager/log/mmap/hdlmtr.mm	Trace management file
/var/DynamicLinkManager/log/dlmwebagent[1-16].log	Hitachi Command Suite Common Agent Component log files
/var/DynamicLinkManager/log/dlmutil[1-2].log	HDLM utility's log file
/var/DynamicLinkManager/log/mmap/dlmutil.mm	HDLM utility's log trace management file
/var/DynamicLinkManager/log/installhdlm.log	Unattended installation execution log

(2) When Installing HDLM in a Boot Disk Environment

1. Log in to AIX as a user with root permissions.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

2. Back up the HDLM settings.

If an upgrade installation or re-installation fails, AIX automatically uninstalls HDLM, and the HDLM settings are deleted.

Perform this step so that a copy of the HDLM settings is available in this case.

If an upgrade installation or re-installation fails, perform a new installation, and then re-execute setup to reflect the settings that have been backed up.

- Save the HDLM environment settings information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys >
any-file-name
```

Make sure that the license has not expired.

- Save the HDLM execution environment ODM settings.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o > any-file-name
```

3. Execute the following command to unmount the file system used by HDLM.

```
# umount file-system-mount-point
```

4. Execute the following command to display all the activated volume groups.

```
# lsvg -o
```

5. Among the displayed volume groups, inactivate the volume groups used by HDLM.

```
# varyoffvg volume-group-name
```

6. Execute the utility indicated below to change the status of the hdisks recognized as HDLM management-target devices by the active kernel, and then stop the HDLM manager.

To inherit the existing hdisk configuration, execute the `dlmrmdev` utility with the `-e` parameter specified.

If you are using HDLM version 6.2 or earlier and you want to inherit the existing

hdisk configuration, use the `dlmrmdev` utility that is included in the installation DVD-ROM of the HDLM version to be installed.

/DVD-ROM-mounted-directory/HDLM_AIX/hdlmtool/dlmrmdev

- Deleting an existing hdisk

When an existing hdisk is successfully deleted, the `KAPL09012-I` message is displayed.

If the `KAPL09012-I` message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the procedure of step 6. The hdisk of the boot disk cannot be deleted.

- Inheriting the existing hdisk configuration

When the existing hdisk configuration is successfully inherited, the `KAPL10531-I` message is displayed.

If the `KAPL10531-I` message is not displayed, make sure that no processes, services, file systems, or volume groups are using any HDLM management-target paths, and then re-execute the procedure in step 6. The status of the boot disk's hdisk cannot be changed.

7. Execute the following command and verify the status of the hdisks recognized as HDLM-managed devices:

```
# lsdev -Cc disk
```

- If you attempted to delete an existing hdisk by executing the `dlmrmdev` utility, verify that the hdisk has been deleted.
- If you attempted to inherit the existing hdisk configuration by executing the `dlmrmdev` utility with the `-e` parameter specified, verify that the status of the hdisks is `Defined`.

```
hdisk0 Available 1S-08-00-8,0      16 Bit LVD SCSI Disk Drive
hdisk1 Available 1S-08-00-9,0      16 Bit LVD SCSI Disk Drive
hdisk2 Available 1S-08-00-10,0     16 Bit LVD SCSI Disk Drive
hdisk3 Defined 1H-08-02           Hitachi Disk Array (Fibre)
hdisk4 Defined 1H-08-02           Hitachi Disk Array (Fibre)
...
```

8. If the license has expired, prepare the license key or license key file.
If the license has not expired, proceed to step 9.

- When only the license key has been provided

Create the `/var/DLM` directory, and then, in this directory, create the license key file (`dml.lic_key`). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
# echo "123456789ABCDEF" > /var/DLM/dml.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

Note that the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

9. Insert the HDLM DVD-ROM into the DVD-ROM drive.

If you install HDLM by using a directory to which the DVD-ROM is copied, you do not have to perform this step.

10. For an upgrade installation, execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installux.sh
```

or

```
# installp -aXgd /directory-in-which-the-DVD-ROM-is-mounted/
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installux.sh
```

or

```
# installp -aXgd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If you execute the `dmlrmdev` utility without the `-e` parameter specified at step 6 and then the `KAPL09172-E` message is displayed, the `hdisk` for the device that is managed by HDLM still remains.

If you execute the `dmlrmdev` utility with the `-e` parameter specified at step 6 and then the `KAPL09172-E` message is displayed, the `hdisk` for the device that is managed by HDLM still remains, and its status is `Available`. Re-execute the

procedure in step 6.

If an upgrade installation ends with an error, HDLM might be uninstalled. In this case, proceed to step 13.

During installation, the KAPL09241-W message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

11. For a re-installation, execute the following command:

- When installing HDLM from the DVD-ROM

```
# /directory-in-which-the-DVD-ROM-is-mounted/installlux.sh
```

or

```
# installp -aXfd /directory-in-which-the-DVD-ROM-is-mounted/  
HDLM_AIX all
```

- When installing HDLM from the directory to which the DVD-ROM was copied

```
# /directory-copied-from-DVD-ROM/installlux.sh
```

or

```
# installp -aXfd /directory-copied-from-DVD-ROM/HDLM_AIX all
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

If you execute the `dlmrmdev` utility without the `-e` parameter specified at step 6 and then the KAPL09172-E message is displayed, the `hdisk` for the device that is managed by HDLM still remains.

If you execute the `dlmrmdev` utility with the `-e` parameter specified at step 6 and then the KAPL09172-E message is displayed, the `hdisk` for the device that is managed by HDLM still remains, and its status is `Available`. Re-execute the procedure in step 6.

If re-installation ends with an error, HDLM might be uninstalled. In this case, proceed to step 13.

During installation, the KAPL09241-W message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

12. Execute the following command to make sure that the package is installed.

```
# lsllpp -la DLManager.mpio.rte
```

Make sure that the fileset item in the output listing contains `DLManager.mpio.rte`, and all the displayed statuses are `COMMITTED`.

If one or more of the displayed statuses are `BROKEN`, uninstall HDLM, and then proceed to step 13 to perform a new installation of HDLM.

13. If HDLM was not upgraded or re-installed properly, perform a new installation of HDLM.

- When the boot disk is in a single-path configuration

Execute the following command to restart the host, and then perform the procedure in (2) *Perform Operations for HDLM Management-Target Device*:

```
# shutdown -Fr
```

- When the boot disk is in a multi-path configuration

Execute the following command to shut down the host, and then perform the procedure in (2) *Perform Operations for HDLM Management-Target Device*:

```
# shutdown -F
```

After performing a new installation of HDLM, set up HDLM again based on the HDLM settings backed up in step 2.

14. Execute the following command to restart the host:

```
# shutdown -Fr
```

15. Execute the following command to make sure that the `hdisk` driver has been installed in the active kernel and is enabled:

```
# lsdev -Cc disk
hdisk0 enabled 1S-08-00-8,0 16-bit LVD SCSI disk drive
hdisk1 enabled 1S-08-00-9,0 16-bit LVD SCSI disk drive
hdisk2 enabled 1S-08-00-10,0 16-bit LVD SCSI disk drive
hdisk3 enabled 1H-08-02 Hitachi Disk Array (Fibre)
hdisk4 enabled 1H-08-02 Hitachi Disk Array (Fibre)
...
```

Make sure that all the displayed HDLM-related devices are enabled.

`hdisk0` through `hdisk2` are the names of the physical device files for internal disks on the host.

The files beginning at `hdisk3` are the names of the logical device files corresponding to the storage system's physical volumes.

After executing the `lspv` command, if there is no `hdisk` other than the one that constitutes `rootvg`, re-execute the procedure starting from step 14.

16. Execute the `dlnkmgr` command's `view` operation to check the status of each program:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(rr)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)          : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size (KB)         : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver             WakeupTime
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver        WakeupTime      ElogMem Size
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver              WakeupTime
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

Even when cluster software is being used, the name of the cluster software is not displayed in `Support Cluster`. However, the cluster support function is operating normally.

17. From the execution result of the `view` operation, check that the correct version of HDLM is installed.

If `HDLM Version` is `x.x.x-xx`, the installed version of HDLM is correct. `x.x.x-xx` is the installed version of HDLM.

If the `KAPL01012-E` message is displayed, the HDLM device has not been configured. Re-execute the procedure starting from step 14.

18. From the execution result of the `view` operation, check that the programs are

running properly.

If HDLM Manager, HDLM Alert Driver, and HDLM Driver are all Alive, all programs are running correctly.

If you are not using a virtual I/O server, the upgrade installation or re-installation of HDLM is complete.

For details about the files to be inherited after the upgrade installation or re-installation of HDLM, see *Table 3-12: List of Files Inherited During an Upgrade Installation or Re-installation*.

19. If you are using a virtual I/O server, define an hdisk as a virtual target device.

Execute the following command on the virtual I/O server:

When creating an hdisk as a virtual target device:

```
$ mkvdev -vdev hdisk-name -vadapter virtual-SCSI-server-adapter-name
```

When creating a logical device as a virtual target device:

```
$ mkvdev -vdev logical-volume-name -vadapter  
virtual-SCSI-server-adapter-name
```

20. Execute the following command in the client logical partition to reconfigure the device:

```
# cfmgr
```

21. Execute the following command in the client logical partition to confirm that the physical volume has been recognized as hdisk.

If the following message is displayed, then the physical volume (hdisk) was recognized correctly:

```
# lsdev -Cc disk
```

```
hdisk1 Available Virtual SCSI Disk Drive
```

Table 3-12: List of Files Inherited During an Upgrade Installation or Re-installation lists and describes the files inherited during an upgrade installation or re-installation of HDLM.

Table 3-12: List of Files Inherited During an Upgrade Installation or Re-installation

File	Description
/usr/DynamicLinkManager/config/dlmmgr.xml	File for setting up HDLM functionality
/var/DynamicLinkManager/log/dlmmgr[1-16].log	Log files of HDLM Manager
/var/DynamicLinkManager/log/dlminquiry[1-2].log	Log files of HDLM Inquiry information
/usr/DynamicLinkManager/config/dlmwebagent.properties	Hitachi Command Suite Common Agent Component settings file
/var/DynamicLinkManager/log/hdlmtr[1-64].log	Trace files
/var/DynamicLinkManager/log/dlmconfig[1-2].log	Configuration log file
/var/DynamicLinkManager/log/mmap/hdlmtr.mm	Trace management file
/var/DynamicLinkManager/log/dlmwebagent[1-16].log	Hitachi Command Suite Common Agent Component log files
/var/DynamicLinkManager/log/dlmutil[1-2].log	HDLM utility's log file
/var/DynamicLinkManager/log/mmap/dlmutil.mm	HDLM utility's log trace management file
/var/DynamicLinkManager/log/installhdlm.log	Unattended installation execution log

(3) When Installing HDLM on Alternate Disks

Perform the procedure below if you want to install HDLM on an alternate disk in a local boot disk environment or a boot disk environment. Only upgrade installations and re-installations are supported when installing HDLM on alternate disks.

1. Log in to AIX as a user with root permissions.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

2. If the license has expired, prepare the license key or license key file.

If the license has not expired, proceed to step 3.

- When only the license key has been provided

Create the /var/DLM directory, and then, in this directory, create the license

key file (`dml.lic_key`). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
# echo "123456789ABCDEF" > /var/DLM/dml.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

Note that the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

3. Insert the DVD-ROM into the DVD-ROM drive.

You do not need to mount the DVD-ROM. If you install HDLM by using a directory to which the DVD-ROM is copied or if you use the `nim` command, you do not have to perform this step.

4. For an upgrade installation, execute the following command:

- When installing HDLM on an alternate disk from the DVD-ROM

```
# alt_disk_copy -d hdisk-name hdisk-name ... -w
DLManager.mpio.rte -l /
directory-in-which-the-DVD-ROM-is-mounted/HDLM_AIX
```

- When installing HDLM onto an alternate disk from the directory to which the DVD-ROM was copied

```
# alt_disk_copy -d hdisk-name hdisk-name ... -w
DLManager.mpio.rte -l /directory-copied-from-DVD-ROM/
HDLM_AIX
```

- When installing HDLM on an alternate disk on a NIM client from a NIM server by using the `nim` command

A NIM server is a machine that manages the installation or upgrade installation of software via a network. A NIM client is a machine whose software installation status is managed by a NIM server.

```
# nim -o alt_disk_install -a source=rootvg -a
disk=hdisk-name hdisk-name ... -a
filesets=DLManager.mpio.rte -a
installp_bundle=NIM-resource-including-HDLM NIM-client
```

For details about the `alt_disk_copy` and `nim` commands, see the manual for AIX.

5. For a re-installation, execute the following command:

- When installing HDLM on an alternate disk from the DVD-ROM

```
# alt_disk_copy -d hdisk-name hdisk-name ... -I aXF -w
DLManager.mpio.rte -l /
directory-in-which-the-DVD-ROM-is-mounted/HDLM_AIX
```

- When installing HDLM onto an alternate disk from the directory to which the DVD-ROM was copied

```
# alt_disk_copy -d hdisk-name hdisk-name ... -I aXF -w
DLManager.mpio.rte -l /directory-copied-from-DVD-ROM/
HDLM_AIX
```

- When installing HDLM on an alternate disk on a NIM client from a NIM server by using the `nim` command

A NIM server is a machine that manages the installation or upgrade installation of software via a network. A NIM client is a machine whose software installation status is managed by a NIM server.

```
# nim -o alt_disk_install -a source=rootvg -a
disk=hdisk-name hdisk-name ... -a
filesets=DLManager.mpio.rte -a
installp_bundle=NIM-resource-including-HDLM -a
installp_flags=aXF NIM-client
```

For details about the `alt_disk_copy` and `nim` commands, see the manual for AIX.

6. When the system is rebooted from the alternate disk, execute the HDLM command's `view` operation to display the status of each program.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version                : xx.x.x-xx
Service Pack Version        :
Load Balance                 : on(rr)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)          : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver             WakeupTime
Alive      xx.x.x-xx         yyyy/mm/dd hh:mm:ss
```

3. Creating an HDLM Environment

```

HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver      WakeupTime
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent  -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss

```

Even when cluster software is being used, the name of the cluster software is not displayed in Support Cluster. However, the cluster support function is operating normally.

7. From the execution result of the `view` operation, check that the correct version of HDLM is installed.

If HDLM Version is `x.x.x-xx`, the installed version of HDLM is correct. `x.x.x-xx` is the installed version of HDLM.

8. From the execution result of the `view` operation, check that the programs are running properly.

If HDLM Manager, HDLM Alert Driver, and HDLM Driver are all Alive, all programs are running correctly.

If you are not using a virtual I/O server, the upgrade installation of HDLM is complete.

For details about the files to be inherited after the upgrade installation of HDLM, see *Table 3-13: List of Files Inherited During an Upgrade Installation or Re-installation*.

Table 3-13: List of Files Inherited During an Upgrade Installation or Re-installation

File	Description
<code>/usr/DynamicLinkManager/config/dlmmgr.xml</code>	File for setting up HDLM functionality
<code>/var/DynamicLinkManager/log/dlmmgr[1-16].log</code>	Log files of HDLM Manager
<code>/var/DynamicLinkManager/log/dlminquiry[1-2].log</code>	Log files of HDLM Inquiry information
<code>/usr/DynamicLinkManager/config/dlmwebagent.properties</code>	Hitachi Command Suite Common Agent Component settings file

File	Description
/var/DynamicLinkManager/log/hdlmtr[1-64].log	Trace files
/var/DynamicLinkManager/log/dlmconfig[1-2].log	Configuration log file
/var/DynamicLinkManager/log/mmap/hdlmtr.mm	Trace management file
/var/DynamicLinkManager/log/dlmwebagent[1-16].log	Hitachi Command Suite Common Agent Component log files
/var/DynamicLinkManager/log/dlmutil[1-2].log	HDLM utility's log file
/var/DynamicLinkManager/log/mmap/dlmutil.mm	HDLM utility's log trace management file
/var/DynamicLinkManager/log/installhdlm.log	Unattended installation execution log

3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later

When HDLM version 5.8.1 or earlier is migrated to HDLM version 5.9 or later, the logical device file that can be controlled by the HDLM driver changes from the HDLM device (`dlmfdrvn`) to `hdisk`. If the user application uses an LU managed by HDLM, modify the user application appropriately.

To migrate to HDLM version 5.9 or later:

1. Log in to AIX as a user with root permissions.
 - If you are using a virtual I/O server, see the virtual I/O server documentation for details about how to log in to AIX.
 - If you are not using a virtual I/O server, proceed to step 10.
2. Check the virtual SCSI disk recognition method being used.

Execute the `dlmodmset` utility for setting the HDLM execution environment ODM in order to check the `unique_id` value:

The following shows an example of executing this utility when HDLM 5.6.3 has been installed:

```
# dlmodmset -o
Inquiry Log           : on
Inquiry Log File Size : 1000
hdisk error check flag : on
HDLM pbuf count       : 16384
Lun Reset              : off
```

3. Creating an HDLM Environment

```
unique_id          : off
HDLM Subclass      : node
KAPL10800-I The dlmodmset utility completed normally.
#
```

If the `unique_id` value is on, the `unique_id` method is being used. If it is off, the PVID method is being used. If the `unique_id` method is being used, proceed to step 8.

3. Execute the following command to activate the volume group that is using the virtual SCSI disk of the HDLM management-target hdisk:

```
# varyonvg volume-group-name
```

4. Execute the following command to mount the file system (under control of the volume group) in the client logical partition:

```
# mount file-system-mount-point
```

5. Execute the following command to back up the volume group in the client logical partition:

```
# savevg -i -f any-file-name-or-device-volume-name volume-group-name
```

6. Execute the following command to unmount the file system in the client logical partition:

```
# umount file-system-mount-point
```

7. Execute the following command to delete the volume group in the client logical partition:

```
# reducevg -df volume-group-name hdisk-name
```

8. Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdisk-name
```

9. Execute the following command to delete the virtual target device in the virtual I/

O server:

```
$ rmdev -dev vtscsin
```

10. Insert the DVD-ROM.

11. If there is no directory for mounting the DVD-ROM, make the directory.

```
# mkdir /cdrom
```

cdrom is the desired directory name. Hereafter, *cdrom* is used for purposes of explanation.

12. Mount the DVD-ROM.

```
# mount -r -v cdrfs /dev/cd0 /cdrom
```

The */dev/cd0* part depends on the system.

13. Back up the HDLM settings.

To check whether the HDLM settings information has been properly inherited after migration, save the HDLM settings information into separate files.

- Save the HDLM environment settings information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys >
any-file-name
```

- Save the HDLM execution environment ODM settings.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o > any-file-name
```

14. Back up the HDLM settings.

Execute the *dlmmigsts* utility, for assisting HDLM migrations, to save the HDLM environment settings and the HDLM execution environment ODM settings. For details about this utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

```
# /cdrom/HDLM_AIX/hdlmtool/dlmmigsts -b -odm /tmp/
any-desired-directory/odm-environment-settings-file-name -set /tmp/
any-desired-directory/set-environment-settings-file-name
```

Also, back up the information for the applications you are using, if necessary.

15. Uninstall HDLM.

See the HDLM manual for the version you are going to uninstall.

Because HDLM version 5.9 or later requires deletion of `hdisk`, do not attempt to perform device configuration (`cfgmgr` command) before performing step 17.

16. Perform a new installation of HDLM version 5.9 or later.

Perform steps 4 to 9 of (1) *When Installing HDLM in a Local Boot Disk Environment* in 3.5.3 *Performing a New Installation of HDLM*. Note that you do not have to perform steps 2 to 3.

17. Execute the `dlmmigsts` utility to restore the HDLM environment settings information and the HDLM execution environment ODM settings that you saved in step 14.

```
# /cdrom/HDLM_AIX/hdlmtool/dlmmigsts -r -odm /tmp/  
any-desired-directory/odm-environment-settings-file-name -set /tmp/  
any-desired-directory/set-environment-settings-file-name
```

For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

18. Execute the following command to reconfigure the device:

```
# cfgmgr
```

19. Make sure that the HDLM settings information has been properly inherited.

- Make sure that the HDLM environment settings information has been properly inherited.

Execute the following command, and then compare the current HDLM environment settings information with the settings information saved in step 13:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
```

- Make sure that the HDLM execution environment ODM settings information has been properly inherited.

Execute the following command, and then compare the current HDLM execution environment ODM settings information with the settings information saved in step 13:

```
# /usr/DynamicLinkManager/bin/dlmodmset -o
```

If the HDLM settings information has been properly inherited, skip to step 21.

20. If the HDLM settings information has not been properly inherited, execute the following command:

```
# /usr/DynamicLinkManager/bin/dlrmdev
```

Check the file names for *odm-environment-settings-file-name* and *set-environment-setting-file-name*, and then perform this procedure again from step 17, specifying the correct file names in the command.

21. Delete the *odm* environment settings file and the *set* environment settings file.

```
# rm -r /tmp/  
any-desired-directory-that-stores-odm-environment-settings-file  
# rm -r /tmp/any-desired-directory-that-stores-set-environment-setting-file
```

22. Perform the procedure described in (1) *When Installing HDLM in a Local Boot Disk Environment* in 3.5.3 *Performing a New Installation of HDLM*, starting from step 14.

23. If you performed step 5, restore the volume group you backed up.

```
# restvg -f any-desired-file-name-or-device-name hdisk-name
```

24. Check the path configuration according to the steps described in 3.6 *Checking the Path Configuration*.

25. Unmount the DVD-ROM.

```
# umount /cdrom
```

26. Delete any mount directory you may have created in step 11.

```
# rm -r /cdrom
```

3.5.7 Installing HDLM in an HACMP Environment

This subsection explains how to install HDLM when you are running HACMP services.

(1) Upgrading or Re-installing HDLM in an HACMP Environment (in a Local Boot Disk Environment)

Because HDLM version 5.8.1 or earlier cannot be upgraded to HDLM version 5.9 or later, migration is necessary. For details about migration, see (3) *Migrating HDLM in an HACMP Environment*.

For details about setting up HACMP, see the HACMP documentation.

To upgrade or re-install HDLM in an environment that uses HACMP and a local boot disk:

1. Log in to AIX as the root user.
If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.
2. Stop HACMP on the standby host.
3. Upgrade or re-install HDLM on the standby host.
To do so, perform steps 2 through 23 in *(1) When Installing HDLM in a Local Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM* on the standby host.
4. Start HACMP on the standby host.
5. Stop HACMP on the active host.
Specify takeover as the shutdown mode.
6. Upgrade or re-install HDLM on the active host.
To do so, perform steps 2 through 23 in *(1) When Installing HDLM in a Local Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM* on the active host.
7. Start HACMP on the active host.

(2) Upgrading or Re-installing HDLM in an HACMP Environment (in a Boot Disk Environment)

For details about setting up HACMP, see the HACMP documentation.

To upgrade or re-install HDLM in an environment that uses HACMP and a boot disk:

1. Log in to AIX as the root user.
If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.
2. Stop HACMP on the standby host.
3. Upgrade or re-install HDLM on the standby host.
To do so, perform steps 2 through 21 in *(2) When Installing HDLM in a Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM* on the standby host.
4. Start HACMP on the standby host.
5. Stop HACMP on the active host.
Specify takeover as the shutdown mode.

6. Upgrade or re-install HDLM on the active host.

To do so, perform steps 2 through 21 in (2) *When Installing HDLM in a Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM* on the active host.

7. Start HACMP on the active host.

(3) Migrating HDLM in an HACMP Environment

When HDLM version 5.8.1 or earlier is migrated to HDLM version 5.9 or later, the logical device file that can be controlled by the HDLM driver changes from the HDLM device (`dlnmfdrvn`) to `hdisk`. If the user application uses an LU managed by HDLM, modify the user application appropriately.

In a virtual I/O server environment, you cannot migrate HDLM when you are running HACMP services.

The following procedure explains how to migrate HDLM in an HACMP environment. This procedure explains how to migrate HDLM when you are using HACMP 5.4. For details about how to use HACMP, see the HACMP documentation along with this manual.

To migrate HDLM in an HACMP environment:

1. Log in to AIX as the root user.
2. If disk heartbeats are set, delete the disk heartbeat settings (because you need to change the disk name from `dlnmfdrvn` to `hdisk`).

For details, see the HACMP documentation.

3. Stop HACMP on the standby host.
4. Migrate HDLM on the standby host.

To do so, perform steps 10 to 26 in 3.5.6 *Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later* on the standby host.

5. Start HACMP on the standby host.

When HACMP starts, a warning message may be output, stating that the custom disk method file (`/usr/DynamicLinkManager/cluster/dlm_hacmp_gdisk_check`) does not exist. This message can be ignored because it does not affect any operations.

The following is an example of such a message:

```
WARNING: Custom disk method: ghostdisks's file:
/usr/DynamicLinkManager/cluster/dlm_hacmp_gdisk_check does
not exist or is not executable on node: xxx#
```

#

Name of the node being used.

6. Stop HACMP on the active host.

Specify takeover as the shutdown mode.

7. Migrate HDLM on the active host.

To do so, perform steps 10 to 26 in *3.5.6 Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later* on the active host.

8. Start HACMP on the active host.

When HACMP starts, a warning message may be output, stating that the custom disk method file (`/usr/DynamicLinkManager/cluster/dlm_hacmp_gdisk_check`) does not exist. This message can be ignored because it does not affect any operations.

The following is an example of such a message:

```
WARNING: Custom disk method: ghostdisks's file:
/usr/DynamicLinkManager/cluster/dlm_hacmp_gdisk_check does
not exist or is not executable on node: xxx#
```

#

Name of the node being used.

If this warning message is output, proceed to step 9. If it is not output, proceed to step 12.

9. While HACMP is running, delete the custom disk method defined in 5.8.1 or earlier, or in 5.9 or later.

10. Add an HDLM custom disk method.

11. Synchronize the cluster resources.

12. Delete the custom disk method.

To do so, perform the procedure described in *3.14.5 Canceling Cluster Software (HACMP) Settings* on the active host.

13. Configure a custom disk method.

To do so, perform the procedure described in *3.10.2 Registering the HDLM Script for HACMP* on the active host.

14. If you deleted the disk heartbeat settings in step 2, re-configure the disk heartbeats.

For details, see the HACMP documentation.

3.5.8 Performing an Unattended Installation of HDLM

This subsection explains how to install HDLM using the `installhdlm` utility. The unused capacity required to execute the `installhdlm` utility is as follows:

- `/tmp` directory
100 KB
- Any log output directory that can be specified by users (the default directory is `/var/tmp`)
200 KB

(1) When Installing HDLM in a Local Boot Disk Environment

To install HDLM in a local boot disk environment:

1. Log in to AIX as the root user.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

2. Insert the DVD-ROM.

If you are installing HDLM from a directory in which files on the DVD-ROM are copied, make sure that the file organization has not been changed. If the file organization has changed, the `installhdlm` utility might not function correctly:

```
# mkdir /cdrom
# mount -r -v cdrfs /dev/cd0 /cdrom
# mkdir /tmp/hdlm
# cp -rp /cdrom/HDLM_AIX /tmp/hdlm/
# cp -p /cdrom/installlux.sh /tmp/hdlm/
```

If you copied the files on the DVD-ROM to your desired directory, proceed to step 5.

3. If there is no directory for mounting the DVD-ROM, make the directory.

```
# mkdir /cdrom
```

`cdrom` is the desired directory name. Hereafter, `cdrom` is used for purposes of explanation.

4. Mount the DVD-ROM.

```
# mount -r -v cdrfs /dev/cd0 /cdrom
```

The `/dev/cd0` part depends on the system.

5. If you are using a copy of the `installhdlm` utility that you have placed in a separate directory to install HDLM, make sure you copy the necessary files from the `/cdrom/HDLM_AIX/hdlmtool/instutil` directory.

The necessary files to be copied from the `/cdrom/HDLM_AIX/hdlmtool/instutil` directory are shown below:

- `installhdlm`
- `installhdlm_analysis`
- `dlmrmddev`

Also, these files need to be copied to the same directory to which the `installhdlm` utility is copied.

For a new installation, proceed to step 7.

6. If you are upgrading or re-installing HDLM, back up the HDLM settings.

If an upgrade installation or re-installation fails, AIX automatically uninstalls HDLM, and the HDLM settings are deleted.

Perform this step so that a copy of the HDLM settings is available in this case.

If an upgrade installation or re-installation fails, perform a new installation, and then re-execute setup to reflect the settings that have been backed up.

- Save the HDLM environment settings information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys > any-file-name
```

Make sure that the license has not expired.
- Save the HDLM execution environment ODM settings.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o > any-file-name
```

7. In the following cases, prepare the license key or the license key file:

- If you are installing HDLM for the first time
- If you are upgrading or re-installing HDLM after the licensing term has expired

If the directory that contains the license key or the license key file is specified in the installation information settings file, you can use any storage directory name and file name.

The following shows examples of when the default storage directory specified in the installation information settings file is to be used:

- When only the license key has been provided

Create the `/var/DLM` directory, and then, in this directory, create the license key file (`dml.lic_key`). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
# echo "123456789ABCDEF" > /var/DLM/dml.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

The license key file or license key is not deleted after the installation.

8. Create an installation information settings file.

To use the sample file, copy it from the DVD-ROM to a directory on the hard disk.

```
# cp -p /cdrom/HDLM_AIX/hdlmtool/instutil/
sample_installhdlm.conf /any-directory
```

You can change the `sample_installhdlm.conf` file name.

The following shows an example of copying the `sample_installhdlm.conf` file, and then changing the file name to `install_set.conf`:

```
# cp -p /cdrom/HDLM_AIX/hdlmtool/instutil/
sample_installhdlm.conf /any-directory/install_set.conf
```

For details about how to edit the installation information settings file, which is used by the `installhdlm` utility, see *7.12.3 Items To Be Defined in an installation-information Settings File*.

9. Execute either of the following commands:

To execute `installux.sh`:

```
# /cdrom/installux.sh -f /any-directory/
installation-information-settings-file
```

To execute `installhdlm`:

```
# /cdrom/HDLM_AIX/hdlmtool/instutil/installhdlm -f /  
any-directory/installation-information-settings-file
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host. When installation is successful, the KAPL09211-I message is output.

During installation, the KAPL09241-W message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the KAPL09241-W message if necessary.

For an upgrade installation or re-installation of HDLM, the configuration of the existing hdisks recognized as HDLM management-target devices is inherited.

10. Unmount the DVD-ROM.

```
# umount /cdrom
```

11. Delete the created mount directory.

```
# rm -r /cdrom
```

12. Delete the installation information settings file.

```
# rm -r /directory-containing-the-installation-information-settings-file
```

13. Perform the procedure appropriate for the installation type.

If you are performing a new installation, perform steps 14 to the end of the procedure described in (1) *When Installing HDLM in a Local Boot Disk Environment* of 3.5.3 *Performing a New Installation of HDLM*.

If you are performing an upgrade installation or a re-installation, perform steps 15 to the end of the procedure described in (1) *When Installing HDLM in a Local Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*.

(2) When Installing HDLM in a Boot Disk Environment

To install HDLM in a boot disk environment:

1. Use a single-path configuration for host and storage systems.

2. Log in to AIX as the root user.

If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.

3. Insert the DVD-ROM.

If you are installing HDLM from a directory in which files on the DVD-ROM are copied, make sure that the file organization has not been changed. If the file organization has changed, the `installhdlm` utility might not function correctly:

```
# mkdir /cdrom
# mount -r -v cdrfs /dev/cd0 /cdrom
# mkdir /tmp/hdlm
# cp -rp /cdrom/HDLM_AIX /tmp/hdlm/
# cp -p /cdrom/installux.sh /tmp/hdlm/
```

If you copied the files on the DVD-ROM to your desired directory, proceed to step 6.

4. If there is no directory for mounting the DVD-ROM, make the directory.

```
# mkdir /cdrom
```

cdrom is the desired directory name. Hereafter, *cdrom* is used for purposes of explanation.

5. Mount the DVD-ROM.

```
# mount -r -v cdrfs /dev/cd0 /cdrom
```

The `/dev/cd0` part depends on the system.

6. If you are using a copy of the `installhdlm` utility that you have placed in a separate directory to install HDLM, make sure you copy the necessary files from the `/cdrom/HDLM_AIX/hdlmtool/instutil` directory.

The necessary files to be copied from the `/cdrom/HDLM_AIX/hdlmtool/instutil` directory are shown below:

- `installhdlm`
- `installhdlm_analysis`
- `dlrmdev`

Also, these files need to be copied to the same directory to which the `installhdlm` utility is copied.

For a new installation, proceed to step 8.

7. If you are upgrading or re-installing HDLM, back up the HDLM settings.

If an upgrade installation or re-installation fails, AIX automatically uninstalls HDLM, and the HDLM settings are deleted.

Perform this step so that a copy of the HDLM settings is available in this case.

If an upgrade installation or re-installation fails, perform a new installation, and then re-execute setup to reflect the settings that have been backed up.

- Save the HDLM environment settings information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys >
any-file-name
```

Make sure that the license has not expired.

- Save the HDLM execution environment ODM settings.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o > any-file-name
```

8. In the following cases, prepare the license key or the license key file:

- If you are installing HDLM for the first time
- If you are upgrading or re-installing HDLM after the licensing term has expired

If the directory that contains the license key or the license key file is specified in the installation information settings file, you can use any storage directory name and file name.

The following shows examples of when the default storage directory specified in the installation information settings file is to be used:

- When only the license key has been provided

Create the `/var/DLM` directory, and then, in this directory, create the license key file (`dml.lic_key`). The following shows an example when the license key is 123456789ABCDEF:

```
# mkdir /var/DLM
# echo "123456789ABCDEF" > /var/DLM/dml.lic_key
```

- When the license key file has been provided

Store the license key file directly under the `/var/tmp/` directory by using the `hdlm_license` name.

```
/var/tmp/hdlm_license
```

The license key file or license key is not deleted after the installation.

9. Create an installation information settings file.

To use the sample file, copy it from the DVD-ROM to a directory on the hard disk.

```
# cp -p /cdrom/HDLM_AIX/hdlmtool/instutil/
sample_installhdlm.conf /any-directory
```

You can change the `sample_installhdlm.conf` file name.

The following shows an example of copying the `sample_installhdlm.conf` file, and then changing the file name to `install_set.conf`:

```
# cp -p /cdrom/HDLM_AIX/hdlmtool/instutil/
sample_installhdlm.conf /any-directory/install_set.conf
```

For details about how to edit the installation information settings file, which is used by the `installhdlm` utility, see 7.12.3 *Items To Be Defined in an installation-information Settings File*.

Additionally, since HDLM must be restarted after installation, change the setting for the `restart` key in the installation information settings file from `n` to `y`.[#]

#

After you have performed an unattended installation, you can also manually restart HDLM.

If you plan to manually restart HDLM, you do not need to change the setting for the `restart` key in the installation information settings file from `n` to `y`.

However, in that case, this procedure must be modified as described below:

- The host does not restart after the `KAPL09211-I` message is output (step 11).
- Before you perform step 13, execute the following command to restart the host:

```
# shutdown -Fr
```

10. Connect cables to all HBAs to change the configuration to a multi-path configuration.

Do not execute the `cfgmgr` command.

11. Execute either of the following commands:

To execute `installux.sh`:

```
# /cdrom/installux.sh -f /any-directory/  
installation-information-settings-file
```

To execute `installhdlm`:

```
# /cdrom/HDLM_AIX/hdlmtool/instutil/installhdlm -f /  
any-directory/installation-information-settings-file
```

Even though a message asking you to restart the host is displayed during installation, you do not have to restart the host.

During installation, the `KAPL09241-W` message might be output. In this case, installation of HDLM continues, but installation of HDLM components has failed. After installing HDLM, resolve the problem according to the `KAPL09241-W` message if necessary.

When installation is successful, the `KAPL09211-I` message is output and the host restarts. After the host has restarted, check to make sure that the settings have been updated as specified in the installation information settings file.

Note that, if the upgrade installation or re-installation ends in an error, HDLM may no longer be installed at all. In this case, proceed to step 12.

If unattended installation ends normally, proceed to step 13.

12. If HDLM was not upgraded or re-installed properly, perform a new installation of HDLM.

- When the boot disk is in a single-path configuration

Execute the following command to restart the host, and then perform the new installation procedure from step 2:

```
# shutdown -Fr
```

- When the boot disk is in a multi-path configuration

Execute the following command to shut down the host, and then perform the new installation procedure from step 1:

```
# shutdown -F
```

After performing a new installation of HDLM, set up HDLM again based on the HDLM settings backed up in step 7.

13. Unmount the DVD-ROM.

```
# umount /cdrom
```

14. Delete the created mount directory.

```
# rm -r /cdrom
```

15. Delete the installation information settings file.

```
# rm -r /directory-containing-the-installation-information-settings-file
```

16. Perform the procedure appropriate for the installation type.

If you are performing a new installation, perform steps 15 to the end of the procedure described in (2) *When Installing HDLM in a Boot Disk Environment* of 3.5.3 *Performing a New Installation of HDLM*.

If you are performing an upgrade installation or a re-installation, perform steps 15 to the end of the procedure described in (2) *When Installing HDLM in a Boot Disk Environment* of 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*.

3.6 Checking the Path Configuration

HDLM functions, such as load balancing and failover, are only available for HDLM management-target *devices* that have more than one active path. After you install HDLM or change the hardware configuration, check the structure and statuses of the paths.

To check the path information, use the `dlkmgr` command's `view` operation.

The following describes how to check path information by using the `dlkmgr` command's `view` operation. For details about the `view` operation, see 6.7 *view (Displays Information)*.

Specify the `-path` parameter and check the output information:

Execute the following command:

```
# /usr/DynamicLinkManager/bin/dlkmgr view -path >
redirect-destination-file-1
```

Open *redirect-destination-file-1* and check the following:

- Make sure that an LU accessed by a path exists.

A path can be identified with `PathName`. The LU that is accessed by a path can be identified with a combination of `DskName` and `iLU`.

- Make sure that all paths are online.

Make sure that `PathStatus` is `Online`. If there is a path whose status is not online, `Reduced` will be displayed.

- Make sure that the combinations of the CHA port (`ChaPort`), through which paths access the same LU, and the HBA port (the HBA adapter number and bus number or the adapter type and adapter number displayed in the `PathName` column) are different.

The digits displayed on the left of `PathName` indicate an HBA adapter number or adapter type. The numbers displayed between the period to the right of the HBA adapter number and the next period indicate a bus number or adapter number.

- Make sure that different HBA adapter numbers and bus numbers (or different adapter types and adapter numbers) exist for the number of the physical HBA ports.

To make sure that the OS and HDLM recognize the same HDLM management-target device:

1. Execute the following command:

```
# lsdev -Cc disk > redirect-destination-file-2
```

2. Open both *redirect-destination-file-1* and *redirect-destination-file-2*.
3. Make sure that all hdisk name displayed in the HDevName column in *redirect-destination-file-1* are the same with hdisk name displayed on the Hitachi Disk Array (Fibre) row in *redirect-destination-file-2*.

3.7 Setting up HDLM

HDLM includes functions like the load balancing function, the automatic failback function, the error logging function, the audit logging function, etc. You can set up these functions by using the `dlnmgr` command's `set` operation. The following subsections describe these setup methods.

3.7.1 Checking the Current Settings

This chapter describes how to check the HDLM function settings before any changes are made by using the `dlnmgr` command's `view` operation.

Check the current settings by executing the following command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys -sfunc
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size(KB)           : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To check the current audit log settings, execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys -audlog
Audit Log                    : off
Audit Log Category           : -
Audit Log Facility           : -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

3.7.2 Setting Up the HDLM Functions

The recommended and default values for each HDLM function is are shown below in *Table 3-14: The Recommended and Default Values of Each Function*.

Table 3-14: The Recommended and Default Values of Each Function

Function	Default value	Recommended value
Load-balancing	on The Extended Least I/Os algorithm is used.	on The recommended algorithm depends on the operating environment.
Path health checking	on 30-minute check interval	on The recommended checking interval depends on the operating environment.
Automatic failback	on 60-minute check interval	The recommended checking interval depends on the operating environment.
Intermittent Error Monitor	off	on The recommended checking interval depends on the operating environment.
Remove LU	(Not specifiable)	(Not specifiable)
Logging level	3: Collects all the error information for the "Information" level or higher	3: Collects all the error information for the "Information" level or higher
Trace level	0: Do not output trace files	0: Do not output trace files
File size for the Error log	9900 (KB)	9900 (KB)
Number of files for the Error logs	2	2
File size for trace information	1000 (KB)	1000 (KB)
Number of files for trace information	4	4
Collection of audit log data	off	Set on, if you want to collect audit log data.
Audit log facility	user	local0 to local7

(1) Setting Up Load Balancing

You can select whether to enable load balancing.

The following is an example command to set load-balancing.

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -lb on -lbtype exlio
```

Set it to `on` to enable load balancing. Otherwise, set it to `off`. When you set `on`, specify one of the following algorithm values after the `-lbtype` option:

- `rr` for the Round Robin algorithm
- `exrr` for the Extended Round Robin algorithm
- `lio` for the Least I/Os algorithm
- `exlio` for the Extended Least I/Os algorithm
- `lbk` for the Least Blocks. algorithm
- `exlbk` for the Extended Least Blocks algorithm

The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even if, you disable the load balancing function by specifying `-lb off`. If you decide to re-enable load balancing at a later time, and you do not specify an algorithm, load balancing will still be executed by using the algorithm that was previously specified.

(2) Setting Up Path Health Checking

You can choose whether you want to use path health checking.

The following is an example of how to set up path health checking by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -pchk on -intvl 10
```

When path health checking is enabled by specifying `on` for the `-pchk` parameter, you can also specify the `-intvl` parameter, in order to specify the *checking* interval. If the *checking* interval is not specified, then the previously specified value will be automatically applied. For example, if you turn off path health checking after the *checking* interval was specified as 15 minutes, and then you enable path health checking again (but without specifying a *checking* interval) the 15 value that was specified from before will be used again.

(3) Setting Up the Automatic Failback Function

When intermittent error monitoring is enabled and the number of error occurrences is 2 or more, the following condition must be satisfied.

error-monitoring-interval \geq *checking-interval-for-automatic-failbacks* \times
number-of-times-an-error-is-to-occur-during-intermittent-error-monitoring

If this condition is not satisfied, an error will occur and the warning message KAPL01080-W will be output.

If this happens, change any of the following settings: the checking interval for automatic failbacks, the intermittent error-monitoring interval, or the number of times that the error needs to occur.

If you set the number of times that the error needs to occur to 1, the above condition does not need to be satisfied.

The following is an example of setting up automatic failback by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -afb on -intvl 10
```

To enable the automatic failback function, set it to `on`. The *checking* interval can be specified by the `-intvl` parameter. The previously specified value will be applied when a *checking* interval is not specified. For example, if you turn off the automatic failback function after the *checking* interval was specified as 5 minutes, and then you turn it back on (but without specifying a *checking* interval) the 5 minutes that were specified from before will be used again.

(4) Setting Up Intermittent Error Monitoring

Intermittent error monitoring is specifiable only when the automatic failback function is enabled. To prevent an intermittent error from reducing I/O performance, we recommend that you monitor intermittent errors when automatic failback is enabled.

When intermittent error monitoring is enabled, you can specify intermittent error conditions. The default value for the intermittent error-monitoring interval is 210. The default value for the number of error occurrences is 3.

The system assumes that an intermittent error has occurred if the specified number of times that the error needs to occur is reached during the specified monitoring interval. A path that is assumed to have an intermittent error is excluded from performing an automatic failback. Intermittent error monitoring starts right when the path is recovered from the error by performing an automatic failback. Monitoring is performed on each, individual path.

When a value of 2 or more is specified for the number of times an error needs to occur, make sure that the condition shown in (3) *Setting Up the Automatic Failback Function* is satisfied.

To determine whether a path is invalid for an automatic failback, you can use the results of the `dlnkmgr` command's `view` operation.

The following is an example of setting up intermittent error monitoring by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -iem on -intvl 20
-iemnum 2
```

`on` specifies that intermittent error monitoring is to be used. To disable intermittent error monitoring, specify `off`. When you set this parameter to `on`, you can specify intermittent error conditions by using the `-intvl` and `-iemnum` parameters. Specify the monitoring interval for an intermittent error in the `-intvl` parameter, and the number of times that the error needs to occur in the `-iemnum` parameter. When these parameters are omitted, the default values of 210 and 3 are used, respectively.

(5) Setting the Error Log Collection Level

The error log (the HDLM manager log (`dlnmgrn.log` (n indicates a file number from 1 to 16)) collection level can be set.

Table 3-15: Values for the Error Log Collection Level Setting lists and describes values for the error log collection level setting.

Table 3-15: Values for the Error Log Collection Level Setting

Value	Description
0	No error logs are collected.
1	All information for errors of the "Error" level or higher is collected.
2	All information for errors of the "Warning" level or higher is collected.
3	All information for errors of the "Information" level or higher is collected.
4	All information for errors of the "Information" level or higher (including maintenance information) is collected.

If an error occurs, you might have to set the error log collection level to 1 or higher to collect any log information.

The higher this value is set, the more information that will be output. As the amount of log information to be output increases, it will take less time to overwrite the old error log information with the new information.

The following is an example of setting up the error log collection level by using a command:

```
# /usr/DynamicLinkManager/bin/dlnmgr set -ellv 2
```

Specify the error log collection level as a number.

(6) Setting the Trace Level

The trace output level can be set.

You can set up the trace level for a trace file `hdlmgrn.log` (n indicates a file number from 1 to 64).

Table 3-16: Values for the Trace Level Setting lists and describes the possible values for the trace level setting.

Table 3-16: Values for the Trace Level Setting

Value	Description
0	No trace is output.
1	Only error information is output.
2	Program operation summaries are output.
3	Program operation details are output.
4	All information is output.

If an error occurs, you may have to set the trace level to 1 or higher to collect any trace information.

The higher this value is set, the more information that will be output. As the amount of trace information to be output increases, it will take less time to overwrite the old trace information with the new information.

For normal operation, we recommend that you set the trace level to 0. If you set the trace level to a value higher than necessary, HDLM performance might decrease, or trace information required to analyze the cause of an error might be overwritten.

The following is an example of setting up the trace level by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -systflv 1
```

Specify the trace level in as a number.

(7) Setting the Error Log File Size

The error log file size (the HDLM manager log (`dlnmgrn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value (in kilobytes) from 100 to 2000000 for the error log file size. The specified value is applied for HDLM manager logs.

When an error log file reaches the specified size, the information in the old error log file is replaced with new information, beginning with the oldest file. By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30 GB) of error logs in total.

The following shows an example of executing the command to set the error log file

size.

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -elfs 1000
```

Specify the size of the error log file in kilobytes.

(8) Setting the Number of Error Log Files

The number of the error log files (the HDLM manager log (`dlnmgrn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value from 2 to 16 for the number of error log files (log files for the HDLM manager).

By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30 GB) of error logs in total.

The following shows an example of setting the number of error log files.

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -elfn 5
```

Specify the number of error log files in numbers.

(9) Setting the Trace File Size

The trace file size can be set.

Trace files for which a trace file size can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64). The length of a trace file is fixed, regardless of how much trace information is actually in the file.

For the trace file size, you can specify a value (in kilobytes) from 100 to 16000. If you specify a value smaller than the setting value, the message (KAPL01097-W) will be displayed to confirm the execution, and the trace file will be temporarily deleted.

When all the trace files become full, the oldest file is overwritten with any new trace data.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000KB of trace data.

The following is an example of setting up the trace file size by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -systfs 2000
```

Specify the size of the trace file in kilobytes.

(10) Setting the Number of Trace Files

You can set the number of the trace files.

Trace files for which the number of files can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64).

For the number of the trace files, you can specify a value from 2 to 64. If you specify a value smaller than the value that has already been specified, the KAPL01097-W message will be displayed to confirm the execution, and the trace file will be temporarily deleted.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000KB of trace data.

The following is an example of setting up the number of trace files by using a command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -systfn 10
```

Specify the number of trace files by using numbers.

(11) Setting Up Audit Log Data Collection

You can set whether to collect audit log data.

If you want to collect audit log data, you must also specify the collection level for audit log data and the audit log categories.

Table 3-17: Values Indicating Audit Log Data Collection Levels describes the values that indicate audit log data collection levels. An audit log data collection level is a severity level. The default is 6.

Table 3-17: Values Indicating Audit Log Data Collection Levels

Value (severity)	Explanation
0	No audit log data is collected.
1	
2	Critical-level audit log data is collected.
3	Critical-level and Error-level audit log data is collected.
4	Critical-level, Error-level, and Warning-level audit log data is collected.
5	
6	Critical-level, Error-level, Warning-level, and Informational-level audit log data is collected.

Value (severity)	Explanation
7	

Table 3-18: Values Indicating Audit Log Data Categories describes the values that indicate audit log data categories. The default is `all`.

Table 3-18: Values Indicating Audit Log Data Categories

Value	Explanation
<code>ss</code>	Audit log events of the <code>StartStop</code> category are collected.
<code>a</code>	Audit log events of the <code>Authentication</code> category are collected.
<code>ca</code>	Audit log events of the <code>ConfigurationAccess</code> category are collected.
<code>all</code>	Audit log events of the <code>StartStop</code> , <code>Authentication</code> , and <code>ConfigurationAccess</code> categories are all collected.

This example shows how to enable the collection of audit log data:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -audlog on -audlv 6
-category all
```

Specify `on` if you want to collect audit log data, and `off` if you do not want to collect audit log data. If you specify `on`, you can use the `-audlv` parameter to specify the collection level for audit log data and the `-category` parameter to specify the audit log categories.

If you want to set the audit log facility, see (12) *Setting the Audit Log Facility*.

(12) Setting the Audit Log Facility

The following describes how to specify the output destination for audit log data.

If you want to specify the output destination for audit log data, first specify the audit log facility by using the `dlnkmgr set -audfac` command. Next, define the output destination of the facility in the `/etc/syslog.conf` file. *Table 3-19: Values Indicating Audit Log Facility* describes the values that indicate audit log facility. The default is `user`.

Table 3-19: Values Indicating Audit Log Facility

Value	Corresponding facility value in the <code>/etc/syslog.conf</code> file
<code>user</code> or <code>1</code>	<code>user</code>
<code>local0</code> or <code>16</code>	<code>local0</code>

Value	Corresponding facility value in the /etc/syslog.conf file
local1 or 17	local1
local2 or 18	local2
local3 or 19	local3
local4 or 20	local4
local5 or 21	local5
local6 or 22	local6
local7 or 23	local7

This example shows how to specify the audit log facility:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -audfac local0
```

3.7.3 Checking the Updated Settings

This chapter describes steps involved in how to check the updated settings by using the `dlnkmgr` command's `set` operation after settings have been changed.

When you change some settings, you can display information about all of HDLM function settings. The following is an example of executing the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 2
Elog File Size(KB)           : 1000
Number Of Elog Files         : 5
Trace Level                  : 1
Trace File Size(KB)          : 2000
Number Of Trace Files        : 10
Path Health Checking         : on(10)
Auto Failback                : on(10)
Intermittent Error Monitor   : on(2/20)
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

After you have set up the collection of audit log data, use the following command to make sure that the setting has been specified correctly:

3. Creating an HDLM Environment

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log                      : on(6)
Audit Log Category             : all
Audit Log Facility             : local0
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```


3.8 Setting up Integrated Traces

When HDLM is used, the `dlncmgr` command logs are output to the *integrated trace information files* of Hitachi Network Objectplaza Trace Library (HNTRLib2) (`/var/opt/hitachi/HNTRLib2/spool/hntr2n.log` (*n* indicates a file number)).

If a lot of integrated trace information is output, the older information might end up getting deleted in a very short amount of time. Also, if a large amount of integrated trace information is suddenly all output at the same time, any integrated trace information that is overflowing the buffer might not be saved into the integrated trace files. To save as much information as possible, change the settings for Hitachi Network Objectplaza Trace Library, increasing the integrated trace file size and buffer size. Note that if the values are too large, it will place a heavy load on the system. When determining these values, be sure to consider these operational tradeoffs.

Table 3-20: Default and Recommended Values for the Integrated Trace File Settings shows the default and recommended values for the integrated trace file settings.

Table 3-20: Default and Recommended Values for the Integrated Trace File Settings

Setting		Default value	Recommended value
Integrated trace file size		256 (KB)	4096 (KB)
Number of integrated trace files		4	8
Buffer size per monitoring interval	Monitoring cycle	10 (seconds)	5 (seconds)
	Buffer size per monitoring interval	64 (KB)	256 (KB)
Number of messages to be output per monitoring interval	Monitoring cycle	0 (seconds)	0 (seconds)
	Number of messages to be output	0	0

If Hitachi Network Objectplaza Trace Library (HNTRLib2) is already installed, the existing settings will be inherited. If you change these settings, keep in mind that programs other than HDLM also use them.

3.8.1 Notes on Using the Hitachi Network Objectplaza Trace Library

Note the following when using Hitachi Network Objectplaza trace library:

- If HNTRLib has already been installed when you install HDLM, the settings in the trace library will not be inherited by HNTRLib2. HDLM uses the HNTRLib2 default settings.

- If HNTRLib2 has already been installed on a host when you install HDLM, the settings in the trace library will be inherited.
- If a different Hitachi product is using HNTRLib2 when you attempt to uninstall HDLM, HNTRLib2 will not be uninstalled

3.8.2 Displaying the Hitachi Network Objectplaza Trace Library setup menu

To display the Hitachi Network Objectplaza Trace Library setup menu:

1. Log on as a root user.
2. Execute the following command:

```
# /opt/hitachi/HNTRLib2/bin/hntr2utl2
```

The Hitachi Network Objectplaza Trace Library setup menu appears.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Select the item you want to change.  (Type 1-7 or e)

      [Log Files]
1: Size of a log file.           256 KB
2: Number of log files.         4
3: Name of log files.           /var/opt/hitachi/HNTRLib2/spool/hntr2*.log

      [Monitor]
4: Size of buffer.              64 KB
5: Interval timer.              10 Sec

      [Logging Restriction]
6: Lookout span.                0 Sec
7: Max messages per span.       0

e: Exit

Enter the number>
```

If you do not want to change the settings, type **e** and then press the **Enter** key to quit the menu.

The following explains how to modify each setting.

3.8.3 Changing the Size of Integrated Trace Files

The following procedure shows how to change the size of integrated trace files.

To change the size of integrated trace files:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 1 and then press the **Enter** key.

A screen to set the size of the integrated trace file will appear. The current value is displayed in **Current Size (KB)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type new file size [8-8192]          (Type '!' to return)

Current Size(KB): 256
New Size(KB):
```

2. Enter the desired size in **New Size (KB)**.

The specifiable range is between 8 KB and 8192 KB, with a default of 256. Set this to a value larger than that set in step 2 of 3.8.5 *Changing the Buffer Size Per Monitoring Interval Duration*. We recommend setting a value of 4096 when collecting an integrated trace.

If you do not want to change the integrated trace file size, leave **New Size (KB)** blank, type !, and then press the **Enter** key to return to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.4 Changing the Number of Integrated Trace Files

The following procedure shows how to change the number of integrated trace files.

To change the number of integrated trace files:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 2 and then press the **Enter** key.

A screen to set the number of integrated trace files will appear. The current value is displayed in **Current Number (KB)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of files [1-16]      (Type '!' to return)

Current Number(KB): 4
New Number(KB):
```

2. Enter the desired number in **New Number (KB)**.

You can specify a value from 1 to 16. The default is 4. The value set here becomes the maximum of n in `/var/opt/hitachi/HNTRLib2/spool/hntr2n.log`. The recommended value for integrated trace collection is 8.

If you do not want to change the number of integrated trace files, leave **New Number (KB)** blank, type `!`, and then press the **Enter** key to return to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.5 Changing the Buffer Size Per Monitoring Interval Duration

The following procedure shows how to change the buffer size per monitoring interval.

To change the buffer size per monitoring interval:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 4 and then press the **Enter** key.

A screen to set the buffer size will appear. The current value is displayed in **Current Size (KB)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type new buffer size [8-2048]      (Type '!' to return)

Current Size(KB):  64
New Size(KB):
```

2. Enter the desired size in **New Size (KB)**.

Set a new buffer size to fit the monitoring interval set in **5: Interval Timer**. The specifiable range is between 8 KB and 2048 KB, with a default of 64. Set this to a value smaller than that set in step 2 of 3.8.3 *Changing the Size of Integrated Trace Files*. We recommend setting a value of 256 when collecting an integrated trace.

To leave the buffer size as is, leave **New Size (KB)** blank, type `!` and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

4. In the Hitachi Network Objectplaza Trace Library setup menu, type 5 and then press the **Enter** key.

A screen to set the monitoring interval will appear. The current value is displayed in **Current Span (sec)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility Rel 2.0

Type the value of interval timer for the monitor [1-300] (Type '!' to return)

Current Span(sec): 10
New Span(sec):
```

5. Enter the desired interval in **New Span (sec)**.

The specifiable range is between 1 second and 300 seconds, with a default of 10. We recommend setting a value of 5 when collecting an integrated trace.

To leave the monitoring interval as is, leave **New Span (sec)** blank, enter ! and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

6. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.6 Adjusting the Number of Messages to be Output Per Monitoring Interval

This section explains how to adjust the number of messages output to fit a particular monitoring interval.

To adjust the number of messages to be output per monitoring interval:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 6 and then press the **Enter** key.

A screen to set the monitoring interval for the amount of messages output to the integrated trace file will appear. The current value is displayed in **Current Span (sec)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of lookout span [1-3600 or 0]      (Type '!' to return)

Current Span(sec):    0
New Span(sec):
```

2. Enter a desired interval in **New Span (sec)**.

The specifiable range is between 0 and 3600 seconds, with a default of 0. We recommend setting a value of 0.

To leave the monitoring interval as is, leave **New Span (sec)** blank, type ! and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

Note that when you specify a monitoring interval of 0, even if you specify the maximum number of messages in **7: Max messages per span**, the amount of integrated trace information to be output will not be adjusted.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

4. In the Hitachi Network Objectplaza Trace Library setup menu, type 7 and press the **Enter** key.

A screen to set the maximum number of messages output to the integrated trace file based on the monitoring interval specified in **6: Lookout span** will appear. The current value is displayed in **Current Max (sec)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of max messages [0-500]      (Type '!' to return)

Current Max(sec):    0
New Max(sec):
```

5. Adjust the maximum number of messages output to the integrated trace files in **New Max (sec)**.

The specifiable range is between 0 messages and 500 messages, with a default of 0. If you want to increase the number of messages which are output to the integrated trace file as much as possible, we recommend setting a value of 0.

When you specify a monitoring interval of 0 in **6: Lookout span**, the value set in **New Max (sec)** will be disregarded.

Also, when you specify a value of 0 for **New Max (sec)**, even if you specify the monitoring interval in **6: Lookout span**, the maximum number of messages output will not be adjusted.

To leave the maximum number of messages output as is, leave **New Max (sec)** blank, enter **!** and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

6. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.7 Finishing the Hitachi Network Objectplaza Trace Library Settings

This section explains how to close the Hitachi Network Objectplaza Trace Library setup menu when you are finished.

1. In the Hitachi Network Objectplaza Trace Library setup menu, type **e** and press the **Enter** key.

You will be asked to if you want to save the new settings.

```
Save or not? {Yes/No}>
```

2. To save the new settings, click **Yes**, otherwise, click **No**.

3.8.8 Applying the Hitachi Network Objectplaza Trace Library Settings

To apply the settings, after you change the amount of integrated trace information by using Hitachi Network Objectplaza Trace Library:

1. Log in as a user with root permissions.
2. Execute the following command to check the programs using HNTRLib2.

In the following example, only HDLM uses HNTRLib2.

```
# /opt/hitachi/HNTRLib2/etc/hntr2dgetname
```

3. Creating an HDLM Environment

```
Hitachi Dynamic Link Manager  
#
```

3. Stop the programs that are using HNTRLib2.

If programs other than HDLM are displayed in step 2, stop the programs, and then go to step 4. You do not need to stop the HDLM manager.

If you do not know how to stop and start programs other than HDLM, do not perform the following steps, and restart the host.

4. Execute the following command to stop the integrated trace collection process:

```
# /opt/hitachi/HNTRLib2/bin/hntr2kill
```

5. Execute the following command to delete the memory mapped file:

```
# rm /opt/hitachi/HNTRLib2/mmap/hntr2mmap.mm
```

6. Execute the following command to start the integrated trace collection process:

```
# /opt/hitachi/HNTRLib2/bin/hntr2mon -d &
```

7. Start the programs stopped in step 3.

If you stopped programs other than HDLM in step 3, start them.

3.9 About the Reservation Policy

The reservation policy settings are explained in the following table.

Table 3-21: Reservation Policy Settings

Setting	Description
no_reserve	<p> Ignores a reservation request and does not reserve an LU. This setting is used when any of the following are applicable:</p> <ul style="list-style-type: none"> • Multiple hosts share an LU and execute unique applications that have an exclusive control feature • A virtual I/O function is used to set up an MPIO configuration for a virtual SCSI disk in a client partition • A virtual I/O function is applied in order to use HACMP in a client partition • In an Oracle RAC environment, the hdisk for an HDLM-managed device is specified as a disk used by Oracle RAC
PR_exclusive	Replaces a reservation with a persistent reservation.

About changing the reservation policy

- You should check that the hdisk is not being accessed by any other programs before you attempt to change the reservation policy.
- When you change the reservation policy, the I/O count and error count are cleared.
- The status of the paths is changed to Online.
- Make sure that there are no path errors before you change the reservation policy.

If the reservation policy is changed while there is an error in a path, the erroneous path is deleted.

To recover from this status, resolve the error and then execute one of the following commands:

```
mkdev -l hdisk-name
cfgmgr
```

3.10 Settings for Using HACMP

To use HACMP, install HDLM on all hosts comprising the cluster, configure the hdisks, set up the storage system (if using Thunder 9500V series, or Hitachi AMS/WMS series devices), and register the HDLM script for HACMP. Also, set up the same reservation policy in all of the hdisks that are shared by multiple hosts in the cluster.

3.10.1 Storage System Settings

(1) Setting Up a Thunder 9500V Series Device

To use a Thunder 9500V series device as the storage system, perform the setup shown in *Table 3-22: Thunder 9500V Series Settings for Using HACMP*. For details about setting up a Thunder 9500V series device, see the manual for Thunder 9500V series.

Table 3-22: Thunder 9500V Series Settings for Using HACMP

Item	Setting
<i>Logical Unit Reset propagation mode in Host connection mode 2 (set to the host group to be used)</i>	ON

(2) Setting Up a Hitachi AMS/WMS Series Device

To use a Hitachi AMS/WMS series device as a storage system, perform the setup as shown in *Table 3-23: Hitachi AMS/WMS Series Setting for Using HACMP*. For details about how to set up a Hitachi AMS/WMS series device, see the documentation for the Hitachi AMS/WMS series.

Table 3-23: Hitachi AMS/WMS Series Setting for Using HACMP

Item	Setting
<i>Reset propagation mode in Host connection mode 2 (set to the host group to be used)</i>	ON

3.10.2 Registering the HDLM Script for HACMP

To use HACMP, you need to add custom disk methods to the HDLM script for HACMP. The HDLM script for HACMP is supplied with HDLM.

The following procedure describes how to specify a custom disk method. This setup procedure assumes that HACMP5.4 is used. The actual screen transitions for the SMIT menu might be different depending on the HACMP version. Therefore, also refer to the HACMP documentation.

To specify a custom disk method:

1. From the SMIT window, display the Add Custom Disk Methods window.

Choose the following sequence of menu items to display this window:

Communications Applications and Services, HACMP for AIX, Extended Configuration, Extended Resource Configuration, HACMP Extended Resource Configuration, Configure Custom Disk Methods, and finally choose **Add Custom Disk Methods**.

2. In the Add Custom Disk Methods window, specify the items as shown below:

The items to be set and setting contents are shown below:

Disk Type (PdDvLn field from CuDv)

- When a HP XP series is used:

```
disk/fcp/HP
```

- When a Thunder 9500V series, Lightning 9900V series (excluding HP XP series), Hitachi USP (excluding HP XP series), Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000), Hitachi Virtual Storage Platform, or Hitachi AMS2000/AMS/WMS/SMS series is used:

```
disk/fcp/Hitachi
```

Method to identify ghost disks

```
SCSI3
```

Method to determine if a reserve is held

```
/usr/DynamicLinkManager/cluster/  
dln_hacmp_gdisk_reserve_check
```

Method to break a reserve

```
TARGET
```

Break reserves in parallel

```
false
```

Method to make the disk available

```
MKDEV
```

3. When you finish specifying the settings, click the **OK** button.
4. From the SMIT window, display the Single Select List window.

Choose the following sequence of menu items to display this window:

Communications Applications and Services, HACMP for AIX, Extended Configuration, and finally choose **Extended Verification and Synchronization**.

3.10.3 Setting the Reservation Policy

When you use HACMP, we usually recommend that you set the `reserve_policy` attribute to `PR_exclusive`. However, when a virtual I/O function is applied in order to use HACMP in a client partition, use the following procedure to check, in the virtual I/O server partition, the settings for the `reserve_policy` attribute of the `hdisk`. If `reserve_policy` is set to `PR_exclusive`, change its value to `no_reserve`.

1. Check the setting for the `reserve_policy` attribute of the `hdisk`.

```
# lsattr -El hdisk-name -a reserve_policy
reserve_policy    PR_exclusive                                N/A TRUE
```

Perform the following steps if `reserve_policy` is set to `PR_exclusive`:

2. Quit all applications that specify and directly access the `hdisk` whose attribute is to be changed.
3. Execute the following command to unmount the file system used by HDLM.

```
# umount file-system-mount-point
```

4. Execute the following command to display all the activated volume groups.

```
# lsvg -o
```

5. Among the displayed volume groups, inactivate the volume groups used by HDLM.

```
# varyoffvg volume-group-name
```

6. Execute the `chdev` command to change the `reserve_policy` attribute to `no_reserve`.

```
# chdev -l hdisk-name -a reserve_policy=no_reserve
```

7. Confirm that the setting was changed to `no_reserve`.

```
# lsattr -El hdisk-name -a reserve_policy
reserve_policy    no_reserve                                N/A TRUE
```

3.11 Settings for Using GPFS

To use GPFS or GPFS+RVSD, carry out the following procedure before starting GPFS or GPFS+RVSD:

1. To use GPFS+RVSD, add the following lines to the last line in the `/etc/vsd/oemdisktypes.lst` file:
 - When a HP XP series is used
`disk/fcp/HP fscsi disk/fcp`
 - When a Thunder 9500V series, Lightning 9900V series (excluding HP XP series), Hitachi USP (excluding HP XP series), Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000), Hitachi Virtual Storage Platform, or Hitachi AMS2000/AMS/WMS/SMS is used
`disk/fcp/Hitachi fscsi disk/fcp`
2. When GPFS or GPFS+RVSD is used, in the `dlmodmset` utility for setting the HDLM execution environment ODM, set the `LUN RESET` option to `on`.

```
# /usr/DynamicLinkManager/bin/dlmodmset -r on
```

3.12 Settings for Using Oracle RAC 10g or Oracle RAC 11g

3.12.1 Settings for MISSCOUNT and DISKTIMEOUT

When a host and an Oracle RAC voting disk are connected by multiple paths, HDLM performs failover processing for those paths (in the same way as for normal paths) when an I/O timeout occurs for one of the paths.

Note that, depending on the settings of Oracle RAC, Oracle RAC might determine that a node error has occurred before the failover processing performed by HDLM is completed, and then re-configure the cluster.

Therefore, when HDLM manages the paths that are connected to an Oracle RAC voting disk, change the following settings according to your version of Oracle RAC:

When using Oracle RAC 10g 10.1.0.3.0 or later or Oracle RAC 11g:

Change the value of `MISSCOUNT` to match the type of storage system. To do so, use the following table to obtain the value to be specified, and then change the current value to a value equal to or greater than the value you have obtained.

Table 3-24: Formula for Calculating MISSCOUNT

Storage system type	Formula for obtaining the value of <code>MISSCOUNT</code>
<ul style="list-style-type: none"> Hitachi AMS2000/AMS/WMS/SMS series Thunder 9500V series 	<i>number-of-paths-connected-to-the-voting-disk</i> x 30 seconds
<ul style="list-style-type: none"> Hitachi USP Lightning 9900V series Universal Storage Platform V/VM Virtual Storage Platform 	<i>number-of-paths-connected-to-the-voting-disk</i> x 60 seconds

When using Oracle RAC 10g 10.2.0.2.0 or later or Oracle RAC 11g:

In addition to the value of `MISSCOUNT` shown above, also change the value of `DISKTIMEOUT`. As with `MISSCOUNT`, the value to be specified in `DISKTIMEOUT` is determined by the type of storage system. To make the change, use the following table to obtain the value to be specified, and then change the current value to a value equal to or greater than the value you have obtained.

Table 3-25: Formula for Calculating DISKTIMEOUT

Storage system type	Number of paths connected to the voting disk	Formula for obtaining the value of DISKTIMEOUT
<ul style="list-style-type: none"> Hitachi AMS2000/AMS/WMS/SMS series Thunder 9500V series 	6 or less	You do not need to change the value of DISKTIMEOUT.
	7 or more	$\text{number-of-paths-connected-to-the-voting-disk} \times 30$ seconds
<ul style="list-style-type: none"> Hitachi USP Lightning 9900V series Universal Storage Platform V/VM Virtual Storage Platform 	3 or less	You do not need to change the value of DISKTIMEOUT.
	4 or more	$\text{number-of-paths-connected-to-the-voting-disk} \times 60$ seconds

For details on how to change MISSCOUNT and DISKTIMEOUT, contact the company with which you have a contract for Oracle Support Services.

Note that when you uninstall HDLM from the above configuration, you must reset the values of MISSCOUNT and DISKTIMEOUT to their original values. Therefore, make a note of the original values of MISSCOUNT and DISKTIMEOUT before changing them.

3.12.2 Settings for Reservation Policy

When you set up an Oracle RAC environment, if you specify the hdisk for an HDLM-managed device as a disk used by Oracle RAC, use the procedure below to check the value of the `reserve_policy` attribute. If `reserve_policy` is set to `PR_exclusive`, change its value to `no_reserve`.

1. Check the setting for the `reserve_policy` attribute of the hdisk.

```
# lsattr -El hdisk-name -a reserve_policy
reserve_policy    PR_exclusive      N/A TRUE
```

Perform the following procedure if `reserve_policy` is set to `PR_exclusive`:

2. Quit all applications that specify and directly access the hdisk whose attribute is to be changed.
3. Execute the following command to unmount the file system used by HDLM.

```
# umount file-system-mount-point
```

3. Creating an HDLM Environment

4. Execute the following command to display all the activated volume groups.

```
# lsvg -o
```

5. Among the displayed volume groups, inactivate the volume groups used by HDLM.

```
# varyoffvg volume-group-name
```

6. Execute the chdev command to change the `reserve_policy` attribute to `no_reserve`.

```
# chdev -l hdisk-name -a reserve_policy=no_reserve
```

7. Confirm that the setting was changed to `no_reserve`.

```
# lsattr -El hdisk-name -a reserve_policy  
reserve_policy    no_reserve          N/A TRUE
```

3.13 Settings for Using VCS

To use VCS, install HDLM on all of the hosts that comprise the cluster, and then configure the HDLM devices. Also, carry out the following procedure before starting VCS:

1. Specify the settings for starting the `preonline` script when VCS starts.

When you have specified the settings for starting the `preonline` script, go to step 2.

For details on the setting method, see the VCS documentation.

The following example shows settings for starting the `preonline` script when VCS starts:

```
# haconf -makerw
# hagr -modify service-group PreOnline 1
# haconf -dump -makero
# cp -r /opt/VRTSvcs/bin/sample_triggers/preonline /opt/VRTSvcs/bin/triggers
```

2. In the `preonline` script used when VCS starts, register the script provided by HDLM.

Add the following code to the line under `# put your code here...` in the `preonline` script.

```
system("/usr/DynamicLinkManager/cluster/dlm_vcs_pgr_release
$ARGV[1]");
```

The following shows an example of editing the `preonline` script. The shaded portion represents the part to be added.

Figure 3-4: Example of Editing the Preonline Script

```

@(#)src/cmd/hattrigger/unix/preonline 2.9 06/06/30 11:30:51 - #
#ident "@(#)VCS:src/cmd/hattrigger/unix/preonline 2.9"
#
# Copyright(C) 2000 VERITAS Software Corporation.  ALL RIGHTS RESERVED.
# UNPUBLISHED -- RIGHTS RESERVED UNDER THE COPYRIGHT
#
$trigger="preonline";
if (!defined $ARGV[0]) {
    $log_message = sprintf("VCS:15005:%s:Failed to continue;
        undefined system name", $trigger);
    ` $vcs_home/bin/halog -add C \" $log_message\" -msgid 15005
        -parameters $trigger`;
    exit;
} elsif (!defined $ARGV[1]) {
    $log_message = sprintf("VCS:15006:%s:Failed to continue;
        undefined group name", $trigger);
    ` $vcs_home/bin/halog -add C \" $log_message\" -msgid 15006
        -parameters $trigger`;
    exit;
}
# put your code here...
system("/usr/DynamicLinkManager/cluster/dlm_vcs_pgr_release $ARGV[1]");
#
# # Here is a sample code that takes into account multiple groups.
#
# $group = $ARGV[1];

```

3.14 Uninstalling HDLM

This section explains how to return the HDLM environment to the way it was before HDLM was installed, and describes each step of the process.

3.14.1 Preparations for HDLM Uninstallation

- Back up all HDLM management-target devices onto a medium such as a tape.
- Uninstall HDLM in a multi-user mode environment.
- When uninstalling HDLM on a host where version 5.0 or later of a Device Manager agent is installed, do not execute any of the following Device Manager agent commands during the uninstallation. Also, do not uninstall HDLM while executing any of the following Device Manager agent commands:

```
hbsasrv, HiScan, hdvmagt_account, hdvmagt_schedule, hldutil,
TIC
```

3.14.2 Uninstalling HDLM

When you uninstall HDLM, if the KAPL09019-E or KAPL09020-E message is output, follow the directions in 3.14.3 *Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)* to uninstall HNTRLib2. However, if the KAPL09026-I message is output, since a program other than HDLM is using Hitachi Network Objectplaza Trace Library (HNTRLib2), only HDLM will be uninstalled.

You can use the `installp` command or SMIT to uninstall HDLM. The following explains how to uninstall HDLM using the `installp` command. For details about how to use SMIT, see the AIX documentation.

For the virtual I/O server and boot disk environment, execute the required steps among those listed below.

(1) When Uninstalling HDLM in a Local Boot Disk Environment

1. Log in to AIX as a user with root permissions.
If you are using a virtual I/O server, see the virtual I/O server documentation to log in to AIX.
If you are not using a virtual I/O server, proceed to step 9.
2. Execute the following command to activate the volume group that is using the virtual SCSI disk of the HDLM management-target hdisk:

```
# varyonvg volume-group-name
```

3. Creating an HDLM Environment

3. Execute the following command for the file system used to configure volume groups in the client logical partition:

```
# mount file-system-mount-point
```

4. Execute the following command to back up the volume group in the client logical partition:

```
# savevg -i -f any-file-name-or-device-volume-name volume-group-name
```

5. Execute the following command to unmount the file system in the client logical partition:

```
# umount file-system-mount-point
```

6. Execute the following command to delete the volume group in the client logical partition:

```
# reducevg -df volume-group-name hdisk-name
```

7. Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdisk-name
```

8. Execute the following command to delete the virtual target device on the virtual I/O server:

```
$ rmdev -dev vtscsin
```

9. Stop all processes and services that use the HDLM management-target paths.
Stop any process or service of an application, such as a DBMS, that is using the HDLM management-target path.
For details about the stopping method, see the manual for each application.
10. Specify the `-A` parameter, as required, and execute the `dlmrmddev` utility to remove HDLM drivers.

When you specify the `-A` parameter and execute the `dlmrmddev` utility, you can skip steps 11 through 14. When `dlmrmddev` is executed, a message appears asking

for confirmation that processing is to continue.

Enter *y* for this message to continue processing.

```
# /usr/DynamicLinkManager/bin/dlmrmdev -A
KAPL10528-I The volume group will be made inactive, and the
file system that is using HDLM will be unmounted. Is this OK?
[y/n]:y
hdisk3 deleted
KAPL09012-I All HDLM drivers were removed.
```

- If you executed this step, proceed to step 16.
- If you did not execute this step, proceed to the following step.

11. Execute the following command to unmount the file system used by HDLM:

```
# umount file-system-mount-point
```

12. Execute the following command to display all the activated volume groups:

```
# lsvg -o
```

13. Among the displayed volume groups in step 12, execute the following command to inactivate the volume groups used by HDLM:

```
# varyoffvg volume-group-name
```

14. Execute the following command to remove the hdisks recognized as HDLM management-target device from the running kernel, and then stop the HDLM manager:

```
# /usr/DynamicLinkManager/bin/dlmrmdev
```

The KAPL09012-I message appears.

If the KAPL09012-I message is not displayed, the HDLM driver has not been deleted, or the HDLM manager has not stopped. Make sure that no process, service, file system, or volume group is using the HDLM management-target path, and then re-execute the above command.

15. Execute the following command to make sure that the hdisks recognized as the devices to be managed by HDLM have been deleted:

```
# lsdev -Cc disk
```

16. If GPFS + RVSD was used, delete the setting information from `/etc/vsd/oemdisktypes.lst`

- If HP XP series was used, delete the following line:

```
disk/fcp/HP fscsi disk/fcp
```

- If Thunder 9500V series, Lightning 9900V series (excluding HP XP series), Hitachi USP (excluding HP XP series), Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000), Hitachi Virtual Storage Platform, or Hitachi AMS2000/AMS/WMS/SMS series was used, delete the following line:

```
disk/fcp/Hitachi fscsi disk/fcp
```

17. If GPFS or GPFS + RVSD was used, execute the following utility to set the LUN RESET option to off:

```
# /usr/DynamicLinkManager/bin/dlmodmset -r off
```

18. If you have been using VCS and have registered VCS scripts, you must delete the VCS script registrations.

Delete the following line that was added to the `preonline` script:

```
system("/usr/DynamicLinkManager/cluster/dlm_vcs_pgr_release  
$ARGV[1] ");
```

19. If you do not need to start the `preonline` script when VCS starts, delete the `preonline` script and specify the settings so that the `preonline` script does not start.

For details on the setting method, refer to the VCS documentation.

In the following example, the settings do not start the `preonline` script when VCS starts:

```
# rm /opt/VRTSvcs/bin/triggers/preonline  
# haconf -makerw  
# hagr -modify service-group PreOnline 0  
# haconf -dump -makero
```

20. Execute the following command:

```
# installp -u DManager.mpio
```

If you are not using a virtual I/O server, uninstallation of HDLM is complete and you do not need to perform the remaining steps.

If the KAPL09022-E message is displayed, the hdisks recognized as the devices to be managed by HDLM still remain. Re-execute the procedure starting from step 14.

21. If you are using a virtual I/O server, define an hdisk as a virtual target device.

On the virtual I/O server, execute one of the following commands:

- To create an hdisk as a virtual target device

```
$ mkvdev -vdev hdisk-name -vadapter
virtual-SCSI-server-adapter-name
```

- To create a logical volume as a virtual target device

```
$ mkvdev -vdev logical-volume-name -vadapter
virtual-SCSI-server-adapter-name
```

22. Execute the following command in the client logical partition to reconfigure the device:

```
# cfgmgr
```

23. Execute the following command in the client logical partition to check that the physical volume has been recognized as hdisk:

```
# lsdev -Cc disk
```

Check that the following execution result is displayed:

```
hdisk1 Available Virtual SCSI Disk Drive
```

24. Execute the following command to restore the backed up volume group:

```
# restvg -f any-desired-file-name-or-device-name hdisk-name
```

(2) When Uninstalling HDLM in the Boot Disk Environment

1. Log in to AIX as a user with root permissions.

If you are using a virtual I/O server, see the virtual I/O server documentation for details about how to log in to AIX.

If you are not using a virtual I/O server, proceed to step 9.

3. Creating an HDLM Environment

2. Execute the following command to activate the volume group that is using the virtual SCSI disk of the HDLM management-target hdisk:

```
# varyonvg volume-group-name
```

3. Execute the following command to mount the file system used to configure volume groups in the client logical partition:

```
# mount file-system-mount-point
```

4. Execute the following command to back up the volume group in the client logical partition:

```
# savevg -i -f any-file-name-or-device-volume-name volume-group-name
```

5. Execute the following command to unmount the file system in the client logical partition:

```
# umount file-system-mount-point
```

6. Execute the following command to delete the volume group in the client logical partition:

```
# reducevg -df volume-group-name hdisk-name
```

7. Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdisk-name
```

8. Execute the following command to delete the virtual target device in the virtual I/O server:

```
$ rmdev -dev vtscsin
```

If the boot disk is in a single-path configuration, proceed to step 12.

9. If the boot disk is in a multi-path configuration, execute the following command to shut down the host.


```
# shutdown -F
```

10. Configure the host and storage system so that only a single path connects the host to the storage system (single-path configuration).
11. Start the host.
12. Execute the following command to unmount the file system used by HDLM:

```
# umount file-system-mount-point
```

13. Execute the following command to inactivate volume groups other than rootvg:

```
# varyoffvg volume-group-name
```

14. Execute the following command to remove the hdisks recognized as HDLM management-target devices from the running kernel, and then stop the HDLM manager:

```
# /usr/DynamicLinkManager/bin/dlrmdev
```

The KAPL09012-I message appears.

If the KAPL09012-I message is not displayed, the HDLM driver has not been deleted, or the HDLM manager has not stopped. Make sure that no process, service, file system, or volume group is using the HDLM management-target path, and then re-execute the above command.

15. Execute the following command to make sure that the hdisk recognized as the device to be managed by HDLM has been deleted:

```
# lsdev -Cc disk
```

16. Execute the HDLM pre-uninstall utility dlmpreuninst.

```
# /usr/DynamicLinkManager/bin/dlmpreuninst
```

If you execute the dlmpreuninst utility, the hdisk recognized as a boot disk stops being the HDLM's management target. When the command terminates normally, the following message appears:

```
KAPL13103-I HDLM can be uninstalled after rebooting the host.
KAPL13101-I The dlmpreuninst utility completed successfully.
```

If the KAPL13108-E message is displayed, the hdisk for the device that is managed by HDLM still remains. Re-execute the procedure starting from step 14.

If the KAPL13110-E message is displayed, the multi-path configuration still remains. Re-execute the procedure starting from step 9.

17. Restart the host.

```
# shutdown -Fr
```

18. If GPFS + RVSD was used, delete the setting information from the `/etc/vsd/oemdisktypes.lst` file.

- If HP XP series is used, delete the following line:

```
disk/fcp/HP fscsi disk/fcp
```

- If Thunder 9500V series, Lightning 9900V series (excluding HP XP series), Hitachi USP (excluding HP XP series), Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000), Hitachi Virtual Storage Platform, or Hitachi AMS2000/AMS/WMS/SMS series was used, delete the following line:

```
disk/fcp/Hitachi fscsi disk/fcp
```

19. If GPFS or GPFS + RVSD was used, execute the following utility to set the LUN RESET option to off:

```
# /usr/DynamicLinkManager/bin/dlmodmset -r off
```

20. If you have been using VCS and have registered VCS scripts, you must delete the VCS script registrations.

Delete the following line that was added to the `preonline` script:

```
system("/usr/DynamicLinkManager/cluster/dlm_vcs_pgr_release  
$ARGV[1]");
```

21. If you do not need to start the `preonline` script when VCS starts, delete the `preonline` script and specify the settings so that the `preonline` script does not start.

For details on the setting method, refer to the VCS documentation.

In the following example, the settings do not start the `preonline` script when VCS starts:

```
# rm /opt/VRTSvcs/bin/triggers/preonline
# haconf -makerw
# hagrps -modify service-group PreOnline 0
# haconf -dump -makero
```

22. Execute the following command:

```
# installp -u DLManager.mpio
```

23. Change the boot device list, according to the host environment you are using.

If you are not using a virtual I/O server, uninstallation of HDLM is complete and you do not need to perform the remaining steps.

24. If you are using a virtual I/O server, define an hdisk as a virtual target device.

On the virtual I/O server, execute one of the following commands:

- To create an hdisk as a virtual target device

```
$ mkvdev -vdev hdisk-name -vadapter
virtual-SCSI-server-adapter-name
```

- To create a logical volume as a virtual target device

```
$ mkvdev -vdev logical-volume-name -vadapter
virtual-SCSI-server-adapter-name
```

25. Execute the following command in the client logical partition to reconfigure the device:

```
# cfgmgr
```

26. Execute the following command in the client logical partition to check that the physical volume has been recognized as hdisk:

```
# lsdev -Cc disk
```

Make sure that the following execution result is displayed:

```
hdisk1 Available Virtual SCSI Disk Drive
```

27. Execute the following command to restore the backed up volume group:

```
# restvg -f any-desired-file-name-or-device-name hdisk-name
```

3.14.3 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)

When you uninstall HDLM, if the KAPL09019-E or KAPL09020-E message is output, follow the directions below to uninstall HNTRLib2.

To uninstall HNTRLib2:

1. Log in to AIX as the root user.
2. Execute the following command to unregister the name of the bundled program products.

```
# /opt/hitachi/HNTRLib2/etc/hntr2cancel "Hitachi Dynamic  
Link Manager"
```

3. Execute the following command.

```
# /opt/hitachi/HNTRLib2/etc/hntr2setup
```

The HNTRLib2 setup menu will appear.

4. From the **Setup** menu, select **9**.

HNTRLib2 will be uninstalled.

If HNTRLib2 is not being used by any other programs:

HNTRLib2 will be uninstalled normally, and the following message will appear.

```
Unsetup is complete.
```

If HNTRLib2 is being used by another program:

HNTRLib2 will not be uninstalled, and the following message will appear.

```
Because a bundle PP name is registered,  
I did not do the Uninstall.
```

If HNTRLib2 was not uninstalled, execute the following command to check if any programs are using it.

```
# /opt/hitachi/HNTRLib2/etc/hntr2getname
```

If you are unable to complete uninstallation even though no programs other

than HDLM are using HNTRLib2, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

Note

If the log output directory set in HNTRLib2 was not the default directory, the log files will not be deleted during uninstallation. In this case, delete these files after uninstallation.

3.14.4 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib)

After you uninstall HDLM version 04-00 or earlier, if no applications other than HDLM are using HNTRLib, uninstall it as follows.

1. Check that no applications other than HDLM are using HNTRLib.
See the manuals and documentation for each program to check whether the program is using Hitachi Network Objectplaza Trace Library.

2. Log in to AIX as a root user.

3. Execute the following command:

```
# /opt/hitachi/HNTRLib/etc/hntrsetup
```

The HNTRLib setup menu will appear.

4. From the setup menu, select **9**.

HNTRLib will be uninstalled.

5. Delete the HNTRLib common library files and the directory in which they are stored.

When you uninstall HNTRLib, all directories within the `/opt/hitachi/HNTRLib` directory will be deleted, but the libraries within the `/opt/hitachi/common/lib` directory will not.

To delete HNTRLib, delete the following files and directory.

- Shared library files (symbolic links)
`/opt/hitachi/common/lib/libhntr*`
- Directory that contains shared library files
`/opt/hitachi/common/lib/D001`

If the `/opt/hitachi` directory only contains the files and directories shown above, delete the directory.

Note

- If the log output directory set in HNTRLib was not the default directory, the

log files will not be deleted during uninstallation. In this case, delete these files after uninstallation.

- Even if you attempt to uninstall HNTRLib2 when HNTRLib is installed, HNTRLib will not be uninstalled. If no other programs are using HNTRLib, delete it manually.

3.14.5 Canceling Cluster Software (HACMP) Settings

When HACMP is used, delete the custom disk method.

The following deletion procedure assumes that HACMP5.4 is used. The actual screen transitions for the SMIT menu might be different depending on the HACMP version. Therefore, please also refer to the HACMP documentation.

To delete a custom disk method:

1. From the SMIT window, display the Configure Custom Disk Methods window.

To display this window, choose the following sequence of menu items:

Communications Applications and Services, HACMP for AIX, Extended Configuration, Extended Resource Configuration, HACMP Extended Resources Configuration, Configure Custom Disk Methods, and finally choose **Remove Custom Disk Methods**.

2. In the Select Custom Disk Methods window, select the following item(s), and then delete it.

- When HP XP series is used

disk/fcp/HP

- When Thunder 9500V series, Lightning 9900V series (excluding HP XP series), Hitachi USP (excluding HP XP series), Universal Storage Platform V/VM (excluding HP XP20000 and HP XP24000), Hitachi Virtual Storage Platform, or Hitachi AMS2000/AMS/WMS/SMS series is used

disk/fcp/Hitachi

Chapter

4. HDLM Operation

This chapter describes operating procedures for HDLM, including how to operate HDLM and the HDLM manager, and how to change the configuration of the operating environment.

Some of the cautionary notes in *4.1 Notes on Using HDLM* are different for HDLM 5.8.1 or earlier and HDLM 5.9 or later. In addition, the contents of *4.5 Changing the Configuration of the HDLM Operating Environment* have changed. For details, see *B. Differences Between HDLM Version 5.9 or Later and Version 5.8.1 or Earlier*.

- 4.1 Notes on Using HDLM
- 4.2 HDLM Operations Using Commands
- 4.3 Starting and Stopping the HDLM Manager
- 4.4 HDLM Resident Processes
- 4.5 Changing the Configuration of the HDLM Operating Environment

4.1 Notes on Using HDLM

This section provides notes on using HDLM and using the environment in which HDLM is installed. Make sure that you read this section.

4.1.1 Displaying Path Information

The `AutoPATH_ID` that is displayed during the HDLM `dlmkmgr` command's `view` operation differs depending on the order in which paths are detected when the host starts. For this reason, you should always use the path name to specify a path.

4.1.2 When a Path Error Is Detected

When a path error is detected by HDLM, you must immediately resolve the error and restore the path.

A check for path errors is performed whenever an I/O is issued. If there are any paths through which I/O is not normally issued, such as a non-owner path, you should enable path health checking in order to detect errors even when there is no I/O. For details about path health checking, see *2.9 Detecting errors by using path health checking*.

When a path is in an error state and the interval specified for a path health check or a failover has been reached and you execute any of the following, the response time of the processing might slow down while the path health check or failover is being executed:

- HDLM command
- HDLM utility
- OS commands for operating volume groups
- `mount/umount` command
- `cfgmgr` command
- `mkdev` command
- `rmdev` command
- `chdev` command

When a path is in an error state, if you perform the online operation of the HDLM command with the `-s` parameter, it might take a long time for the command processing to finish.

When a path is in an error state and you want to place all paths or several paths online at the same time, we recommend that you execute the command without specifying the `-s` parameter. If you do this and a path cannot be placed online, a message confirming that you want to continue the processing is displayed. If you enter `n` in response to this

message, you can suspend the command.

4.1.3 Storage System

- Start up the storage system before you start up the hosts, so that AIX can detect the storage system.
- To delete an LU from the storage system, you must delete the hdisk first, and then you can delete the LU.
- If you change the storage system's owner controller for the LU, you must re-configure the hdisk or restart the server.

4.1.4 Notes on Shutting Down a Host

When a cluster environment is not being used and you shut down a host without inactivating a volume group that satisfies all of the following conditions, other hosts will no longer be able to operate the volume group:

- The volume group was created by an LU shared by multiple hosts
- The reservation policy for the LU used to configure the volume group was set to `PR_exclusive`

Before shutting down a host, execute the following command to inactivate the volume group:

```
# varyoffvg volume-group-name
```

If you shut down the volume group without inactivating it, restart the host, activate and then inactivate the volume group.

4.1.5 Notes on Errors in a Host

If a cluster environment is not being used and an error occurs on a host where the reservation policy is set to `PR_exclusive` in order to exclusively use an LU, other hosts are no longer able to access the LU. In such a case, execute the `dlmpr` utility to clear the HDLM persistent reservation.

For details about the `dlmpr` utility, see *7.9 dlmpr Utility for Clearing HDLM Persistent Reservation*.

While you are performing direct access operations by specifying the hdisk recognized as an HDLM management-target device, I/O might fail if you perform the operation below. Before performing this operation, you should make sure that the volume group is inactive, then perform the direct access operation by specifying the hdisk recognized as an HDLM management-target device that is not being used.

- Using the `dlmpr` utility to clear the reserve key.

4.1.6 Notes on Enabling Both Primary and Secondary Volumes to Be Viewed From the Same Server

To enable both primary and secondary volumes to be viewed from the same server, operate the disks according to the following steps:

1. Create a pair of the primary volume and the secondary volume (`paircreate`).
2. Split the pair (`pairsplit`).
3. Enable the secondary volume to be recognized as a volume group (`recreatevg`).
When you execute the `recreatevg` command, characteristics of the volume group will be initialized. Therefore, change the characteristics of the volume group (`chvg`) as necessary.
4. Access the primary volume and the secondary volume.
5. Export the volume group, and then delete the volume information (`exportvg`).
6. Re-synchronize the volume pair (`pairresync`).
7. If there are several pairs of primary and secondary volumes, repeat the above steps for each pair (step 2 to step 6).

4.1.7 Notes on an LVM Mirror Configuration

When an error (such as one that might occur in a LVM mirror configuration) is detected and I/O access for a path in the Online(E) status continues, detection of errors will continue. When the `-i` parameter of the utility for setting the HDLM execution environment ODM (`dlmodmset`) is set to `on`, I/O access is suppressed until troubleshooting measures are taken. This can shorten the time needed to deal with the problem.

However, when this parameter is set to `on`, I/O access to the path in the Online(E) status will be suppressed, so I/O success will not automatically change the path to the Online status. To recover the path, use an `online` command or the auto failback function.

For details about the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

4.1.8 Notes on When the OS Functionality is Not Available in a Boot Disk Environment

When both of the following conditions exist, the reservation for the LU used for the boot disk is not canceled:

- The reservation policy of the boot disk has been set to `PR_exclusive`.
- The OS cannot start because OS functionality is not available due to a problem such as an error occurring in all of the boot disk's paths.

To cancel the reservation for the LU, execute the `dlmpr` utility from a host that can access this LU. For details on this utility, see *7.9 dlmpr Utility for Clearing HDLM Persistent Reservation*.

4.1.9 Notes on Replicating a System

You can use the OS's `mksysb` command to back up hosts that include HDLM-managed devices. If you then replicate (clone) a system from a `mksysb` image created in this manner onto another LPAR or host, you must update the HDLM information to match that of the destination system's environment.

To update the HDLM information to match that of the destination system's environment, use the following procedure to execute the HDLM restoration support utility (`dlmpostrestore`) after you have restored the `mksysb` image.

To update HDLM information:

1. After restoring the image, log in to the activated host as a user with root permissions.
2. Execute the `dlmpostrestore` utility.

```
# /usr/DynamicLinkManager/bin/dlmpostrestore
```

A message for confirming whether to continue processing is displayed (`KAPL10552-I` is displayed in a local boot disk environment, and `KAPL10555-I` is displayed in a boot disk environment). To continue processing, enter `y` in response to this message.

If you executed the utility in a boot disk environment, you must then restart the host.

For details about the `dlmpostrestore` utility, see *7.8 dlmpostrestore Utility for HDLM Restoration Support*.

4.2 HDLM Operations Using Commands

This section explains how to use the HDLM command. For details on the various command operations, see 6. *Command Reference*.

4.2.1 Notes on Using Commands

- Execute the command as a user with root permissions.
- To specify a parameter value containing one or more spaces, enclose the entire value in double quotation marks ("").

4.2.2 Viewing Path Information

This section explains how to display path information by using an HDLM command.

To display path information, execute the `dlnmgr` command's `view` operation with the `-path` parameter specified. The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -path
```

To display information only for the paths accessing the specified host device, execute the `dlnmgr` command's `view` operation with the `-path` and `-hdev` parameters specified. The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -path -hdev hdisk1
Paths:000001 OnlinePaths:000001
PathStatus IO-Count IO-Errors
Online      0         0

PathID PathName          ChaPort Status      Type IO-Count IO-Errors DNum HDevName
iLU
000006 08.11.00000000000000E2.0001 HITACHI .OPEN-3 .15001
0005      1H      Online      Own          0         0      0 hdisk1
000013 08.1D.00000000000000E3.0001 HITACHI .OPEN-3 .15001
0005      2H      Online      Own          0         0      0 hdisk1
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7 *view (Displays Information)*.

4.2.3 Changing the Status of Paths

This section explains how to change path statuses.

(1) Changing the Status of Paths to Online

To change the status of paths to online:

1. Check the current status of the paths.

To change the status of the path for each HBA port, CHA port, or path to online, first check the path name or AutoPATH_ID.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

To change the path status to online by specifying a host device name, first check the host device name for the path and the OS management path ID.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
```

2. To change the status of paths to online, execute the dlnkmgr command's online operation.

The paths to be placed online can be specified by using an HBA port, CHA port, single path, or host device. For details on how to specify paths, see *6.5 online (Places Paths Online)*.

For example, if you want to place all the paths that pass through a specific HBA port online, execute the dlnkmgr command's online operation with the -hba parameter specified. The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hba 01.01
KAPL01057-I All the paths which pass the specified HBA will
be changed to the Online status. Is this OK? [y/n]:y
KAPL01061-I 3 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

3. Check to see if the statuses of all the applicable paths have changed.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

(2) Changing the Status of Paths to Offline(C)

To change the status of paths to Offline(C):

1. Check the current status of the paths.

To change the status of the path for each HBA port, CHA port, or path to Offline(C), first check the path name or AutoPATH_ID.

To change the path status to Offline(C) by specifying a host device name, first check the host device name for the path and the OS management path ID.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
```

2. To change the status of paths to Offline(C), execute the dlnkmgr command's offline operation.

The paths to be placed offline can be specified by using an HBA port, CHA port, single path, or host device. For details on specifying paths, see 6.4 *offline (Places Paths Offline)*.

For example, if you want to place all the paths that pass through a specific HBA port offline, execute the dlnkmgr command's offline operation with the -hba parameter specified. The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 01.01
KAPL01055-I All the paths which pass the specified CHA port
will be changed to the Offline(C) status. Is this OK? [y/n]:y
KAPL01056-I If you are sure that there would be no problem
when all the paths which pass the specified HBA are placed
in the Offline(C) status, enter y. Otherwise, enter n. [y/
n]:y
KAPL01061-I 3 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline
#
```

3. Check to see if the statuses of all the applicable paths have changed.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

4.2.4 Viewing LU Information

This section explains how to display LU information by using an HDLM command.

To display LU information, execute the `dlnkmgr` command's `view` operation with the `-lu` parameter specified. The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
Product       : USP
SerialNumber  : 0014010
LUs           : 10

iLU  HDevName  OSPathID  PathID  Status
003A hdisk0    00000    000000  Online
      00001    000001  Online
003B hdisk1    00000    000002  Online
      00001    000003  Online
003C hdisk2    00000    000004  Online
      00001    000005  Online
003D hdisk3    00000    000006  Online
      00001    000007  Online
003E hdisk4    00000    000008  Online
      00001    000009  Online
003F hdisk5    00000    000010  Online
      00001    000011  Online
0040 hdisk6    00000    000012  Online
      00001    000013  Online
0041 hdisk7    00000    000014  Online
      00001    000015  Online
0042 hdisk8    00000    000016  Online
      00001    000017  Online
0043 hdisk9    00000    000018  Online
      00001    000019  Online
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7 *view (Displays Information)*.

4.2.5 Displaying the Correspondences Between hdisks, OS Management Path IDs, and LDEVs

This section explains the use of an HDLM command to display the correspondences between hdisks, OS management path IDs, and LDEVs.

You display this information by executing the HDLM command's `view` operation with the `-drv` parameter specified. For details on the `view` operation, see 6.7 *view (Displays Information)*. The execution result of this operation is displayed on a single line for each path.

The following shows an example in which the `view` operation is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName OSpPathID LDEV
000000 hdisk0 00000 9500V.0051.0005
000001 hdisk1 00000 9500V.0051.0015
000002 hdisk2 00000 9500V.0051.0020
000003 hdisk0 00001 9500V.0051.0005
000004 hdisk1 00001 9500V.0051.0015
000005 hdisk2 00001 9500V.0051.0020
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7 *view (Displays Information)*.

4.2.6 Initializing Statistical Information for Paths

This section explains how to initialize statistical information (I/O counts and I/O errors) for all the paths managed by HDLM.

This procedure is useful when you want to check the number of I/O operations and I/O errors that have occurred since the last time the I/O counts and I/O errors were initialized to 0.

To initialize statistical information for paths:

1. Check the current status of the path.

The following shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

2. To initialize statistical information for all the paths managed by HDLM, execute the `dlnkmgr` command's `clear` operation with the `-pdst` parameter specified.

The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr clear -pdst
KAPL01049-I Would you like to execute the operation?
Operation name = clear [y/n]:y
KAPL01001-I The HDLM command completed normally. Operation
```



```
name = clear, completion time = yyyy/mm/dd hh:mm:ss
#
```

3. Check to see whether the statistical information for all the paths has been initialized.

The following shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

4.2.7 Viewing and Setting Up the Operating Environment

This section explains how to display and set up the HDLM operating environment.

(1) Viewing the Operating Environment

To display the operating environment, execute the `dlnkmgr` command's `view` operation with the `-sys` and `-sfunc` parameters specified.

The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size(KB)           : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To display the operating environment of the audit log, execute the HDLM command's `view` operation with the `-sys` and `-audlog` parameters specified.

The following example shows how to execute the command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log                    : off
Audit Log Category           : -
```

```
Audit Log Facility          : -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7 *view (Displays Information)*.

(2) Setting Up the Operating Environment

To set up the HDLM operating environment, execute the `dlmkmgr` command's `set` operation. This operation allows you to set up the following functions:

- Load balancing
- Path health checking
- Automatic failback
- Intermittent error monitoring
- Error log collection level
- Trace level
- Error log file size
- The number of error log files
- Trace file size
- The number of trace files
- Audit log data collection
- Audit log facility

For details on how to set up each function, see 6.6 *set (Sets Up the Operating Environment)*.

For example, to set up the error log collection level, execute the `dlmkmgr` command's `set` operation with the `-ellv` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command.

The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlmkmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation
name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation name
= set, completion time = yyyy/mm/dd hh:mm:ss
#
```

To check whether the settings have been applied, see (1) *Viewing the Operating Environment*.

4.2.8 Viewing License Information

This section explains how to display license information.

To display license information, execute the `dlnmgr` command's `view` operation with the `-sys` and `-lic` parameters specified.

The following shows an example in which the command is executed.

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys -lic
License Type Expiration
Permanent          -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7 *view (Displays Information)*.

4.2.9 Updating the License

This section explains how to update the license.

To update the license, execute the `dlnmgr` command's `set` operation with the `-lic` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command. If the license key file does not exist, a message asking you to enter the license key appears, so enter the license key.

Note:

When you are executing the `dlnmgr` command's `set` operation with the `-lic` parameter to install the license, you can only execute it once a time. If you attempt to execute more than one `dlnmgr` command containing the `set` operation with the `-lic` parameter, a core file is created and the following message might appear:

```
KAPL01075-E
```

```
A fatal error occurred in HDLM. The system environment is
invalid.
```

If this message appears, execute the `dlnmgr` command's `view` operation with the `-sys -lic` parameter to make sure that the license is installed correctly.

The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnmgr set -lic
```

```
KAPL01049-I Would you like to execute the operation? Operation
name = set [y/n]: y
KAPL01071-I A permanent license was installed.
#
```

4.2.10 Viewing HDLM Version Information

This section explains how to display HDLM version information.

To display HDLM version information, execute the `dlnmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)         : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)         : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver            WakeupTime
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver        WakeupTime      ElogMem Size
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver              WakeupTime
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

The value displayed in `HDLM version` indicates the HDLM version.

4.2.11 Viewing HDLM Component Information

This section explains how to display HDLM component information.

To display HDLM component information, execute the `dlnmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in

which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size (KB)          : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
HDLM Manager Ver            WakeupTime
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver        WakeupTime      ElogMem Size
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver              WakeupTime
Alive      x.x.x-xx  yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Among the displayed items, HDLM Manager, HDLM Alert Driver, and HDLM Driver indicate the HDLM component information.

Also, you can view information for each HDLM component. Execute the `dlnkmgr` command's `view` operation with the `-sys` and subsequent parameter specified. The following shows an example in which the command is executed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -adrv
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv
```

4.3 Starting and Stopping the HDLM Manager

If an error occurs in the system, such as in an HDLM program, you may need to manually stop or start HDLM to recover from the error.

4.3.1 Starting the HDLM Manager

To start the HDLM manager, log in to AIX as a user with root permissions and then execute the following command.

```
# startsrc -s DLManager
```

Lower case characters can be used for the command name (dlmmanager).

```
# startsrc -s dlmmanager
```

The startup script that was set up during HDLM installation runs, and starts the HDLM manager.

Use the following HDLM command's view operation to confirm that the HDLM manager is running:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager      Ver      WakeupTime
Alive             x.x.x-xx   yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

When the HDLM Manager column shows Alive, the HDLM manager is active.

4.3.2 Stopping the HDLM Manager

To stop the HDLM manager, log in to AIX as a user with root permissions, and then execute the following command:

```
# stopsrc -s DLManager
```

Lower case characters can be used for the command name (dlmmanager).

```
# stopsrc -s dlmmanager
```

The stop script that was set up during HDLM installation runs, and stops the HDLM manager.

Use the following `dlmkmgr` command's `view` operation to confirm that the HDLM manager has stopped.

```
# /usr/DynamicLinkManager/bin/dlmkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Dead
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

When the HDLM Manager column shows `Dead`, the HDLM manager is inactive.

4.4 HDLM Resident Processes

Table 4-1: HDLM resident processes lists and describes the resident processes in HDLM. To monitor these processes, use the names below.

Table 4-1: HDLM resident processes

Process	Description
dmmgr	HDLM manager process
hbsa_service	Hitachi Command Suite Common Agent Component [#] process
hntr2mon	Hitachi Network Objectplaza Trace Library (HNTRLib2) process

#

You only need to monitor this process when HDLM is linked to Global Link Manager.

4.5 Changing the Configuration of the HDLM Operating Environment

This chapter describes the procedures for changing the configuration of an HDLM operating environment.

4.5.1 Changing an HDLM Management-Target Device

This subsection explains how to add and delete HDLM management-target devices and how to change their attributes.

(1) Adding an HDLM Management-Target Device

Connect the device to the system and execute the following command:

```
# cfmgr
```

(2) Deleting an HDLM Management-Target Device

1. Execute the following command to check the device (hdisk) to be deleted:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

2. Stop all processes and services that are using the device that is to be deleted.
3. Execute the following command to unmount the file system that uses the device that is to be deleted:

```
# umount file-system-mount-point
```

4. If the device to be deleted is registered in a volume group, execute the following command to inactivate the volume group:

```
# varyoffvg volume-group-name
```

5. Execute the following command to delete the device (or devices):

- To delete all devices

```
# /usr/DynamicLinkManager/bin/dlrmdev
```

- To delete a specific device

```
# rmdev -dl hdisk-name
```

6. Execute the following command to check that device deletion was successful:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

If you deleted all devices, check that the following message appears:

```
KAPL01019-W The target path was not found. Operation name =  
view
```

If you deleted a specific device, check that the deleted device (hdisk name) is no longer displayed.

(3) Changing an HDLM Management-Target Device

Note

If you execute the `chdev` command while a path is in error status, that path will be deleted. In such a case, first recover from the path error, then re-execute the `cfgmgr` command, and finally perform the following steps:

1. Inactivate the volume group used by HDLM.

```
# varyoffvg volume-group-name
```

2. Execute the `chdev` command to change attributes.

The following example changes the queue depth and timeout value:

```
# chdev -l hdisk-name -a queue_depth=8 -a rw_timeout=60
```

3. Inactivate the volume group used by HDLM.

```
# varyonvg volume-group-name
```

4.5.2 Changing hdisk attributes

hdisk attributes consist of default values and values actually used. When a new hdisk is configured, or deleted and then reconfigured, the actual value for hdisk attributes is set using the default values.

The HDLM default settings modification utility (`dlnmchpdattr`) can be used to change the default values.

Note:

To change attribute values for an individual hdisk, use the `chdev` command

instead of the `d1mchpdattr` utility to change the values actually used. The following explains how to use the `d1mchpdattr` utility to change default hdisk values, and apply them as the actually used values.

If you execute the `d1mchpdattr` utility with the `-A` parameter specified, after the default values are changed, hdisks will be automatically reconfigured. Note that even though you can execute the utility without specifying the `-A` parameter to change the default value, you have to manually reconfigure the hdisks.

To automatically reconfigure hdisks, perform the procedure in (1) *Automatically Performing hdisk Reconfiguration*. To manually reconfigure hdisks, perform the procedure in (2) *Manually Performing hdisk Reconfiguration*.

For details on the `d1mchpdattr` utility, see 7.3 *d1mchpdattr Utility for Changing HDLM Default Settings*.

(1) Automatically Performing hdisk Reconfiguration

To automatically reconfigure an hdisk:

1. Log in to AIX as a user with root permissions.
2. Execute the `d1mchpdattr` utility with the `-A` parameter specified.

```
# /usr/DynamicLinkManager/bin/d1mchpdattr -A -a
reserve_policy=no_reserve
```

A message is displayed to confirm whether processing should continue. Enter `y` to continue processing.

If the command terminates normally, the KAPL10571-I message is displayed.

3. Make sure that the default value for the hdisk reservation policy has changed.

Execute the `d1mchpdattr` utility with the `-o` parameter specified.

```
# /usr/DynamicLinkManager/bin/d1mchpdattr -o
uniquetype = disk/fcp/Hitachi
  reserve_policy      : no_reserve
KAPL10571-I The d1mchpdattr utility completed successfully.
```

If the execution environment is a boot disk environment, proceed to step 4. If the execution environment is a local boot disk environment, proceed to step 5.

4. Execute the following command to restart the host.

```
# shutdown -Fr
```

5. Execute the following command to make sure that the status of the hdisks recognized as HDLM-managed devices is Available.

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0 16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0 16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

In this example, hdisk3 and hdisk4 are recognized as HDLM-managed devices.

If the status of all hdisks is Available, proceed to step 7. If there are any hdisks with the Defined status, proceed to step 6.

6. Execute the following command to change the hdisk status to Available.

```
# cfgmgr
```

After executing the command, perform step 5 again.

7. Check the setting for the hdisk reservation policy attribute.

Make sure that the changed default value is reflected in the value actually used.

```
# lsattr -El hdisk-name | grep reserve_policy
reserve_policy no_reserve Reserve Policy TRUE
```

8. Activate the volume group used by HDLM.

```
# varyonvg volume-group-name
```

9. Mount the file system used by HDLM.

```
# mount file-system-mount-point
```

(2) Manually Performing hdisk Reconfiguration

The procedure below explains how to manually reconfigure an hdisk.

Note:

In the procedure below, if you execute the `d1mchpdattr` utility without performing

either step 2 or 6, any changed values will not be applied, even though the `lsattr` command execution results will show that the changed values were applied. To apply the changed values, perform step 2, and then perform step 10 for a local boot disk environment, or perform step 12 for a boot disk environment.

To manually reconfigure an hdisk:

1. Log in to AIX as a user with root permissions.

Reconfigure the HDLM device. Proceed to step 2 to automatically perform the processing needed to unmount for reconfiguration, and processing to change the active status of the volume group. Proceed to step 3 to perform these actions manually.

2. Execute the utility for deleting HDLM drivers (`dlmrmddev`) with the `-e` parameter and `-A` parameter specified.

```
# /usr/DynamicLinkManager/bin/dlmrmdev -e -A
```

For details on the `dlmrmddev` utility, see *7.11 dlmrmdev Utility for Deleting HDLM Drivers*.

If the command terminates normally, the KAPL10531-I message is displayed.

If the KAPL10531-I message is not displayed, make sure that HDLM-managed paths are not being used by a process, service, file system, or volume group, and then perform step 2 again.

If the `dlmrmddev` utility is executed properly, proceed to step 7.

3. Execute the following command to unmount the file system used by HDLM.

```
# umount file-system-mount-point
```

4. Execute the following command to display all the activated volume groups.

```
# lsvg -o
```

5. Among the displayed volume groups, inactivate the volume groups used by HDLM.

```
# varyoffvg volume-group-name
```

6. Execute the `dlmrmddev` utility with the `-e` parameter specified.

```
# /usr/DynamicLinkManager/bin/dlmrmdev -e
```

If the command terminates normally, the KAPL10531-I message is displayed. If the KAPL10531-I message is not displayed, make sure that HDLM-managed paths are not being used by a process, service, file system, or volume group, and then perform step 6 again.

7. Execute the following command to make sure that the status of the hdisks recognized as HDLM-managed devices is Defined.

```
# lsdev -Cc disk
hdisk0 Available 1S-08-00-8,0      16 Bit LVD SCSI Disk Drive
hdisk1 Available 1S-08-00-9,0      16 Bit LVD SCSI Disk Drive
hdisk2 Available 1S-08-00-10,0     16 Bit LVD SCSI Disk Drive
hdisk3 Defined 1H-08-02           Hitachi Disk Array (Fibre)
hdisk4 Defined 1H-08-02           Hitachi Disk Array (Fibre)
...
```

In this example, hdisk3 and hdisk4 are recognized as HDLM-managed devices.

8. Execute the utility for changing HDLM default settings (dlmchpdattr).

```
# /usr/DynamicLinkManager/bin/dlmchpdattr -A -a
reserve_policy=no_reserve
```

A message is displayed to confirm whether processing should continue. Enter y to continue processing.

If the command terminates normally, the KAPL10571-I message is displayed.

9. Make sure that the default value for the hdisk reservation policy has been changed.

Execute the dlmchpdattr utility with the -o parameter specified.

```
# /usr/DynamicLinkManager/bin/dlmchpdattr -o
uniquetype = disk/fcp/Hitachi
  reserve_policy      : no_reserve
KAPL10571-I The dlmchpdattr utility completed successfully.
```

Perform the following according to the execution environment:

- If the execution environment is a local boot disk environment:
Proceed to step 10.

- If the execution environment is a boot disk environment:

Proceed to step 11.

10. Execute the following command to change the hdisk status to Available.

```
# cfgmgr
```

After executing the command, proceed to step 13.

11. Execute the utility for clearing HDLM persistent reservation (`dlmpr`) for all hdisks comprising rootvg.

```
# dlmpr -c name-of-HDLM-device-comprising-rootvg
```

A message is displayed to confirm whether processing should continue. Enter `y` to continue processing.

If the reserve was cleared normally, the KAPL10642-I message is displayed. If the reserve was not cleared normally, the KAPL10650-I message is displayed.

For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

12. Execute the following command to restart the host.

```
# shutdown -Fr
```

13. Execute the following command to make sure that the status of the hdisks recognized as HDLM-managed devices is Available.

```
# lsdev -Cc disk
hdisk0    Available 1S-08-00-8,0  16 Bit LVD SCSI Disk Drive
hdisk1    Available 1S-08-00-9,0  16 Bit LVD SCSI Disk Drive
hdisk2    Available 1S-08-00-10,0 16 Bit LVD SCSI Disk Drive
hdisk3    Available 1H-08-02      Hitachi Disk Array (Fibre)
hdisk4    Available 1H-08-02      Hitachi Disk Array (Fibre)
...
```

In this example, `hdisk3` and `hdisk4` are recognized as HDLM-managed devices.

If the status of all hdisks is Available, proceed to step 14. If there are any hdisks with the Defined status, perform step 10 again.

14. Check the setting for the hdisk reservation policy attribute.

Make sure that the changed default value is reflected in the value actually used.

```
# lsattr -El hdisk-name | grep reserve_policy
reserve_policy no_reserve Reserve Policy TRUE
```

15. Activate the volume group used by HDLM.

```
# varyonvg volume-group-name
```

16. Mount the file system used by HDLM.

```
# mount file-system-mount-point
```

4.5.3 Changing a Path

This subsection explains how to add and delete paths.

(1) Adding a Path (to a Volume Group Other than rootvg)

Connect the path to the system and execute the following command:

```
# cfmgr
```

(2) Adding a Path (to a Device Included in rootvg)

The following shows an example of adding a path to `hdisk0` in an environment where `rootvg` consists of `hdisk0` and `hdisk1`.

1. Connect the path to the system, and then execute the following command:

```
# cfmgr
```

2. Check the list of current boot disks.

The following shows an example of executing the command:

```
# bootlist -m normal -o
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

3. Specify a boot disk according to the host environment to be used.

The following shows an example of executing the command:


```
# bootlist -m normal hdisk0 hdisk1
```

4. Make sure that the boot disk is configured with the specified number of paths.

The following shows an example of executing the command:

```
# bootlist -m normal -o
hdisk0 blv=hd5
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

(3) Deleting a Path (of a Volume Group Other than rootvg)

The following shows an example of deleting a path of a volume group other than rootvg.

1. Execute the following HDLM command to check the OS management path ID of the path that is to be deleted and to determine the devices (hdisk name) connected to the path.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName  OSpaThID LDEV
000000 hdisk5      00000    USP.0014050.0065
000001 hdisk5      00001    USP.0014050.0065
000002 hdisk5      00002    USP.0014050.0065
000003 hdisk10     00000    9500V.5457.0102
000004 hdisk10     00001    9500V.5457.0102
000005 hdisk10     00002    9500V.5457.0102
```

For each path ID (PathID column), check the entries in the HDevName and OSpaThID columns. In the following steps, *device-name* and *OS-management-path-ID* refer to the HDevName and OSpaThID items, respectively, that you checked in this step.

2. Execute the following command to check the parent device and connection of the path to be deleted:

Specify the *device-name* checked in step 1 in executing the following command:

```
# lspath -Hl device-name -F "name path_id parent connection"
```

When hdisk10 is specified, the command and the execution results would be as follows:

4. HDLM Operation

```
# lspath -Hl hdisk10 -F "name path_id parent connection"
name    path_id parent connection

hdisk10    0      fscsi4 50060e800436e240,6a000000000000
hdisk10    1      fscsi4 50060e800436e250,6a000000000000
hdisk10    2      fscsi5 50060e800436e240,6a000000000000
```

Search for lines in which the `path_id` item matches *OS-management-path-ID*. If matching lines are found, check the `parent` and `connection` entries. In the following steps, the checked `parent` and `connection` items correspond to *fscsi-number* and *connection-position*, respectively.

3. Delete the path.

```
# rmpath -l device-name -p fscsi-number -w connection-position
```

The following example deletes the path whose *OS-management-path-ID* is 2:

```
# rmpath -l hdisk10 -p fscsi5 -w
50060e800436e240,6a000000000000
```

4. Check that the path has been deleted.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
```

(4) Deleting a Path (of a Device Included in rootvg)

The following shows an example of deleting a path of `hdisk0` in an environment where `rootvg` consists of `hdisk0` and `hdisk1`.

1. Delete a path of a volume group other than `rootvg` by performing the procedure described in (3) *Deleting a Path (of a Volume Group Other than rootvg)*:
2. Check the list of current boot disks.

The following shows an example of executing the command:

```
# bootlist -m normal -o
hdisk0 blv=hd5
-
hdisk1 blv=hd5
...
```

3. Specify a boot disk according to the host environment to be used.

The following shows an example of executing the command:

```
# bootlist -m normal hdisk0 hdisk1
```

4. Make sure that the boot disk is configured with the specified number of paths.

The following shows an example of executing the command:

```
# bootlist -m normal -o
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

4.5.4 Replacing an HBA

If there are multiple active paths for an LU, you can replace a desired HBA while running your applications by placing offline only the path that goes through the HBA to be replaced and using other paths to continue access.

To replace an HBA:

1. Execute the following command to find the `fscsi` number that corresponds to the HBA that is to be replaced:

```
# lsdev -C | grep fscsi
```

The following are execution examples:

```
fscsi0 available 1H-08-02 FC SCSI I/O controller protocol
device
fscsi1 available 11-08-02 FC SCSI I/O controller protocol
device
```

In the second line of the above examples, 11 in 11-08-02 indicates the bus number and 08 indicates the HBA adapter number. The `fscsi` number to be used when replacing this HBA is 1.

2. Execute the `dlmodmset` utility for setting the HDLM execution environment ODM to check the NPIV option setting.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o
```

The following are execution examples:

4. HDLM Operation

```
Lun Reset                : off
Online(E) IO Block       : on
NPIV Option               : off
```

Check the NPIV Option line.

3. Place in Offline (C) status the path that goes through the HBA to be replaced.

Depending on the NPIV option setting for the `dlmodmset` utility checked in step 2, execute one of the following commands:

- If the NPIV option is set to `off`:

Specify the HBA adapter number and bus number, and then execute the command shown below. The following example shows how to place the path in Offline (C) status when the path goes through an HBA whose HBA adapter number is 08 and whose bus number is 11:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 08.11
```

- If the NPIV option is set to `on`:

Use the `fscsi` number found in step 1 to execute the command below. The following example shows how to place the path in Offline (C) status when the path goes through `fscsi` number 1 (`fscsi1`):

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 00.01
```

4. Execute the command shown below to delete the path connected to the HBA that is to be replaced.

Specify the device name (`fscsi` device) of the HBA that is to be replaced (where *n* is the instance number of the `fscsi` device).

```
# rmpath -p fscsin -d
```

Because the `fscsi` number found in step 1 is 1 (`fscsi1`), the result is as follows:

```
# rmpath -p fscsi1 -d
```

5. If LUN security has been set up for the storage system, add the WWN of the new

HBA to the LUN security.

6. Execute the following command:

```
# diag
```

Note

For details on the operations after executing the `diag` command, see the AIX documentation. Steps 7 to 14 below provide an example of the execution procedure for AIX V6.1 (Technology Level 02).

7. From the displayed menu, choose **Task Selection**.

The Task Selection List window appears.

8. Choose **Hot Plug Task**.

The Hot Plug Task window appears.

9. Choose **PCI Hot Plug Manager**.

The PCI Hot Plug Manager window appears.

10. Select **List PCI Hot Plug Slots** to check the PCI slot to be replaced:

# Slot	Description	Device(s)
P1-I3	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-I4	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-I5	PCI 64 bit, 66MHz, 3.3 volt slot	fcs0
P1-I6	PCI 64 bit, 50MHz, 5 volt slot	Empty
P1-I7	PCI 64 bit, 50MHz, 5 volt slot	mg20
P1-I8	PCI 64 bit, 66MHz, 3.3 volt slot	fcs1
P1-I9	PCI 64 bit, 66MHz, 3.3 volt slot	scsi2 scsi3
P1-I10	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-I11	PCI 64 bit, 50MHz, 5 volt slot	pci12 ent1 ent2 ent3 ent4
P1-I12	PCI 64 bit, 50MHz, 5 volt slot	Empty

The shading indicates the PCI slot where the HBA is to be replaced.

11. Go back to the PCI Hot Plug Manager window, select **Unconfigure a Device**, and enter in **Device name** the device that is to be replaced.

For the **Unconfigure any Child Devices** and **KEEP definition in database items**, select **yes**.

* Device Name	[fcs0]	
Unconfigure any Child Devices	yes	+
KEEP definition in database	yes	+
		+

12. Go back to the PCI Hot Plug Manager window, select **Replace/Remove a PCI Hot Plug Adapter**.

Select the HBA to be replaced.

13. Select **Replace** in the input field.

14. When the following message is displayed, replace the HBA:

The visual indicator for the specified PCI slot has been set to the identify state. Press Enter to continue or enter x to exit.

The visual indicator for the specified PCI slot has been set to the action state. Replace the PCI card in the identified slot and press Enter to continue. Enter x to exit. Exiting now leaves the PCI slot in the removed state.

When you finish replacing the HBA, connect the cable and press **Enter**.

15. Execute the following command to reconfigure the device:

```
# cfgmgr -l fcsn
```

To reconfigure the device, specify the device name of the PCI slot where the HBA was replaced (*fcs* device); *n* indicates the instance number of the *fcs* device.

16. If LUN security has been set up for the storage system, delete the WWN of the previous HBA from the LUN security.
17. Execute the following command to check the path information:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

For details about the path information, see 6.7 *view (Displays Information)*.

Notes

- If you replace all HBAs for a volume group without following the above

procedure when all the following conditions are satisfied[#], the volume group cannot be activated after the host is restarted:

- The host was shut down while a volume group was active, and the volume group consisted of hdisks that had paths going through the HBAs to be replaced.
- The hdisk reservation policy for the hdisks that make up the volume group has been set to `PR_exclusive`.

#

If you replace some HBAs for the volume group, after the host is restarted, the volume group is activated and the paths going through the new HBAs are added. However, the paths that go through the old HBAs remain defined, so delete such paths as necessary.

To activate a volume group, perform the following:

- **For a volume group comprising rootvg**

Clear the reservation for the applicable LUs from the storage system or other servers.

- **For a volume group other than rootvg**

1. If LUN security has been set up for the storage system, add the WWNs of the new HBAs to the LUN security.
2. Start the host.
3. Execute the following command to delete the HDLM devices on the paths that go through the old HBAs:

```
# rmdev -dl hdisk-name
```

n indicates the instance number of the HDLM device.

4. If LUN security has been set up for the storage system, delete the WWNs of the old HBAs from the LUN security.
5. Execute the following command to reconfigure the devices:

```
# cfgmgr -l fcsn
```

Specify the device name of the PCI slot (*fcs* device) where each HBA has been replaced. *n* indicates the instance number of the *fcs* device.

6. Execute the following command to check path information:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

For details on path information, see 6.7 *view (Displays Information)*.

7. Execute the utility for clearing HDLM persistent reservation (dlmpr) to clear the reservation of LUs comprising the applicable volume group:

```
# /usr/DynamicLinkManager/bin/dlmpr -c hdisk-name
hdisk-name ...
```

8. Execute the following command to activate the applicable volume group:

```
# varyonvg volume-group-name
```

- After you replace an HBA, any paths that go through that HBA might be removed (due to AIX specifications) from the paths to a specified boot disk *hdisk* (logical device file), which will no longer be recognized as the boot disk. If this happens, it is necessary to restart the host, and then re-specify the path that goes through the replaced HBA as a path to the boot disk, as shown in the procedure below.

To re-specify a device called *hdisk10* on the storage system as a boot disk:

1. Execute the following command to restart the host:

```
# shutdown -Fr
```

2. Make sure that the boot disk is in a multi-path configuration:

```
# lspath -l hdisk10 -s available
Available hdisk10 fscsi0
Available hdisk10 fscsi1
...
```

3. Check the current boot disk list:

```
# bootlist -m normal -o
hdisk10 blv=hd5
hdisk0 blv=hd5
hdisk1 blv=hd5
...
```

4. Specify boot disks that are suitable for your host environment:

```
# bootlist -m normal hdisk10 hdisk0 hdisk1
```

5. Make sure that the number of configured boot disks is the same as the number of paths that you checked in step 2:

```
# bootlist -m normal -o
hdisk10 blv=hd5
```



```

hdisk10 blv=hd5
hdisk0 blv=hd5
hdisk1 blv=hd5
...

```

4.5.5 Replacing a Fiber Cable

If there are multiple active paths for an LU, you can replace a desired cable while running your applications by placing offline only the path that goes through the cable to be replaced and using other paths to continue access.

Note

The following procedure is only for replacing a fiber cable.

To replace a fiber cable:

1. Execute the `dlmodmset` utility for setting the HDLM execution environment ODM to check the NPIV option setting.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o
```

The following are execution examples:

```

Lun Reset           : off
Online(E) IO Block  : on
NPIV Option         : off

```

Check the NPIV Option line.

2. Place in Offline (C) status the path that goes through the cable to be replaced (path that goes through the HBA to which the cable is connected).

Depending on the NPIV option setting for the `dlmodmset` utility checked in step 1, execute one of the following commands:

- If the NPIV option is set to `off`:

Specify the HBA adapter number and bus number, and then execute the command shown below. The following example shows how to place the path in Offline (C) status when the path goes through an HBA whose HBA adapter number is 08 and whose bus number is 11:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 08.11
```

- If the NPIV option is set to `on`:

Use the `fscsi` number to execute the command below. The following example shows how to place the path in Offline (C) status when the path goes through `fscsi` number 1 (`fscsi1`):

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 00.01
```

3. Replace the cable.

Note

If you change the port on the Fibre Channel switch or on the storage system, the path configuration will be changed. Delete the `hdisk` that are associated with the cable to be replaced and then reconfigure the device.

4. Place in Online status the path that goes through the replaced cable.

Place in Online status the path that goes through the HBA to which the replaced cable is connected.

Depending on the NPIV option setting for the `dlmodmset` utility checked in step 1, execute one of the following commands:

- If the NPIV option is set to `off`:

Specify the HBA adapter number and bus number, and then execute the command shown below. The following example shows how to place the path in Offline (C) status when the path goes through an HBA whose HBA adapter number is 08 and whose bus number is 11:

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hba 08.11
```

- If the NPIV option is set to `on`:

Use the `fscsi` number to execute the command below. The following example shows how to place the path in Offline (C) status when the path goes through `fscsi` number 1 (`fscsi1`):

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hba 00.01
```

5. Execute the following command to check the path information:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

For details about path information, see 6.7 *view (Displays Information)*.

4.5.6 Replacing a Fibre Channel Switch

If there are multiple active paths for an LU, you can replace a desired Fibre Channel switch while running your applications by placing offline only the path that goes through the Fibre Channel switch to be replaced and by using other Fibre Channel switches to continue access.

Note

The following procedure is only for replacing a Fibre Channel switch.

To replace a Fibre Channel switch:

1. Execute the following command to find the `fscsi` number that corresponds to the path that goes through the Fibre Channel switch that is to be replaced (the path that goes through the HBA to which the Fibre Channel switch is connected):

```
# lsdev -C | grep fscsi
```

The following are execution examples:

```
fscsi0 available 1H-08-02 FC SCSI I/O controller protocol
device
fscsi1 available 11-08-02 FC SCSI I/O controller protocol
device
```

In the second line of the above examples, 11 in 11-08-02 indicates the bus number and 08 indicates the HBA adapter number. If the Fibre Channel switch is connected to this HBA, the corresponding `fscsi` number is 1.

2. Execute the `dlmodmset` utility for setting the HDLM execution environment ODM to check the NPIV option setting.

```
# /usr/DynamicLinkManager/bin/dlmodmset -o
```

The following are execution examples:

```
Lun Reset                : off
Online(E) IO Block       : on
NPIV Option              : off
```

Check the `NPIV` option line.

3. Place in Offline (C) status the path that goes through the Fibre Channel switch to be replaced.

Depending on the `NPIV` option setting for the `dlmodmset` utility checked in step 2, execute one of the following commands:

- If the `NPIV` option is set to `off`:

Specify the HBA adapter number and bus number, and then execute the command shown below. The following example shows how to place the path in Offline (C) status when the path goes through an HBA whose HBA adapter number is 08 and whose bus number is 11:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 08.11
```

- If the `NPIV` option is set to `on`:

Use the `fscsi` number found in step 1 to execute the command below. The following example shows how to place the path in Offline (C) status when the path goes through `fscsi` number 1 (`fscsi1`):

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 00.01
```

4. Execute the following command to delete the path that goes through the Fibre Channel switch to be replaced:

Specify the device name (`fscsi` device) of the HBA connected to the Fibre Channel switch that is to be replaced to delete the path (where *n* is the instance number of the `fscsi` device).

```
# rmpath -p fscsin -d
```

Because the `fscsi` number found in step 1 is 1 (`fscsi1`), the result is as follows:

```
# rmpath -p fscsi1 -d
```

5. Execute the following command to get the name of the parent device:

```
# lsdev -C -l fscsin -F parent
```

6. Delete the HBA device associated with the Fibre Channel switch that is to be replaced.

```
# rmdev -dl fcs $sn$  -R
```

7. Replace the Fibre Channel switch.
8. Execute the following command to reconfigure the HBA device:

```
# cfgmgr -l fcs $n$ 
```

$fcsn$ indicates the name of the parent device that was acquired in step 5; n indicates the instance number of the fcs device.

9. Execute the following command to check the path information:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path
```

For details about path information, see 6.7 *view (Displays Information)*.

Chapter

5. Troubleshooting

This chapter describes how to check HDLM error information, and how to take action if an error occurs in HDLM. Descriptions of the actions are separated into those for path errors, HDLM program errors, and other types of errors.

- 5.1 Information Collected by the DLMgetras Utility for Collecting HDLM Error Information
- 5.2 Checking error information in messages
- 5.3 What To Do for a Path Error
- 5.4 What To Do for a Program Error
- 5.5 What To Do for Other Errors

5.1 Information Collected by the DLMgetras Utility for Collecting HDLM Error Information

Immediately after an error occurs, execute the `DLMgetras` utility for collecting HDLM error information, since restarting the machine might delete error information before the information is collected by `DLMgetras`. For details about the `DLMgetras` utility and the error information it collects, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

5.2 Checking error information in messages

When you want to configure the system so that HDLM messages are output to syslog, specify `user` for the name of the system function defined in the `/etc/syslog.conf` file. In the following example, the system function name is `user`, and messages at the Information level or higher are output to the `/etc/syslog.conf` file:

```
user.info                /tmp/syslog.user.log
```

You can check path errors by referring to the `KAPL08xxx` messages that are output to syslog.

To obtain detailed information about the failed path, check the execution results of the `view` operation as indicated by the error message.

For details on this operation, see *6.7 view (Displays Information)*.

Based on the applicable message, detailed information about a path can be obtained by checking the execution results of the `view` operation.

The following is an example of a message:

```
KAPL08022-E Error in path occurred. ErrorCode = aa...aa, PathID
= bb...bb, PathName = cc...cc.dd...dd.ee...ee.ff...ff, DNum =
gg...gg, HDevName = hh...hh
```

The elements of the message are explained below.

ErrorCode

The error number generated when AIX detected the path error.

PathID

The ID assigned to a path. This ID is called the `AutoPATH_ID`. `AutoPATH_ID`s are re-assigned every time the host is restarted or every time the path configuration is changed. When you want to add a new LU without restarting the host, `AutoPATH_ID`s are re-assigned to each path of the LU when you execute the `cfgmgr` command.

This path ID is the same as the path ID displayed by the `dlnkmgr` command's `view` operation.

For details on this operation, see *6.7 view (Displays Information)*.

PathName

The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the paths that will be affected by the change.

A path name consists of the following four elements, separated by periods:

- HBA adapter number or adapter type (character string)
- Bus number or adapter number (character string)
- Target ID (hexadecimal)
- Host LU number (hexadecimal)

This path name is also the same as `PathName` displayed by the `dlnmgr` command's `view` operation. For details on the path name, see 6.7 *view (Displays Information)*.

DNum

A Dev number, which is equivalent to a logical volume number in AIX.

A Dev number beginning from 0 is assigned to the Dev in the LU.

In AIX, this value is fixed to 0 because one LU contains one Dev.

This is the same as the `DNum` that is displayed by the `dlnmgr` command's `view` operation. For details on this operation, see 6.7 *view (Displays Information)*.

HDevName

The name of the host device.

Hdisk name is displayed.

This is the same as the `HDevName` that is displayed by the `dlnmgr` command's `view` operation. For details on this operation, see 6.7 *view (Displays Information)*.

5.3 What To Do for a Path Error

When a path error is detected, HDLM performs a failover on the path and outputs the KAPL08022-E message. This message indicates that an error has occurred in the components that make up the path. *Figure 5-1: Error location when the KAPL08022-E message is output* indicates these components.

Figure 5-1: Error location when the KAPL08022-E message is output

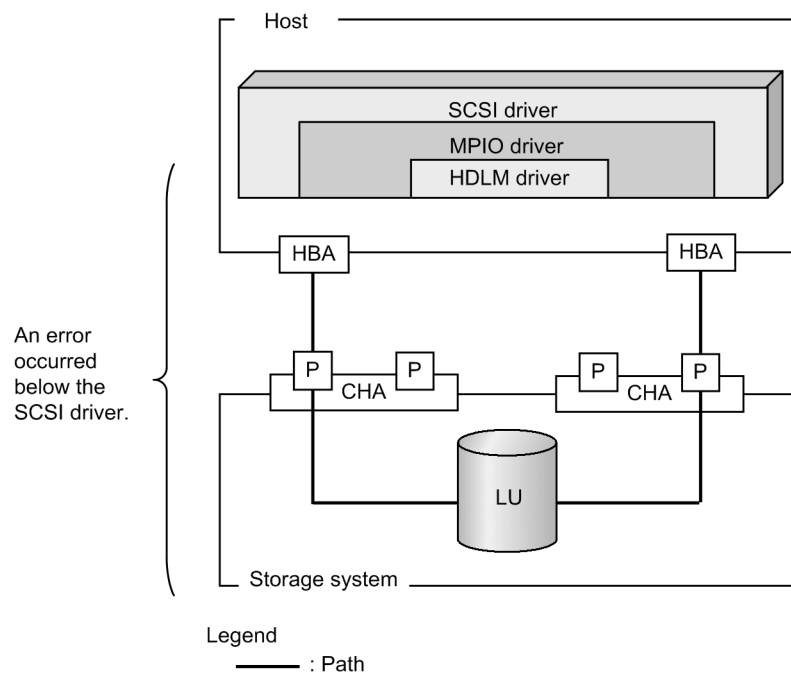
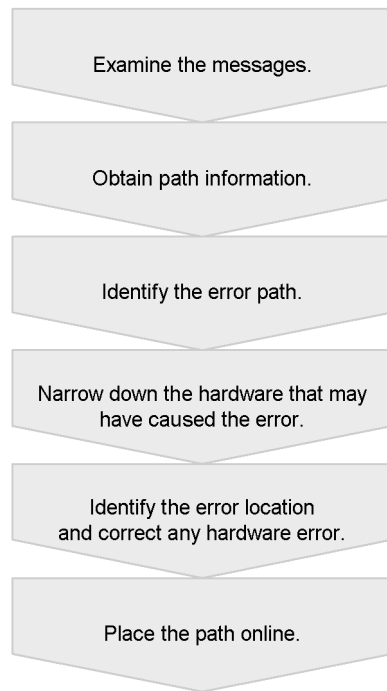


Figure 5-2: Troubleshooting procedure when a path error occurs shows the troubleshooting procedure when the KAPL08022-E message is output.

Figure 5-2: Troubleshooting procedure when a path error occurs

The following shows the procedure for using the HDLM command (`dlnmgr`) to handle a path error.

5.3.1 Examining the messages

Examine the message that is output to syslog in the management-target host by using applications or tools for monitoring messages. If the KAPL08022-E message is output, view the message to check the path in which the error occurs. For details on each item displayed in the message, see 5.2 *Checking error information in messages*.

5.3.2 Obtain path information

Obtain path information to narrow down the hardware in which an error has occurred.

Execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -path -iem
-hbaportwnn > pathinfo.txt
```

`pathinfo.txt` is the redirection-output file name. Use a file name that matches your environment.

5.3.3 Identifying the Error Path

Check the obtained path information to find the path with the error. In the `Status` column, the error path has the status `Offline(E)` or `Online(E)`.

5.3.4 Narrowing Down the Hardware That Might Have Caused the Error

Check the `DskName`, `iLU`, `ChaPort`, and `HBAPortWWN` columns of the path with the error to narrow down the hardware that may be the cause of the error. To physically identify the hardware corresponding to `DskName`, `iLU`, and `ChaPort`, use the information provided by the storage-system management program.

5.3.5 Identifying the Error Location and Correcting any Hardware Errors

Use the AIX and hardware management tools to identify the error location, and then take appropriate, corrective action. For hardware maintenance, contact your hardware vendor or maintenance company if there is a maintenance contract.

5.3.6 Placing the Path Online

After the path has recovered from the error, use the `dlnmgr` command's `online` operation to place the path back online. For details on the `online` operation, see *6.5 online (Places Paths Online)*. Execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnmgr online
```

Executing this command places all the offline paths online.

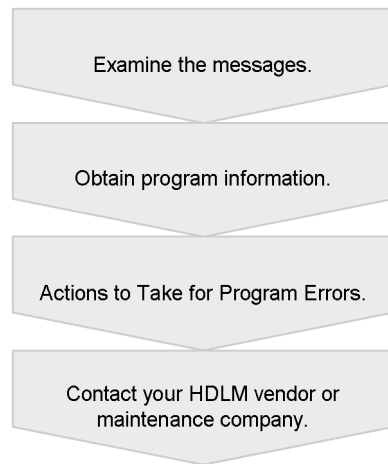
If any path cannot be placed online due to an error, the `KAPL01039-W` message will appear. To ignore such paths and to continue processing, type `y`. Type `n` to cancel processing.

Check the statuses of the paths that cannot be placed online, and resolve the problem.

5.4 What To Do for a Program Error

The following describes what to do to handle errors that occur in an HDLM program. *Figure 5-3: Troubleshooting Procedure When a Program Error Occurs* shows the troubleshooting procedure.

Figure 5-3: Troubleshooting Procedure When a Program Error Occurs



The following shows the procedure for handling a program error by using the HDLM command (`dlnkmgr`).

5.4.1 Examining the Messages

Examine the message that is output to syslog in the host. If an error occurs in an HDLM program, a message other than KAPL08.xxx is output to syslog. Examine the content of the message. Messages with error level E (Error) or higher require corrective action.

5.4.2 Obtaining Program Information

Obtain the information that you need to report to your HDLM vendor or maintenance company.

Use the `DLMgetras` utility for collecting HDLM error information. For details on the `DLMgetras` utility and the information it collects, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

Some of the information collected by the `DLMgetras` utility might be cleared when the host is restarted. Because of this, whenever an error occurs, execute the `DLMgetras` utility as soon as possible.

5.4.3 What To Do for the Program Error

Follow the recommended actions for messages in 8. *Messages*.

If the error occurs again after you thought that you had resolved the problem, use the `dlmkmgr` command's `view` operation to check the status of the HDLM program, and then do whatever is necessary to resolve the problem. For details on the `view` operation, see 6.7 *view (Displays Information)*.

Execute the following command:

Example:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
```

If the KAPL01012-E message appears as a result of executing the command

The following shows the KAPL01012-E message:

```
KAPL01012-E Could not connect the HDLM manager. Operation
name = view
```

Start the HDLM manager.

For details about how to start the HDLM manager, see 4.3.1 *Starting the HDLM Manager*.

If the KAPL01013-E message appears as a result of executing the command

The following shows the KAPL01013-E message:

```
KAPL01013-E An error occurred in internal processing of the
HDLM command. Operation name = view, details = aa...aa
```

aa...aa indicates character string. Restart the host.

If the same error re-occurs after you thought you had resolved the problem, go to the subsection 5.4.4 *Contacting your HDLM Vendor or Maintenance Company*

5.4.4 Contacting your HDLM Vendor or Maintenance Company

If the error cannot be resolved, contact your HDLM vendor or maintenance company, and report the information that was collected by the `DLMgetras` utility.

5.5 What To Do for Other Errors

When the cause of an error may be related to HDLM but is neither a path error nor an HDLM program error, execute the `DLMgetras` utility to collect the HDLM error information, and then report the collected information to the HDLM vendor or maintenance company. For details about the `DLMgetras` utility and the information it collects, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

Chapter

6. Command Reference

This chapter describes the HDLM command (`dlnmgr`) and its operations.

- 6.1 Overview of the HDLM Command `dlnmgr`
- 6.2 `clear` (Returns the Path Statistics to the Initial Value)
- 6.3 `help` (Displays the Operation Format)
- 6.4 `offline` (Places Paths Offline)
- 6.5 `online` (Places Paths Online)
- 6.6 `set` (Sets Up the Operating Environment)
- 6.7 `view` (Displays Information)

6.1 Overview of the HDLM Command dlnkmgr

This section describes command formats and operations used for HDLM.

Command format

Enter the command using the following format:

```
dlnkmgr operation-name [parameter [parameter-value]]
```

```
dlnkmgr
```

The command name.

operation-name

The type of operation entered after dlnkmgr.

parameter

A value required for an operation.

parameter-value

A value required for a parameter.

Operations of the dlnkmgr command

Table 6-1: Operations of the dlnkmgr Command shows the operations of dlnkmgr and their functions.

Table 6-1: Operations of the dlnkmgr Command

Operation	Functions
clear	Initializes(0) the statistics (I/O count and I/O errors) of all paths managed by the HDLM system. For details, see 6.2 <i>clear (Returns the Path Statistics to the Initial Value)</i> .
help	Displays the format of the operation used for HDLM. For details, see 6.3 <i>help (Displays the Operation Format)</i> .
offline	Places offline an online path or paths. For details, see 6.4 <i>offline (Places Paths Offline)</i> .
online	Places online an offline path or paths. For details, see 6.5 <i>online (Places Paths Online)</i> .
set	Sets the HDLM operating environment. For details, see 6.6 <i>set (Sets Up the Operating Environment)</i> .
view	Displays HDLM program information, path information, LU information, HBA port information, CHA port information, and information about correspondences between hdisks, OS management path IDs, and LDEVs. For details, see 6.7 <i>view (Displays Information)</i> .

Note

- Execute the command as a user with root permissions.
- To specify a value that contains a space in its parameter, enclose the entire value in double quotes (").

6.2 clear (Returns the Path Statistics to the Initial Value)

The `dlnmgr` command's `clear` operation clears the statistics (I/O count and I/O errors) of all paths that are managed by HDLM, and returns them to their initial value.

6.2.1 Format

(1) To Set the Path Statistics to 0

```
/usr/DynamicLinkManager/bin/dlnmgr clear -pdst [-s]
```

(2) To Display the Format of the Clear Operation

```
/usr/DynamicLinkManager/bin/dlnmgr clear -help
```

6.2.2 Parameters

(1) To Set the Path Statistics to 0

`-pdst`

Clears statistics (I/O count and I/O errors) of all paths managed by HDLM to the initial value (0).

Example

```
# /usr/DynamicLinkManager/bin/dlnmgr clear -pdst
KAPL01049-I Would you like to execute the operation?
Operation name = clear [y/n]:y
KAPL01001-I The HDLM command completed normally.
Operation name = clear, completion time = yyyy/mm/dd
hh:mm:ss
#
```

`-s`

Executes the command without displaying a message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

```
# /usr/DynamicLinkManager/bin/dlnmgr clear -pdst -s
KAPL01001-I The HDLM command completed normally.
Operation name = clear, completion time = yyyy/mm/dd
hh:mm:ss
#
```

(2) To Display the Format of the Clear Operation

-help

Displays the format of the `clear` operation.

Example

```
# /usr/DynamicLinkManager/bin/dlnkmgr clear -help
clear:
  Format
    dlnkmgr clear -pdst [-s]
KAPL01001-I The HDLM command completed normally.
Operation name = clear, completion time = yyyy/mm/dd
hh:mm:ss
#
```

6.3 help (Displays the Operation Format)

The `dlnmgr` command's `help` operation displays the list of operations available for the HDLM command, or the format of individual operations.

6.3.1 Format

```
/usr/DynamicLinkManager/bin/dlnmgr help
[operation] [operation] ...
```

6.3.2 Parameter

operation

Specify the HDLM command operation whose format you want to know.

You can specify one of the following operations:

- `clear`
- `help`
- `online`
- `offline`
- `set`
- `view`

If you do not specify any operations, the `help` operation displays all operations available for the HDLM command.

Examples

Example 1

The following example shows how to display all the operations available in the HDLM command.

```
# /usr/DynamicLinkManager/bin/dlnmgr help
dlnmgr:
  Format
    dlnmgr { clear | help | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation
name = help, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 2

The following example shows how to display the formats of multiple operations.

```

# /usr/DynamicLinkManager/bin/dlnkmgr help online offline
help
online:
  Format
    dlnkmgr online [-path] [-s]
    dlnkmgr online [-path]
    { -hba HBAPortNumber.BusNumber | -hbaid HBA_ID }
  [-s]
    dlnkmgr online [-path] { -cha -pathid AutoPATH_ID | -chaid
CHA_ID } [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
    dlnkmgr online [-path] [-hdev Host_Device_Name [-ospathid
OS_Path_ID]] [-s]
  Valid value
    AutoPATH_ID { 000000 - 999999 }(Decimal)
    HBA_ID { 00000 - 99999 }(Decimal)
    CHA_ID { 00000 - 99999 }(Decimal)
    OS_Path_ID { 00000 - 99999 }(Decimal)
offline:
  Format
    dlnkmgr offline [-path]
    { -hba HBAPortNumber.BusNumber | -hbaid HBA_ID }
  [-s]
    dlnkmgr offline [-path] { -cha -pathid AutoPATH_ID |
-chaid CHA_ID } [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -hdev Host_Device_Name -ospathid
OS_Path_ID [-s]
  Valid value
    AutoPATH_ID { 000000 - 999999 }(Decimal)
    HBA_ID { 00000 - 99999 }(Decimal)
    CHA_ID { 00000 - 99999 }(Decimal)
    OS_Path_ID { 00000 - 99999 }(Decimal)
help:
  Format
    dlnkmgr help { clear | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation
name = help, completion time = yyyy/mm/dd hh:mm:ss
#

```

Example 3

The following example shows how to display the operations that can be specified by the help operation

```

# /usr/DynamicLinkManager/bin/dlnkmgr help help
help:

```

6. Command Reference

```
Format
      dlkmgr help { clear | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation
name = help, completion time = yyyy/mm/dd hh:mm:ss
#
```

6.4 offline (Places Paths Offline)

The `dlnmgr` command's `offline` operation places online paths offline. Specify the paths to be placed offline by specifying an HBA port, CHA port, single path, or host device.

There must always be at least one online path accessing each LU.

Placing too many paths offline might prevent paths from being able to switch if an error occurs. Before placing a path offline, use the `view` operation to check how many online paths remain. For details about the `view` operation, see 6.7 *view (Displays Information)*.

6.4.1 Format

(1) To Place Paths Offline

```
/usr/DynamicLinkManager/bin/dlnmgr offline
[-path]
{-hba HBA-adapter-number.bus-number-or-adapter-type.adapter-number
|-hbaid HBA-port-ID
|-cha -pathid AutoPATH_ID
|-chaid CHA-port-ID
|-pathid AutoPATH_ID
|-hdev host-device-name -ospathid OS-management-path-ID}
[-s]
```

(2) To Display the Format of the Offline Operation

```
/usr/DynamicLinkManager/bin/dlnmgr offline -help
```

6.4.2 Parameters

(1) To Place Paths Offline

`-path`

Indicates that the target of the operation is a path managed by HDLM.

This parameter is optional because `offline` is always used for paths, so it is assumed.

Make sure that you specify the paths to be placed offline by using the `-hba`, `-hbaid`, `-cha`, `-chaid`, or `-pathid` parameter, or the `-hdev` and `-ospathid` parameters.

-hba *HBA-adapter-number.bus-number*

Or

-hba *adapter-type.adapter-number*

Use this parameter to place offline, at one time, all the paths that pass through a specific HBA port. The command will place offline all the paths connected to the HBA port that has the specified *HBA-adapter-number.bus-number* or *adapter-type.adapter-number*.

Specify the HBA adapter number and bus number, or adapter type and adapter number, of the target HBA port: the numbers are found in the PathName field displayed using the `view` operation. Enter a period between these two parameter values. For details about the `view` operation, see 6.7 *view (Displays Information)*. The *HBA-adapter-number.bus-number* and *adapter-type.adapter-number* strings are case-sensitive.

Example

The following example shows how to place offline all paths connected to the HBA port whose HBA adapter number is 01 and bus number is 01.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 01.01
KAPL01055-I All the paths which pass the specified HBA
will be changed to the Offline(C) status. Is this OK? [y/
n]:y
KAPL01056-I If you are sure that there would be no problem
when all the paths which pass the specified HBA are placed
in the Offline(C) status, enter y. Otherwise, enter n.
[y/n]:y
KAPL01061-I 3 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#
```

-hbaid *HBA-port-ID*

Use this parameter to place offline, at one time, all paths that pass through a specific HBA port. The command will place offline all paths connected to the HBA port that has the specified *HBA-port-ID*. To display the HBA port IDs, execute the following `view` operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -hba
```

For details about how to execute the `view` operation to display the HBA port IDs, see (4) *To Display HBA Port Information* in 6.7.2 *Parameters*.

Example

The following example shows how to place offline all paths connected to the HBA port whose *HBA-port-ID* is 00001.

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hbaid
00001
KAPL01102-I All the paths which pass the specified HBA
port will be changed to the Offline(C) status. Is this
OK? [y/n]:y
KAPL01103-I If you are sure that there would be no problem
when all the paths which pass the specified HBA port are
placed in the Offline(C) status, enter y. Otherwise,
enter n. [y/n]:y
KAPL01061-I 15 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#
```

`-cha -pathid AutoPATH_ID`

Use this parameter to place offline, at one time, all the paths that pass through a specific CHA port. The command will place offline all the paths that pass through the CHA port to which the path with the specified *AutoPATH_ID* is connected.

Specify the current *AutoPATH_ID* of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7 *view (Displays Information)*. Leading zeros can be omitted (000001 and 1 indicate the same *AutoPATH_ID*); however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

*AutoPATH_ID*s are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, *AutoPATH_ID*s are re-assigned to each path of the LU when you execute the `cfgmgr` command. Always make sure that you use the `view` operation to find the current *AutoPATH_ID* of the target path, before executing the `offline` operation.

Example

The following example shows how to place offline all the paths connected to the CHA port 0A. In this example, a path whose *AutoPATH_ID* is 000001 is connected to the target CHA port.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -cha
-pathid 000001
KAPL01055-I All the paths which pass the specified CHA
```

```

port will be changed to the Offline(C) status. Is this
OK? [y/n]:y
KAPL01056-I If you are sure that there would be no problem
when all the paths which pass the specified CHA port are
placed in the Offline(C) status, enter y. Otherwise,
enter n. [y/n]:y
KAPL01061-I 2 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#

```

`-chaid` *CHA-port-ID*

Use this parameter to place offline, at one time, all paths that pass through a specific CHA port. The command will place offline all paths connected to the CHA port that has the specified *CHA-port-ID*. To display the CHA port IDs, execute the following view operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -cha
```

For details about how to execute the view operation to display the CHA port IDs, see (5) *To Display CHA Port Information* in 6.7.2 *Parameters*.

Example

The following example shows how to place offline all paths connected to the CHA port whose *CHA-port-ID* is 00001.

```

# /usr/DynamicLinkManager/bin/dlnkmgr offline -chaid
00001
KAPL01102-I All the paths which pass the specified CHA
port will be changed to the Offline(C) status. Is this
OK? [y/n]:y
KAPL01103-I If you are sure that there would be no problem
when all the paths which pass the specified HBA port are
placed in the Offline(C) status, enter y. Otherwise,
enter n. [y/n]:y
KAPL01061-I 15 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#

```

`-pathid` *AutoPATH_ID*

Use this parameter to place a single path offline.

Specify the current *AutoPATH_ID* of the target path, which is displayed by using the view operation. For details about the view operation, see 6.7 *view (Displays Information)*. Leading zeros can be omitted (000001 and 1 indicate the same *AutoPATH_ID*); however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the `cfgmgr` command. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation.

`-hdev` *host-device-name* `-ospathid` *OS-management-path-ID*

Use this parameter to place offline path connected to the specified host device.

For *host-device-name*, specify the value of `HDevName`.

For *OS-management-path-ID*, specify the value of `OSPathID`. Leading zeroes can be omitted from the OS management path ID (00001 and 1 are the same value).

To display `HDevName` and `OSPathID`, execute the `view` operation as follows:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
```

For details on how to execute the `view` operation and display the host device name and OS management path ID, see (3) *To Display LU Information in 6.7.2 Parameters*. Only one set of values can be specified for the `-hdev` parameter. This parameter is not case sensitive.

Example

The following shows an example of placing offline path for which the host device name is `hdisk0` and OS management path ID is 00001 while confirming command operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -path
-hdev hdisk0 -ospathid 1
KAPL01052-I The currently selected paths will be changed
to the Offline(C) status. Is this OK? [y/n]:y
KAPL01053-I If you are sure that there would be no problem
when the path is placed in the Offline(C) status, enter
y. Otherwise, enter n. [y/n]:y
KAPL01061-I 1 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#
```

`-s`

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

The following example shows how to place a path, whose AutoPATH_ID is 000001, offline without asking for confirmation of command execution from the user:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -pathid 1
-s
KAPL01061-I 1 path(s) were successfully placed
Offline(C); 0 path(s) were not. Operation name = offline
#
```

(2) To Display the Format of the Offline Operation

-help

Displays the format of the offline operation.

Example

The following example shows how to display the format of the offline operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -help
offline:
  Format
    dlnkmgr offline [-path]
      { -hba HBAPortNumber.BusNumber | -hbaid HBA_ID
} [-s]
    dlnkmgr offline [-path] { -cha -pathid AutoPATH_ID |
-chaid CHA_ID } [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -hdev Host_Device_Name
-ospathid OS_Path_ID [-s]
  Valid value
    AutoPATH_ID      { 000000 - 999999 } (Decimal)
    HBA_ID            { 00000 - 99999 } (Decimal)
    CHA_ID            { 00000 - 99999 } (Decimal)
    OS_Path_ID       { 00000 - 99999 } (Decimal)
KAPL01001-I The HDLM command completed normally.
Operation name = offline, completion time = yyyy/mm/dd
hh:mm:ss
#
```

Reference

Using the `view` operation together with standard UNIX commands enables you to filter the path information listed for a specific HBA port or CHA port. For details about the `view` operation, see *6.7 view (Displays Information)*.

We recommend that you use the following command and verify the information on the target paths before you execute the `offline` operation to place offline all the paths

connected to a specific HBA port or CHA port.

Example 1

The following example shows how to filter and display the information on all paths that pass through the HBA port whose HBA adapter number is 04 and bus number is 01.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path | grep  
04.01
```

The above command will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all the paths that pass through the CHA port 0A of the Thunder 9500V series:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -stname |  
grep 9500V | grep 0A
```

The above command will display information pertaining to only those paths that pass through the specified CHA port.

6.5 online (Places Paths Online)

The `dlnmgr` command's `online` operation places offline paths online. Specify the paths to be placed online by specifying an HBA port, CHA port, single path, or host device.

6.5.1 Format

(1) To Place Paths Online

```
/usr/DynamicLinkManager/bin/dlnmgr online
[-path]
[-hba HBA-adapter-number . bus-number-or-adapter-type . adapter-number
|-hbaid HBA-port-ID
|-cha -pathid AutoPATH_ID
|-chaid CHA-port-ID
|-pathid AutoPATH_ID
|-hdev host-device-name [-ospathid OS-management-path-ID]]
[-s]
```

(2) To Display the Format of the Online Operation

```
/usr/DynamicLinkManager/bin/dlnmgr online -help
```

6.5.2 Parameters

(1) To Place Paths Online

`-path`

Indicates that the target of the operation is a path managed by HDLM.

This parameter is optional because `online` is always used for paths, so it is assumed.

Specify the paths to be placed online by using the `-hba`, `-hbaid`, `-cha`, `-chaid`, `-pathid`, or `-hdev` parameter. If you do not specify any of these parameters, the command will place all the offline paths online. If there is a path that cannot be placed online, a message asks whether you would like to continue processing. To ignore the offline path that cannot be placed online and to continue processing, enter `y`. To stop the processing, enter `n`.

`-hba` *HBA-adapter-number . bus-number*

Or

`-hba adapter-type.adapter-number`

Use this parameter to place online, at one time, all the paths that pass through a specific HBA port. The command will place online all the paths connected to the HBA port that has the specified *HBA-adapter-number.bus-number* or *adapter-type.adapter-number*.

Specify the HBA adapter number and bus number, or adapter type and adapter number, of the target HBA port: the numbers are found in the PathName field displayed using the `view` operation. Enter a period between these two parameter values. For details about the `view` operation, see 6.7 *view (Displays Information)*. The *HBA-adapter-number.bus-number* and *adapter-type.adapter-number* strings are case-sensitive.

Example

The following example shows how to place online all paths connected to an HBA port whose HBA adapter number is 01 and bus number is 01.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hba 01.01
KAPL01057-I All the paths which pass the specified HBA
will be changed to the Online status. Is this OK? [y/n]:y
KAPL01061-I 3 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

`-hbaid HBA-port-ID`

Use this parameter to place online, at one time, all paths that pass through a specific HBA port. The command will place online all paths connected to the HBA port that has the specified *HBA-port-ID*. To display the HBA port IDs, execute the following `view` operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -hba
```

For details about how to execute the `view` operation to display the HBA port IDs, see (4) *To Display HBA Port Information* in 6.7.2 *Parameters*.

Example

The following example shows how to place online all paths connected to the HBA port whose *HBA-port-ID* is 00001.

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hbaid
00001
KAPL01104-I All the paths which pass the specified HBA
```

```

port will be changed to the Online status. Is this OK?
[y/n]:y
KAPL01061-I 15 path(s) were successfully placed Online;
0 path(s) were not. Operation name = online
#

```

`-cha -pathid AutoPATH_ID`

Use this parameter to place online, at one time, all the paths that pass through a specific CHA port. The command will place online all the paths that pass through the CHA port to which the path with the specified *AutoPATH_ID* is connected.

Specify the current *AutoPATH_ID* of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7 *view (Displays Information)*. Leading zeros can be omitted (000001 and 1 indicate the same *AutoPATH_ID*); however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

*AutoPATH_ID*s are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, *AutoPATH_ID*s are re-assigned to each path of the LU when you execute the `cfgmgr` command. Always make sure that you use the `view` operation to find the current *AutoPATH_ID* of the target path, before executing the `online` operation.

Example

The following example shows how to place online the paths connected to the CHA port 0A. In this example, a path whose *AutoPATH_ID* is 000002 is connected to the target CHA port.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```

# /usr/DynamicLinkManager/bin/dlnkmgr online -cha
-pathid 000002
KAPL01057-I All the paths which pass the specified CHA
port will be changed to the Online status. Is this OK?
[y/n]:y
KAPL01061-I 2 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#

```

`-chaid CHA-port-ID`

Use this parameter to place online, at one time, all paths that pass through a specific CHA port. The command will place online all paths connected to the CHA port that has the specified *CHA-port-ID*. To display the CHA port IDs, execute the following `view` operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -cha
```

For details about how to execute the `view` operation to display the CHA port IDs, see (5) *To Display CHA Port Information* in 6.7.2 *Parameters*.

Example

The following example shows how to place online all paths connected to the CHA port whose CHA-*port-ID* is 00001.

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -chaid
00001
KAPL01104-I All the paths which pass the specified CHA
port will be changed to the Online status. Is this OK?
[y/n]:y
KAPL01061-I 15 path(s) were successfully placed Online;
0 path(s) were not. Operation name = online
#
```

`-pathid AutoPATH_ID`

Use this parameter to place a single path online.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7 *view (Displays Information)*. Leading zeros can be omitted (000001 and 1 indicate the same AutoPATH_ID); however, when the target AutoPATH_ID is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the `cfgmgr` command. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation.

`-hdev host-device-name [-ospathid OS-management-path-ID]`

Use this parameter to place online path connected to the specified host device. If the `-ospathid` parameter is not specified, path with the specified host device name are placed online.

For *host-device-name*, specify the value of HDevName.

For *OS-management-path-ID*, specify the value of OSPathID. Leading zeroes can be omitted from the OS management path ID (00001 and 1 are the same value).

To display HDevName and OSPathID, execute the `view` operation as follows:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
```

For details on how to execute the `view` operation and display the host device name and OS management path ID, see (3) *To Display LU Information* in 6.7.2 *Parameters*. Only one set of values can be specified for the `-hdev` parameter. This parameter is not case sensitive.

Example

The following shows an example of placing online path for which the host device name is `hdisk0` and OS management path ID is `00001` while confirming command operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -path -hdev
hdisk0 -ospathid 1
KAPL01050-I The currently selected paths will be changed
to the Online status. Is this OK? [y/n]:y
KAPL01061-I 1 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

`-s`

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

The following example shows how to place a path, whose `AutoPATH_ID` is `000002`, online without asking for confirmation of command execution from the user:

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -pathid 2
-s
KAPL01061-I 1 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

(2) To Display the Format of the Online Operation

`-help`

Displays the format of the `online` operation.

Example

The following example shows how to display the format of the `online` operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -help
online:
  Format
    dlnkmgr online [-path] [-s]
    dlnkmgr online [-path]
      { -hba HBAPortNumber.BusNumber | -hbaid HBA_ID }
  [-s]
    dlnkmgr online [-path] { -cha -pathid AutoPATH_ID |
  -chaid CHA_ID } [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
    dlnkmgr online [-path] [-hdev Host_Device_Name
  [-ospathid OS_Path_ID]] [-s]
  Valid value
    AutoPATH_ID      { 000000 - 999999 } (Decimal)
    HBA_ID            { 00000 - 99999 } (Decimal)
    CHA_ID            { 00000 - 99999 } (Decimal)
    OS_Path_ID       { 00000 - 99999 } (Decimal)
  KAPL01001-I The HDLM command completed normally.
  Operation name = online, completion time = yyyy/mm/dd
  hh:mm:ss
  #
```

Reference

Using the `view` operation together with standard UNIX commands enables you to filter the path information listed for a specific HBA port or CHA port. For details about the `view` operation, see *6.7 view (Displays Information)*.

We recommend that you use the following command and verify the information on the target paths before you execute the `online` operation to place online all the paths connected to a specific HBA port or CHA port.

Example 1

The following example shows how to filter and display the information on all paths that pass through the HBA port whose HBA adapter number is 04 and bus number is 01.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path | grep
04.01
```

The above command will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all paths that pass through the CHA port 0A of the Thunder 9500V series:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -stname |  
grep 9500V | grep 0A
```

The above command will display information pertaining to only those paths that pass through the specified CHA port.

6.6 set (Sets Up the Operating Environment)

The `dlnmgr` command's `set` operation sets the HDLM operating environment.

6.6.1 Format

(1) To Set Up the HDLM Operating Environment

```
/usr/DynamicLinkManager/bin/dlnmgr set
    {-lb {on [-lbtype {rr|exrr|lio|exlio|lbk|exlbk}] |off}
    |-ellv error-log-collection-level
    |-elfs error-log-file-size
    |-elfn number-of-error-log-files
    |-systflv trace-level
    |-systfs trace-file-size
    |-systfn number-of-trace-files
    |-pchk {on [-intvl checking-interval] |off}
    |-afb {on [-intvl checking-interval] |off}
    |-iem { on [-intvl error-monitoring-interval]
    [-iemnum number-of-times-error-is-to-occur] | off }
    |-lic
    |-audlog {on [-audlv audit-log-data-collection-level] [-category
    [[ss] [a] [ca] |all]] |off}
    |-audfac facility-value
    [-s]
```

(2) To Display the Format of the Set Operation

```
/usr/DynamicLinkManager/bin/dlnmgr set -help
```

6.6.2 Parameters

(1) To Set Up the HDLM Operating Environment

Table 6-2: Default and Recommended Values shows the defaults and recommended values for each setting. If you change the value of the `set` operation, the new value takes effect immediately.

Table 6-2: Default and Recommended Values

Item name	Default value	Recommended value
Load balancing	<code>on</code> The Extended Least I/Os algorithm is used.	<code>on</code> The recommended algorithm depends on the operating environment.
Error log collection level	<code>3</code> : Collect error information for the Information level and higher.	<code>3</code> : Collect error information for the Information level and higher.
Error log file size	<code>9900</code> (KB)	<code>9900</code> (KB)
Number of error log files	<code>2</code>	<code>2</code>
Trace level	<code>0</code> : Do not output any trace.	<code>0</code> : Do not output any trace.
Trace file size	<code>1000</code> (KB)	<code>1000</code> (KB)
Number of trace files	<code>4</code>	<code>4</code>
Path health checking	<code>on</code> (Interval is 30 minutes.)	<code>on</code> The recommended checking interval depends on the operating environment.
Automatic failback	<code>on</code> (Interval is 60 minutes.)	The recommended checking interval depends on the operating environment.
Intermittent error monitoring	<code>off</code>	<code>on</code> The recommended checking interval depends on the operating environment.
Collecting audit log data	<code>off</code>	Set <code>on</code> , if you want to collect audit log data.
Audit log facility	<code>user</code>	<code>local0</code> to <code>local7</code>

```
-lb {on [-lbtype {rr|exrr|lio|exlio|lbk|exlbk}]}|off}
```

Enables or disables load balancing.

`on`: Enabled

`off`: Disabled

Load balancing distributes load among paths and prevents the performance of the entire system from deteriorating. As such, we recommend that you set this parameter to `on`.

```
-lbtype {rr|exrr|lio|exlio|lbk|exlbk}
```

Specify the algorithm to be used for load balancing.

`rr`: The Round Robin algorithm

`exrr`: The Extended Round Robin algorithm

`lio`: The Least I/Os algorithm

`exlio`: The Extended Least I/Os algorithm

`lbk`: The Least Blocks algorithm

`exlbk`: The Extended Least Blocks algorithm

The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even when you disable the load balancing function by specifying `-lb off`. Therefore, if when you re-enable the load balancing function without specifying an algorithm, load balancing will be performed according to the algorithm that is stored in the system.

`-ellv` *error-log-collection-level*

Specify the level of error information you want to collect for an error log.

The HDLM manager log (`dlnmgr [1-16] .log`) contains log files in which an error log collection level can be set.

Table 6-3: Values of the Error Logging Level shows the values of the error logging level. If an error occurs, you may have to set the error log collection level to 1 or higher to collect log information.

Table 6-3: Values of the Error Logging Level

Value	Description
0	Collects no error log.
1	Collects error information for the Error or higher level.
2	Collects error information for the Warning or higher level.
3	Collects error information for the Information or higher level.
4	Collects error information for the Information or higher level (including maintenance information).

The higher the error log collection level value, the more log information will be output. As the amount of log information that is output increases, the amount of time before existing information will be overwritten becomes shorter.

Example

```
# /usr/DynamicLinkManager/bin/dlnmgr set -ellv 1
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
```

```
KAPL01001-I The HDLM command completed normally.
Operation name = set, completion time = yyyy/mm/dd
hh:mm:ss
#
```

-elfs *error-log-file-size*

Specify a value from 100 to 2000000 (KB) for the size of the error log files (dlmmgrn.log (*n* indicates a file number from 1 to 16)). The specified value is used for HDLM manager logs.

By specifying both the log file size and the number of log files, you can collect up to 32,000,000KB (approximately 30 GB) of error logs in total.

When the size of all the log files in a log file group reaches their maximum value, the new log data will overwrite the existing log data data, starting with the oldest log data.

-elfn *number-of-error-log-files*

Specify the number of error log files (dlmmgrn.log (*n* indicates a file number from 1 to 16)). Specify a value from 2 to 16.

By specifying both the log file size and the number of log files, you can collect up to 32,000,000KB (approximately 30GB) of error logs in total.

-systflv *trace-level*

Specify the trace output level.

The trace files for which trace levels can be set are hdlmtrn.log (*n* indicates a file number from 1 to 64).

Table 6-4: Trace Level Values shows the values of the trace level. If an error occurs, set the trace level to 1 or higher to collect the log information.

Table 6-4: Trace Level Values

Value	Description
0	Does not output any trace.
1	Only outputs error information.
2	Outputs a summary of program operation.
3	Outputs details of program operation.
4	Outputs all information.

The higher the error log collection level value, the more log information will be output. As the amount of log information that is output increases, the amount of

time before existing information is overwritten becomes shorter.

`-sysdfs trace-file-size`

Specify the size of the trace file in kilobytes. Specify a value from 100 to 16000.

When combined with the specification for the number of trace files, the maximum size of the trace files that can be collected is 1024000KB.

If the value is changed to something smaller than the value that is currently set, the execution confirmation message KAPL01097-W will be displayed and the trace file will be deleted temporarily.

The trace files for which a file size can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64). The trace files are fixed in length. Thus, even if the amount of written trace information is less than the setting file size, the size of each output trace file is always the same. When all the trace files become full, the new trace data will overwrite the oldest trace data.

`-sysdfs number-of-trace-files`

Specify the number of trace files. Specify a value from 2 to 64.

When combined with the specification for the trace file size, the maximum total size of the trace files that can be collected is 1024000KB.

If the value is changed to something smaller than the value that is currently set, the execution confirmation message KAPL01097-W will be displayed and the trace file will be deleted temporarily.

The trace files for which the number of files can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64).

`-pchk {on [-intvl checking-interval] | off}`

Enables or disables path health checking.

`on`: Enabled

`off`: Disabled

For a standby host, or a host connected to the Thunder 9500V series, or Hitachi AMS/WMS series storage system, we recommend that you activate path health checking so that you can detect errors in paths where I/Os operations do not occur.

When you specify `on`, specify the checking interval of path health checking by specifying the parameter immediately following `on`. If you do not specify a checking interval, path health checking is executed in the following interval:

- When the checking interval has not been specified before:
Every 30 minutes (default setting)
- When the checking interval has been specified before:

The previously specified interval

The explanation for the following sub-parameter describes how to specify the checking interval.

`-intvl checking-interval`

Specify the checking interval between path health checks. Specify a value from 1 to 1440 minutes depending on the user environment.

When you change the checking interval, the new setting takes effect immediately. When the checking interval is shortened and the checking interval after the change (from the end of the previous path health check) has already elapsed, the path health check will start over.

The path health check interval setting remains stored in the system even if you disable the function by changing the path health checking to `off`.

Therefore, when you re-enable path health checking and do not change the interval, the path health interval stored in the system is used.

`-afb {on [-intvl checking-interval] | off}`

Enables or disables automatic failback.

`on`: Enabled

`off`: Disabled

Enabling automatic failbacks might automatically place online paths online that were intentionally placed offline (for example, paths placed offline for maintenance work).

If you want to prevent such paths from automatically being placed online, disable this function. When intermittent errors occur in paths or storage systems, statuses of paths alternates between the online and offline status frequently, thus decreasing I/O performance.

Automatic failbacks are performed on the following types of paths:

- Paths where an error occurred and for which the KAPL08022-E message was displayed
- Path where an error occurred during the startup of the HDLM manager.

To prevent intermittent errors from deteriorating I/O performance, we recommend that you also enable intermittent error monitoring when the automatic failback function is enabled. Intermittent error monitoring is specifiable only when automatic failbacks are enabled.

See *Table 6-5: Relationship Between the Setting for the Automatic Failback Function and Intermittent Error Monitoring and the Executable Operations* for the relationship between automatic failbacks and intermittent error monitoring.

When you specify `on`, specify the checking interval by specifying the parameter immediately following `on`. If you do not specify a checking interval, path statuses will be checked in the following way:

- When the checking interval has not been specified before:
Every 60 minute (default setting)
- When the checking interval has been specified before:
The previously used interval

The explanation for the following sub-parameter describes how to specify the interval between path status checks.

`-intvl checking-interval`

Specify the interval between path status checks. Specify a value from 1 to 1440 minutes. The default is 60. Specify an interval appropriate for your operating environment.

If intermittent error monitoring is `on` and the number of times that the error is to occur is set to a value of 2 or more, the following condition must be satisfied:

$$\text{error-monitoring-interval} \geq \text{checking-interval-for-automatic-failback} \times \text{number-of-times-error-is-to-occur-during-intermittent-error-monitoring}$$

If this condition is not satisfied, the KAPL01080-W message will be output and an error will occur. If this happens, change any of the following settings: the checking interval for automatic failbacks, intermittent error-monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

When you changed the error monitor interval while intermittent error monitoring is running, the new settings will take effect immediately. When the checking interval is shortened and the checking interval time after the change has already elapsed during the current checking interval, the path status check will start over.

This setting remains stored in the system, even if you disable the function by changing the setting of automatic failbacks to `off`. Therefore, if you re-enable automatic failbacks and do not change the interval, path status checks will be executed at the interval already stored in the system.

`-iem { on [-intvl error-monitoring-interval] [-iemnum`

number-of-times-error-is-to-occur] | *off* }

Enables or disables intermittent error monitoring.

on: Enabled

off: Disabled

Intermittent error monitoring can be enabled only when automatic failback is set to *on*.

When you use automatic failback, we recommend that you set intermittent error monitoring to *on* to prevent an intermittent error from reducing I/O performance.

If *on* is specified, be sure to also specify the intermittent error monitoring interval and the number of times that the error is to occur. The system assumes that an intermittent error is occurring if the specified number of times that the error is to occur is reached during the monitoring interval. A path that is assumed to have an intermittent error is excluded from automatic failbacks. Intermittent error monitoring is performed on each path. Intermittent error monitoring starts when a path is recovered from an error by performing an automatic failback.

If you omit the intermittent error monitoring interval or the number of times that the error is to occur, each setting is specified as follows:

- When the intermittent error monitoring interval or the number of times that the error is to occur has not been specified before:

The intermittent error monitoring interval is set to 210 minutes, and the number of times that the error is to occur is set to 3.

- When the intermittent error monitoring interval or the number of times that the error is to occur has been specified before:

The values specified from the last time are used.

When a value of 2 or more is specified for the number of times, the following condition must be satisfied:

error-monitoring-interval \geq *checking-interval-for-automatic-failback* \times
number-of-times-error-is-to-occur-during-intermittent-error-monitoring

If this condition is not satisfied, the KAPL01080-W message will be output and an error will occur. If this happens, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

The following shows the sub-parameters that should be specified: the error monitoring interval and the number of times that the error is to occur:

`-intvl error-monitoring-interval`

Specify the monitoring interval for an intermittent error. Use a value from 1 to 1440 minutes. The default is 210.

During intermittent error monitoring, if changes are made to the intermittent error monitoring interval setting or the setting for the number of times that an error is to occur, the error count and the elapsed time measured since monitoring has started are reset to 0.

When intermittent error monitoring is not being performed, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the new settings will take effect after the next time an automatic failback is successful. Because the errors and elapsed time are not counted or measured while intermittent errors are not being monitored, the those values will not change.

The monitoring interval specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and a monitoring interval is not specified, error monitoring will be performed by using the stored monitoring interval.

`-iemnum number-of-times-error-is-to-occur`

Specify the number of times the error is to occur. Valid values are from 1 to 99. The default is 3.

During intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the number of errors and the time that has passed since intermittent error monitoring has started are reset to 0. The changed setting will take effect immediately and intermittent error monitoring will restart.

When intermittent error monitoring is not being performed, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the new value will take effect after the next automatic failback successfully completes. When intermittent error monitoring is not being performed, the number of errors that determine that an intermittent error has occurred is not counted and this value is not changed.

The number of times that the error is to occur is stored in the system, even

when `-iem off` is specified and intermittent error monitoring is disabled. Therefore, when you re-enable intermittent error monitoring without specifying the number of times, the error monitoring will be executed using the value stored in the system.

When the `set -iem on` operation is executed during error monitoring, even though you do not change the conditions for intermittent error monitoring, the number of errors and the time that has passed since the error monitoring has started are reset to 0. Intermittent error monitoring will then resume with the changed settings.

If you set the automatic fallback function to `off` while intermittent error monitoring is `on`, intermittent error monitoring will be disabled. Note, however, that if you use the `view -sys` operation to display the HDLM functionality configuration, `Intermittent Error Monitor` will be shown as `on`. When the automatic fallback function is returned to `on`, intermittent error monitoring will once again be enabled.

The executable operations for the automatic fallback function and intermittent error monitoring depend on the settings for those functions.

Table 6-5: Relationship Between the Setting for the Automatic Fallback Function and Intermittent Error Monitoring and the Executable Operations shows the relationship between the settings for the automatic fallback function and intermittent error monitoring and the executable operations for those functions.

Table 6-5: Relationship Between the Setting for the Automatic Fallback Function and Intermittent Error Monitoring and the Executable Operations

Setting		Available operation	Result of operation
AFB	IEM		
on	on	Set AFB to <code>on</code> .	The operations of AFB and IEM do not change.
		Change the AFB setting.	AFB is performed under the new settings. ^{#1}
		Set AFB to <code>off</code> .	<ul style="list-style-type: none"> AFB and IEM are disabled. The error count, elapsed monitoring time, and information about paths not subject to automatic fallback are cleared.

Setting		Available operation	Result of operation
AFB	IEM		
		Set IEM to <code>on</code> .	<ul style="list-style-type: none"> When a path is being monitored (during a period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring will restart. When a path is not being monitored, nothing changes.
		Change the IEM settings.	<ul style="list-style-type: none"> While a path is being monitored, the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring will restart.^{#1} When a path is not being monitored, the IEM settings will take effect again when the path is recovered from the error status by performing an automatic failback.
		Set IEM to <code>off</code> .	<ul style="list-style-type: none"> IEM is disabled. The error count, elapsed monitoring time, and information about paths not subject to automatic failbacks are cleared.
	<code>off</code>	Set AFB to <code>on</code> .	The operations of AFB and IEM do not change.
		Change the AFB setting.	AFB operates using new settings.
		Set AFB to <code>off</code> .	AFB is disabled.
		Set IEM to <code>on</code> .	IEM is enabled. ^{#1}
	<code>off</code>	Set AFB to <code>on</code> .	AFB and IEM are enabled. ^{#1}
		Set AFB to <code>off</code> .	The operations of AFB and IEM do not change.
	<code>off</code>	Set AFB to <code>on</code> .	AFB is enabled.
		Set AFB to <code>off</code> .	The operations of AFB and IEM do not change.

Legend:

AFB: Automatic failback

IEM: Intermittent error monitoring

^{#1}

When this condition is not satisfied, the KAPL01080-W message is output and an error occurs. The status of intermittent error monitoring does not change.

#2

Because automatic failback is `off`, intermittent error monitoring is disabled.

Example

The following example shows how to monitor for intermittent errors.

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -iem on -intvl
20 -iemnum 2
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally.
Operation name = set, completion time = yyyy/mm/dd
hh:mm:ss
#
```

`-lic`

Specify this option for when a license is updated. The HDLM license is provided via a license key or license key file. A license key file is a file that stores the HDLM license key.

If a license key file is provided:

Store the license key file named `hdlm_license` directly under `/var/tmp`, and then execute the `set -lic` operation. A message confirming that the license key has been registered is displayed, depending on the license key type defined in the license key file. When a temporary license key or emergency license key has been registered, the expiration period is displayed (KAPL01071-I, KAPL01072-I).

If a license key is provided:

When the `set -lic` operation is executed, a message (KAPL01068-I) asking the user to enter a license key appears. Enter the license key. A message confirming that the license key has been registered is displayed, depending on the license key type described in the license key file. When a temporary license key or emergency license key, the expiration period is also displayed (KAPL01071-I, KAPL01072-I).

Table 6-6: License Key Types lists the license key types.

Table 6-6: License Key Types

Type	Description
Permanent license key	Permanent licenses are valid for using HDLM permanently.

Type	Description
Temporary license key [#]	Temporary license key are used temporarily, for example, when a user needs to perform product evaluations. Temporary licenses keys are valid for 120 days after the installation. You cannot reuse a temporary license key.
Emergency license key	Emergency license keys are used temporarily, for example, when waiting for issuing a permanent license key to be issued. Emergency licenses keys are valid for 30 days after they are entered. You cannot reuse an emergency license key.

#

A temporary license key cannot be installed by using the `dlnmgr set` operation.

Example 1

The following example shows how to update the license key when the license key file exists:

```
# /usr/DynamicLinkManager/bin/dlnmgr set -lic
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01071-I A permanent license was installed.
#
```

Example 2

The following example shows how to update the license key when the license key file does not exist:

```
# /usr/DynamicLinkManager/bin/dlnmgr set -lic
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01083-I There is no license key file. File name =/
var/tmp/hdlm_license
KAPL01068-I Enter a license key:*****
KAPL01071-I A permanent license was installed.
#
```

```
-audlog {on [-audlv audit-log-data-collection-level] [-category [[ss]
[a] [ca] |all]] |off}
```

Specifies whether to collect audit log data.

`on`: Audit log data is collected.

`off`: Audit log data is not collected.

`-audlv audit-log-data-collection-level`

Specifies the severity level of audit log data to be collected.

Table 6-7: Values Indicating Audit Log Data Collection Levels describes the values that indicate audit log data collection levels. The default is 6.

Table 6-7: Values Indicating Audit Log Data Collection Levels

Value (severity)	Explanation
0	No audit log data is collected.
1	
2	Critical-level audit log data is collected.
3	Critical-level and Error-level audit log data is collected.
4	Critical-level, Error-level, and Warning-level audit log data is collected.
5	
6	Critical-level, Error-level, Warning-level, and Informational-level audit log data is collected.
7	

`-category [[ss] [a] [ca] |all]`

Specifies the categories of audit log data to be collected. *Table 6-8: Values Indicating Audit Log Data Categories* lists the values that indicate categories of audit log data. The default is `all`. Note that if you enter `-category` without specifying any category (`ss`, `a`, `ca`, or `all`), it is assumed that `all` is specified.

Table 6-8: Values Indicating Audit Log Data Categories

Value	Explanation
<code>ss</code>	Audit log events of the <code>StartStop</code> category are collected.
<code>a</code>	Audit log events of the <code>Authentication</code> category are collected.
<code>ca</code>	Audit log events of the <code>ConfigurationAccess</code> category are collected.
<code>all</code>	Audit log events of the <code>StartStop</code> , <code>Authentication</code> , and <code>ConfigurationAccess</code> categories are collected.

`-audfac facility-value`

Specifies the audit log facility.

Table 6-9: Values of the Audit Log Facility describes the values of the audit log facility. The default is `user`.

Table 6-9: Values of the Audit Log Facility

Value	Corresponding facility value in the /etc/syslog.conf file
user or 1	user
local0 or 16	local0
local1 or 17	local1
local2 or 18	local2
local3 or 19	local3
local4 or 20	local4
local5 or 21	local5
local6 or 22	local6
local7 or 23	local7

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

(2) To Display the Format of the Set Operation

-help

Displays the format of the set operation.

Example

The following example shows how to display the format of the set operation:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -help
```

```
set:
```

```
Format
```

```
dlnkmgr set { -lb on [ -lbtype { rr | exrr | lio | exlio | lbk | exlbk } ]
              | -lb off
              | -ellv ElogLevel
              | -elfs ElogFileSize
```

6. Command Reference

```
| -elfn Number-Of-ElogFiles
| -systflv TraceLevel
| -systfs TraceFileSize
| -systfn Number-Of-TraceFiles
| -pchk on [ -intvl Interval-Time ]
| -pchk off
| -afb on [ -intvl Interval-Time ]
| -afb off
| -iem on
|
| [ -intvl Error-Monitor-Interval ]
| [ -iemnum Number-Of-Times ]
| -iem off
| -lic
| -audlog on
|
| [ -audlv AudlogLevel ]
| [ -category Category-Value ]
| -audlog off
| -audfac { Facility-Name | Facility-Number }
}
[-s]
```

Valid value

ElogLevel	{ 0 1 2 3 4 }	(Default Value 3)
ElogFileSize	{ 100 - 2000000 }	(KB) (Default Value 9900)
Number-Of-ElogFiles	{ 2 - 16 }	(Files) (Default Value 2)
TraceLevel	{ 0 1 2 3 4 }	(Default Value 0)
TraceFileSize	{ 100 - 16000 }	(KB) (Default Value 1000)
Number-Of-TraceFiles	{ 2 - 64 }	(Files) (Default Value 4)
Interval-Time	{ 1 - 1440 }	(Minute) (Default Value 30)

```

      (pchk)

Interval-Time          { 1 - 1440 } (Minute)  (Default Value 60)

      (afb)

Error-Monitor-Interval { 1 - 1440 } (Minute)  (Default Value 210)

Number-Of-Times        { 1 - 99 } (Times)      (Default Value 3)

AudlogLevel            { 0 - 7 }                (Default Value 6)

Category-Value         { [ss] [a] [ca] |
                        all } (Default Value all)

Facility-Name          { user |
                        local0 - local7 } (Default Value user)

Facility-Number        { 1 | 16 - 23 }          (Default Value 1)

KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss

#

```

6.7 view (Displays Information)

The `view` option displays HDLM program information, path information, LU information, HBA port information, CHA port information, and the correspondences between hdisks, OS management path IDs, and LDEVs.

6.7.1 Format

(1) To Display Program Information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -sys
[-sfunc|-msrv|-adrv|-pdrv|-lic|-audlog]
[-t]
```

(2) To Display Path Information

To display path information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -path
[-hdev host-device-name]
[-stname]
[-iem]
[-srt {pn|lu|cp}]
[-hbaportwwn]
[-t]
```

To display path information (by selecting a display item)

```
/usr/DynamicLinkManager/bin/dlnkmgr view -path -item
[pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
[hbaportwwn]
[-hdev host-device-name]
[-stname]
[-srt {pn|lu|cp}]
[-t]
```

To display a summary of path information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -path -c
[-stname]
```



```
[-srt {lu|cp}]
```

```
[-t]
```

(3) To Display LU Information

To display LU information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -lu
```

```
[-hdev host-device-name | -pathid AutoPATH_ID]
```

```
[-t]
```

To display LU information (by adding items to be displayed)

```
/usr/DynamicLinkManager/bin/dlnkmgr view -lu -item
```

```
[ [slpr] [pn] [cp] [clpr] [type] [ic] [ie] [dnu] [iep]
```

```
[vg] | all ]
```

```
[-hdev host-device-name | -pathid AutoPATH_ID]
```

```
[-t]
```

To display a summary of LU information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -lu -c [-t]
```

To display a summary of LU information (by adding items to be displayed)

```
/usr/DynamicLinkManager/bin/dlnkmgr view -lu -c -item
```

```
[[slpr] [vg] | all ]
```

```
[-t]
```

(4) To Display HBA Port Information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -hba [-srt pb]
```

```
[-portwn] [-t]
```

(5) To Display CHA Port Information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -cha [-srt cp] [-t]
```

(6) Correspondences Between hdisks, OS Management Path IDs, and LDEVs

```
/usr/DynamicLinkManager/bin/dlnkmgr view -drv [-t]
```

(7) To Display the Format of the View Operation

```
/usr/DynamicLinkManager/bin/dlnkmgr view -help
```

6.7.2 Parameters

This section describes the parameters for the view operation, in the following order:

- (1) *To Display Program Information*
- (2) *To Display Path Information*
- (3) *To Display LU Information*
- (4) *To Display HBA Port Information*
- (5) *To Display CHA Port Information*
- (6) *To Display the Correspondences Between hdisks, OS Management Path IDs, and LDEVs*
- (7) *To Display the Format of the View Operation*

(1) To Display Program Information

`-sys [-sfunc | -msrv | -adrv | -pdrv | -lic | -audlog]`

Displays the HDLM program information.

Use one of the sub-parameters (following `-sys`) to specify the program information that you want to display. If you do not specify a sub-parameter, the command displays all of the program information except the information about audit log data collection settings.

Table 6-10: Displayed Program Information describes the specifiable parameters, displayed information, displayed items, and a corresponding description.

`-t`

Does not display the title for each information item.

Table 6-10: Displayed Program Information

Parameter and program information to be displayed	Item	Description
-sfunc Information about the HDLM function settings	HDLM Version	HDLM version number
	Service Pack Version	HDLM SP version number. This item is blank if no a SP is present.

Parameter and program information to be displayed	Item	Description
	Load Balance	Settings for load balancing <ul style="list-style-type: none"> Setting status: <ul style="list-style-type: none"> on: Enabled off: Disabled Algorithm <p>When the setting status of load balancing is on, one of the following types of algorithms is used for load balancing is displayed in the parentheses following on.</p> <ul style="list-style-type: none"> rr: The Round Robin algorithm extended rr: The Extended Round Robin algorithm lio: The Least I/Os algorithm extended lio: The Extended Least I/Os algorithm lbk: The Least Blocks algorithm extended lbk: The Extended Least Blocks algorithm
	Support Cluster	Blank [#]
	Elog Level	Error logging level: <ul style="list-style-type: none"> 0: Collects no error information. 1: Collects error information at the Error level or higher. 2: Collects error information at the Warning level or higher. 3: Collects error information at the Information level or higher. 4: Collects error information at the Information level or higher (including maintenance information).
	Elog File Size (KB)	Size of the error log file in kilobytes
	Number Of Elog Files	Number of error log files
	Trace Level	Trace output level: <ul style="list-style-type: none"> 0: Does not output any trace. 1: Only outputs error information. 2: Outputs a summary of program operation. 3: Outputs details of program operation. 4: Outputs all information.
	Trace File Size (KB)	Trace file size in kilobytes
	Number Of Trace Files	Number of trace files.

Parameter and program information to be displayed	Item	Description
	Path Health Checking	<ul style="list-style-type: none"> Settings for path health checking: on: Enabled off: Disabled Checking interval: When the setting of the path health checking is on, the checking interval of path health checking is displayed within the parentheses following on. The time is in minutes.
	Auto Failback	<ul style="list-style-type: none"> Settings for an automatic failback: on: Enabled off: Disabled Checking interval: When the setting of the automatic failback is on, the checking interval of automatic failback is displayed within the parentheses following on. The time is in minutes.
	Intermittent Error Monitor	<ul style="list-style-type: none"> Setting for intermittent error monitoring on: Enabled off: Disabled When automatic failback is off, intermittent error monitoring is disabled although Intermittent Error Monitor will be shown as on. When the automatic failback function is on, intermittent error monitoring will be enabled. Intermittent error monitoring interval and number of times that the error needs to occur When intermittent error monitoring is on, the specified intermittent error monitoring interval and number of times that the error needs to occur are displayed within the parentheses following on. The format is <i>number-of-times-error-is-to-occur/monitoring-interval</i>. The time is in minutes.
-msrv Information about the HDLM manager	HDLM Manager	Status of the HDLM manager: Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM manager
	WakeupTime	Startup time of the HDLM manager
-adrv Information about the HDLM alert driver	HDLM Alert Driver	Status of the HDLM alert driver: Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM alert driver

Parameter and program information to be displayed	Item	Description
	WakeupTime	Startup time of the HDLM alert driver
	ElogMem Size	Size of error log memory for the HDLM alert driver in kilobytes
-pdrv Information about the HDLM driver	HDLM Driver	Status of the HDLM driver: Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM driver
	WakeupTime	Startup time of the HDLM driver
-lic Information about the HDLM license	License Type	License type <ul style="list-style-type: none"> Permanent: permanent license Temporary: temporary license Emergency: emergency license
	Expiration	License expiration When using a permanent license: - When using a temporary license or emergency license: The license expiration period is displayed in the format: <i>yyyy/mm/dd (ndays after)</i> . When the <code>view -sys -lic</code> operation is executed, (<i>ndays after</i>) appears if there are <i>n</i> days left until the license period expires. <ul style="list-style-type: none"> When there are 100 days left until the license period (2006/08/21) expires 2006/08/21(100days after)
-audlog Information about audit log data collection settings	Audit Log	Settings for audit log data collection: <ul style="list-style-type: none"> Whether collection is enabled: <ul style="list-style-type: none"> on: Enabled off: Disabled Audit log data collection level: When audit log data collection is on, the collection level that has been set is displayed within the parentheses following on. The collection level indicates a severity level. A value from 0 to 7 is displayed as the collection value.

Parameter and program information to be displayed	Item	Description
	Audit Log Category	The categories of audit log data to be output are displayed. When more than one category is displayed, commas (,) are used as separators. ss: StartStop a: Authentication ca: ConfigurationAccess If all the above categories are specified, all is displayed. If the collection of audit log data is disabled, a hyphen (-) is displayed.
	Audit Log Facility	The name of the audit log facility is displayed. user, local0, local1, local2, local3, local4, local5, local6, or local7 is displayed. If the collection of audit log data is disabled, a hyphen (-) is displayed.

#

When you use cluster software, the settings of the cluster support function and the product name of the cluster software is not displayed. However, the cluster support function will operate normally.

Examples

Example 1

The following example shows how to display information about the HDLM function settings:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version                : x.x.x-xx
Service Pack Version        :
Load Balance                 : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size(KB)           : 9900
Number Of Elog Files         : 2
Trace Level                  : 1
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(60)
Intermittent Error Monitor   : off
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

#

Example 2

The following example shows how to display information about the HDLM manager.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager      Ver      WakeupTime
Alive             x.x.x-xx   yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 3

The following example shows how to display information about the HDLM alert driver.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -adrv
HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive             x.x.x-xx   yyyy/mm/dd hh:mm:ss 4000
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 4

The following example shows how to display information about the HDLM driver.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv
HDLM Driver      Ver      WakeupTime
Alive            x.x.x-xx   yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 5

The following example shows how to display information about the HDLM license.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -lic
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 6

The following example shows how to display information about the audit log settings:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log                      : off
Audit Log Category             : -
Audit Log Facility              : -
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

(2) To Display Path Information

When displaying path information, if you specify either the `-item` or `-c` parameter and also specify the `-path` parameter, you can select the items to display and display a summary of path information. This section describes each parameter, path information and displayed items.

Parameters to display path information:

`-path`

When you specify the `-path` parameter and do not specify either the `-c` or `-item` parameter, the information will be displayed about the HDLM managed paths without abbreviating or selecting items.

In the sub-parameters (following `-path`), you can filter the paths to be listed using `-hdev` and sort the list using `-srt`. When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

For details on what is displayed in each item, see *Table 6-12: Displayed Path Information*.

AutoPATH_IDs displayed by the `-path` parameter depend on the sequence in which HDLM detects the paths after when a host is started up. Because of this, make sure that you use the path name `PathName` to identify a path.

The sub-parameters are as follows:

`-hdev host-device-name`

Displays information only for the paths accessing the specified host device.

Specify hdisk name for *host-device-name*.

The *host-device-name* string is case -sensitive.

`-srtname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information displayed for product IDs, see *Table 6-14: Product ID Displayed by the View -Path Operation*.

`-iem`

Use this parameter to add `IEP` to path information and display information about intermittent errors.

`-srt {pn|lu|cp}`

Use this parameter to sort the path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `pn`: Path name
- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in ascending order of `AutoPATH_ID`s.

`-hbaportwwn`

Displays port WWN information for the HBAs connected to the storage system.

`-t`

Omits the title for each information item.

Example

The following example shows how to display information about the paths that access a host device `hdisk1`.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -hdev hdisk1
Paths:000001 OnlinePaths:000001
PathStatus   IO-Count   IO-Errors
Online       0             0

PathID PathName                               DskName
iLU      ChaPort Status      Type IO-Count   IO-Errors  DNum HDevName
000006 08.11.00000000000000E2.0001      HITACHI .OPEN-3      .15001
0005      1H      Online      Own      0           0      0 hdisk1
000013 08.1D.00000000000000E3.0001      HITACHI .OPEN-3      .15001
0005      2H      Online      Own      0           0      0 hdisk1
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Parameters to display path information by selecting a display item:

`-path -item`

When you specify the `-path` parameter together with the `-item` parameter, the command only displays the items specified by the value of the `-item` parameter.

If you specify no value for the `-item` parameter, only the `PathID` and the `Status` fields are displayed.

Table 6-11: Items That Can Be Selected by the -path -item Parameter and the Sub-parameters shows the items that can be selected by using the `-item` parameter and the sub-parameters that can be specified after the `-item` parameter.

Table 6-11: Items That Can Be Selected by the -path -item Parameter and the Sub-parameters

Selectable items	Sub-parameters
PathID [#]	None
PathName	pn
HBAPortWWN	hbaportwwn
DskName	dn
iLU	lu
ChaPort	cp
Status [#]	None
Type	type
IO-Count	ic

Selectable items	Sub-parameters
IO-Errors	ie
DNum	dnu
HDevName	hd
IEP	iep

#

Because both `PathID` and `Status` are always displayed, you do not have to specify any parameters.

In the sub-parameters following `-path -item`, you can list the paths (`-hdev`) and sort the list (`-srt`). If you omit both parameters, the command displays information for all the paths in ascending order of `AutoPATH_IDs`.

These sub-parameters are:

`-hdev` *host-device-name*

Displays information only for the paths accessing the specified host device.

Specify `hdisk` name for *host-device-name*.

The *host-device-name* string is case sensitive.

When you specify this parameter, `HDevName` is displayed by default. Therefore, it is not necessary to specify `hd` for the `-item` parameter.

`-stname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information displayed for product IDs, see *Table 6-14: Product ID Displayed by the View -Path Operation*.

When you use this parameter, `DskName` is displayed by default. Therefore, it is not necessary to specify `dn` for the `-item` parameter.

`-srt` {pn|lu|cp}

Use this parameter to sort the path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the

storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `pn`: Path name
- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in ascending order of `AutoPATH_ID`s.

When you use this parameter, the items used for the sorting keys (`DskName`, `AutoPATH_ID`, and the item specified by this parameter) are displayed by default. Therefore, it is not necessary to specify these items for the `-item` parameter.

`-t`

Omits the title for each information item.

Example

In the following example, `IO-Count` is selected as the display item and the path information is sorted in ascending order by LUs.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -item ic -srt lu -stname
aths:000010 OnlinePaths:000010
PathStatus IO-Count IO-Errors
Online      500      0

PathID DskName iLU Status IO-
Count
000003 HITACHI .9500V .0123 0180 Online
400
000009 HITACHI .9500V .0123 0180 Online
420
000004 HITACHI .9500V .0123 0181 Online
410
000010 HITACHI .9500V .0123 0181 Online
399
000005 HITACHI .9500V .0123 0182 Online
405
000011 HITACHI .9500V .0123 0182 Online
405
000000 HITACHI .USP_V .0014050 000050 Online
1005
000006 HITACHI .USP_V .0014050 000050 Online
897
000001 HITACHI .USP_V .0014050 000051 Online
0
000007 HITACHI .USP_V .0014050 000051 Online
0
000002 HITACHI .USP_V .0014050 000052 Online
0
000008 HITACHI .USP_V .0014050 000052 Online
0
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

To display a summary of path information

`-path -c`

If the `-c` parameter is specified at the same time as the `-path` parameter, only PathID, DskName, iLU, CP, Status, and Type are displayed for the path information. The displayed contents are also shortened, so that each path information item is displayed on a single line.

The items that are displayed are PathID, DskName, iLU, CP, Status, and Type.

For details on what is displayed for each item, see *Table 6-12: Displayed Path Information*.

When you use the `-c` parameter, the number of characters that can be displayed in the product ID element of the DskName field is limited to 10. When there are

11 or more characters in the product ID, the 8th and following characters are abbreviated to ellipses (. . .).

The sub-parameters (following `-path -c`) are:

`-stname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information about product IDs, see

Table 6-14: Product ID Displayed by the View -Path Operation.

`-srt {lu|cp}`

Use this parameter to sort the path information in ascending order, according to the specified sorting key.

The sorting keys are as follows: the first sorting key is the name of the storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in ascending order of `AutoPATH_ID`s.

`-t`

Omits the title for each information item.

Example

The following example shows how to display a summary of the path information in order of iLUs.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -c -srt lu
Paths:000012 OnlinePaths:000012
PathStatus   IO-Count   IO-Errors
Online       1616         0

PathID DskName                               iLU                               CP Status   Type
000000 HITACHI .DF600F .0051 0005 0A Online Own
000003 HITACHI .DF600F .0051 0005 1A Online Non
000001 HITACHI .DF600F .0051 0014 0A Online Non
000004 HITACHI .DF600F .0051 0014 1A Online Own
000002 HITACHI .DF600F .0051 0015 0A Online Non
000005 HITACHI .DF600F .0051 0015 1A Online Own
000006 HITACHI .OPEN-3 .15001 0005 1H Online Own
000009 HITACHI .OPEN-3 .15001 0005 2H Online Own
000007 HITACHI .OPEN-3 .15001 0015 1H Online Own
000010 HITACHI .OPEN-3 .15001 0015 2H Online Own
000008 HITACHI .OPEN-3 .15001 0020 1H Online Own
000011 HITACHI .OPEN-3 .15001 0020 2H Online Own
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Displayed path information

Table 6-12: Displayed Path Information describes the displayed path information. The following explains the table headings:

- No summary displayed: The user specifies only the `-path` parameter or the `-path -item` parameter.
- Summary displayed: The user specifies the `-path -c` parameter.

Table 6-12: Displayed Path Information

Displayed Item		Description
No summary displayed	Summary displayed	
Paths		Total number of displayed paths, indicated by a decimal (i.e., base 10) number.
OnlinePaths		Number of online paths from within the displayed paths, indicated by a decimal number. When the value of <code>Paths</code> equals the value of <code>OnlinePaths</code> , then all the paths are online. If the value of <code>OnlinePaths</code> is less than that of <code>Paths</code> , some paths are offline. In this case, you should check the offline paths and take appropriate action for any paths that have an error status.

Displayed Item		Description
No summary displayed	Summary displayed	
PathStatus		<p>Status of the displayed paths. The displayed status indicates the following:</p> <ul style="list-style-type: none"> • Online: All paths are available. • Reduced: Some paths are not available. <p>Reduced means that some paths might have an error status, in which case you should check the status of individual paths and resolve the problem for any paths that have an error status.</p>
IO-Count		Total I/O count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.
IO-Errors		Total I/O error count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.
PathID		<p>The AutoPATH_ID indicated by a decimal number.</p> <p>The AutoPATH_ID is assigned every time the host is restarted or when a path configuration is changed. When a new LU was added and the host has not been restarted, AutoPATH_ID is assigned to each path of the LU when you execute the <code>cfgmgr</code> command.</p>
PathName [#]	-	<p>The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the path that will be affected by the change. Path name consists of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> • HBA adapter number or adapter type (character string) • Bus number or adapter number (character string) • Target ID (hexadecimal number) • Host LU number (hexadecimal number) <p>For details about each element of the path name and its representation in AIX, see <i>Table 6-13: Elements of a Path Name</i>.</p>
DskName [#]	DskName	<p>Storage system name, which identifies the storage system that is accessed by a path.</p> <p>A storage system name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> • Vendor ID: The name of the storage system vendor (for example, <code>HITACHI</code>). • Product ID: Indicates the storage system product ID, emulation type, or model name (for example, <code>OPEN-3</code>). • Serial number: The serial number of the storage system (for example, <code>15001</code>). <p>You can identify an actual storage system by referencing the above information from the storage system management program.</p>

Displayed Item		Description
No summary displayed	Summary displayed	
<code>iLU[#]</code>	<code>iLU</code>	<p>LU number of the storage system</p> <p>This number combined with the storage system name (shown in <code>DskName</code>) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> For the Lightning 9900V series, Hitachi Universal Storage Platform 100, Hitachi Universal Storage Platform 600, Hitachi Universal Storage Platform 1100, or Hitachi NSC55, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. For HP XP10000/HP XP12000, or SVS, indicated by a hexadecimal number. The first three characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. The first character of the CU number is the value 0. For the Thunder 9500V series, or Hitachi AMS2000/AMS/WMS/SMS series, indicated by a decimal number. The entire value of <code>iLU</code> is the internal LU number within the storage system. You can identify an actual LU by referencing <code>iLU</code> from the storage system management program. For Universal Storage Platform V/VM, or Virtual Storage Platform indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU.
<code>ChaPort[#]</code>	<code>CP</code>	<p>Port number of the CHA, which identifies the CHA port that is mounted on the storage system.</p> <p>You can identify an actual CHA port by referencing this number from the storage system management program.</p>
<code>Status</code>		<p>Status of the path</p> <ul style="list-style-type: none"> <code>Online</code>: Online <code>Offline(C)</code>: Offline status caused by a command operation <code>Offline(E)</code>: Offline due to an error <code>Online(E)</code>: Failure has occurred (If none of the paths accessing one LU have an <code>Online</code> status, one of those paths is changed to the <code>Online(E)</code> status.) <p>Paths that are <code>Offline(E)</code> or <code>Online(E)</code> require corrective action. The appropriate action can be determined by referring to 5.3 <i>What To Do for a Path Error</i>.</p>
<code>Type[#]</code>	<code>Type</code>	<p>Attribute of the path</p> <ul style="list-style-type: none"> <code>Own</code>: Owner path <code>Non</code>: Non-owner path <p>When connecting to the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS, all paths are owner paths.</p>

Displayed Item		Description
No summary displayed	Summary displayed	
IO-Count [#]	-	<p>Total I/O count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it will re-start from 0.</p> <p>To reset the IO-Count value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (IO-Errors) to 0. For details about the <code>clear</code> operation, see 6.2 <i>clear (Returns the Path Statistics to the Initial Value)</i>.</p>
IO-Errors [#]	-	<p>Total I/O error count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it will re-start from 0.</p> <p>To reset the IO-Errors value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to 0.</p> <p>For details about the <code>clear</code> operation, see 6.2 <i>clear (Returns the Path Statistics to the Initial Value)</i>.</p>
DNum [#]	-	<p>Dev number, indicated by a decimal number.</p> <p>This item pertains to a logical volume number.</p> <p>There is one Dev in an LU, so the number is fixed to 0.</p>
HDevName [#]	-	<p>Host device name.</p> <p>Hdisk name is displayed.</p>
IEP [#]	-	<p>Information about the intermittent error.</p> <p>This item is displayed only when you specify <code>-iem</code> with the <code>-path</code> parameter. One of the following values is displayed for each path:</p> <ul style="list-style-type: none"> - Indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. A value of at least 0 Indicates the number of errors that occurred during intermittent error monitoring. * Indicates that an intermittent error occurred (automatic failbacks do not check the path).
HBAPortWWN	-	<p>A 16-digit hexadecimal number indicating the WWN information for an HBA connected to the storage system.</p> <p>This item is displayed only when you specify <code>-iem</code> together with the <code>-hbaportwwn</code> parameter.</p>

Legend:

-: Not displayed

#

The path information is displayed only when a value is specified for the `-path` `-item` parameter.

Table 6-13: Elements of a Path Name

Element	AIX representation	Corresponding information
HBA adapter number (example: 08) ^{#1}	HBA adapter number	The HBA adapter number, which is displayed by executing the <code>lsdev -Cc disk</code> command
Bus number (example: 14) ^{#1}	PCI bus number	The parent bus number, which is displayed by executing the <code>lsdev -Cc disk</code> command
Adapter type (example: 00) ^{#2}	None	Always 00
Adapter number (example: 01) ^{#2}	<code>fscsi</code> number (the <code>xx</code> part of <code>fscsixx</code>)	The <code>fscsi</code> number, which is displayed by executing the <code>lsdev -C</code> command
Target ID (example: 00000000000000E2)	Target ID	The value of <code>scsi_id</code> , which is displayed by executing the <code>lsattr -El hdisk-name</code> command
Host LU number(example: 0001)	Logical unit ID or LUN	The value of <code>lun_id</code> , which is displayed by executing the <code>lsattr -El hdisk-name</code> command

#1

This element is applied when the NPIV option is set to `off` for the `dlmodmset` utility for setting the HDLM execution environment ODM.

#2

This element is applied when the NPIV option is set to `on` for the `dlmodmset` utility for setting the HDLM execution environment ODM.

Table 6-14: Product ID Displayed by the View -Path Operation

Model names of storage systems	Product ID	
	Without the -sname parameter	With the -sname parameter (Displays the following for the model name)
Thunder 9500V series	product identifier [#]	9500V
Hitachi AMS2000 series		AMS
Hitachi AMS		AMS
Hitachi WMS		WMS
Hitachi SMS		SMS
Lightning 9900V series	Emulation type [#]	9970/9980
SVS		SVS
<ul style="list-style-type: none"> Hitachi Universal Storage Platform 100 Hitachi Universal Storage Platform 600 Hitachi Universal Storage Platform 1100 Hitachi NSC55 		USP
<ul style="list-style-type: none"> Hitachi Universal Storage Platform V Hitachi Universal Storage Platform VM 		USP_V
Hitachi Virtual Storage Platform		VSP
P9500		P9500
HP XP128		XP128
HP XP1024		XP1024
HP XP10000		XP10000
HP XP12000		XP12000
HP XP20000		XP20000
HP XP24000		XP24000

#

When a summary is displayed by specifying the `-path -c` parameter and there are 11 or more characters in the summary string, any characters after the 9th character are not displayed, and ellipsis (. . .) are displayed instead.

(3) To Display LU Information

When displaying LU information, if the `-item` parameter, `-c` parameter, or the `-c -item` parameter is specified at the same time as the `-lu` parameter, you can add and display items and display a summary of LU information. This section describes each parameter and the LU information and displayed items.

To display LU information

`-lu`

When neither the `-c` nor `-item` parameter is specified with the `-lu` parameter, the information about the LU recognized by HDLM is displayed without selecting items to be displayed or displaying a summary. The sorting key is iLU and its configuration information is displayed for each LU.

By using the subsequent parameter (`-hdev` or `-pathid`), you can filter the LU information to be displayed. If you do not specify `-hdev` or `-pathid`, the information about all LUs recognized by HDLM is displayed. For details on the contents of each displayed item, see *Table 6-17: Displayed LU Information*.

The subsequent parameters are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify *hdisk* name for *host-device-name*.

The *host-device-name* string is case-sensitive.

`-pathid` *AutoPATH_ID*

Use this parameter to display only the information about the LU that is connected to the path with that specified *AutoPATH_ID*.

`-t`

Omits the title for each information item.

Example

The following example shows how to display the LU information without selecting items to be displayed:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : USP
SerialNumber  : 0014010
LUs          : 10
```

```

iLU   HDevName  OSpaHID  PathID  Status
003A  hdisk0    00000    000000  Online
      00001    000001  Online
003B  hdisk1    00000    000002  Online
      00001    000003  Online
003C  hdisk2    00000    000004  Online
      00001    000005  Online
003D  hdisk3    00000    000006  Online
      00001    000007  Online
003E  hdisk4    00000    000008  Online
      00001    000009  Online
003F  hdisk5    00000    000010  Online
      00001    000011  Online
0040  hdisk6    00000    000012  Online
      00001    000013  Online
0041  hdisk7    00000    000014  Online
      00001    000015  Online
0042  hdisk8    00000    000016  Online
      00001    000017  Online
0043  hdisk9    00000    000018  Online
      00001    000019  Online
KAPL01001-I The HDLM command completed normally.
Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
#

```

To display LU information (by adding items to be displayed)

`-lu -item`

The items specified with the `-item` option are displayed among with those displayed by the `-lu` option.

If no value or `all` is specified for the `-item` parameter, all the items that can be added are displayed.

Table 6-15: Items That Can Be Added by Using the -lu -item Parameter and Sub-parameters lists the items that can be added by using the `-item` parameter and the parameters that can be specified after the `-item` parameter.

Table 6-15: Items That Can Be Added by Using the -lu -item Parameter and Sub-parameters

Item that can be added	Subsequent parameter
SLPR	slpr
PathName	pn

Item that can be added	Subsequent parameter
ChaPort	cp
CLPR	clpr
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
IEP	iep
VG	vg
All items are displayed	all

In the sub-parameters, `-hdev` or `-pathid`, you can filter the LU information to be displayed. If you omit both parameters, the command displays the information about all the LUs recognized by HDLM.

For details on the contents of each displayed item, see *Table 6-17: Displayed LU Information*.

The sub-parameters are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify hdisk name for *host-device-name*.

The *host-device-name* string is case-sensitive.

`-pathid` *AutoPATH_ID*

Use this parameter to display only the information about the LU that is connected to the path with that specified *AutoPATH_ID*.

`-t`

Omits the title for each information item.

Example:

The following example shows how to add SLPR, PathName, ChaPort, CLPR, Type, IO-Count, IO-Errors, DNum, IEP, and VG to the displayed items for LU information.

6. Command Reference

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu -item slpr pn cp clpr type ic ie dnu iep vg
Product      : USP
SerialNumber : 0014050
LUs          : 10

iLU  SLPR HDevName VG      OSPathID PathID PathName                      ChaPort CLPR
Status Type IO-Count IO-Errors DNum IEP
0150 12 hdisk0 -      00000 000000 08.11.0000000000660B00.0000 2B      1
Online Own      0      00001 000001 08.1D.0000000000660C00.0000 3B      1
Online Own      0      00000 000002 08.11.0000000000660B00.0001 2B      1
Online Own      0      00001 000003 08.1D.0000000000660C00.0001 3B      1
Online Own      0      00000 000004 08.11.0000000000660B00.0002 2B      1
Online Own      0      00001 000005 08.1D.0000000000660C00.0002 3B      1
Online Own      0      00000 000006 08.11.0000000000660B00.0003 2B      1
Online Own      0      00001 000007 08.1D.0000000000660C00.0003 3B      1
Online Own      0      00000 000008 08.11.0000000000660B00.0004 2B      1
Online Own      0      00001 000009 08.1D.0000000000660C00.0004 3B      1
Online Own      0      00000 000010 08.11.0000000000660B00.0005 2B      1
Online Own      0      00001 000011 08.1D.0000000000660C00.0005 3B      1
Online Own      0      00000 000012 08.11.0000000000660B00.0006 2B      1
Online Own      0      00001 000013 08.1D.0000000000660C00.0006 3B      1
Online Own      0      00000 000014 08.11.0000000000660B00.0007 2B      1
Online Own      0      00001 000015 08.1D.0000000000660C00.0007 3B      1
Online Own      0      00000 000016 08.11.0000000000660B00.0008 2B      1
Online Own      0      00001 000017 08.1D.0000000000660C00.0008 3B      1
Online Own      0      00000 000018 08.11.0000000000660B00.0009 2B      1
Online Own      0      00001 000019 08.1D.0000000000660C00.0009 3B      1
Online Own      0      00000 000000 08.11.0000000000660B00.0000 2B      1
Online Own      0      00001 000001 08.1D.0000000000660C00.0000 3B      1

KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymmdd hh:mm:ss
#
```

To display a summary of LU information

-lu -c

When the -c parameter is specified with the -lu parameter, a summary of LU configuration information is displayed on one line. The total number of paths recognized by HDLM and the number of online paths are displayed for each LU.

You cannot specify the `-c` parameter together with the `-hdev` or `-pathid` parameter.

For details on the contents of each display item, see *Table 6-17: Displayed LU Information*.

`-t`

Does not display the title for each information item.

Example

The following example shows how to display a summary of the LU information (without selecting items to be displayed):

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu -c
Product      S/N      LUs iLU  HDevName  Paths  OnlinePaths
USP          0014010   10  003A hdisk0      2        2
              003B hdisk1      2        2
              003C hdisk2      2        2
              003D hdisk3      2        2
              003E hdisk4      2        2
              003F hdisk5      2        2
              0040 hdisk6      2        2
              0041 hdisk7      2        2
              0042 hdisk8      2        2
              0043 hdisk9      2        2

KAPL01001-I The HDLM command completed normally.
Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
#
```

To display a summary of LU information (by adding items to be displayed)

`-lu -c -item`

The items displayed when the `-item` option is added to the `-lu -c` option options.

If no value is specified for the `-item` parameter, all the items that can be added are displayed. See *Table 6-17: Displayed LU Information* for the contents of each displayed item.

Table 6-16: Items That Can Be Added by Using the `-lu -c -item` Parameter and Sub-parameters lists the items that can be added by using the `-item` parameter and the sub-parameters.

Table 6-16: Items That Can Be Added by Using the -lu -c -item Parameter and Sub-parameters

Item that can be added	Sub-parameter
SLPR	slpr
VG	vg
All items	all

The sub-parameter is:

-t

Omits the title for each information item.

Example

The following example describes how to add and display a summary of SLPR and VG.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu -c -item
Product      S/N      LUs iLU  SLPR HDevName  VG      Paths  OnlinePaths
USP          0014050  10 0150   12 hdisk0    -        2        2
              0151   12 hdisk1    samplevg001  2        2
              0152   12 hdisk2    samplevg002  2        2
              0153   12 hdisk3     -        2        2
              0154   12 hdisk4     -        2        2
              0155   12 hdisk5     -        2        2
              0156   12 hdisk6     -        2        2
              0157   12 hdisk7     -        2        2
              0158   12 hdisk8     -        2        2
              0159   12 hdisk9     -        2        2
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Displayed LU information

Table 6-17: Displayed LU Information describes the displayed LU information. The following explains the table headings:

- No summary displayed: The user specifies the -lu parameter or -lu -item parameter.
- Summary displayed: The user specifies the -lu -c parameter or -lu -c -item parameter.

Table 6-17: Displayed LU Information

Displayed item		Description
No summary displayed	Summary displayed	
Product		Model ID of the storage system
Serial number	S/N	Serial number of the storage system
LUs		Total number of LUs managed by HDLM among the LUs in the storage system
iLU		<p>LU number in the storage system This number combined with the storage system name (shown in <code>DskName</code>) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> For the Lightning 9900V series, Hitachi Universal Storage Platform 100, Hitachi Universal Storage Platform 600, Hitachi Universal Storage Platform 1100, or Hitachi NSC55, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. For HP XP10000/HP XP12000, or SVS, indicated by a hexadecimal number. The first three characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. The first character of the CU number is the value 0. For the Thunder 9500V series, or Hitachi AMS2000/AMS/WMS/SMS series, indicated by a decimal number. The entire value of <code>iLU</code> is the internal LU number within the storage system. You can identify an actual LU by referencing <code>iLU</code> from the storage system management program. For Universal Storage Platform V/VM, or Virtual Storage Platform indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU.
SLPR ^{#1}	SLPR ^{#2}	The number of the SLPR to which an LU belongs, indicated by a number from 0 to 31. A hyphen (-) is displayed if the storage logical partition functionality for the storage system for the target LU is not supported.
HDevName ^{#1}	-	Host device name. Hdisk name is displayed.
OSPathID	-	OS management path ID.
PathID	-	<p>AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the host is restarted or when a path configuration is changed. When a new LU was added and the host has not been restarted, AutoPATH_ID is assigned to each path of the LU when you execute the <code>cfgmgr</code> command.</p>

Displayed item		Description
No summary displayed	Summary displayed	
PathName ^{#1}	-	<p>The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the path that will be affected by the change. Path name consists of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> • HBA adapter number or adapter type (character string) • Bus number or adapter number (character string) • Target ID (hexadecimal number) • Host LU number (hexadecimal number) <p>For details about each element of the path name and its representation in AIX, see <i>Table 6-13: Elements of a Path Name</i></p>
ChaPort ^{#1}	-	<p>Port number of the CHA, which identifies the CHA port that is mounted on the storage system.</p> <p>You can identify an actual CHA port by referencing this number from the storage system management program.</p>
CLPR ^{#1}	-	<p>The number of the CLPR to which the CHA port belongs, indicated by a decimal number from 0 to 31. Note that a hyphen (-) is displayed if the following items are subject to display:</p> <ul style="list-style-type: none"> • CHA ports in the storage system that do not support cache logical partition functionality • Paths connected to the Snapshot image of the Copy-on-write Snapshot of the Hitachi AMS2000/AMS/WMS/SMS series
Status	-	<p>Status of the path</p> <ul style="list-style-type: none"> • Online: Online • Offline (C): Offline status caused by a command operation • Offline (E): Offline due to an error • Online (E): Failure has occurred (If none of the paths accessing one LU have an Online status, one of those paths is changed to the Online (E) status.) <p>Paths that are Offline (E) or Online (E) require corrective action. The appropriate action can be determined by referring to <i>5.3 What To Do for a Path Error</i></p>
Type ^{#1}	-	<p>Attribute of the path</p> <ul style="list-style-type: none"> • Own: Owner path • Non: Non-owner path <p>When connected to the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform Hitachi AMS2000 series, or Hitachi SMS, all paths are owner paths.</p>

Displayed item		Description
No summary displayed	Summary displayed	
IO-Count ^{#1}	-	Total I/O count for a path. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Count value to 0, execute the <code>dlncmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (IO-Errors) to 0. For details about the <code>clear</code> operation, see 6.2 <i>clear (Returns the Path Statistics to the Initial Value)</i> .
IO-Errors ^{#1}	-	Total I/O error count for a path. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Errors value to 0, execute the <code>dlncmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to 0. For details about the <code>clear</code> operation, see 6.2 <i>clear (Returns the Path Statistics to the Initial Value)</i> .
DNum ^{#1}	-	Dev number, indicated by a decimal number. This item pertains to a logical volume number. There is one Dev in an LU, so the number is fixed to 0.
IEP ^{#1}	-	The displayed paths are assumed to be in an intermittent error status and checked whether those paths are to be operated for automatic failback. One of the following values is displayed for each path: <ul style="list-style-type: none"> -: Indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. A value of at least 0: Indicates the number of errors that occurred during intermittent error monitoring. *: Indicates that an intermittent error occurred (automatic failback does not check the path).
VG ^{#1}	VG ^{#2}	The volume group name LU is registered. When the LU is not registered as the volume group, a hyphen (-) is displayed.
-	Paths	Total number of the paths recognized by HDLM for the LU to be displayed.
-	OnlinePaths	Number of available paths in the displayed paths, indicated by a decimal number. When the value of <code>Paths</code> equals the value of <code>OnlinePaths</code> , all paths are online. If the value of <code>OnlinePaths</code> is less than that of <code>Paths</code> , some paths are offline. In this case, you should check the offline paths and take appropriate action for any paths that have an error status.

Legend:

-: Not displayed

#1

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -item` parameter.
- `all` was specified.
- No value was specified for the parameter.

#2

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -c -item` parameter.
- `all` was specified.
- No value was specified for the parameter.

(4) To Display HBA Port Information`-hba`

Use this parameter to display information about the paths to each HBA port. HDLM displays the unique HBA port ID assigned to each HBA port. This HBA port ID can also be used in `Offline` and `Online` operations. *Table 6-18: Items Displayed as HBA Port Information* lists and describes the displayed items.

Table 6-18: Items Displayed as HBA Port Information

Item	Description
HbaID	HBA port ID
Port.Bus	Port (HBA adapter number in character string) and Bus (bus number in character string), or adapter type and adapter number, separated by a period
HBAPortWWN	A 16-digit hexadecimal number indicating the WWN information for an HBA connected to the storage system. This item is displayed only if <code>-portwnn</code> is specified together with <code>-hba</code> .
IO-Count	Total I/O count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.
IO-Errors	Total I/O error count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.
Paths	Total number of displayed paths, indicated by a decimal number.

Item	Description
OnlinePaths	Number of online paths in the displayed paths, indicated by a decimal number. When the value of Paths equals the value of OnlinePaths, all paths are online. If the value of OnlinePaths is less than that of Paths, some paths are offline. In this case, you should check the offline paths and take appropriate action for any path that has an error status.

Example

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -hba
HbaID Port.Bus IO-Count IO-Errors Paths OnlinePaths
00000 08.11      71520         0      20         20
00001 08.1D       425         100     20         10
KAPL01001-I The HDLM command completed normally.
Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
#
```

The subsequent sub-parameters are:

-srt pb

Sorts the HBA port information by the HBA adapter number (Port) and bus numbers (Bus) (or adapter type and adapter number).

-portwwn

Displays port WWN information for HBAs connected to the storage system using a 16-digit hexadecimal number.

-t

Omits the title for each information item.

(5) To Display CHA Port Information

-cha

Use this parameter to display information about the paths to each CHA port. HDLM displays the unique CHA port ID assigned to each CHA port. This CHA port ID is used in Offline and Online operations. *Table 6-19: Items Displayed as CHA Port Information* lists and describes the displayed items.

Table 6-19: Items Displayed as CHA Port Information

Item	Description
ChaID	CHA port ID
Product	Model ID of the storage system
S/N	Serial number of the storage system

Item	Description
ChaPort	Port number of the CHA, which identifies the CHA port that is mounted on the storage system. You can identify an actual CHA port by referencing this number from the storage system management program.
IO-Count	Total I/O count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.
IO-Errors	Total I/O error count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.
Paths	Total number of displayed paths, indicated by a decimal number.
OnlinePaths	Number of online paths in the displayed paths, indicated by a decimal number. When the value of Paths equals the value of OnlinePaths, all paths are online. If the value of OnlinePaths is less than that of Paths, some paths are offline. In this case, you should check the offline paths and take appropriate action for any path that has an error status.

Example

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -cha
ChaID Product      S/N      ChaPort IO-Count  IO-Errors Paths OnlinePaths
00000 USP          1100     7A       777       0       10       10
00001 USP          1000     7B       100       0       20       20
00002 USP          1100     8A        0        0       10       10
00003 USP          1000     8B       333       77       20       10
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymm/dd hh:mm:ss
#
```

The subsequent sub-parameters are:

-srt cp

Sorts the CHA port information by the storage system model IDs (Product), storage system serial numbers (S/N), and CHA port numbers (ChaPort).

-t

Does not display the title for each information item.

(6) To Display the Correspondences Between hdisks, OS Management Path IDs, and LDEVs

-drv

Use this parameter to display the PathIDs, hdisk name, OS management path IDs,

and information about the LDEVs in a storage system (identified by the storage system model ID, serial number, and LU number, separated by periods).

For details on the contents of each display item, see *Table 6-20: Items Displayed as the Correspondences Between hdisks, OS Management Path IDs, and LDEVs*.

-t

Does not display the title for each information item.

Table 6-20: Items Displayed as the Correspondences Between hdisks, OS Management Path IDs, and LDEVs

Item	Description
PathID	AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the host is restarted or when a path configuration is changed. When a new LU was added and the host has not been restarted, AutoPATH_ID is assigned to each path of the LU, AutoPATH_ID is assigned when you execute the <code>cfgmgr</code> command.
HDevName	Host device name. Hdisk name is displayed.
OSPathID	OS management path ID.
LDEV	The model ID, serial number, and iLU number for the storage system, separated by periods. The information about an LDEV can physically identify an LU.

Example

To display corresponding information about PathIDs, hdisks, OSpahtIDs, and LDEVs

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName OSpahtID LDEV
000000 hdisk0 00000 9500V.0051.0005
000001 hdisk1 00000 9500V.0051.0015
000002 hdisk2 00000 9500V.0051.0020
000003 hdisk0 00001 9500V.0051.0005
000004 hdisk1 00001 9500V.0051.0015
000005 hdisk2 00001 9500V.0051.0020
KAPL01001-I The HDLM command completed normally.
Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
#
```

(7) To Display the Format of the View Operation**-help**Use this parameter to display the `view` operation format.**Example**The following example shows how to display the format of the `view` operation.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -help

view:

Format

dlnkmgr view -sys [ -sfunc | -msrv | -adrv | -pdrv | -lic | -audlog ] [-t]

dlnkmgr view -path [ -hdev HostDeviceName ] [-stname] [-iem]
                        [-srt {pn | lu | cp}] [-hbaportwwn] [-t]

dlnkmgr view -path
        -item [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu]
                        [hd] [iep] [hbaportwwn]
        [ -hdev HostDeviceName ] [-stname] [-srt {pn | lu | cp}] [-t]

dlnkmgr view -path -c [-stname] [-srt {lu | cp}] [-t]

dlnkmgr view -lu [ -hdev HostDeviceName | -pathid AutoPATH_ID ] [-t]

dlnkmgr view -lu
        -item [ [slpr] [vg] [pn] [cp] [clpr] [type]
                        [ic] [ie] [dnu] [iep] | all ]
        [ -hdev HostDeviceName | -pathid AutoPATH_ID ] [-t]

dlnkmgr view -lu -c [-t]

dlnkmgr view -lu -c -item [ [slpr] [vg] | all ] [-t]

dlnkmgr view -drv [-t]

dlnkmgr view -hba [-srt pb] [-portwwn] [-t]

dlnkmgr view -cha [-srt cp] [-t]
```

```
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time  
= yyyy/mm/dd hh:mm:ss  
#
```


Chapter

7. Utility Reference

This chapter explains the utilities used by HDLM.

- 7.1 Overview of the Utilities
- 7.2 DLMgetras Utility for Collecting HDLM Error Information
- 7.3 dlmchpdattr Utility for Changing HDLM Default Settings
- 7.4 dlmgetrasinst Utility for Collecting HDLM Installation Error Information
- 7.5 dlminstcomp Utility for HDLM Component Installation
- 7.6 dlmmigsts Utility for Assisting HDLM Migration
- 7.7 dlmodmset Utility for Setting the HDLM Execution Environment ODM
- 7.8 dlmpostrestore Utility for HDLM Restoration Support
- 7.9 dlmpr Utility for Clearing HDLM Persistent Reservation
- 7.10 dlmpreuninst Utility for Executed Before Uninstalling HDLM
- 7.11 dlrmrdev Utility for Deleting HDLM Drivers
- 7.12 installhdlm Utility for Installing HDLM
- 7.13 installux.sh Utility for HDLM Common Installer

7.1 Overview of the Utilities

HDLM provides the following utilities:

- The `DLMgetras` utility for collecting HDLM error information
 When an error occurs, this utility collects the files that contain information to be submitted to your HDLM vendor or maintenance company. For details about the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.
- The `d1mchpdattr` utility for changing HDLM default settings
 This utility changes the default value for the `hdisk` attribute. For details about the `d1mchpdattr` utility, see *7.3 d1mchpdattr Utility for Changing HDLM Default Settings*.
- The `d1mgetrasinst` utility for collecting HDLM installation error information
 When an error occurs, this utility collects the files that contain information to be submitted to your HDLM vendor or maintenance company. For details about the `d1mgetrasinst` utility, see *7.3 d1mchpdattr Utility for Changing HDLM Default Settings*.
- HDLM component installation utility (`d1minstcomp`)
 If you installed HDLM in an environment that does not satisfy the JDK version requirement indicated in *JDK required for linkage with Global Link Manager* section in *3.1.1 Host and OS Support for HDLM*, execute this utility to complement the HDLM installation.
 For details about the `d1minstcomp` utility, see *7.5 d1minstcomp Utility for HDLM Component Installation*.
- The `d1mmigsts` utility for assisting HDLM migration
 When migrating from HDLM version 5.8.1 or earlier to version 5.9, the ODM and HDLM settings can be inherited by executing this utility. For details about this utility, see *7.6 d1mmigsts Utility for Assisting HDLM Migration*.
- The `d1modmset` utility for setting the HDLM execution environment ODM.
 This utility sets ODM to define HDLM operations. For details about the `d1modmset` utility, see *7.7 d1modmset Utility for Setting the HDLM Execution Environment ODM*.
- The HDLM restoration support utility (`d1mpostrestore`)
 This utility updates HDLM information to match that of the target system environment when a system replication (clone) is created from an `mksysb` image

that includes HDLM-managed devices.

For details about the `dlmpostrestore` utility, see 7.8 *dlmpostrestore Utility for HDLM Restoration Support*.

- The `dlmpr` utility for clearing HDLM persistent reservation

The persistent reservation of a logical unit (LU) may not be canceled due to some reason when multiple hosts share a volume group rather than making up a cluster configuration using HACMP. In this case, this utility clears the Reservation Key to cancel the persistent reservation. For details about the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

- The `dlmpreuninst` utility executed before uninstalling HDLM

This utility excludes the hdisk recognized as a boot disk from being an HDLM management target. Execute this utility before uninstalling HDLM. For details about the `dlmpreuninst` utility, see 7.10 *dlmpreuninst Utility for Executed Before Uninstalling HDLM*.

- The `dlmrmddev` utility for removing HDLM devices

This utility deletes hdisks according to the parameter settings. When all the hdisks recognized as HDLM management-target devices have been successfully deleted, the HDLM manager stops. The hdisk recognized as a boot disk is not deleted. For details about the `dlmrmddev` utility, see 7.11 *dlmrmddev Utility for Deleting HDLM Drivers*.

- The `installhdlm` utility for installing HDLM

The `installhdlm` utility is used to execute an unattended installation when a new installation, upgrade installation, or re-installation of HDLM is being performed. For details about the `installhdlm` utility, see 7.12 *installhdlm Utility for Installing HDLM*. For details about how to perform an unattended installation, see 3.5.8 *Performing an Unattended Installation of HDLM*.

- The `installux.sh` utility for HDLM Common Installer

HDLM will be installed on, and installs the corresponding version of HDLM from the DVD-ROM. This utility can also perform unattended installations via a parameter specification. For details about the `installux.sh` utility, see 7.13 *installux.sh Utility for HDLM Common Installer*. For details about how to use this utility to install HDLM, see 3.5.3 *Performing a New Installation of HDLM*, 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*, or 3.5.8 *Performing an Unattended Installation of HDLM*.

Note

- The utilities must be executed by a user with root permissions.
- The starting time of the host and execution time of the utility depend on the

number of LUs and paths.

Table 7-1: Examples of the Starting Time of the Host and the Execution Time of the Utilities lists examples of the starting time of the host and the execution time of the HDLM utilities.

Table 7-1: Examples of the Starting Time of the Host and the Execution Time of the Utilities

Operation	Number of paths for an LU/ Total number of paths ^{#2}	Execution time ^{#1, #3}
Execution time of the device configuration on starting the host (when HDLM is installed)	4/1024	42 seconds
	8/2048	42 seconds
	16/4096	43 seconds
Execution time of the device configuration on starting the host (when HDLM is not installed)	4/1024	32 seconds
	8/2048	38 seconds
	16/4096	1 minutes 37 seconds
Executing <code>cfgmgr</code>	4/1024	53 seconds
	8/2048	1 minutes 14 seconds
	16/4096	1 minutes 51 seconds
Executing <code>dlmrdev</code>	4/1024	1 minutes 15 seconds
	8/2048	1 minutes 27 seconds
	16/4096	1 minutes 51 seconds
Executing <code>view -path</code>	4/1024	0.42 seconds
	8/2048	1.51 seconds
	16/4096	3.41 seconds

#1

The starting time of the host and the execution time of the utilities depend on the following conditions:

- The hardware configuration (for example, whether you use Fibre Channel switches)
- The number of hdisk created under the `/dev` directory

#2

The number of LUs is 256.

#3

The execution environment is as follows:

Machine Spec: CPU: Power4 1200MHz x 2

7.2 DLMgetras Utility for Collecting HDLM Error Information

This utility collects information that is needed to analyze HDLM errors that have occurred: information such as error logs, integrated trace files, trace files, definition files, core files, system crash dump files, and libraries. The collected information is archived in a file and saved to the directory that you specified. The following files are output:

- *Name-of-the-directory-containing-a-system-crash-dump-file/
system-crash-dump-file*

This file contains a symbolic link to the system crash dump file.

- *hbsa.tar.Z*

This file contains compressed error information of the Hitachi Command Suite products other than HDLM.

This file is output only when using the Hitachi Command Suite products that is the target for collecting error information.

- *getras.tar.Z*

This file contains compressed HDLM information and system information.

For details about the information that is stored in the system crash dump file and *getras.tar.Z*, see 7.2.3 *List of Collected Error Information*.

When you want to collect information other than that in 7.2.3 *List of Collected Error Information*, define the information to collect in the *information- collection- definition file*. Information defined in *information- collection- definition file* is compressed into *getras.tar.Z*.

When the system is restarted, a part of the information that was collected by the DLMgetras utility will be cleared. If an error occurs, immediately execute this utility.

7.2.1 Format

```
/usr/DynamicLinkManager/bin/DLMgetras
{directory-to-which-collected-information-is-output
[-f file-that-defines-information-to-be-collected] | -h}
```

You can also use lower-case characters (*dmlmgetras*) as follows:

```
/usr/DynamicLinkManager/bin/dlmgetras
{directory-to-which-collected-information-is-output
[-f file-that-defines-information-to-be-collected] | -h}
```

7.2.2 Parameters

directory-to-which-collected-information-is-output

Specify the output directory for the information that is to be collected by the DLMgetras utility for collecting HDLM error information. The collected information is compiled into two files shown in *Function* and output in the specified directory.

-f *file-that-defines-information-to-be-collected*

Use this parameter when you want to specify certain directories or files to be collected. In this parameter, specify the *file-that-defines-information-to-be-collected*, which defines the files and directories you want to collect.

Use an absolute path to specify *file-that-defines-information-to-be-collected*.

Figure 7-1: Coding Example of a File that Defines the Information to be Collected shows an example of the coding in this file.

Figure 7-1: Coding Example of a File that Defines the Information to be Collected

<pre># HDLM manager core file /opt/DynamicLinkManager/bin/core # # Oracle initial parameter /u01/app/oracle/admin/sandb/pfile/init.ora # # Oracle Alert Directory /u01/app/oracle/rdbms/log</pre>	<div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 5px;">}</div> <div>Collects the core file of HDLM.</div> </div> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="font-size: 2em; margin-right: 5px;">}</div> <div>Collects the initial parameter for the database (Oracle).</div> </div> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="font-size: 2em; margin-right: 5px;">}</div> <div>Collects the alert information directory for the database (Oracle).</div> </div>
---	---

Rules for coding a file that defines the information to be collected

- Use an absolute path to specify a directory or file whose information is to be collected. If you use a relative path to specify a directory or file, that directory or file will be searched for only within the directory in which the DLMgetras utility was executed, and the files found will be collected.
- Do not specify a directory that contains the directory to which the collected information is output. If you specify this directory, the DLMgetras utility will run indefinitely.
- Lines beginning with the hash mark (#) are handled as comment lines.
- If the hash mark (#) is encountered anywhere other than at the beginning of a line, it is assumed to be part of the path name.
- Only one file or directory can be specified per line.
- The root directory (/) cannot be specified.
- When a directory is specified, the DLMgetras utility collects all the

files in that directory, including files contained in the directory's subdirectories. If no files are found in a specified directory, the utility does not perform file collection for that directory and does not create a directory for it in the destination directory.

- Set up the specified file or directory so that it can be read by users with root permissions. The DLMgetras utility can only obtain information for a file or directory that can be read.

-h

Displays the format of the DLMgetras utility.

Note

- Because DLMgetras first stores error information in the specified output directory before compressing, ensure that information collection areas allocated are of adequate size.
- If the specified directory to which collected information is output already exists, an overwrite confirmation message is displayed. Responding by entering *y* instructs the DLMgetras utility to overwrite the existing files; entering *n* (or anything other than *y*) instructs the utility to terminate without executing.

In the latter case, you can either rename the existing directory before re-executing the utility, or you can execute the utility with a different directory name specified.

- If you create an archive for the system crash dump collected by the DLMgetras utility, execute the following:

```
# cd directory-to-which-collected-information-is-output
# tar cvfh archive-file-name ./var
```

7.2.3 List of Collected Error Information

The following illustrates the error information collected by executing the DLMgetras utility, which is explained separately in each output file.

- *Name-of-the-directory-containing-a-system-crash-dump-file/
name-of-the-system-crash-dump-file*

This file contains a symbolic link to the system crash dump file.

The DLMgetras utility executes the `sysdumpdev -l` command and sets all files in the directories that are output to the `copy` directory value.

- *hbsa.tar.Z*

This file contains compressed error information of the Hitachi Command Suite products other than HDLM.

This file is output only when using the Hitachi Command Suite products that is the target for collecting error information.

- `getras.tar.Z`

This file contains HDLM information and system information.

When you execute the `DLMgetras` utility, specifying the file that defines information to be collected, the `getras.tar.Z` file contains the information stored in the file that defines information to be collected.

Table 7-2: Information Stored in the getras.tar.Z File lists the detailed information stored in the `getras.tar.Z` file.

Table 7-2: Information Stored in the getras.tar.Z File lists the collected information with or without specifying the file that defines information to be collected.

Table 7-2: Information Stored in the getras.tar.Z File

Output directory ^{#1}	Files	Explanation
Directly under the directory to which collected information is output	<code>getras.log</code>	DLMgetras utility log file
<code>var/DynamicLinkManager/log</code>	<code>dlmmgr[1-16].log</code>	HDLM Manager log (including the driver log)
	<code>dlmwebagent[1-16].log</code>	Hitachi Command Suite Common Agent Component log files
	<code>dlminquiry[1-2].log</code> <code>dlminquiry[1-2].txt</code>	Inquiry log
	<code>dlmguinst.log</code>	Installation linkage script log used when linking with Hitachi Command Suite products other than HDLM
	<code>hdlmtr[1-64].log</code>	Trace file
	<code>dlmconfig[1-2].log</code> <code>dlmconfig[1-2].txt</code>	HDLM configuration log
	<code>dlmutil[1-2].log</code>	HDLM utility's log file
	<code>installhdlm.log</code>	Unattended installation execution log
<code>var/DynamicLinkManager/log/mmap</code>	<code>hdlmtr.mm</code>	Trace management file
	<code>dlmutil.mm</code>	HDLM utility's log trace management file

7. Utility Reference

Output directory ^{#1}	Files	Explanation
opt/hitachi/HNTRLib2/mmap	hntr2mmap.mm	Memory mapped file (HNTRLib2)
<i>integrated-trace-file-output-directory-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> (Default: var/opt/hitachi/HNTRLib2/spool)	<i>integrated-trace-file-prefix-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> 2 [1-64] .log ^{#2} (default prefix: hntr)	Integrated trace file (HNTRLib2)
opt/hitachi/HNTRLib/mmap	hntrmmap.mm	Memory mapped file (HNTRLib) output
<i>integrated-trace-file-output-directory-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> (Default: opt/hitachi/HNTRLib/spool)	hntr[1-16].log	Integrated trace file (HNTRLib) output
usr/DynamicLinkManager/config	dmmgr.xml	dmmgr setting file
	dmmwebagent.properties	Hitachi Command Suite Common Agent Component settings file
etc	filesystems	Mount information of the file system
	inittab	inittab file
	syslog.conf	File for defining the directory for the output destination of syslog
<i>error-log-file</i>	<i>error-log-file</i>	Error log file obtained by /usr/lib/errdemon -l
<i>syslog-output-directory-name</i>	<i>syslog-name</i>	syslog files and backup files defined in /etc/syslog.conf
getrasinfo	(Not applicable)	Directory in which command execution results are stored
	.bash_history	Default history file in the Bourne Again shell (bash)
	.history	Default history file in the C shell (csh)
	.sh_history	Default history file in the Korn shell (ksh)
	alog.txt	System diagnosis message
	bootinfo-r.txt	Physical memory size

Output directory ^{#1}	Files	Explanation
	bootinfo.txt	Information about the operation mode of the kernel (32/64 bit) and multi-CPU support
	bootlist-v.txt	List of boot devices
	Config_Rules.txt	Information of Object Database Manager
	crontab.txt	crontab information
	CuAt.txt	Information of Object Database Manager
	CuDv.txt	Information of Object Database Manager
	CuDvDr.txt	Information of Object Database Manager
	CuPath.txt	Information of Object Database Manager
	CuPathAt.txt	Information of Object Database Manager
	CuVPD.txt	Information of Object Database Manager
	disk.txt	List of disks in the /dev directory
	dlngetomtrace.dmp	HDLM function trace
	dlmls-la.txt	HDLM directory information file
	dlmmgr-cha.txt	CHA port information
	dlmmgr-drv.txt	hdisk information
	dlmmgr-hba.txt	HBA port information
	dlmmgr-lu.txt	HDLM LU information
	dlmmgr-lu-all.txt	HDLM LU information (including the number of times an intermittent error occurred)
	dlmmgr-path.txt	HDLM path information
	dlmmgr-path-iem.txt	HDLM path information (including the number of times an intermittent error occurred)
	dlmmgr-sys.txt	HDLM system settings
	dlmodmset.txt	HDLM execution environment ODM settings
	dlmpr-k.txt	Persistent reservation key information

Output directory ^{#1}	Files	Explanation
	env.txt	Environment variable file
	errpt-a.txt	Error log edit file
	genkex.txt	Information of loaded drivers
	hacmp.txt	Information on the HACMP configuration
	histfile_XXXX	File specified in the HISTFILE environment variable
	ioutil.txt	Driver information
	lscfg.txt	Firmware version of HBA etc
	lsdev-C.txt	Kernel parameter value
	lsdev-proc.txt	CPU information
	lsfs.txt	File system information
	lslpp.txt	List of installed packages
	lspath.txt	MPIO path information
	lsps-a.txt	Swap area, usage of swap
	lspv.txt	Physical volume information
	lsvg.txt	Information of volume groups
	Maintenance-Level.txt	Maintenance level of information, displayed when the <code>instfix -i</code> command was executed
	mount.txt	Mount information
	oslevel.txt	OS level information
	pagesize.txt	Memory page size
	PdAt.txt	Information of Object Database Manager
	PdAtXtd.txt	Information of Object Database Manager
	PdPathAt.txt	Information of Object Database Manager
	PdDv.txt	Information of Object Database Manager
	ps-ef.txt	Information on the executing process

Output directory ^{#1}	Files	Explanation
	ulimit-a.txt	Limits on system resources (data segments, stack segments, file descriptors) that are available to processes
	uname-a.txt	Information on the AIX version
	unix	UNIX file
	whatlist.txt	Information output by the <code>what</code> command
usr/sbin	kdb_64 kdb_mp ^{#3} kdb_up ^{#3}	Kernel debugger
etc/VRTSvcs/conf/config	main.cf	VCS configuration definition file
opt/VRTSvcs/bin/triggers	preonline	VCS trigger file
var/VRTSvcs/log	/var/VRTSvcs/ <i>all-files-under-log</i>	VCS log file
<i>hacmp.out-output-directory</i>	hacmp.out	HACMP execution log
/etc/vsd/	oemdisktypes.lst	VSD settings file
/var/adm/csd	vsd.log	VSD execution log
var/adm/ras	boot.log	OS boot log file

#1

An output directory is created in the specified directory when you open the `getras.tar.Z` file.

#2

In the actual file name, a file number is appended to *Trace-file-prefix specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility2*. For example, the default will be `hntr21.log` to `hntr216.log`. Note that the number 2 following the integrated trace file prefix does not represent a file number.

#3

For AIX V6.1, this file is not collected because it does not exist.

7.3 dlmchpdattr Utility for Changing HDLM Default Settings

This utility changes the default value for the hdisk attribute.

By changing the default value, the attribute value set for an hdisk can be changed in the following cases:

- When a new hdisk is configured.
- When the `chdev` command is used to set as defined, and then reconfigure, an existing individual hdisk for which the attribute value has not changed.
- When deleting an existing hdisk[#], and then reconfiguring it.

#

When an hdisk for which the attribute value has been defined is reconfigured without being deleted, the set attribute value is carried over.

If the attribute value for individual hdisks needs to be changed, instead of using this utility, execute the `chdev` command for the necessary hdisks.

Note that if the attribute value has been set for each hdisk, the set attribute values will be applied.

Supplemental Information:

For HDLM 6.2, the default value for the hdisk reservation policy was set to `PR_exclusive`. When the conditions listed in *Table 3-21: Reservation Policy Settings* in *3.9 About the Reservation Policy* are met, to change the reservation policy to `no_reserve`, the `chdev` command had to be executed for each hdisk.

In HDLM 6.3 or later, the default reservation policy values for multiple hdisks can be changed simultaneously by executing the `dlmchpdattr` utility.

7.3.1 Format

```
/usr/DynamicLinkManager/bin/dlmchpdattr
  {-a Attribute=Value [Attribute=Value ...]
  [-u { HTC | XP }] [-A] [-s]
  | -o
  | -h}
```

7.3.2 Parameters

`-a Attribute=Value`

Specifies one or more attribute name and attribute value pairs. If specifying

multiple pairs, separate them by using a space, and enclose the list of pairs in double quotation marks (").

Table 7-3 shows the attribute names and values that can be specified in the `d1mchpdattr` utility.

Table 7-3: Attribute names and values that can be specified in `d1mchpdattr`

Attribute names that can be specified in <code>d1mchpdattr</code>	Values that can be specified
<code>reserve_policy</code>	Specifies the reservation policy to be used. <code>no_reserve</code> : Reservation requests are ignored, and LUs are not reserved. <code>PR_exclusive</code> : Reservations are converted to persistent reservations. The default is <code>PR_exclusive</code> .
<code>max_transfer</code>	Specifies the maximum size of data that can be transferred to the disk. The range of specifiable values conforms to the applicable PdAt ODM rule for <code>HTC_ODM</code> or <code>XP_ODM</code> .
<code>queue_depth</code>	Specifies the maximum number of requests that the queue on the disk can hold. The range of specifiable values conforms to the applicable PdAt ODM rule for <code>HTC_ODM</code> or <code>XP_ODM</code> .
<code>rw_timeout</code>	Specifies the timeout value for a read or write operation. The range of specifiable values conforms to the applicable PdAt ODM rule for <code>HTC_ODM</code> or <code>XP_ODM</code> .

`-u {HTC|XP}`

Specifies the type of ODM whose default value you want to change.

HTC: Specify this if you want to change the default value for `HTC_ODM`.

XP: Specify this if you want to change the default value for `XP_ODM`.

If this parameter is omitted, the change is applied to both `HTC_ODM` and `XP_ODM`.

`-A`

Performs automatic hdisk reconfiguration required to reflect the changed reservation policy. If this parameter is omitted, the hdisk reconfiguration needs to be performed manually.

`-s`

Prevents the confirmation message from being displayed when the utility is executed.

-o

Displays the current value set for the reservation policy.

-h

Displays the format of the `d1mchpdattr` utility.

Notes

- Before you execute the `d1mchpdattr` utility, stop all application processes that access HDLM-managed devices.
- Before you execute the `d1mchpdattr` utility, make sure that no path errors are occurring. If there are any errors, the `d1mchpdattr` utility might end with an error.
- If you cancel the execution of the `d1mchpdattr` utility by pressing **Ctrl + C**, the KAPL10571-I message might be output depending on the timing of the cancellation. This message signifies that the setting change was not successful. If this message is output, re-execute the `d1mchpdattr` utility with the same parameters specified. To return the settings to their previous state, make sure that the above setting change was successful, and then execute the `d1mchpdattr` utility with the original parameters specified.

Examples

In the following example, the utility changes the default hdisk reservation policy to `no_reserve`:

```
# /usr/DynamicLinkManager/bin/d1mchpdattr -a
reserve_policy=no_reserve
KAPL10579-I The HDLM default values will be changed. Is this
OK? [y/n]:y
KAPL10571-I The d1mchpdattr utility completed successfully.
```

In the following example, the utility displays the current default hdisk reservation policy:

```
# /usr/DynamicLinkManager/bin/d1mchpdattr -o
uniquetype = disk/fcp/Hitachi
reserve_policy : no_reserve
KAPL10571-I The d1mchpdattr utility completed successfully.
```

In the following example, the utility displays Help:

```
Usage : d1mchpdattr {-a Attribute=Value [Attribute=Value
...]}
                        [-u { HTC | XP }] [-A] [-s] | -o | -h}

Attributes
reserve_policy={ PR_exclusive | no_reserve }
max_transfer=Numeric
queue_depth=Numeric
rw_timeout=Numeric
```

7.4 dlmgetrasinst Utility for Collecting HDLM Installation Error Information

This utility collects information that is needed to analyze errors that have occurred for some reason during installation of HDLM. The collected information is archived in a file and saved to the directory that you specified. The following files are output:

- `getrasinst.tar.Z`

This file contains compressed system information.

For details about the information that is stored in the system crash dump file and `getrasinst.tar.Z`, see 7.4.3 *List of Collected Error Information*.

7.4.1 Format

DVD-ROM-drive-directory/HDLM_AIX/hdlmtool/dlmgetrasinst
 {*directory-to-which-collected-information-is-output* | -h}

7.4.2 Parameters

directory-to-which-collected-information-is-output

Specify the output directory for the information that is to be collected by the `dlmgetrasinst` utility for collecting HDLM installation error information. The collected information is compiled into two files shown in *Function* and output in the specified directory.

-h

Displays the format of the `dlmgetrasinst` utility.

Note

- We recommend that you execute the `dlmgetrasinst` utility on the HDLM installation DVD-ROM. If you use the utility by copying it to another location from the DVD-ROM, also copy the `UtilAudLog` file to the same directory to which you copy the `dlmgetrasinst` file.
- Because `dlmgetrasinst` first stores error information in the specified output directory before compressing, ensure that information collection areas allocated are of adequate size.
- If the specified directory to which collected information is output already exists, an overwrite confirmation message is displayed. Responding by entering `y` instructs the `dlmgetrasinst` utility to overwrite the existing files; entering `n` (or anything other than `y`) instructs the utility to terminate without executing.

In the latter case, you can either rename the existing directory before re-executing the utility, or you can execute the utility with a different directory name specified.

7.4.3 List of Collected Error Information

Table 7-4: Information Stored in the getrasinst.tar.Z File shows the error information collected by the dlmgetrasinst utility.

Table 7-4: Information Stored in the getrasinst.tar.Z File

Output directory [#]	Files	Explanation
Directly under the directory to which collected information is output	getrasinst.log	dlmgetrasinst utility log file
etc	filesystems	Mount information of the file system
	inittab	inittab file
	syslog.conf	File for defining the directory for the output destination of syslog
log	HBaseAgent_install.log	Hitachi Command Suite Common Agent Component installation log files
<i>syslog-output-directory-name</i>	<i>syslog-name</i>	syslog files and backup files defined in /etc/syslog.conf
getrasinfo	(Not applicable)	Directory in which command execution results are stored
	.bash_history	Default history file in the Bourne Again shell (bash)
	.history	Default history file in the C shell (csh)
	.sh_history	Default history file in the Korn shell (ksh)
	bootlist-v.txt	List of boot devices
	Config_Rules.txt	Information of Object Database Manager
	crontab.txt	crontab information
	CuAt.txt	Information of Object Database Manager
	CuDv.txt	Information of Object Database Manager
	CuDvDr.txt	Information of Object Database Manager
	CuPath.txt	Information of Object Database Manager
	CuPathAt.txt	Information of Object Database Manager

Output directory [#]	Files	Explanation
	CuVPD.txt	Information of Object Database Manager
	disk.txt	List of disks in the /dev directory
	dlmls-la.txt	HDLM directory information file
	env.txt	Environment variable file
	errpt-a.txt	Error log edit file
	genkex.txt	Information of loaded drivers
	histfile_XXXXX	File specified in the HISTFILE environment variable
	lscfg.txt	Firmware version of HBA etc
	lsdev-C.txt	Kernel parameter value
	lsdev-proc.txt	CPU information
	lsfs.txt	File system information
	lslpp.txt	List of installed packages
	lspath.txt	MPIO path information
	lspas-a.txt	Swap area, usage of swap
	lspv.txt	Physical volume information
	lsvg.txt	Information of volume groups
	Maintenance-Level.txt	Maintenance level of information, displayed when the <code>instfix -i</code> command was executed
	mount.txt	Mount information
	oslevel.txt	OS level information
	pagesize.txt	Memory page size
	PdAt.txt	Information of Object Database Manager
	PdAtXtd.txt	Information of Object Database Manager
	PdPathAt.txt	Information of Object Database Manager
	PdDv.txt	Information of Object Database Manager
	ps-ef.txt	Information on the executing process

Output directory [#]	Files	Explanation
	ulimit-a.txt	Limits on system resources (data segments, stack segments, file descriptors) that are available to processes
	uname-a.txt	Information on the AIX version
	rootvginfo.txt	rootvg information

#

An output directory is created in the specified directory when you open the `getrasinst.tar.Z` file

7.5 dlminstcomp Utility for HDLM Component Installation

This utility complements HDLM installation.

Execute this utility when both of the following conditions are satisfied:

- Linkage with Global Link Manager is used
- When HDLM is installed, the KAPL09241-W message is output[#]

#

Execute this utility after installing the JDK.

For details about the JDK version to be installed, see the *JDK required for linkage with Global Link Manager* section in 3.1.1 *Host and OS Support for HDLM*.

7.5.1 Format

```
/usr/DynamicLinkManager/bin/dlminstcomp [-h]
```

7.5.2 Parameter

-h

Displays the format of the dlminstcomp utility.

7.6 dlmmigsts Utility for Assisting HDLM Migration

This utility saves HDLM program information and the HDLM execution environment ODM settings, making it possible to inherit settings information when migrating from HDLM version 5.8.1 or earlier to version 5.9. Execute this utility from the HDLM version 5.9 installation DVD-ROM.

7.6.1 Format

```
DVD-ROM-drive-directory/HDLM_AIX/hdlmtool/dlmmigsts
  {{{-b | -r} -odm odm-environment-settings-file-name -set
  set-environment-settings-file-name [-s] }
  | -h
  }
```

7.6.2 Parameters

-b

Saves the settings files by using the names specified in the `-odm` and `-set` parameters.

Notes on specifying the `-b` parameter

- Do not save *odm-environment-settings-file* and *set-environment-settings-file* to an HDLM-related directory. If you do so, the saved file will be deleted during HDLM uninstallation.

The followings are HDLM-related directories:

```
/usr/DynamicLinkManager
/var/DynamicLinkManager
/var/DLM
/opt/hitachi
```

- Make sure you have write permission for *odm-environment-settings-file*, *set-environment-settings-file*, and the storage directory before executing.
- Do not change the contents of the saved *odm-environment-settings-file* and *set-environment-settings-file*.

-r

Restores the settings files by using the names specified in the `-odm` and `-set` parameters.

`-odm odm-environment-settings-file-name`

Specifies the file name in which the ODM environment settings are defined.

Specify the file path.

Specify a file name different from *set-environment-settings-file-name*.

`-set set-environment-settings-file-name`

Specifies the file name in which the `set` operation environment settings are defined.

Specify the file path.

Specify a file name different from *odm-environment-settings-file-name*.

`-s`

Executes the utility without displaying the overwrite confirmation message.

`-h`

Displays the format of the `dlmmigsts` utility.

Examples

In the following example, the utility saves the ODM environment settings in the `/tmp/odmset` file and the `set` environment settings in the `/tmp/dlnkset` file, when the DVD-ROM drive directory is `cdrom`:

```
# cdrom/HDLM_AIX/hdlmtool/dlmmigsts -b -odm /tmp/odmset -set
/tmp/dlnkset
KAPL13001-I The dlmmigsts utility completed successfully.
```

In the following example, the utility displays Help when the DVD-ROM drive directory is `cdrom`:

```
# cdrom/HDLM_AIX/hdlmtool/dlmmigsts -h
Usage :dlmmigsts {{{-b | -r} -odm odmsetfile -set dlnksetfile
[-s]} | -h}
```

7.7 dlmodmset Utility for Setting the HDLM Execution Environment ODM

This utility sets ODM to define HDLM operations.

7.7.1 Format

```
/usr/DynamicLinkManager/bin/dlmodmset
  {{-r {on | off}
    | -i {on | off }
    | -v {on | off }} [-s]
    | -h
    | -o }
```

7.7.2 Parameters

-r { on | off }

Enables or disables the LUN RESET option.

on: Enable

off: Disable

The default is **off**.

To use GPFS, specify **on**.

You do not need to reconfigure the hdisk or restart the host when you change this parameter.

-i { on | off }

Prevents I/O on the Online(E) path.

on: Prevents I/O on the Online(E) path.

off: Allows I/O on the Online(E) path

The default is **off**.

When an error (such as one that might occur in a LVM mirror configuration) is detected and I/O access for a path in the Online(E) status continues, detection of errors will continue. When this parameter is set to **on**, I/O access is suppressed until troubleshooting measures are taken. This can shorten the time needed to deal with the problem.

You do not need to reconfigure the hdisk or restart the host when you change this

parameter.

Note

When this parameter is set to `on`, I/O access to the Online(E) path will be suppressed, so I/O success will automatically change the path to the Online status. To recover the path, use an `online` command or the auto failback function.

`-v { on | off }`

Enables or disables the NPIV option.

`on`: Enable

`off`: Disable

The default is `off`.

To use HDLM in a client partition to which a virtual HBA is applied by using the NPIV functionality of the virtual I/O server, specify `on`. For details, see *3.4.3 Notes on the Virtual I/O Server*.

`-s`

Prevents the confirmation message from being displayed when the utility is executed.

`-o`

Displays the current setting information.

`-h`

Displays the format of the `dlmodmset` utility.

Examples

In the following example, the utility enables the LUN RESET option:

```
# /usr/DynamicLinkManager/bin/dlmodmset -r on
KAPL10805-I The setup of the HDLM execution environment ODM
will be changed. Lun Reset = on. Is this OK? [y/n]:y
KAPL10800-I The dlmodmset utility completed normally.
```

In the following example, the utility displays the current setting information:

```
# /usr/DynamicLinkManager/bin/dlmodmset -o
Lun Reset : off
Online(E) IO Block : on
NPIV Option : off
KAPL10800-I The dlmodmset utility completed normally.
#
```

In the following example, the utility displays Help:

```
# /usr/DynamicLinkManager/bin/dlmodmset -h
Usage : dlmodmset {{-r {on | off}
                  | -i {on | off}
                  | -v {on | off}
                  }
          [ -s ]
          | -o
          | -h
          }
```

7.8 dlmpostrestore Utility for HDLM Restoration Support

This utility updates HDLM information to match that of the target system environment when a system replication (clone) is created from a `mksysb` image that includes HDLM-managed devices.

7.8.1 Format

```
/usr/DynamicLinkManager/bin/dlmpostrestore [-s | -h]
```

7.8.2 Parameters

-s

Suppresses display of a confirmation message when the utility executes.

-h

Displays the format of the `dlmpostrestore` utility.

Notes

- When the `dlmpostrestore` utility is executed in a local boot disk environment, the devices are reconfigured; when the utility is executed in a boot disk environment, the host is restarted.
- Before you execute the `dlmpostrestore` utility, stop all application processes that access HDLM-managed devices.
- Before you execute the `dlmpostrestore` utility, make sure that no path errors are occurring. If a path error occurs, release of a reservation may fail.

7.9 dlmpr Utility for Clearing HDLM Persistent Reservation

The persistent reservation of a logical unit (LU) may not be canceled due to some reason when multiple hosts share a volume group rather than making up a cluster configuration. In this case, this utility clears the Reservation Key to cancel the persistent reservation.

7.9.1 Format

```
/usr/DynamicLinkManager/bin/dlmpr {{-k | -c} [hdisk-name]  
[hdisk-name] ... [-a] | -h}
```

7.9.2 Parameters

-k

Specify this parameter to display the Reservation Key. The following explains the items displayed when the -k parameter is specified:

Reservation Key

An asterisk (*) is displayed at the end of the Reservation Key for a Reservation Key of another host.

If the Reservation Key is not set, [0x0000000000000000] is displayed.

Regist Key

The registered Keys are displayed.

Key Count

The number of registered Keys is displayed.

-c

Specify this parameter to clear the Reservation Key.

Note

- Do not use the -c parameter during normal operation. Once the Reservation Key is cleared, the hdisk can be accessed from other hosts, which may lead to data corruption.

Use the -c parameter only when you need to clear a Reservation Key that was improperly retained.
- When the *hdisk-name* parameter is omitted, the Reservation Key for the hdisks that makes up rootvg will not be cleared. In this case, the KAPL10670-I message is displayed in the execution result.

hdisk-name

Specify the hdisk for which you want to display or clear the Reservation Key. You can specify more than one volume.

If you omit this parameter, the utility assumes all hdisks.

-a

When multiple hdisks are specified, even if an error occurs during processing, the processing continues for all hdisks.

-h

Displays the format of the dlmpr utility.

Note

[0x????????????????] appears for Reservation Key if the destination storage system does not support the persistent reservation or if a hardware error occurs.

Example

To check the Reservation Keys, and then clear the Reservation Keys other than those for the local host:

1. Execute the dlmpr utility to display the Reservation Keys for hdisk1, hdisk2, hdisk3, hdisk4

```
# /usr/DynamicLinkManager/bin/dlmpr -k hdisk1 hdisk2 hdisk3
hdisk4
self   Reservation Key: [0xaaaaaaaaaaaaaaaa]
hdisk1 Reservation Key: [0xaaaaaaaaaaaaaaaa]
       Regist Key   : [0xaaaaaaaaaaaaaaaa], Key Count : 2
hdisk2 Reservation Key: [0xbbbbbbbbbbbbbbbbbb]*
       Regist Key   : [0xbbbbbbbbbbbbbbbbbb], Key Count : 2
hdisk3 Reservation Key: [0xbbbbbbbbbbbbbbbbbb]*
       Regist Key   : [0xbbbbbbbbbbbbbbbbbb], Key Count : 2
hdisk4 Reservation Key: [0x0000000000000000]
```

2. Execute the dlmpr utility to clear the Reservation Keys for other hosts (marked by an asterisk (*)).

```
# /usr/DynamicLinkManager/bin/dlmpr -c hdisk2 hdisk3
```

3. The confirmation message appears. Enter y to clear. Otherwise, enter n.

```
KAPL10641-I Reservation Key will now be cleared. Is this OK?
[y/n]:y
KAPL10642-I Reservation Key of hdisk2 was cleared.
KAPL10642-I Reservation Key of hdisk3 was cleared.
```

In the following example, the utility displays Help:

```
# /usr/DynamicLinkManager/bin/dlmp -h
Usage : dlmp { { -k | -c } [hdisk-name...] [-a] | -h }
```

7.10 dlmpreuninst Utility for Executed Before Uninstalling HDLM

This utility excludes the hdisk recognized as a boot disk from being an HDLM management target. In a boot disk environment, before you uninstall HDLM you must exclude the hdisk recognized as a boot disk from being an HDLM management target.

7.10.1 Format

```
/usr/DynamicLinkManager/bin/dlmpreuninst [-h | -s]
```

7.10.2 Parameters

-h

Displays the format of the dlmpreuninst utility.

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message (for example, when you want to execute the command in a shell script or batch file).

Examples

In the following example, the utility is executed in a boot disk environment:

```
# /usr/DynamicLinkManager/bin/dlmpreuninst -s
KAPL13103-I HDLM can be uninstalled after rebooting the host.
KAPL13101-I The dlmpreuninst utility completed successfully.
```

In the following example, the utility displays Help:

```
# /usr/DynamicLinkManager/bin/dlmpreuninst -h
Usage : dlmpreuninst [-h | -s]
```

7.11 dlmrmdev Utility for Deleting HDLM Drivers

This utility deletes hdisks or changes the status of hdisks to `Defined` according to the parameter settings. When all the hdisks recognized as HDLM management-target devices have been successfully deleted or changed to `Defined`, the HDLM manager stops.

Note that the hdisk recognized as a boot disk will not be deleted or changed to `Defined`.

7.11.1 Format

```
/usr/DynamicLinkManager/bin/dlmrmdev [[-e | -f] [-A [-s]] | -h]
```

7.11.2 Parameters

- e
Changes the status of hdisks recognized as HDLM-managed devices to `Defined`.
- f
Deletes all hdisks recognized as devices that are either managed by HDLM or intended to be managed by HDLM.
- A
Unmounts file systems and deactivates volume groups that are being used by HDLM before deleting the hdisks that are recognized as HDLM management-target devices or changing the status of those hdisks to `Defined`.
- s
Prevents the confirmation message for unmounting and deactivating the volume groups, when the -A parameter is specified.
- h
Displays the format of the `dlmrmdev` utility.

Note

Before executing the `dlmrmdev` utility, stop all processes and services using the paths managed by HDLM. If you execute the `dlmrmdev` utility without stopping the processes and services that are using the paths managed by HDLM, hdisks recognized as HDLM management-target devices might not be deleted completely or changed to the `Defined` status.

Examples

In the following example, the utility unmounts the file system used by HDLM,

inactivates the volume group used by HDLM, and deletes all the hdisks recognized as HDLM management-target devices:

```
# /usr/DynamicLinkManager/bin/dlmrmdev -A
KAPL10528-I The volume group will be made inactive, and the
file system that is using HDLM will be unmounted. Is this OK?
[y/n]:y
hdisk3 is deleted
KAPL09012-I All HDLM drivers were removed.
```

In the following example, the utility displays Help:

```
# /usr/DynamicLinkManager/bin/dlmrmdev -h
Usage : dlmrmdev [[-e | -f] [-A [-s]] | -h]
```

7.12 installhdlm Utility for Installing HDLM

This utility is used to execute an unattended installation when a new installation, upgrade installation, or re-installation of HDLM is being performed. You can perform an unattended installation even when you are installing HDLM in a boot disk environment. Before you perform an unattended installation, you must define the information that is required during the installation in the installation information settings file.

For details about how to perform an unattended installation, see 3.5.8 *Performing an Unattended Installation of HDLM*.

7.12.1 Format

```
/directory-in-which-the-DVD-ROM-is-mounted-or-copied/HDLM_AIX/hdlmtool/  
instutil/installhdlm { -f installation-information-settings-file-name | -h }
```

7.12.2 Parameters

-f *installation-information-settings-file-name*

Defines the information needed for installing HDLM.

For details about the installation-information settings file, see 7.12.3 *Items To Be Defined in an installation-information Settings File*.

-h

Displays the format of the `installhdlm` utility.

7.12.3 Items To Be Defined in an installation-information Settings File

The following describes the information defined in the installation information settings file.

[INSTALLATION_SETTINGS] section

This section defines information that is used when the `installhdlm` utility is executed. Specify this section name at the beginning of the installation information settings file (although an empty paragraph or comment line can be inserted above this section name).

Table 7-5: Keys in the [INSTALLATION_SETTINGS] Section lists the keys defined in the [INSTALLATION_SETTINGS] section.

Table 7-5: Keys in the [INSTALLATION_SETTINGS] Section

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
installfile_location	Specify the absolute path name of the directory in which the DVD-ROM is mounted or copied. The default is /dev/cd0.	Optional	Optional	60
logdir	Specify the absolute path name of the directory in which the file that contains log information is output. The default is /var/tmp. For details about the log file, see 7.12.4 <i>Log file</i> .	Optional	Optional	60
licensekeyfile ^{#3}	Specify an absolute path to a license key file stored in the host. The file specified here is not deleted after an unattended installation is performed. The default is /var/tmp/hdlm_license. If you perform an upgrade installation or re-installation without updating the license, delete the licensekeyfile key and value.	Optional ^{#4}	Optional ^{#4}	60
licensekey ^{#3}	Specify the absolute path name of the file that records the license key stored on the host. The file specified here is not deleted after an unattended installation is performed. The default is /var/DLM/dlm.lic_key. If you perform an upgrade installation or re-installation without updating the license, delete the licensekey key and value.	Optional ^{#4}	Optional ^{#4}	60

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>driver_config</code>	Specify one of the following values to indicate whether to configure the HDLM driver: y: Configure the HDLM driver (default). n: Do not configure the HDLM driver. In a boot disk environment, the HDLM driver is not configured, regardless of the value specified here.	Optional	Optional	1
<code>restart</code>	Specify whether to restart the host after installation. Specify either of the following values: y: Restart. n: Do not restart (default).	Optional	Optional	1

Legend:

Optional: If a key and its setting are not specified, the default value will be used.

However, for an upgrade installation or re-installation, the previous license information will be inherited for the `licensekeyfile` and `licensekey` keys.

#1

Enter one key and one setting per line.

#2

If the value is not of an allowable type, an error will occur.

#3

You need to delete the `licensekeyfile` key if you specify the `licensekey` key. However, you do not need to delete the `licensekey` key if you specify the `licensekeyfile` key.

If no value is specified for either of these keys, the files below are read in the order listed:

1. License key file (`/var/tmp/hdlm_license`)
2. File containing the license key (`/var/DLM/dlm.lic_key`)

If none of these files exist when you attempt to perform a new installation, unattended installation ends with an error.

#4

When you perform a new installation of HDLM, or when you perform an upgrade installation while the license is expired, prepare the license key or the license key file.

[DISK_DEFAULT_SETTINGS] section

This section defines operation information for the HDLM default settings modification utility (`d1mchpdattr`). This section can be omitted. If the section name is omitted, or the section contains no defined keys, the `d1mchpdattr` utility cannot be used to specify settings.

For details about the `d1mchpdattr` utility, see 7.3 *d1mchpdattr Utility for Changing HDLM Default Settings*.

Table 7-6: Keys in the [DISK_DEFAULT_SETTINGS] Section lists the keys defined in the [DISK_DEFAULT_SETTINGS] section.

Table 7-6: Keys in the [DISK_DEFAULT_SETTINGS] Section

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>reserve_policy</code>	Specify the disk reservation policy. <code>no_reserve</code> : Reservation requests are ignored, and no LU is reserved. <code>PR_exclusive</code> : Persistent reservation is used to reserve disks (default).	Optional	Optional	12

Legend:

Optional: If a key and its setting are not specified, one of the following values will be used:

- For a new installation:
The default value will be used.
- For an upgrade installation or re-installation:
The previous setting will be inherited.

#1

Enter one key and one setting per line.

#2

If the value is not of an allowable type, an error will occur.

[ODM_SETTINGS] section

Defines information used when the `dlmodmset` utility is executed. This section is optional. If this section name is omitted, or if any of the keys in the section are not defined, setup by means of the `dlmodmset` utility will not be executed.

For details about the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

Table 7-7: *Keys in the [ODM_SETTINGS] Section* lists the keys defined in the [ODM_SETTINGS] section.

Table 7-7: Keys in the [ODM_SETTINGS] Section

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>odm_lun_reset</code>	Specify one of the following values to indicate whether to enable or disable the LUN RESET option: on: Enabled off: Disabled (default)	Optional	Optional	3
<code>odm_online_e_io_block</code>	Specify one of the following values to indicate whether to enable or disable suppression of I/O access on the Online(E) status path: on: Enabled off: Disabled (default)	Optional	Optional	3
<code>odm_npiv_option</code>	Specify one of the following values to indicate whether to enable or disable the NPIV option: on: Enabled off: Disabled (default)	Optional	Optional	3

Legend:

Optional: If a key and its setting are not specified, one of the following values will be used:

- For a new installation:
The default value will be used.
- For an upgrade installation or re-installation:
The previous setting will be inherited.

#1

Enter one key and one setting per line.

#2

If the value is not of an allowable type, an error will occur.

For details about the functions set by these keys, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

[ENVIRONMENT_SETTINGS] section

This section defines information that is used when the `set` operation of the HDLM command is executed. This section is optional. If this section name is omitted, or if any of the keys in the section are not defined, setup by means of the `set` operation of the HDLM command will not be executed.

For details on the `set` operation, see 6.6 *set (Sets Up the Operating Environment)*.

Table 7-8: Keys in the [ENVIRONMENT_SETTINGS] Section lists the keys defined in the [ENVIRONMENT_SETTINGS] section.

Table 7-8: Keys in the [ENVIRONMENT_SETTINGS] Section

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
load_balance	Specify one of the following values to indicate whether to enable or disable the load balancing function: on: Enabled (default) off: Disabled	Optional	Optional	3

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
load_balance_type	Specify one of the following values to indicate the load balancing algorithm: rr: The Round Robin algorithm exrr: The Extended Round Robin algorithm lio: The Least I/Os algorithm exlio: The Extended Least I/Os algorithm (default) lbk: The Least Blocks algorithm exlbk: The Extended Least Blocks algorithm	Optional	Optional	5
error_log_level	Set the level of error information that is collected as error logs. You can set a level from 0 to 4. The default is 3.	Optional	Optional	1
error_log_size	Set the size of the error log files (dlmmgr[I-16].log) in kilobytes. You can set a size from 100 to 2000000. The default is 9900.	Optional	Optional	7
error_log_number	Set the number of error log files (dlmmgr[I-16].log). You can set a value from 2 to 16. The default is 2.	Optional	Optional	2
trace_level	Set the trace output level. You can set a level from 0 to 4. The default is 0.	Optional	Optional	1
trace_file_size	Set the size of the trace files (hdlmtr[I-64].log) in kilobytes. You can set a size from 100 to 16000. The default is 1000.	Optional	Optional	5
trace_file_number	Set the number of trace files (hdlmtr[I-64].log). You can set a value from 2 to 64. The default is 4.	Optional	Optional	2

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
path_health_check	Specify one of the following values to indicate whether to enable or disable the path health check function: on: Enabled (default) off: Disabled	Optional	Optional	3
path_health_check_interval	Specify the interval in minutes at which the path health check is performed. You can specify a check interval from 1 to 1440. The default is 30.	Optional	Optional	4
auto_failback	Specify one of the following values to indicate whether to enable or disable the automatic failback function for failed paths: on: Enabled (default) off: Disabled	Optional	Optional	3
auto_failback_interval	Specify the interval in minutes from the time the previous path status check finished until the time the next path status check started. You can specify a check interval from 1 to 1440. The default is 60.	Optional	Optional	4
intermittent_error_monitor ^{#3, #4}	Specify one of the following values to indicate whether to enable or disable intermittent error monitoring: on: Enabled off: Disabled (default)	Optional	Optional	3
intermittent_error_monitor_interval ^{#4}	Specify the interval in minutes that monitoring for intermittent errors is performed. You can specify a check interval from 1 to 1440. The default is 210.	Optional	Optional	4
intermittent_error_monitor_number ^{#4}	Specify the number of times an error (that is assumed to be an intermittent error) occurs. You can specify a value from 1 to 99. The default is 3.	Optional	Optional	2

Legend:

Optional: If a key and its setting are not specified, one of the following values will be used:

- For a new installation
The default value will be used.
- For an upgrade installation or re-installation:
The previous setting will be inherited.

Note:

Setting of audit logs is not supported.

#1

Enter one key and one setting per line.

#2

If the value is not of an allowable type, an error will occur.

For details about the functions set by these keys, see *6.6 set (Sets Up the Operating Environment)*.

#3

You can specify this key only in the following cases:

- For a new installation:
When `on` is specified for the `auto_failback` key in the installation information settings file
- For an upgrade installation or re-installation:
When `on` is specified for the `auto_failback` key in the installation information settings file, or when automatic failback is enabled in the installation pre-settings

#4

If you want to enable intermittent error monitoring, specify this key after specifying the `auto_failback` and `auto_failback_interval` keys.

The following shows an example of an edited installation information settings file.

```
[INSTALLATION_SETTINGS]
installfile_location=/dev/cd0
logdir=/var/tmp
licensekeyfile=/var/tmp/hdlm_license
licensekey=/var/DLM/dlm.lic_key
driver_config=y
restart=n
```

```
[DISK_DEFAULT_SETTINGS]
reserve_policy=PR_exclusive
[ODM_SETTINGS]
odm_lun_reset=off
odm_online_e_io_block=off
odm_npiv_option=off
[ENVIRONMENT_SETTINGS]
load_balance=on
load_balance_type=exlio
error_log_level=3
error_log_size=9900
error_log_number=2
trace_level=0
trace_file_size=1000
trace_file_number=4
path_health_check=on
path_health_check_interval=30
auto_failback=on
auto_failback_interval=60
intermittent_error_monitor=off
# intermittent_error_monitor_interval=210
# intermittent_error_monitor_number=3
```

Note:

- If a hash mark (#) is placed at the beginning of a line in the installation information settings file, that line is assumed to be a comment.
- If you do not want to specify a key, enter a hash mark (#) at the beginning of the line that defines that key.

7.12.4 Log file

A log file (`installhdlm.log`) is output after an unattended installation of HDLM.

The following explains the `installhdlm.log` file.

- `installhdlm.log` is created in the folder whose path is specified by the `logdir` key in the installation-information settings file. Do not share the log file output directory among the hosts on which unattended installation is being performed. If no value is specified for `logdir` key, the log file is output to the `/var/tmp` directory.
- If `installhdlm.log` already exists, log information is added to this log file. For details about the unused capacity required for the log output directory, see *3.5.8 Performing an Unattended Installation of HDLM*.

Note

- Note that `installhdlm.log` is not deleted after HDLM is uninstalled.

Therefore, delete the original `installhdlm.log` manually if it is no longer required.

- If the `installhdlm.log` file cannot be output for some reason, such as there being insufficient capacity on the output disk, a message is output to this effect immediately before the `installhdlm` utility ends.

7.13 installux.sh Utility for HDLM Common Installer

This utility determines what OS HDLM will be installed on, and installs the corresponding version of HDLM from the DVD-ROM. This utility can also perform unattended installations via a parameter specification.

For details about how to use this utility to install HDLM, see 3.5.3 *Performing a New Installation of HDLM*, 3.5.5 *Performing an Upgrade Installation or Re-installation of HDLM*, or 3.5.8 *Performing an Unattended Installation of HDLM*.

7.13.1 Format

```
/directory-in-which-the-DVD-ROM-is-mounted-or-copied/installux.sh [ -f
installation-information-settings-file-name | -h]
```

7.13.2 Parameters

`-f installation-information-settings-file-name`

Defines the information needed for an unattended installation.

For details about installation-information settings files, see 7.12.3 *Items To Be Defined in an installation-information Settings File*.

`-h`

Displays the format of the `installux.sh` utility.

7.13.3 Log file

The `installux.sh` utility outputs execution information to the log file `/var/tmp/hdlm_installux_sh.log`. If the `hdlm_installux_sh.log` log file already exists, the utility appends execution information onto the end of the log file.

If the size of the log file is equal to or greater than 1 MB when the utility is executed, the log file is renamed to `hdlm_installux_sh2.log`, and a new log file is created and named `hdlm_installux_sh.log`, to which the execution information is output.

Note

The `hdlm_installux_sh.log` and `hdlm_installux_sh2.log` log files are not deleted when HDLM is uninstalled. Manually delete the log files, if they are no longer required.

Chapter

8. Messages

This chapter describes the format and meaning of the message IDs, and also the terms used in the messages and message explanations. For details on the meaning of the return codes output by HDLM when it receives a request from Global Link Manager and measures to take for them, see *8.14 Return Codes for Hitachi Command Suite Common Agent Component*.

8.1 Before Viewing the List of Messages

8.2 KAPL01001 to KAPL02000

8.3 KAPL03001 to KAPL04000

8.4 KAPL04001 to KAPL05000

8.5 KAPL05001 to KAPL06000

8.6 KAPL06001 to KAPL07000

8.7 KAPL07001 to KAPL08000

8.8 KAPL08001 to KAPL09000

8.9 KAPL09001 to KAPL10000

8.10 KAPL10001 to KAPL11000

8.11 KAPL11001 to KAPL12000

8.12 KAPL13001 to KAPL14000

8.13 KAPL15001 to KAPL16000

8.14 Return Codes for Hitachi Command Suite Common Agent Component

8.1 Before Viewing the List of Messages

This section explains the following information that is needed to locate messages and understand the explanations in the sections from 8.2 *KAPL01001 to KAPL02000*.

- Format and meaning of the message IDs
- Terms used in the messages and message explanations

This information is explained below.

8.1.1 Format and Meaning of Message IDs

Each message has a message ID. The following shows the format and meaning of message IDs.

Table 8-1: Format and Meaning of the Message ID KAPLnnnnn-l

Format	Meaning
KAPL	Indicates that the message is an HDLM message.
nnnnn	Message serial number for the module
l	Message level C: Critical E: Error W: Warning I: Information

8.1.2 Terms Used in Messages and Message Explanations

The following shows the terms that may appear in messages and message explanations.

Table 8-2: Terms Used in the Messages and Message Explanations

Terms	Meaning
aa...aa	Variable (if there are multiple variables in a message, aa...aa is followed by bb...bb, cc...cc, and so on)
CS	Cluster support
FO	Failover
LB	Load balancing
Operation name	The operation name that is input after <code>dlnkmgx</code> in the command.

8.1.3 Components that Output Messages to syslog

Some messages for the following components are output to syslog:

- HDLM manager
- HDLM driver (filter component)
- HDLM alert driver
- HDLM management target

8.2 KAPL01001 to KAPL02000

KAPL01001-I

The HDLM command completed normally. Operation name = *aa...aa*,
completion time = *bb...bb*

Details

The HDLM command completed successfully.

aa...aa: clear, help, offline, online, set, or view

bb...bb: Year/month/day hour:minute:second

Action

None.

KAPL01002-I

The HDLM command started. Operation name = *aa...aa*

Details

The HDLM command was executed.

aa...aa: clear, offline, online, set, or view

Action

None.

KAPL01003-W

No operation name is specified.

Details

An operation name is missing.

Action

Specify the operation name, and then retry.

KAPL01004-W

The operation name is invalid. Operation name = *aa...aa*

Details

aa...aa: Specified operation name

Action

Execute the `help` operation of the HDLM command (`dlmkmgr`) to check the operation name, and then retry. For details on the `help` operation, see *6.3 help (Displays the Operation Format)*.

KAPL01005-W

A parameter is invalid. Operation name = *aa...aa*, parameter = *bb...bb*

Details

aa...aa: clear, set, online, offline, or view

bb...bb: Specified parameter

Action

Execute `help operation-name` of the HDLM command (`dlnkmgr`) to check the parameter, and then retry. For details on the `help` operation, see 6.3 *help* (*Displays the Operation Format*).

KAPL01006-W

A necessary parameter is not specified. Operation name = *aa...aa*

Details

The specified operation does not contain the necessary parameter.

aa...aa: clear, set, offline, or view

Action

Execute `help operation-name` of the HDLM command (`dlnkmgr`) to check the parameter. Specify the correct parameter, and then retry. For details on the `help` operation, see 6.3 *help* (*Displays the Operation Format*).

KAPL01007-W

A duplicate parameter is specified. Operation name = *aa...aa*, parameter = *bb...bb*

Details

aa...aa: clear, offline, online, set, or view

bb...bb: Duplicate parameter

Action

Delete the duplicate parameter, and then retry.

KAPL01008-W

A necessary parameter value is not specified. Operation name = *aa...aa*, parameter = *bb...bb*

Details

aa...aa: offline, online, set, or view

bb...bb: Parameter name

Action

Specify the parameter value, and then retry.

KAPL01009-W

A parameter value is invalid. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*, Valid value = *dd...dd*

Details

aa...aa: offline, online, set, or view

bb...bb: Parameter name

cc...cc: Specified parameter value

dd...dd: Specifiable parameter value range

Action

Specify a correct value for the parameter, and then retry.

KAPL01012-E

Could not connect the HDLM manager. Operation name = *aa...aa*

Details

In the `view -sys -sfunc` operation, information must be collected from the HDLM manager but the manager cannot be accessed.

aa...aa: view

Action

Execute the `view` operation of the HDLM command (`dlmkmgr`) to check whether the HDLM manager has started. Start the HDLM manager if it has not started, and then retry the HDLM command. For details on the `view` operation, see 6.7 *view (Displays Information)*.

KAPL01013-E

An error occurred in internal processing of the HDLM command. Operation name = *aa...aa* details = *bb...bb*

Details

An error unrelated to a user operation occurred during command processing.

aa...aa: clear, offline, online, set, or view

bb...bb: The name of the function and processing on which the error occurred

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL01014-W

No authority to execute the HDLM command. Operation name = *aa...aa*

Details

You do not have the administrator permissions necessary to execute the HDLM command.

aa...aa: clear, offline, online, set, or view

Action

Execute the command as a user with root permissions.

KAPL01015-W

The target HBA was not found. Operation name = *aa...aa*

Details

No path was found with the port number and path number, or the adapter type and adapter number, specified for the *-hba* parameter.

aa...aa: offline or online

Action

Execute the *view* operation of the HDLM command (*dlnkmgr view -path*) and check the value displayed in *PathName*. Use the two leftmost digits of *PathName* for the relevant HBA port, and then retry. For details on the *view* operation, see 6.7 *view (Displays Information)*.

KAPL01016-W

The target CHA port was not found. Operation name = *aa...aa*

Details

The path ID of the path management path (*Path_ID*) specified in the *-pathid* option required by the *-cha* parameter could not be found, or the CHA that has the channel ID (*CHA_ID*) specified in the *-chaid* parameter could not be found.

aa...aa: offline or online

Action

- If the path ID of the path management path was specified in *-pathid*
Execute the *view* operation of the HDLM command (*dlnkmgr view -path*), and check the value of the target CHA port and the path ID of the path management path that passes through that CHA port. Then, specify the applicable path management path ID, and retry the operation. For details about the *view* operation, see 6.7 *view (Displays Information)*.
- If the channel ID (*CHA_ID*) was specified in *-chaid*
Execute the *view* operation of the HDLM command (*dlnkmgr view*

-cha), and check the target CHA port and the CHA ID of that CHA port. Then, specify the applicable CHA ID, and retry the operation. For details about the `view` operation, see 6.7 *view (Displays Information)*.

KAPL01018-W

The target device was not found. Operation name = *aa...aa*

Details

The specified host device name could not be found.

aa...aa: `view`

Action

Execute the `view` operation of the HDLM command (`dlnkmgr view -path`) to check the value displayed in `HDevName`. Specify a host device for the value of `HDevName`, and then retry. For details on the `view` operation, see 6.7 *view (Displays Information)*.

KAPL01019-W

The target path was not found. Operation name = *aa...aa*

Details

aa...aa: `offline`, `online`, or `view`

- `offline/online` operation

The specified path does not exist.

- `view` operation

The paths have not been configured because creation of the HDLM environment or configuration changes to the HDLM operating environment have not finished.

Action

- `offline/online` operation

Use the `view` operation of the HDLM command (`dlnkmgr`) to check the settings, and then retry. For details on the `view` operation, see 6.7 *view (Displays Information)*.

- `view` operation

Refer to 3. *Creating an HDLM Environment*. Creating an HDLM Environment or 4.5 *Changing the Configuration of the HDLM Operating Environment*, and then configure any paths that exist. If the same message appears again, execute the `DLMgetras` utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract. For details on

the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL01021-E

Cannot execute the HDLM command due to insufficient memory.

Details

Memory required for HDLM command processing could not be allocated.

Action

Terminate unneeded applications to increase the amount of free memory, and then retry.

KAPL01023-W

The last Online path for the device cannot be placed Offline(C).

Details

The path specified in the `offline` operation cannot be placed in the Offline(C) status because it is the last path for the applicable logical unit.

Action

Use the `view` operation of the HDLM command (`dlnkmgr`) to check the status of the paths. For details on the `view` operation, see 6.7 *view (Displays Information)*.

KAPL01024-W

The specified parameters cannot be specified at the same time.
Operation name = *aa...aa*, parameters = *bb...bb*

Details

aa...aa: `clear`, `offline`, `online`, `set`, or `view`

bb...bb: Parameters that cannot be specified at the same time

Action

Execute `help` operation of the HDLM command (`dlnkmgr`) to check which parameters can be specified at the same time, and then retry. For details on the `help` operation, see 6.3 *help (Displays the Operation Format)*.

KAPL01036-E

The Offline path cannot be placed online. PathID = *aa...aa*

Details

aa...aa: Path ID (decimal (base-10) number)

Action

Remove the error in the path, and then retry.

KAPL01039-W

During the online operation processing of the HDLM command, a path that cannot be placed in the Online status was detected. PathID = *aa...aa* Would you like to continue the processing of the online operation? [y/n]:

Details

A path that cannot be placed Online was detected during multipath online processing.

To ignore this path and perform online processing for the next path, enter *y*.

To cancel processing, enter *n*.

aa...aa: Path ID (decimal (base-10) number)

Action

If you want to continue processing of the online operation of the HDLM command for other paths, enter *y*. If you want to terminate processing, enter *n*. For details on the online operation, see 6.5 *online (Places Paths Online)*.

KAPL01040-W

The entered value is invalid. Re-enter [y/n]:

Details

A value other than *y* and *n* was entered. Enter *y* or *n*.

Action

Enter *y* or *n*.

KAPL01041-E

The entered value is invalid. The operation stops. Operation name = *aa...aa*

Details

Command processing will be aborted because an incorrect value was entered three times in a row for a request.

aa...aa: clear, offline, online, or set

Action

Check the correct value, and then re-execute the HDLM command.

KAPL01044-W

A duplicate parameter value is specified. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*

Details

aa...aa:view

bb...bb: Parameter name

cc...cc: Duplicate parameter value

Action

Delete the duplicate parameter value, and then retry.

KAPL01045-W

Too many parameter values are specified. Operation name = *aa...aa*, parameters = *bb...bb*, parameter value = *cc...cc*

Details

aa...aa: offline, online, set, or view

bb...bb: Parameter name

cc...cc: Parameter value

Action

Execute `help operation-name` of the HDLM command (`dlnkmgr`) to check the parameter value, and then retry. For details on the `help` operation, see 6.3 *help (Displays the Operation Format)*.

KAPL01048-W

Help information cannot be found. Operation name = *aa...aa*.

Details

The specified operation is not an operation of the HDLM command.

aa...aa: Specified operation name

Action

Use the `help` operation of the HDLM command (`dlnkmgr`) to check the operation name. And then retry. For details on the `help` operation, see 6.3 *help (Displays the Operation Format)*.

KAPL01049-I

Would you like to execute the operation? Operation name = *aa...aa*
[y/n]:

Details

The `clear/set` operation will be started. To continue the operation, enter y. To cancel the operation, enter n.

aa...aa: clear or set

Action

If you want to execute the operation, enter y. If you want to terminate processing, enter n. For details on the `clear` operation, see 6.2 *clear (Returns the Path*

Statistics to the Initial Value). For details on the `set` operation, see 6.6 *set (Sets Up the Operating Environment)*.

KAPL01050-I

The currently selected paths will be changed to the Online status. Is this OK? [y/n]:

Details

The online operation will be started. To continue the online operation, enter y. To cancel the operation, enter n.

Action

If you want to execute online processing, enter y. If you want to terminate processing, enter n. For details on the `online` operation, see 6.5 *online (Places Paths Online)*.

KAPL01051-I

Because no path has been selected among the currently displayed paths, the paths in the Offline(C), Offline(E), and Online(E) statuses will be changed to the Online status. Is this OK? [y/n]:

Details

All the paths will be placed Online because the path selection parameter is not specified for the `online` operation. To place all the paths Online, enter y. To cancel the operation, enter n.

Action

If you want to execute online processing, enter y. If you want to terminate processing, enter n. Before you execute the processing, be sure to execute the view operation of the HDLM command (`dlnkmgr`) to check the path status. For details on the `view` operation, see 6.7 *view (Displays Information)*. For details on the `online` operation, see 6.5 *online (Places Paths Online)*.

KAPL01052-I

The currently selected paths will be changed to the Offline(C) status. Is this OK? [y/n]:

Details

The offline operation will be started. To continue the offline operation, enter y. To cancel the operation, enter n.

Action

If you want to execute the offline processing, enter y. If you want to terminate processing, enter n. For details on the `offline` operation, see 6.4 *offline (Places Paths Offline)*.

KAPL01053-I

If you are sure that there would be no problem when the path is placed in the Offline(C) status, enter y. Otherwise, enter n.
[y/n]:

Details

The offline operation will be started. To continue the offline operation, enter y. To cancel the operation, enter n.

Action

If you want to execute offline processing, enter y. If you want to terminate processing, enter n. For details on the offline operation, see 6.4 *offline (Places Paths Offline)*.

KAPL01054-W

During the offline operation processing of the HDLM command, a path that cannot be placed in the Offline(C) status was detected. PathID = aa...aa Would you like to continue the processing of the offline operation? [y/n]:

Details

A path that cannot be set to Offline(C) was detected during multipath offline processing. To ignore this path and perform offline processing for the next path, enter y. To cancel offline processing, enter n.

aa...aa: Path ID (decimal (base-10) number)

Action

If you want to continue processing the offline operation of the HDLM command for other paths, enter y. If you want to terminate processing, enter n. For details on the offline operation, see 6.4 *offline (Places Paths Offline)*.

KAPL01055-I

All the paths which pass the specified aa...aa will be changed to the Offline(C) status. Is this OK? [y/n]:

Details

Multiple paths will be collectively set to Offline(C) because the -hba or -cha parameter was specified. To collectively set place multiple paths to Offline(C), enter y. To cancel the operation, enter n.

aa...aa: CHA port, HBA

Action

If you want to execute offline processing for the paths that meet the specified requirements, enter y. If you want to terminate processing, enter n.

KAPL01056-I

If you are sure that there would be no problem when all the paths which pass the specified *aa...aa* are placed in the Offline(C) status, enter y. Otherwise, enter n. [y/n]:

Details

This message re-asks the user whether they want to set place all the paths to Offline(C). To set all the paths to Offline(C), enter y. To cancel the operation, enter n.

aa...aa: CHA port, HBA

Action

If you want to execute offline processing for the paths that meet the specified requirements, enter y. If you want to terminate processing, enter n.

KAPL01057-I

All the paths which pass the specified *aa...aa* will be changed to the Online status. Is this OK? [y/n]:

Details

Multiple paths will all be placed in Online status because the -hba or -cha parameter was specified. To continue the operation, enter y; to cancel the operation, enter n.

aa...aa: CHA port, HBA

Action

If you want to execute online processing for the paths that meet the specified requirements, enter y. If you want to terminate processing, enter n.

KAPL01058-W

The specified parameter value is not needed. Operation name = *aa...aa*, parameter = *bb...bb*, parameter value = *cc...cc*

Details

A parameter value was specified in a parameter that does not need a any parameter value.

aa...aa: clear, offline, online, set, or view

bb...bb: Parameter name

cc...cc: Parameter value

Action

Execute `help operation-name` of the HDLM command (`dlmkmgr`) to check the parameter and parameter value, and then retry. For details on the `help` operation,

see 6.3 *help (Displays the Operation Format)*.

KAPL01059-W

Cannot specify the parameter *aa...aa* at the same time if you specify parameter *bb...bb* and parameter value *cc...cc*. Operation name = *dd...dd*

Details

A parameter value is conflicting with the value of another parameter.

bb...bb: Parameter name

cc...cc: Parameter value

aa...aa: Parameter name

dd...dd: view or set

Action

Execute *help operation-name* of the HDLM command (*dlnkmgr*) to check the parameter and parameter value, and then retry. For details on the *help* operation, see 6.3 *help (Displays the Operation Format)*.

KAPL01060-I

The user terminated the operation. Operation name = *aa...aa*

Details

Command processing will be aborted because n was entered for a required confirmation.

aa...aa: online, offline, set, or clear

Action

None.

KAPL01061-I

aa...aa path(s) were successfully placed *bb...bb*; *cc...cc* path(s) were not. Operation name = *dd...dd*

Details

This message indicates the number of the paths processed in an online/offline operation.

aa...aa: Number of paths where the online/offline operation was successful (decimal (base-10) number)

bb...bb: Online or Offline(C)

cc...cc: Number of paths where the online/offline operation was unsuccessful (decimal (base-10) number)

dd...dd: online, or offline

Action

None. For details on the `online` operation, see 6.5 *online (Places Paths Online)*. For details on the `offline` operation, see 6.4 *offline (Places Paths Offline)*.

KAPL01063-I

The target path(s) are already *aa...aa*.

Details

As a result of a previous `online/offline` operation, the specified path has already been set to Online/Offline(C).

aa...aa: Online or Offline(C)

Action

Use the `view` operation of the HDLM command (`dlnkmgr`) to check the status of the path. For details on the `view` operation, see 6.7 *view (Displays Information)*. For details on the `online` operation, see 6.5 *online (Places Paths Online)*. For details on the `offline` operation, see 6.4 *offline (Places Paths Offline)*.

KAPL01068-I

Enter a license key:

Details

The license key will now be renewed. Enter a license key.

Action

None.

KAPL01069-W

The entered license key is invalid.

Details

The entered license key is invalid.

Action

Enter a valid license key.

KAPL01070-E

The entered license key is invalid. Renewal of the license key will now stop.

Details

The license key renewal processing will be aborted because an invalid license key

was entered three times in a row.

Action

Obtain a valid license key, and then retry.

KAPL01071-I

The permanent license was installed.

Details

The license was renewed and is registered as a permanent license.

Action

None.

KAPL01072-I

The emergency license was installed. The license expires on *aa...aa*.

Details

A license was renewed and is registered as an emergency license.

aa...aa: Year (4 digits)/month (01-12)/day (01-31)

Action

Install a permanent license by the expiration day.

KAPL01073-E

The temporary license expired.

Details

The temporary license has expired. Register a permanent license.

Action

Register a permanent license.

KAPL01074-E

The emergency license expired.

Details

The emergency license has expired. Register a permanent license.

Action

Register a permanent license.

KAPL01075-E

A fatal error occurred in HDLM. The system environment is invalid.

Details

The license information file is missing.

Action

Re-install HDLM.

KAPL01076-I

The permanent license has been installed.

Details

You need not install a license because a permanent license has already been installed.

Action

None.

KAPL01078-W

The operation terminated because the path configuration changed during execution of the HDLM command. Operation name = *aa...aa*

Details

aa...aa: offline, online, view

Action

After the processing to change the path configuration has finished, retry.

KAPL01079-W

The intermittent error monitoring function cannot be set up because automatic failback is disabled.

Details

The intermittent error monitoring function cannot be set up because automatic failbacks are disabled.

Action

Enable automatic failbacks, and then re-execute.

KAPL01080-W

The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.

Details

An intermittent error cannot be detected by using the values specified for the following: the checking interval for automatic failbacks, the error-monitoring interval, and the number of times the error needs to occur.

Action

Set the intermittent error-monitoring interval to a value that is equal to or greater than (*automatic-failback-checking-interval* x *number-of-times-error-is-to-occur-for-intermittent-error-monitoring*).

KAPL01081-E

The license key file is invalid. File name = *aa...aa*

Details

The format of the license key file is invalid.

aa...aa: /var/tmp/hdlm_license

Action

Save the correct license key file in the designated, and then re-execute.

/var/tmp/hdlm_license

KAPL01082-E

There is no installable license key in the license key file. File name = *aa...aa*

Details

There is no useable license key for HDLM in the license key file.

aa...aa: /var/tmp/hdlm_license

Action

Make sure that the license key file is correct, and then re-execute.

/var/tmp/hdlm_license

KAPL01083-I

There is no license key file. File name = *aa...aa*

Details

There is no license key file in the designated directory:

aa...aa: /var/tmp/hdlm_license

Action

When the message that prompts you to enter the license key is displayed, enter the license key.

Alternatively, cancel the HDLM command, save the correct license key file in the designated directory, and then re-execute the HDLM command.

aa...aa: /var/tmp/hdlm_license

KAPL01084-W

An attempt to delete the license key file has failed. File name = *aa...aa*

Details

aa...aa: /var/tmp/hdlm_license

Action

If a license key file exists, delete it.

aa...aa: /var/tmp/hdlm_license

KAPL01088-W

The specified parameter values cannot be specified at the same time. Operation name = *aa...aa*, parameter = *bb...bb*, parameter values = *cc...cc*

Details

aa...aa:view

bb...bb: Parameter name

cc...cc: Parameter values that cannot be specified at the same time

Action

Execute *help operation-name* of the HDLM command (*dlmkmgr*) to check which parameter can be specified, and then retry. For details on the *help* operation, see 6.3 *help (Displays the Operation Format)*.

KAPL01089-E

One of the following was executed at the same time as an HDLM command *set -lic* operation: another *set -lic* operation, or an update of the license for an update installation.

Action

Check the license by using the HDLM command's *view -sys -lic* operation. If necessary, re-execute the HDLM command's *set -lic* operation. If the same error message is output again, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

Do not perform the following operations:

- Simultaneously execute the HDLM command's *set -lic* operation with the *view -sys -lic* operation.
- Execute the HDLM command's *set -lic* operation while the license for an upgrade or re-installation is being updated.

KAPL01095-E

An attempt to acquire the HDLM version information has failed.
 details = *aa...aa*

Details

aa...aa: Code showing the reason for the error

Action

Re-execute the command. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.

KAPL01096-E

An attempt to acquire the Service Pack version information has failed. details = *aa...aa*

Details

aa...aa: Code showing the reason for the error

Action

Re-execute the command. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.

KAPL01097-W

All the current trace files will be deleted. Is this OK? [y/n]

Details

If you set a value that is less than the current value of the trace file size or number of trace files, all the current trace files will be deleted. To continue the operation, enter `y`. To cancel the operation, enter `n`.

Action

If you want to execute the operation of the HDLM command, enter `y`. If you want to terminate processing, enter `n`.

KAPL01100-I

aa...aa

Details

This message indicates the executed command line.

aa...aa: Name of the executed command.

Action

None.

KAPL01101-W

The target HBA port was not found. Operation name = *aa...aa*

Details

The HBA having the HBA_ID specified in the -hbaid parameter could not be found.

aa...aa: offline, online

Action

Use the view operation of the HDLM command (`dlnmgr view -hba`) to check the target HBA port and the HBA_ID of the target HBA port. After that, specify the appropriate HBA_ID, and then retry.

KAPL01102-I

All the paths which pass the specified *aa...aa* port will be changed to the Offline(C) status. Is this OK? [y/n]:

Details

Multiple paths will be collectively placed Offline(C) because the -hbaid or -chaid parameter was specified. To collectively place multiple paths Offline(C), enter y. To not collectively place them Offline(C), enter n.

aa...aa: CHA, HBA

Action

If you want to execute the offline processing for the paths which pass the specified target, enter y. If you want to terminate the processing, enter n.

KAPL01103-I

If you are sure that there would be no problem when all the paths which pass the specified *aa...aa* port are placed in the Offline(C) status, enter y. Otherwise, enter n. [y/n]:

Details

This message re-asks the user whether to place all the paths Offline(C). To place all the paths Offline(C), enter y. To not place them Offline(C), enter n.

aa...aa: CHA, HBA

Action

If you want to execute the offline processing for the paths which pass the specified target, enter y. If you want to terminate the processing, enter n.

KAPL01104-I

All the paths which pass the specified *aa...aa* port will be changed to the Online status. Is this OK? [y/n]:

Details

Multiple paths will be collectively placed Online because the `-hbaid` or `-chaid` parameter was specified. To collectively place multiple paths Online, enter `y`. To not collectively place them Online, enter `n`.

`aa...aa`: CHA, HBA

Action

If you want to execute the Online processing for the paths which pass the specified target, enter `y`. If you want to terminate the processing, enter `n`.

KAPL01112-E

An attempt to connect to the HDLM driver has failed. Operation name = `aa...aa`

Details

HDLM driver information must be collected to execute the given HDLM command, but the HDLM driver cannot be accessed.

`aa...aa`: clear, offline, online, set, or view

Action

Perform one of the following procedures.

When performing an installation

See 3.5 *Installing HDLM*, and then complete the installation.

When performing an uninstallation

See 3.14.2 *Uninstalling HDLM*, and then complete the uninstallation.

When performing neither of the above, or if the same error continues to occur even after one of the above procedures is performed, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL01114-W

The audit log configuration file does not exist. Restart the HDLM Manager, and execute the `"dlkmgr view -sys -audlog"` command and check the setting.

Details

The audit log configuration file does not exist.

Action

Restart the HDLM Manager, and execute the `dlmkmgr view -sys -audlog` command, and then specify the desired setting by using the `dlmkmgr set -audlog` command or the `dlmkmgr set -audfac` command as necessary.

KAPL01115-W

The audit log configuration file cannot be opened. Execute the "`dlmkmgr view -sys -audlog`" command and check whether a normal result is displayed.

Details

The audit log configuration file cannot be opened.

Action

If the `dlmkmgr view -sys -audlog` command does not display a normal result, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

KAPL01116-W

The audit log configuration file is invalid. Restart the HDLM Manager, and execute the "`dlmkmgr view -sys -audlog`" command and check the setting.

Details

The audit log configuration file is invalid.

Action

Restart the HDLM Manager, and execute the `dlmkmgr view -sys -audlog` command, and then specify the desired setting by using the `dlmkmgr set -audlog` command or the `dlmkmgr set -audfac` command as necessary.

KAPL01117-W

An error occurred during processing to read the audit log configuration file.

Details

An internal error occurred while reading the audit log configuration file.

Action

Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

KAPL01118-W

An error occurred during processing to output the audit log configuration file.

Details

An internal parameter error when the audit-log data was output.

Action

Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

KAPL01119-W

An error occurred during processing to output the audit log configuration file.

Details

An internal parameter error when the audit-log data was output.

Action

Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

KAPL01120-W

A storage subsystem model ID could not be displayed. Details = *aa...aa*, *bb...bb*

Details

A storage system model ID could not be displayed.

aa...aa: Storage recognition information

bb...bb: Error code

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL01121-W

HNTRLib2 initialization failed. Integrated trace information cannot be collected.

Action

Execute the HDLM command as a user who has root permissions.

If neither of above are the source of the problem, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

8.3 KAPL03001 to KAPL04000

KAPL03001-I

HDLM API information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: Trace information

Action

None.

KAPL03003-E

HDLM API Error information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: API trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL03004-C

A critical error occurred in the HDLM API. (*aa...aa*)

Details

This information is required for resolving problems.

aa...aa: API trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL03006-E

An access to the HDLM driver causes an error. (*aa...aa*)

Details

This information is required for resolving problems.

aa...aa: API trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL03007-E

An error occurred during communication with the HDLM manager.
(*aa...aa*)

Details

This information is required for resolving problems.

aa...aa: API trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL03008-E

An error occurred during log input to the HDLM alert driver.
(*aa...aa*)

Details

This information is required for resolving problems.

aa...aa: API trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL03999-E

An unexpected error occurred.

Details

Conflicting versions of HDLM modules are being used.

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance

contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

8.4 KAPL04001 to KAPL05000

KAPL04001-I

HDLM manager started.

Action

None.

KAPL04002-E

Could not start the HDLM manager.

Details

The HDLM manager failed to start because the current environment is unsuitable for the HDLM manager to run in.

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04003-E

The startup parameter is invalid.

Details

The HDLM manager internal parameter is invalid.

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04004-I

HDLM manager will now terminate.

Action

None.

KAPL04008-E

Cannot open the option definition file (`aa...aa`).

Details

HDLM manager could not start normally because it was unable to open the option definition file.

aa...aa: Option definition file name

Action

Check whether another program is currently using this file (for example, the file is being opened in a text editor), or whether the file has been inadvertently deleted.

KAPL04009-E

The option definition is invalid.

Details

HDLM manager could not start normally because some of the definitions in the option definition file were invalid.

Action

If the KAPL04033-W message is output after this message, execute the `dlmkmgr view -sys -sfunc` command, and then check the option settings.

For options with setting values that have returned to default values, use the `dlmkmgr set` operation to reset the values.

If the KAPL04033-W message is not output, restart HDLM manager.

If the same error occurs, re-install HDLM. For details on the `view` operation, see *6.7 view (Displays Information)*. For details on the `set` operation, see *6.6 set (Sets Up the Operating Environment)*.

KAPL04010-E

Could not open the error log file.

Details

HDLM manager cannot start normally (unable to open the error log file `/var/opt/DynamicLinkManager/log/dlmmgr[1-16].log`).

Action

Check whether another program is using the file (or has opened the file with Notepad), or whether the error log file has been deleted inadvertently.

KAPL04011-E

Could not output the error log file.

Details

The log information could not be output to the error log file `/var/DynamicLinkManager/log/dlmmgr[1-16].log`.

Action

Make sure that the disk has enough unused capacity.

KAPL04012-E

Could not create a communication pipe. RC = aa...aa

Details

HDLM manager could not start normally because it was unable to create a pipe file, which is used in communication with HDLM commands.

aa...aa: OS error code (decimal (base-10) number)

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04013-E

Input is impossible via the communication pipe. RC = aa...aa

Details

Data could not be read from the pipe file while communicating with an HDLM command.

aa...aa: OS error code (decimal (base-10) number)

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04014-E

Output is impossible via the communication pipe. RC = aa...aa

Details

Data could not be written to the pipe file while communicating with an HDLM command.

aa...aa: OS error code (decimal (base-10) number)

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04019-E

Could not collect the error information. RC = aa...aa

Details

An attempt to read the log information from the alert driver failed.

aa...aa: API return code (decimal (base-10) number)

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04021-I

HDLM manager information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: HDLM manager trace information

Action

None.

KAPL04022-W

HDLM manager warning information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: HDLM manager trace warning information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04023-E

HDLM manager error information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: HDLM manager trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras*

*Utility for Collecting HDLM Error Information.***KAPL04024-C**

A critical error occurred in the HDLM manager. (aa...aa)

Details

This information is required for resolving problems.

aa...aa: HDLM manager trace error information

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL04025-C

A memory shortage occurred in the HDLM manager.

Details

There was not enough memory to run the HDLM manager processes.

Action

Increase the amount of memory available for the process.

KAPL04026-I

The temporary license is valid. The license expires in aa...aa days on (bb...bb) .

Details

aa...aa: Expiration day

bb...bb: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)

Action

Install a permanent license by the expiration day.

KAPL04027-I

The emergency license is valid. The license expires in aa...aa days on (bb...bb) .

Details

aa...aa: Expiration day

bb...bb: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)

Action

Install a permanent license by the expiration day.

KAPL04028-E

The temporary license expired.

Action

Install a permanent license.

KAPL04029-E

The emergency license expired.

Action

Install a permanent license.

KAPL04030-E

The temporary license has already expired.

Action

Install a permanent license.

KAPL04031-E

The emergency license has already expired.

Action

Install a permanent license.

KAPL04032-C

A fatal error occurred in HDLM. The system environment is invalid

Details

A part of the HDLM configuration file is missing.

Action

Re-install HDLM.

KAPL04033-W

The option definition file was re-created.

Details

When an existing option definition file cannot be read, a new option definition file will be re-created by using the default values. If some of the options can be read, those values can be used. As for any remaining values, the default values will be used.

Action

For any non-defaults options, use the `dlkmgr set` operation to set the options again. For details on the `set` operation, see *6.6 set (Sets Up the Operating Environment)*.

KAPL04034-E

An attempt to create the option definition file has failed.

Details

An attempt to re-create an option definition file (/usr/DynamicLinkManager/config/dlmmgr.xml) using the default values has failed.

Action

Remove unnecessary files and secure unused capacity on the file system, Check the write permissions for the directory and file.

KAPL04035-I

The path health check will now start. Total number of paths = *aa...aa*

Details

aa...aa: Total number of paths

Action

None.

KAPL04036-I

The path health check for the path *aa...aa* was executed. Number of error paths = *bb...bb*

Details

The path health check has completed normally.

aa...aa: Number of paths targeted for path health checking.

bb...bb: Number of paths determined to have an error by path health checking.

Action

None.

KAPL04037-I

The path health check completed normally. Path ID = *aa...aa*

Details

All the paths that path health checking examined are fine.

aa...aa: Path ID for the path examined by path health checking.

Action

None.

KAPL04042-I

HDLN SNMP TRAP information - *aa...aa*

Details

All the paths that path health checking examined are fine.

aa...aa: Start or stop

Action

None.

KAPL04045-I

HDLN SNMP TRAP was sent. Trap ID = *aa...aa*, IP Address = *bb...bb*, Port Number= *cc...cc*, Community = *dd...dd*, Trap Data = *ee...ee*

Details

SNMP TRAP was sent.

aa...aa: Trap ID

bb...bb: Destination IP address of the trap

cc...cc: Destination port number of the trap

dd...dd: Community name given to the trap

ee...ee: Transmission data

Action

None.

KAPL04046-E

An attempt to connect to the HDLM alert driver has failed. RC = *aa...aa*. The HDLM manager will now terminate.

Details

An attempt to connect to the HDLM alert driver during HDLM manager startup has failed. The HDLM manager will now terminate.

aa...aa: OS error code (decimal number)

Action

See *3.5 Installing HDLM*, and then complete the installation. If the same error continues to occur even after the procedure is performed, execute the *DLMgetras* utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the *DLMgetras* utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

8.5 KAPL05001 to KAPL06000

KAPL05003-I

The HDLM driver (filter component) was successfully attached to Disk (*aa...aa*), Partition (*bb...bb*).

Details

The path corresponding to Disk (*aa...aa*: Disk sequence number) and Partition (*bb...bb*: Fixed at 0) was successfully registered in the core logic.

Action

None.

KAPL05008-E

Could not allocate memory. (*aa:bb*) Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

The OS memory allocation function was started but an error was returned from the memory allocation function.

aa...aa: Number of program lines

bb...bb: Memory capture size

Action

Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL05011-E

Could not attach the HDLM driver (filter component) to Disk (*aa*), Partition (*bb*). (*cc:dd*) Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

Registration of the path corresponding to Disk (*aa...aa*: physical volume (hdisk) decimal sequence number) and Partition (*bb...bb*: Partition decimal number) failed in the core logic.

cc...cc: Error code (hexadecimal number)

dd...dd: Filter driver management table address (hexadecimal number)

Action

Check whether the HDLM driver has started normally. If it has not started or contains an error, contact your HDLM vendor or the maintenance company, if there is a maintenance contract for HDLM, and report the error and detail code.

KAPL05014-I

The device object (*aa...aa*) was registered as the path (*bb...bb*).

Details

The path (*bb...bb*: Core logic path identifier) of the device object (*aa...aa*: Filter driver management table address) was successfully registered into the core logic.

Action

None.

KAPL05018-W

The FO processing in the path (*aa*) failed. (*bb:cc*) Check the connection status of the path %x. If there is no problem with the connection status, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

FO processing failed in the path (*aa...aa*: Identifier of the core logic path where FO processing failed (hexadecimal number)).

bb...bb: Error code (hexadecimal number)

cc...cc: Fixed at 0

Action

The I/O being processed is discarded. Check the status of the device path and take an appropriate action. If there is no problem with the connection status of the path, execute the DLMgetras utility for collecting error information, and then contact the HDLM vendor or the maintenance company if you have a maintenance contract for HDLM

KAPL05021-I

Processing of IOCTL (*aa...aa*) completed normally.

Details

The processing for the requested IOCTL operation was successful.

aa...aa: IOCTL code (hexadecimal number)

Action

None.

KAPL05023-E

Could not process the IOCTL(*aa*). (*aa:cc*) Check the message of the HDLM command or the HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

Processing corresponding to the requested IOCTL (*aa...aa*: IOCTL code (hexadecimal number)) is unsuccessful.

bb...bb: Fixed at 0

cc...cc: Fixed at 0

Action

Check the message of the HDLM command (dlnkmgr) or the HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL05501-E

The path could not be created. (*aa*, *bb*, *cc*) Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

The driver instance could not be registered in the kernel side.

aa...aa: HDLM driver instance name

bb...bb: Logical device file name of hdisk

cc...cc: Error code (decimal number)

Action

Contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM.

KAPL05819-I

Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*.

8. Messages

Details

The filter driver outputs this message for maintenance.

aa...aa: Device minor number

bb...bb: Message output location information

cc...cc: Detailed information 1

dd...dd: Detailed information 2

Action

None.

8.6 KAPL06001 to KAPL07000

KAPL06003-I

Initialization of the HDLM alert driver (*aa...aa*) was successful.

Details

Initialization of the alert driver (*aa...aa*: alert driver management table address (hexadecimal number)) completed normally.

Action

None.

KAPL06004-E

Could not allocate memory. (*aa...aa:bb...bb*)

Details

An attempt to reserve memory to save alert information has failed.

aa...aa: Program line (hexadecimal number)

bb...bb: Target memory size (hexadecimal number)

Action

Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL06009-I

Invalid IOCTL (*aa...aa*) was received. The processing is canceled.

Details

A request having an invalid IOCTL code (*aa...aa*: IOCTL code (hexadecimal number)) was issued to the alert driver.

Action

None.

KAPL06010-E

Could not process the IOCTL (*aa...aa*) . (*bb...bb:cc...cc*)

Details

Although the IOCTL request (*aa...aa*: code (hexadecimal number)) from the HDLM manager or API was accepted, it is not one of the requests expected to be

processed by the alert driver.

bb...bb: error code (hexadecimal number)

cc...cc: 0 (fixed)

Action

Check the message of the HDLM command (`dlnkmgr`) or HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL06013-E

Could not write log information into the log buffer.
(*aa...aa:bb...bb*)

Details

When a log output request was made from the filter driver, the log information was discarded because of a memory allocation failure. Alternatively, although an HDLM driver message or HDLM alert driver message, or a non-emergency message (C/I) by the core logic was generated, its log information was discarded by the HDLM alert driver.

aa...aa: log message code (hexadecimal number)

bb...bb: log area size (hexadecimal number)

Action

Check whether any other error occurred. The information that could not be written is discarded.

Review the actual memory size when another error does not occur.

When the actual memory size is insufficient, increase the actual memory size.

When the actual memory size is sufficient, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL06014-E

Could not write emergency information into the emergency information buffer. (*aa...aa:bb...bb*)

Details

When a log output request was made from the filter driver, the log information was discarded because of a memory allocation failure. Alternatively, although an emergency message (such as a path error message) detected by the core logic was generated as an output message, its log information was discarded by the HDLM alert driver.

aa...aa: Message code (hexadecimal number)

bb...bb: Buffer size (hexadecimal number)

Action

Check whether any other error occurred. The information that could not be written is discarded.

Review the actual memory size if another error does not occur.

If the actual memory size is insufficient, increase the actual memory size.

If the actual memory size is sufficient, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

8.7 KAPL07001 to KAPL08000

KAPL07819-I

Data for maintenance: *aa...aa bb...bb cc...cc dd...dd*.

Details

This message is generated by the core logic for maintenance.

aa...aa: Detailed information 1 (decimal (base-10) number)

bb...bb: Internal function number of the core logic (decimal (base-10) number)

cc...cc: Detailed information 2 (decimal (base-10) number)

dd...dd: Detailed information 3 (decimal (base-10) number)

Action

None.

8.8 KAPL08001 to KAPL09000

KAPL08019-E

The path (*aa...aa*) detected an error (*bb...bb*) . (*cc...cc*)

Details

An error occurred in the path. The error is most likely due to a disconnected cable.

aa...aa: Path identifier (hexadecimal number)

bb...bb: Error code (hexadecimal number)

- When the path error is detected by a path health checking or the online operation

Displays 0x000F0000 (Fixed).

- When a path error is detected through an I/O error

The OS error code is displayed.

cc...cc: 0x00000000 (fixed)

Action

Check the path in which the error was detected.

KAPL08022-E

A path error occurred. ErrorCode = *aa...aa*, PathID = *bb...bb*,
PathName = *cc...cc.dd...dd.ee...ee.ff...ff*, DNum = *gg...gg*, HDevName = *hh...hh*

Details

A physical or logical error occurred in the path.

aa...aa: Error code (hexadecimal number)

- When the path error was detected by a path health checking or the online operation

Displays 0x000F0000 (Fixed).

- When the path error was detected through an I/O error

Displays the OS error code.

bb...bb: Path ID (same as PathID of `view -path`) (decimal number)

cc...cc: HBA adapter number or Adapter type (same as PathName of `view -path`) (character string)

dd...dd: Bus number or Adapter number (character string)

ee...ee: Target ID (hexadecimal number)

ff...ff: Host LU number (same as PathName of `view -path`) (hexadecimal number)

gg...gg: Dev number (same as DNum of `view -path`) (decimal number)

hh...hh: Host device name

Action

There could be an error in the path. See 5.3 *What To Do for a Path Error* and restore the path displayed in the message to running status.

KAPL08023-I

A path was recovered. PathID = *aa...aa*, PathName = *bb...bb.cc...cc.dd...dd.ee...ee*, DNum = *ff...ff*, HDevName = *gg...gg*

Details

The path has been recovered.

aa...aa: Path ID (same as PathID of `view -path`) (decimal number)

bb...bb: HBA adapter number or Adapter type (same as PathName of `view -path`) (character string)

cc...cc: Bus number or Adapter number (character string)

dd...dd: Target ID (hexadecimal number)

ee...ee: Host LU number (same as PathName of `view -path`) (hexadecimal number)

ff...ff: Dev number (same as DNum of `view -path`) (decimal number)

gg...gg: Host device name

Action

None.

KAPL08026-E

An error occurred on all the paths of the LU. PathID = *aa...aa*

Details

An error occurred in the last, remaining path of an LU. (This is most likely as a result of a disconnection.)

aa...aa: Path ID (same as PathID of `view -path`) (decimal (base-10) number)

Action

Errors are detected in all the paths connected to the LUs. See 5.3 *What To Do for a Path Error* to make the path shown in the error message or the paths connected

to the target LU.

KAPL08027-E

A path was excluded from the items subject to automatic failback.
PathID = *aa...aa*

Details

A path was excluded from being subject to automatic failbacks because the system judged that an intermittent error was occurring in that path.

aa...aa: Path ID (same as PathID of view -path) (decimal (base-10) number)

Action

An intermittent error has occurred. Check the path for any possible problems. For details on what to do, see 5.3 *What To Do for a Path Error*, and switch the path shown in the message into Online.

KAPL08032-I

A path was recovered. (PathID = *aa...aa*)

Details

The path has changed to an online status.

aa...aa: Path ID (same as PathID of view -path) (decimal (base-10) number)

Action

None.

8.9 KAPL09001 to KAPL10000

KAPL09003-E

Cannot install in this system. Install HDLM on a supported OS.

Details

HDLM cannot be installed on this system.

Action

See *3.1.1 Host and OS Support for HDLM* and install HDLM on a supported OS.

KAPL09011-E

Cannot find a license key file `"/var/DLM/dlm.lic_key"`.

Details

The license key file `/var/DLM/dlm.lic_key` is not in the specified directory.

Action

Create a license key file, and re-execute the installation program.

KAPL09012-I

All HDLM drivers were removed.

Details

All the HDLM drivers were successfully removed, the HDLM manager was successfully stopped, and HDLM was stopped.

Action

None.

KAPL09013-E

Some HDLM drivers could not be removed.

Details

The `dlmrmdev` command was run, but HDLM drivers could not be removed.

Action

Check the HDLM driver status and remove the drivers.

KAPL09019-E

An attempt to cancel the registration of the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed. Uninstall Hitachi Network Objectplaza Trace Library 2 by referring to HDLM User's Guide section "Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)".

Action

Manually cancel the PP name registration, and then uninstall Hitachi Network Objectplaza Trace Library 2. If the attempt to cancel the registration of the PP name and to uninstall Hitachi Network Objectplaza Trace Library 2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

KAPL09020-E

An attempt to uninstall Hitachi Network Objectplaza Trace Library 2 failed.

Details

An attempt to uninstall HNTRLib2 has failed.

Action

Manually uninstall Hitachi Network Objectplaza Trace Library 2. If the attempt to uninstall Hitachi Network Objectplaza Trace Library 2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

KAPL09021-E

An attempt to register the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.

Details

An attempt to register the PP name of HNTRLib 2 has failed.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

KAPL09022-E

HDLM cannot be uninstalled. *aa...aa* is running.

Details

HDLM cannot be uninstalled because the HDLM manager, HDLM driver is running.

aa...aa: HDLM manager, HDLM driver

Action

Execute the `dlmrmdev` utility, and then re-execute the uninstallation program.

KAPL09023-E

A file or directory related to HDLM could not be found.
Re-install HDLM.

Details

A target file to copy to the directory of Hitachi Command Suite products other than HDLM could not be found among the files related to HDLM

Action

Re-install HDLM.

KAPL09024-E

An attempt to copy a file or directory related to HDLM has failed. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.

Details

An attempt to copy a file related to HDLM to the directory of Hitachi Command Suite products other than HDLM has failed.

Action

If this message is output while installing HDLM, re-install HDLM.

If this message is output while installing a Hitachi Command Suite product other than HDLM, re-install that product.

KAPL09025-W

An attempt to delete a file or directory has failed.

Details

An attempt to delete a file related to HDLM from the directory of Hitachi Command Suite products other than HDLM has failed.

Action

If the following files or directories are on the host, remove them manually.

```
/usr/HDVM/agent/classes/com/Hitachi/soft/HiCommand/DVM/  
agent/module/HDLWebAgent.class
```

```
/usr/HDVM/agent/classes/jp
```

```
/usr/HDVM/agent/classes/com/Hitachi/soft/HiCommand/DVM/  
agent/module/hdlm
```

```
/usr/HDVM/HBaseAgent/agent/classes/com/Hitachi/soft/  
HiCommand/DVM/agent/module/HDLWebAgent.class
```

```
/usr/HDVM/HBaseAgent/agent/classes/jp
```

```
/usr/HDVM/HBaseAgent/agent/classes/com/Hitachi/soft/  
HiCommand/DVM/agent/module/hdlm
```

KAPL09028-E

An attempt to install Hitachi Network Objectplaza Trace Library 2 failed.

Details

An attempt to install HNTRLib2 failed.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.

KAPL09029-E

This version of HDLM cannot be updated by installation.
Uninstall the already installed version of HDLM.

Action

Uninstall the HDLM that has already been installed.

KAPL09047-E

Downgrading from *aa...aa* to *bb...bb* is not supported.

Details

Downgrade installation is not supported.

aa...aa: DLManager.mpio.rte *Level-of-the-filesset* (character string)

bb...bb: DLManager.mpio.rte *Level-of-the-filesset* (character string)

Action

Uninstall HDLM, and then re-execute the installation program.

KAPL09048-E

HDLM cannot be installed. *aa...aa* is running.

Details

An attempt to install HDLM failed because either of *aa...aa* is running.

aa...aa: HDLM manager, HDLM driver

Action

Execute the `dlmrmdev` utility, and then re-execute the installation program.

KAPL09076-I

The permanent license was installed.

Details

The permanent license was installed.

Action

None.

KAPL09077-I

The temporary license was installed. The license expires on *aa...aa*.

Details

A temporary license was installed.

aa...aa: Year (4 digits)/month (01-12)/day (01-31)

Action

Install a permanent license by the expiration day.

KAPL09078-I

The emergency license was installed. The license expires on *aa...aa*.

Details

An emergency license was installed.

aa...aa: Year (4 digits)/month (01-12)/day (01-31)

Action

Install a permanent license by the expiration day.

KAPL09079-I

The permanent license has been installed.

Action

None.

KAPL09080-I

The temporary license has been installed. The license expires on *aa...aa*.

Details

The temporary license has been installed.

aa...aa: Year (4 digits)/month (01-12)/day (01-31)

Action

Install a permanent license by the expiration day.

KAPL09081-I

The emergency license has been installed. The license expires on *aa...aa*.

Details

The emergency license has been installed.

aa...aa: Year (4 digits)/month (01-12)/day (01-31)

Action

Install a permanent license by the expiration day.

KAPL09082-W

The temporary license expired.

Action

Enter a permanent license key.

KAPL09083-W

The emergency license expired.

Action

Install a permanent license.

KAPL09087-E

The entered license key is invalid. Renewal of the license key will now stop. Obtain a valid license key, and then re-install HDLM.

Details

The renewal of the license key will be aborted because an invalid license key was entered.

Action

Obtain a valid license key, and then re-install HDLM.

KAPL09088-E

The entered license key is invalid. The HDLM installation will now terminate. Obtain a valid license key, and then re-install HDLM.

Action

Obtain a valid license key, and then re-install HDLM.

KAPL09090-W

This operation will now be continued without updating the license.

Details

This operation will continue without updating the license.

Action

Install a permanent license at a later time.

KAPL09091-E

A fatal error occurred in HDLM. The system environment is invalid. Contact your HDLM vendor or the maintenance company if there is a maintenance contract of HDLM.

Details

A part of the HDLM configuration file is missing.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract of HDLM.

KAPL09100-E

Installation is not possible because *aa...aa* is already installed.

Details

Installation is not possible because the fileset that was output in the message is installed.

aa...aa: DLManager.rte or AutoPath.rte (character string)

Action

Re-install after uninstalling the fileset that was output in the message.

KAPL09112-E

The license key file is invalid. File name = *aa...aa*
Place the correct license key file in the designated directory, and then re-install HDLM.

Details

The format of the license key file is invalid.

aa...aa: /var/tmp/hdlm_license

Action

Place the correct license key file in the designated directory, and then re-install HDLM.

/var/tmp/hdlm_license

KAPL09113-E

There is no installable license key in the license key file. File name = *aa...aa*

Make sure that the license key file is correct, and then re-install HDLM.

Details

There is no HDLM-installable license key in the license key file.

aa...aa: /var/tmp/hdlm_license

Action

Make sure that the license key file is correct, and then re-install HDLM.

/var/tmp/hdlm_license

KAPL09114-I

There is no license key file. File name = *aa...aa*

Details

There is no license key file in the designated directory.

aa...aa: /var/tmp/hdlm_license

Action

When the message that prompts you to enter the license key is displayed, enter the license key.

Alternatively, cancel the installation, save the correct license key file in the designated directory, and then re-execute the installation.

/var/tmp/hdlm_license

KAPL09115-W

An attempt to delete the license key file has failed. File name = *aa...aa*

Details

An attempt to delete the license key file has failed.

aa...aa: /var/tmp/hdlm_license

Action

If a license key file exists, delete it.

/var/tmp/hdlm_license

KAPL09116-W

The command could not be installed. (command = *aa...aa*)

Details

The output HDLM command cannot be used.

aa...aa: Command name

Action

The output command can be executed by using a different name. If you want to

use the output name, use the output command to overwrite or re-install.

KAPL09135-E

One of the following was executed at the same time as an HDLM command `set -lic` operation: another `set -lic` operation, or an update of the license for an update installation.

Action

Check the license by using the HDLM command's `view -sys -lic` operation. Then, if necessary, update the license by using the `set -lic` operation during or after installation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

Do not perform the following operation:

Execution of the HDLM command's `set -lic` operation simultaneously with an update of the license for an upgrade installation

KAPL09142-E

HDLM *aa...aa* cannot be performed. Wait a while, and then perform *aa...aa* again. Error Code = *bb...bb*

Details

HDLM cannot be installed or uninstalled.

aa...aa: "installation" or "uninstallation"

bb...bb: Internal code (decimal (base-10) number)

Action

Wait a while, and then reperform the installation or uninstallation. After the installation or uninstallation has finished, use the backup acquired in advance and specify the HDLM settings.

KAPL09143-E

HDLM *aa...aa* cannot be performed. Error Code = *bb...bb*

Details

HDLM cannot be installed or uninstalled.

aa...aa: "installation" or "uninstallation"

bb...bb: Internal code (decimal number)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09171-E

An internal error occurred in the installation of the HDLM. Error Code = *aa...aa bb...bb*

Details

A system-based error, not caused by the user, occurred during installation of HDLM processing.

aa...aa: The error number which specifies the performed processing (decimal number)

bb...bb: Return value of the executed processing (decimal number)

Action

If the error code is 3, *nnnn*:

ODM is being used. Wait a while, and then try again.

If any other error code is output:

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09172-E

Installation is not possible because an hdisk exists.

Action

Delete the hdisk, and then re-execute the installation program.

KAPL09179-I

Data for maintenance: *aa...aa bb...bb*

Details

aa...aa: Message output location information (decimal (base-10) number)

bb...bb: Detailed information (character string)

Action

None.

KAPL09183-I

HDLM version *aa...aa* is installed. This version will now be overwritten with version *bb...bb*.

Details

aa...aa: Installed version number of HDLM

bb...bb: Version number of HDLM you attempted to install

Action

None.

KAPL09187-W

No parameter is specified.

Details

No installation-information settings file has been specified in the `installhdlm` utility for installing HDLM.

Action

Make sure that an actual installation-information settings file for the `installhdlm` utility is appropriate, and then try again.

KAPL09188-W

Too many parameters are specified.

Details

More than two parameters have been specified for the `installhdlm` utility for installing HDLM.

Action

Make sure that the parameters for `installhdlm` are appropriate, and then try again.

KAPL09190-W

The installation information settings file is not specified.

Details

The installation information settings file is not specified for the second parameter in the `installhdlm` utility for installing HDLM.

Action

Make sure that the parameters in the `installhdlm` utility are appropriate, and then try again.

KAPL09191-W

The installation information settings file does not exist.

Details

The installation information settings file specified for the second parameter does not exist.

Action

Make sure that the path name of the installation-information settings file is appropriate, and then try again.

KAPL09210-I

aa...aa will now start.

Details

aa...aa has just started.

aa...aa: installhdlm, installp, cfgmgr, dlmodmset, dlncmgr, or
dlmrmddev

Action

None.

KAPL09211-I

aa...aa completed successfully.

Details

aa...aa completed successfully.

aa...aa: installhdlm, installp, cfgmgr, dlmodmset, dlncmgr, or
dlmrmddev

Action

None.

KAPL09212-E

aa...aa ended abnormally.

Details

aa...aa ended abnormally.

aa...aa: installhdlm, installp, cfgmgr, dlmodmset, dlncmgr, or
dlmrmddev

Action

Check the error message that was output just before this message, and then perform the action indicated in that error message.

KAPL09213-W

An error occurred during *aa...aa* processing.

Details

Although the *aa...aa* processing has ended, an error occurred during the processing.

aa...aa: installhdlm, installp, cfgmgr, dlmodmset, dlncmgr, or
dlmrmddev

Action

Check the error message that was output just before this message, and then perform the action indicated in that error message.

KAPL09214-W

A parameter is invalid. parameter = *aa...aa*

Details

A parameter is invalid.

aa...aa: The specified parameter (character string)

Action

Specify the `-h` parameter for the `installhdlm` utility, confirm the parameter that should be specified, and then retry the operation.

KAPL09215-E

The system environment is invalid. Error Code = *aa...aa*

Details

The system environment is not valid as an environment for executing the `installhdlm` utility.

aa...aa: Error number (decimal number) that specifies the executed processing

Action

If the error code is 1:

The `/tmp` directory does not exist. Prepare the `/tmp` directory, and then retry the operation.

If the error code is 2:

You do not have write permission for the `/tmp` directory. Make sure that you have access permissions for the `/tmp` directory.

If the error code is 3:

You do not have write permission for the file system of the `/tmp` directory. Make sure you have access permissions for the storage location of the `/tmp` directory.

If the error code is 4:

The `/var/tmp` directory does not exist. Prepare the `/var/tmp` directory, and then retry the operation.

If the error code is 5:

You do not have write permission for the `/var/tmp` or `/var/DLM` directory. Make sure you have access permissions for these directories.

If the error code is 6:

You do not have write permission for the file system of the `/var/tmp` or `/var/DLM` directory. Make sure you have access permissions for the storage location of these directories.

If the error code is 7:

There is not enough unused capacity for the file system of the `/var/tmp` or `/var/DLM` directory. Make sure there is enough unused capacity for these directories.

If the error code is 8:

The `/var` directory does not have enough unused capacity, or the user does not have write permission for it. Make sure there is enough unused capacity and that the user has write permission for this directory, and then try again.

If the error code is 9:

The status of the installed HDLM is `BROKEN`. Please uninstall HDLM.

If the error code is 10:

The `cfgmgr` command is not in the correct location, or you do not have a required permission.

Check the state of the `cfgmgr` command.

If the error code is 11:

The `shutdown` command is not in the correct location, or you do not have a required permission.

Check the state of the `shutdown` command.

KAPL09216-E

An error occurred during I/O of a file that `installhdlm` uses.
Error Code = *aa...aa,bb...bb*

Details

An error occurred during I/O of a file that `installhdlm` uses.

aa...aa: Error number that indicates the executed processing (decimal (base-10) number)

bb...bb: Return value of the executed processing (decimal (base-10) number)

Action

Make sure that sufficient unused capacity exists for the `/tmp` directory. If the capacity is insufficient, allocate the required amount of capacity, and then retry the operation. For details about how to determine the amount of capacity that is

required, see 3.5.8 *Performing an Unattended Installation of HDLM*.

KAPL09217-E

An error occurred during reading of the installation information settings file. Error Code = *aa...aa*, *bb...bb*

Details

An error occurred while reading the installation information settings file.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

Action

If the error code is 9001,-1:

You do not have read permissions for the installation information settings file. Make sure that you have access permissions.

If any other error code is output:

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09218-E

aa...aa cannot be executed.

Details

A utility or command that `installhdlm` uses was not in the correct location, or you do not have a required permission.

aa...aa: `installhdlm_analysis`, `dlmodmset`, `dlmkmgr`, or `dlmrmdv`

Action

If *aa...aa* is `dlmodmset` or `dlmkmgr`:

The correct location of `dlmodmset` and `dlmkmgr` is `/usr/DynamicLinkManager/bin`. If `dlmodmset` or `dlmkmgr` was not in the correct location, or you did not have a required permission, re-execute `installhdlm`.

If *aa...aa* is `dlmrmdv` or `installhdlm_analysis`:

The correct location of `dlmrmdv` and `installhdlm_analysis` is the same directory as `installhdlm`. Make sure that the utility you want to execute is in the correct location and that you have the required permissions. If a utility is not in the correct location, copy the required files to the correct location, and then retry the operation. If you do not have a required permission, grant required permissions to yourself, and then retry the operation.

KAPL09219-E

An internal error occurred in the installhdlm_analysis. Error Code = *aa...aa,bb...bb*

Details

An internal error occurred in the installhdlm_analysis.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09220-W

The composition of the installation information settings file is invalid. Error Code = *aa...aa,bb...bb*

Details

In the installation information settings file, the length of a single line exceeds 1,023 characters, or the first non-whitespace, non-comment line that appears is not [INSTALLATION_SETTINGS].

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

Action

Specify the revised installation information settings file, and then retry the operation.

KAPL09221-W

The definition of the installation information settings file includes an unusable character. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A character that cannot be used in a non-comment line was used.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file, and then retry the operation.

KAPL09227-W

The definition of the installation information settings file includes an invalid key. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A key that does not exist is included.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09228-W

The definition of the installation information settings file includes an invalid key value. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

The format of a key value is invalid.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09229-W

The definition of the installation information settings file includes an invalid section name. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A section that does not exist is included.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the

operation.

KAPL09230-W

The definition of the installation information settings file includes a duplicated section name. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A duplicated section name is included.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09231-W

The definition of the installation information settings file includes a duplicated key. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A duplicated key is included.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09232-W

The composition of the definition of the installation information settings file is invalid. Error Code = *aa...aa,bb...bb*, line = *cc...cc*

Details

A key, key value, or equal sign (=) is missing.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09233-W

The definition of the installation information settings file is too long. Error Code = *aa...aa*, *bb...bb*, line = *cc...cc*

Details

The length of a single line of the definition exceeds 1023 characters.

aa...aa: Error number (decimal number) that specifies the executed processing

bb...bb: Return value (decimal number) of the executed processing

cc...cc: Line number (decimal number) of an installation information settings file.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09234-W

A folder or file specified by the installation information settings file does not exist. Name = *aa...aa*

Details

A folder or file specified by the installation information settings file does not exist.

aa...aa: Name of the folder or file that does not exist.

Action

Specify the revised installation information settings file and then retry the operation.

KAPL09235-E

The log file cannot be output to its destination because the environment is invalid. Error Code = *aa...aa*

Details

The log file cannot be output in this environment, because certain environment settings are invalid.

aa...aa: Error number (decimal number) that specifies the executed processing.

Action

If the error code is 1:

The log file destination directory does not exist. Prepare the directory, and then retry the operation.

If the error code is 2:

You do not have write permission for the log file destination directory.
Modify your access permissions as necessary, and then retry the operation.

If the error code is 3:

You do not have write permission for the file system of the log file. Modify your access permissions as necessary, and then try again.

If the error code is 4:

You do not have write permission for the `installhdlm.log` file.
Modify your access permissions as necessary, and then retry the operation.

KAPL09236-W

An error occurred during the output of a log file.

Details

A memory shortage occurred at the output destination of the log file.

Action

Check the error message output before this message, and then perform the action indicated in that error message.

KAPL09237-I

A user operation ended `installhdlm`.

Details

The process has been terminated by an operation such as Ctrl+C.

Action

Check the status of HDLM by executing `lspp -la DLManager.mpio.rte`.

If HDLM is not installed:

Re-execute `installhdlm`.

If the status of HDLM is COMMITTED:

Perform the following procedures according to the installation status:

- If installing HDLM by using the `installhdlm` utility has already finished, setting up HDLM might have not completed.
You need to manually set up the values that are not set up, or re-execute `installhdlm`.
- If HDLM before the upgrade or re-installation still exists, re-execute `installhdlm`.

If the status of HDLM is not COMMITTED:

Perform uninstallation or cleanup according to the displayed status. If an uninstallation or cleanup attempt fails, contact either your HDLM vendor or the maintenance company (if an HDLM maintenance contract exists).

KAPL09238-W

The specified file is not a normal one. Fail name = *aa...aa*

Details

A file other than a normal one (for example, a directory file or a special file.) is specified.

aa...aa: Specified file name (character string)

Action

Specify the correct file, and then retry the operation.

KAPL09239-I

The system will now restart.

Details

The host will restart because restart was specified in the installation information settings file.

Action

none.

KAPL09241-W

An attempt to install an HDLM component failed. Error Code = *aa...aa*

Details

An attempt to install an HDLM component failed.

aa...aa: Error number that identifies the executed processing

Action

If there is no need to access the Hitachi Command Suite products that use HDLM remote access interface, no action is required. Note that this requires no particular action, because HDLM operation is not affected when linkage with Global Link Manager is not used.

If the error code is 3 or 100:

Wait a while, and then execute `dlminstcomp` utility.

If the error code is 5:

Install a prerequisite JDK version, and then re-execute `dlminstcomp` utility.

If the error code is 200:

Execute `dlminstcomp` utility.

If any other error code is output:

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09242-E

No usable JDK or JRE exists.

Details

No prerequisite JDK version is installed in the system.

Action

Install a prerequisite JDK version, and then re-execute `dlminstcomp` utility.

KAPL09243-I

`dlminstcomp` completed successfully.

Details

`dlminstcomp` utility completed successfully.

Action

None.

KAPL09246-E

An attempt to install an HDLM component failed because an HDLM component was operating. Error Code = *aa...aa*

Details

An attempt to install an HDLM component failed because an HDLM component was operating.

aa...aa: Error number that identifies the executed processing

Action

Wait a while, and then re-execute `dlminstcomp` utility.

KAPL09247-E

An attempt to install an HDLM component failed. Error Code = *aa...aa*

Details

An attempt to install an HDLM component failed.

aa...aa: Error number that identifies the executed processing

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL09248-W

A parameter is invalid. parameter = *aa...aa*

Details

An invalid parameter is specified.

aa...aa: The specified parameter (character string)

Action

With the *-h* parameter specified, execute the *dlminstcomp* utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL09504-E

The language environments of HDLM and the Service Pack are different.

Details

The Japanese Service Pack was applied to the English edition of HDLM, or vice versa.

Action

Acquire the Service Pack that has the same language as the installed HDLM, and then try again.

KAPL09601-E

Cannot install in this system. Install HDLM on a supported OS.

Details

HDLM cannot be installed on this system.

Action

Execute the installation in a supported OS.

KAPL09602-E

The installation will now stop because a file or directory is missing. Confirm that the file or directory (*aa...aa*) exists.

Details

aa...aa: Name of the missing file or directory

Action

If an installation is performed from the DVD-ROM, confirm that the DVD-ROM is not damaged.

If an installation is performed by using files copied from the DVD-ROM, re-copy

all of the DVD-ROM files.

KAPL09603-E

The installation will now stop because a command or utility cannot be executed. Confirm that the command or utility (*aa...aa*) exists, and that you have the proper permission.

Details

aa...aa: Name of the command or utility that cannot be executed.

Action

When the output information is an HDLM utility:

- If an installation is performed from the DVD-ROM, confirm that the DVD-ROM is not damaged.
- If an installation is performed by using files copied from the DVD-ROM, re-copy all of the DVD-ROM files. After that, confirm the permission of the HDLM utility that caused the error.

When the output information is an OS command:

- Confirm that the OS command exists, and that you have the proper permission.

KAPL09604-E

A system error occurred. The installation will now stop.
(command = *aa...aa*, error code = *bb...bb*)

Details

aa...aa: Command that failed

bb...bb: Return value

Action

Acquire the log `/var/tmp/hdlm_installux_sh.log`, and then contact your HDLM vendor or, if you have a maintenance contract, contact the maintenance company.

8.10 KAPL10001 to KAPL11000

KAPL10001-W

No parameter has been specified.

Details

No directory to which the collected information will be output has been specified.

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10002-W

Too many parameters have been specified.

Details

Four or more parameters have been specified.

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10003-W

The first parameter has not been set to a directory. Value = *aa...aa*

Details

The first parameter must be set to a directory to which collected information is output.

aa...aa: First parameter

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10004-W

The parameter contains an incorrect value. Value = *aa...aa*

Details

The first parameter must be a directory. The second parameter must be `-f`.

aa...aa: Invalid parameter

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10005-W

The number of parameters is insufficient.

Details

The `-f` parameter exists but the file for defining the information to be collected does not exist.

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10006-W

The file for defining the information to be collected does not exist, or cannot be read. Value = *aa...aa*

Details

The file for defining the information to be collected does not exist, or the specified file exists but the permission to read the file is missing.

aa...aa: Name of the file for defining the information to be collected

Action

Check whether the specified file for defining the information to be collected exists, and check whether you have access permission for the specified file.

KAPL10007-W

A directory has been specified in the third parameter. Value = *aa...aa*

Details

The `-f` parameter is specified to a directory.

aa...aa: Third parameter

Action

Check the parameters of the `DLMgetras` utility for collecting HDLM error information, and then retry. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10008-W

You lack write permission for the specified directory. Value = *aa...aa*

Details

You do not have write permission for the specified directory, or the creation of a subdirectory of the specified directory failed.

aa...aa: first parameter

Action

Check the following.

1. Check whether you have access permission for the specified directory.
2. Check whether the specified directory name is correct.
3. Check that the disk has sufficient unused capacity.

KAPL10009-W

The specified directory already exists. Do you want to overwrite it? [y/n] :

Details

The specified directory already exists. Enter y to overwrite it, or n to cancel.

Action

The specified directory already exists. Enter y to overwrite the existing file. Enter n or press any other key to terminate the DLMgetras utility for collecting HDLM error information without executing it. For details on the DLMgetras utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10010-W

A root directory has been specified. Line = *aa...aa*

Details

The root "/" has been specified as a directory to be collected in the file for defining the information to be collected.

aa...aa: Line number of the file for defining information to be collected (decimal number)

Action

Delete the coding of the root directory from the specified file. The displayed directory will be ignored and the DLMgetras utility for collecting HDLM error information will continue. For details on the DLMgetras utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10011-W

More than one file or directory has been specified on one line.
Line = *aa...aa*, Value = *bb...bb*

Details

Two or more file names or directory names exist in the file for defining the information to be collected.

aa...aa: Line number of the file for defining information to be collected (decimal number)

bb...bb: Indicated contents in a line

Action

After the `DLMgetras` utility for collecting HDLM error information terminates, check the contents of the file for defining the information to be collected. This file is shown in the message. If the contents of the file are incorrect, correct them and then try to collect error information again. The `DLMgetras` utility for collecting HDLM error information will ignore the specified file or directory and continue processing. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10012-W

The specified file or directory does not exist. Line = *aa...aa*,
Value = *bb...bb*

Details

The specified file or directory does not exist in the file for defining the where information is to be collected.

aa...aa: Line number of the file for defining which information to be collected (decimal (base-10) number)

bb...bb: Indicated contents of a line

Action

After the `DLMgetras` utility for collecting HDLM error information terminates, check the contents of the file for defining which information to be collected. This file is shown in the message. If the contents of the file are incorrect, correct them, and then try to collect error information again. The `DLMgetras` utility will ignore the specified file or directory and continue processing. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10013-W

You lack read permission for the specified file. Line = *aa...aa*,
Value = *bb...bb*

Details

You lack read permission for the specified file in the file for defining information to be collected.

aa...aa: Line number of the file for defining information to be collected (decimal

number)

bb...bb: Indicated contents in a line

Action

After the `DLMgetras` utility for collecting HDLM error information terminates, check the contents of the file for defining the information to be collected. This file is shown in the message. If the contents of the file are incorrect, correct them and then try to collect error information again. The `DLMgetras` will ignore the specified file and continue processing. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10014-W

You lack read permission for the specified directory. Line = *aa...aa*, Value = *bb...bb*

Details

You lack read permission for the specified directory in the file for defining information to be collected.

aa...aa: Line number of the file for defining information to be collected (decimal number)

bb...bb: Indicated contents in a line

Action

After the `DLMgetras` utility for collecting HDLM error information terminates, check the contents of the file for defining the information to be collected. This file is shown in the message. If the contents of the file are incorrect, correct them and then try to collect error information again. The `DLMgetras` will ignore the specified file and continue processing. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10015-W

The file format is invalid. Value = *aa...aa*

Details

The file format in the file for defining information to be collected is not a text file.

aa...aa: Third parameter

Action

After the `DLMgetras` utility for collecting HDLM error information terminates, check whether the file for defining the information to be collected is a text file. The file is shown in the message. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10016-W

The root directory has been specified in the first parameter.

Details

A root "/" cannot be specified in a directory to which collected information is output.

Action

Check the parameters of the DLMgetras utility for collecting HDLM error information, and then re-execute. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10017-W

You lack privileges for executing the utility for collecting HDLM error information.

Details

The DLMgetras utility for collecting HDLM error information must be executed by a user with root permissions.

Action

Re-execute as a user with root permissions. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10020-I

The file has been obtained successfully. File = *aa...aa*, Collection time = *bb...bb* (GMT:*bb...bb*)

Details

The file to be collected has been obtained.

aa...aa: Collected file name

bb...bb: Year/month/day hour:minute:second

Action

None.

KAPL10021-I

Processing terminated before completion because a signal was received.

Details

The process has been terminated by an operation such as Ctrl+C.

Action

The utility for collecting HDLM error information terminated before completion. If the directory is unnecessary, delete directory. For details on the DLMgetras

utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10022-I

The utility for collecting HDLM error information completed normally.

Details

Error information has been collected.

Action

None. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10030-I

A user terminated the utility for collecting HDLM error information.

Details

Processing of the DLMgetras utility for collecting HDLM error information has been terminated because the user replied to the confirmation with an n response.

Action

None. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10031-W

The entered value is invalid. Continue operation ? [y/n]:

Details

A value other than y or n has been entered for a [y/n] request. Enter y or n.

Action

Enter y or n.

KAPL10032-W

The entered value is invalid. The utility for collecting HDLM error information stops.

Details

Processing of the DLMgetras utility for collecting HDLM error information will terminate because an invalid response was sent three times in a row to a request.

Action

Re-execute the DLMgetras utility. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL10033-W

The file does not exist. Filename = aa...aa

Details

No file to collect information exists.

aa...aa: File to collect

Action

None.

KAPL10034-E

The file could not be copied. Filename = *aa...aa*, Details = *bb...bb*

Details

Execution of the `cp` command failed.

aa...aa: File name you tried to copy

bb...bb: `cp` command output message

Action

An error occurred while the information collection file was being copied. The error might be a result of an unstable user environment. Check the system configuration.

KAPL10035-E

An attempt to archive the error information failed. Details = *aa...aa*

Details

Execution of the `tar` command failed.

aa...aa: `tar` command output message

Action

See the details in the message, and then remove the cause of the error. For information about the error, collect the archive in the output directory specified at the time of execution, and then contact your HDLM vendor or your maintenance company if you have a maintenance contract for HDLM.

KAPL10036-E

An attempt to compress the error information failed. Details = *aa...aa*

Details

Execution of the `compress` command failed.

aa...aa: `compress` command output message

Action

See the details in the message, and then remove the cause of the error. For information about the error, collect the archive in the output directory specified at the time of execution, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM.

KAPL10049-I

Error information collection command = aa...aa, Return value = bb...bb, Execution time = cc...cc

Details

A command was executed to collect information targeted for collection.

aa...aa: Executed command

bb...bb: Return value of the executed command

cc...cc: year (4 digits)/month/date hour:minute:second

Action

None.

KAPL10050-I

The utility for collecting HDLM error information started. Start time = aa...aa (GMT aa...aa)

Details

The utility for collecting HDLM error information started.

aa...aa: year (4 digits)/month/date hour:minute:second

Action

None.

KAPL10521-W

A parameter is invalid. (parameter = aa...aa)

Details

aa...aa: invalid parameter (character string)

Action

Execute help of the `dlmrmdev` utility to check the parameters that can be specified, and then retry.

For details on the `dlmrmdev` utility, see *7.11 dlmrmdev Utility for Deleting HDLM Drivers*.

KAPL10523-E

An attempt to unmount the file system has failed. (file system = aa...aa)

Details

aa...aa: failed file system (character string)

Action

Make sure of the status of the failed file system and then re-execute the program.
Unmount the failed file system manually and re-execute the program.

For details on the `dlmrmdev` utility, see *7.11 dlmrmdev Utility for Deleting HDLM Drivers*.

KAPL10524-E

An attempt to inactivate the volume group has failed. (volume group = *aa...aa*)

Details

An attempt to inactivate the volume group has failed.

aa...aa: failed volume group (character string)

Action

Make sure of the status of failed volume group and then re-execute the program.
Inactivate the failed volume group manually and re-execute the program.

For details on the `dlmrmdev` utility, see *7.11 dlmrmdev Utility for Deleting HDLM Drivers*.

KAPL10525-E

An internal error occurred in the `dlmrmdev` utility. (error code = *aa...aa*) Execute the `DLMgetras` utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the `DLMgetras` utility.

Details

In the `dlmrmdev` utility an error not caused by a user occurred.

aa...aa: error code (decimal number)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL10526-I

An attempt to unmount the file system has succeeded. (file system = *aa...aa*)

Details

aa...aa: file system succeeded (character string)

Action

None.

KAPL10527-I

An attempt to inactivate the volume group has succeeded. (volume group = *aa...aa*)

Details

aa...aa: volume group succeeded (character string)

Action

None.

KAPL10528-I

The volume group will be made inactive, and the file system that is using HDLM will be unmounted. Is this OK? [y/n]:

Details

Notice unmount of the file system used by HDLM or inactivation of the volume group to prompt the users to make sure of the status.

Action

Type in "y" to continue the operation, or type "n" to stop the operation.

KAPL10529-I

All hdisks to be deleted were deleted successfully.

Details

All hdisks for deletion were successfully removed. If the HDLM driver was configured, the HDLM manager has successfully stopped, and HDLM has stopped.

Action

None.

KAPL10530-E

Some hdisks could not be deleted.

Details

The `dlmrmddev` command was executed, but some hdisks could not be deleted.

Action

Check the hdisk status and re-execute the `dlmrmddev` utility.

KAPL10531-I

The status of all of the HDLM drivers was changed to "Defined".

Action

None.

KAPL10532-E

The status of one or more HDLM drivers could not be changed to "Defined".

Action

Check the hdisk status and re-execute the dlmrmdev utility.

KAPL10551-I

The dlmpostrestore utility completed successfully.

Action

None.

KAPL10552-I

Executing the dlmpostrestore utility will reconfigure the device. Is this OK? [y/n] :

Details

Executing the dlmpostrestore utility will reconfigure the device.

Action

To execute dlmpostrestore utility, enter y.

If you do not want to execute dlmpostrestore utility, enter n.

KAPL10553-W

Too many parameters have been specified.

Action

With the -h parameter specified, execute the dlmpostrestore utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10554-W

A parameter is invalid. parameter = aa...aa

Details

An invalid parameter is specified.

aa...aa: The specified parameter

Action

With the -h parameter specified, execute the dlmpostrestore utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10555-I

Executing the dlmpostrestore utility will reboot the host. Is this OK? [y/n] :

Details

Executing the `dlmpostrestore` utility will reboot the host.

Action

To execute `dlmpostrestore` utility, enter `y`.

If you do not want to execute `dlmpostrestore` utility, enter `n`.

KAPL10556-W

The entered value is invalid. Re-enter. `[y/n]`:

Details

A value other than `y` or `n` has been entered for a `[y/n]` request.

Action

Enter either `y` or `n`.

KAPL10557-I

The user stopped the operation.

Details

The `dlmpostrestore` utility has been terminated because `n` was sent to a request.

Action

None.

KAPL10558-E

The entered value is invalid. The operation will now stop.

Details

The `dlmpostrestore` utility has been stopped because an invalid response was sent three times consecutively to a request.

Action

To execute `dlmpostrestore` utility again, enter either `y` or `n`.

KAPL10559-E

An internal error occurred in the `dlmpostrestore` utility. Error Code = *aa...aa*, *bb...bb*

Details

A system-based error, not caused by the user, occurred during `dlmpostrestore` utility processing.

aa...aa: Error number (decimal number)

bb...bb: Return code (decimal number)

Action

If the error code is 3.1:

Confirm that all of the processes and services that use HDLM managed paths have stopped. After confirming that all the processes and services have stopped, restart them.

Any other error code:

Contact your HDLM vendor or the maintenance company, if you have an HDLM maintenance contract.

KAPL10560-E

The system environment is invalid. Error Code = *aa...aa*

Details

The system environment is not valid as an environment for executing the `dlmpostrestore` utility.

aa...aa: Error number (decimal number)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL10561-I

A user operation ended `dlmpostrestore` utility.

Details

The `dlmpstrestore` process has been terminated by an operation such as Ctrl+C.

Action

None.

KAPL10571-I

The `dlmchpdattr` utility completed successfully.

Action

None.

KAPL10572-W

No parameter has been specified.

Action

With the `-h` parameter specified, execute the `dlmchpdattr` utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10573-W

A parameter is invalid. parameter = *aa...aa*

Details

An invalid parameter is specified.

aa...aa: The specified parameter

Action

With the *-h* parameter specified, execute the *d1mchpdattr* utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10574-W

The specified parameters cannot be specified at the same time.
parameter = *aa...aa*

Details

aa...aa: The specified parameter

Action

With the *-h* parameter specified, execute the *d1mchpdattr* utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10575-W

No parameter value has been specified.

Action

With the *-h* parameter specified, execute the *d1mchpdattr* utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10576-W

A parameter value is invalid. parameter value = *aa...aa*

Details

An invalid parameter value has been specified.

aa...aa: The specified parameter value

Action

With the *-h* parameter specified, execute the *d1mchpdattr* utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10577-W

An attribute is invalid. attribute = *aa...aa*

Details

An invalid attribute has been specified.

aa...aa: The specified attribute

Action

With the `-h` parameter specified, execute the `dlmchpdattr` utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10578-W

An attribute value is invalid. attribute value = *aa...aa*

Details

An invalid attribute value is specified.

aa...aa: The specified attribute

Action

With the `-h` parameter specified, execute the `dlmchpdattr` utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10579-I

The HDLM default values will be changed. Is this OK? [y/n]:

Details

This message confirms whether it is okay to execute the `dlmchpdattr` utility.

Action

With the `-h` parameter specified, execute the `dlmchpdattr` utility. Make sure that the format of the utility is correct, and then re-execute it.

KAPL10580-W

The entered value is invalid. Re-enter. [y/n]:

Details

A value other than y or n has been entered for a [y/n] request.

Action

Enter either "y" or "n".

KAPL10581-I

The user stopped the operation.

Details

The `dlmchpdattr` utility was terminated because the response to a request was "n".

Action

None.

KAPL10582-E

The entered value is invalid. The operation will now stop.

Details

The `d1mchpdattr` utility has been stopped because an invalid response was sent three times consecutively to a request.

Action

To execute `d1mchpdattr` utility again, enter either "y" or "n".

KAPL10583-E

An internal error occurred in the `d1mchpdattr` utility. Error Code = *aa...aa,bb...bb*

Details

A system-based error, not caused by the user, occurred during `d1mchpdattr` utility processing.

aa...aa: Error number (decimal number)

bb...bb: Return code (decimal number)

Action

If the error code is 9,1:

Confirm that all of the processes and services that use HDLM managed paths have stopped, and then restart them.

If the error code is 19,1:

Check for path errors. If there is a path error, restore the path status and then retry.

Any other error code:

Contact your HDLM vendor or the maintenance company, if you have an HDLM maintenance contract.

KAPL10584-E

The system environment is invalid. Error Code = *aa...aa,bb...bb*

Details

The system environment is not valid as an environment for executing the `d1mchpdattr` utility.

aa...aa: Error number (decimal number)

bb...bb: Return code (decimal number)

Action

If the error code is 3,2 or 4,-1:

The `d1mrmddev` utility is not in the default location, or the user does not have

execution permissions for the `d1mrmddev` utility. Check the status of the `d1mrmddev` utility.

If the error code is 6,2 or 7,-1:

The `bosboot` command is not in the default location, or the user does not have execution permissions for the `bosboot` command. Check the status of the `bosboot` command.

If the error code is 9,2 or 10,-1:

The `d1mpr` utility is not in the default location, or the user does not have execution permissions for the `d1mpr` utility. Check the status of the `d1mpr` utility.

If the error code is 11,2 or 12,-1:

The `mkdev` command is not in the default location, or the user does not have execution permissions for the `mkdev` command. Check the status of the `mkdev` command.

Any other error code:

Contact your HDLM vendor or the maintenance company, if you have an HDLM maintenance contract.

KAPL10585-I

Reboot the host.

Details

Reboot the host to apply the changes to the settings.

Action

None.

KAPL10586-I

Processing terminated before completion because a signal was received.

Details

The `d1mchpdattr` process has been terminated by an operation such as Ctrl+C.

Action

None.

KAPL10587-W

The specified ODM is not installed. parameter value = *aa...aa*

Details

The specified ODM is not installed.

aa...aa: Specified parameter value

Action

Specify an ODM that has been installed, and then retry the operation.

KAPL10588-W

A duplicate attribute has been specified. attribute = *aa...aa*

Details

A duplicate attribute has been specified.

aa...aa: Specified attribute

Action

Delete the duplicate attribute, and then retry the operation.

KAPL10641-I

Reservation Key will now be cleared. Is this OK? [y/n]:

Details

Enter y to clear and n to not clear the Reservation Key.

Action

Enter y or n.

KAPL10642-I

Reservation Key of *aa...aa* was cleared.

Details

The Reservation Key has been cleared.

aa...aa: logical device file name for the HDLM management-target device

Action

None.

KAPL10643-W

A necessary parameter is not specified.

Details

A parameter is not specified for the `dlmpr` utility.

Action

Execute the `dlmpr -h` utility to check the parameter, and then retry execution. For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

KAPL10644-W

The specified parameters cannot be specified at the same time.
parameter = *aa...aa*

Details

The specified parameters cannot be specified for the `dlmpr` utility at the same time.

aa...aa: specified parameter (character string)

Action

Execute the `dlmpr -h` utility to check the parameter, and then retry execution. For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

KAPL10645-W

A parameter value is invalid. parameter = *aa...aa*

Details

An invalid parameter value has been specified for the `dlmpr` utility.

aa...aa: specified parameter (character string)

Action

Specify the correct value for the parameter, and then retry. For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

KAPL10646-W

A parameter is invalid. parameter = *aa...aa*

Details

An invalid parameter has been specified for the `dlmpr` utility.

aa...aa: specified parameter (character string)

Action

Execute help of the `dlmpr` utility to check the parameters that can be specified, and then retry. For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

KAPL10648-E

An internal error occurred in the `dlmpr` utility. Error Code = *aa...aa*

Details

An error not caused by the user has occurred in the `dlmpr` utility.

aa...aa: error number (decimal number)

Action

If a message with Error Code = 35 is output, check for the hdisk was deleted. If the hdisk was deleted, recover the state of the hdisk and then retry. If the KAPL10648-E message has been issued but the hdisk was not deleted, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

If a message with Error Code = 36 is output, check for a path error. If there is a path error, restore the path status and then retry. If the KAPL10648-E message has been issued but there is no path error, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL10649-E

aa...aa: An attempt to perform Reservation Key clear processing has failed. Make sure that an error has not occurred in the HDLM-management target device, and that the device can be managed by HDLM. If either of the above conditions are not met, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.

Details

An attempt to perform Reservation Key clear processing has failed.

aa...aa: Hdisk name

Action

Make sure that an error has not occurred in the HDLM-management target device, and that the device can be managed by HDLM. If either of the above conditions are not met, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL10650-I

aa...aa: NO RESERVATION

Details

A LU has not been reserved.

aa...aa: Hdisk name

Action

None.

KAPL10651-I

The user terminated the operation.

Details

The `dlmpr` utility has been terminated because `n` was sent to a request.

Action

None.

KAPL10652-E

The entered value is invalid. The operation stops.

Details

An invalid response was sent three times consecutively to a request.

Action

Re-execute the `dlmpr` utility.

KAPL10653-W

The entered value is invalid. Please re-enter it [y/n]:

Details

A value other than `y` or `n` has been entered for a [y/n] request.

Action

Enter `y` or `n`.

KAPL10665-I

The `dlmpr` utility completed.

Details

The `dlmpr` utility completed normally.

Action

None. For details on the `dlmpr` utility, see 7.9 *dlmpr Utility for Clearing HDLM Persistent Reservation*.

KAPL10670-I

`aa...aa`: The HDLM driver's `hdisk`, which is the boot disk, was excluded from the hard disks subject to the clear operation.

Details

`aa...aa`: Hdisk name

Action

If you want to clear the Reservation Key of the HDLM driver's `hdisk`, which is the boot disk, specify and execute the `dlmpr` utility to clear the HDLM persistent reservation.

KAPL10800-I

The `dlmodmset` utility completed normally.

Details

The `dlmodmset` utility completed normally.

Action

None. For details on the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

KAPL10801-W

No parameter has been specified. operation = aa...aa

Details

No parameter has been specified.

aa...aa: Specified operation (character string)

Action

Execute help of the `dlmodmset` utility to check the parameters that can be specified, and then retry. For details on the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

KAPL10802-W

A parameter is invalid. operation = aa...aa, parameter = bb...bb

Details

The specified parameter is invalid.

aa...aa: Specified operation (character string)

bb...bb: invalid parameter (character string)

Action

Execute help of the `dlmodmset` utility to check the parameters that can be specified, and then retry. For details on the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

KAPL10804-E

An internal error occurred in the `dlmodmset` utility. Error Code = aa...aa Execute the `DLMgetras` utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the `DLMgetras` utility.

Details

An error not caused by the user has occurred in the `dlmodmset` utility.

aa...aa: Error Code (character string)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the `dlmodmset` utility, see *7.7 dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

KAPL10805-I

The setup of the HDLM execution environment ODM will be changed. *aa...aa* = *bb...bb*. Is this OK? [y/n]:

Details

We recommend that you report the setup of the HDLM execution environment ODM that you want to change to the user for confirmation.

aa...aa: Lun Reset, Online(E) IO Block (character string)

bb...bb: on, off (character string)

Action

Enter y to execute setup, or enter n to cancel.

KAPL10806-W

The entered value is invalid. Re-enter [y/n]:

Details

A value other than y or n has been entered for a [y/n] request. Enter [y/n].

Action

Enter y or n.

KAPL10807-E

The entered value is invalid. The operation stops.

Details

An invalid response was sent three times consecutively to a request.

Action

Re-execute the `dlmodmset` utility.

KAPL10808-I

The user terminated the operation.

Details

The utility has been terminated because n was sent to a request.

Action

None.

KAPL10809-W

No operation has been specified.

Details

No operation has been specified.

Action

Execute help of the `dlmodmset` utility to check the operations that can be specified, and then retry. For details on the `dlmodmset` utility, see *7.7 dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

KAPL10810-W

An operation is invalid. operation = *aa...aa*

Details

The specified operation is invalid.

aa...aa: invalid operation (character string)

Action

Execute help of the `dlmodmset` utility to check the operations that can be specified, and then retry. For details on the `dlmodmset` utility, see *7.7 dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

8.11 KAPL11001 to KAPL12000

KAPL11901-I

aa...aa has started.

Details

The operation has started on the host.

aa...aa: Operation (character string)

- Get Path Information
- Get Option Information
- Set Option Information
- Clear Data
- Get HDLM Manager Status
- Get HDLM Driver Status
- Get HDLM Alert Driver Status
- Get SNMP Trap Information
- Set SNMP Trap Information
- Set LU Load Balance
- Get Path Status Log Information
- Get Local Time

Action

None.

KAPL11902-I

aa...aa has started. PathID = *bb...bb*

Details

The operation has started on the management-target host.

aa...aa: Operation (character string)

- Online
- Offline

bb...bb: The Path ID of the target path (decimal number)

Action

None.

KAPL11903-I

aa...aa has completed normally.

Details

The operation has completed normally on the host.

aa...aa: Any of the following operations (character string)

- Get Path Information
- Get Option Information
- Set Option Information
- Clear Data
- Get HDLM Driver Status
- Get HDLM Manager Status
- Get HDLM Alert Driver Status
- Online
- Offline
- Get SNMP Trap Information
- Set SNMP Trap Information
- Set LU Load Balance
- Get Path Status Log Information
- Get Local Time

Action

None.

KAPL11904-E

aa...aa has completed abnormally. Error status = *bb...bb*

Details

The operation has completed abnormally on the host.

aa...aa: Operation (character string)

- Get Path Information
- Get Option Information
- Set Option Information

- Clear Data
- Get HDLM Driver Status
- Get HDLM Manager Status
- Get HDLM Alert Driver Status
- Online
- Offline
- Get SNMP Trap Information
- Set SNMP Trap Information
- Set LU Load Balance
- Get Path Status Log Information

bb...bb: Error status returned from API (character string)

Action

Execute the `DLMgetras` utility for collecting HDLM error information to collect the error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL11905-E

An unexpected error occurred.

Details

An exception occurred during processing on the host.

Action

Execute the `DLMgetras` utility for collecting HDLM error information to collect the error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

KAPL11906-I

GUI information - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: Trace information

Action

8. Messages

None.

KAPL11907-I

XML reception - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: XML information

Action

None.

KAPL11908-I

XML transmission - *aa...aa*

Details

This information is required for resolving problems.

aa...aa: XML information

Action

None.

8.12 KAPL13001 to KAPL14000

KAPL13001-I

The dlmmigsts utility completed successfully.

Action

None.

KAPL13002-E

The dlmmigsts utility ended abnormally.

Action

Refer to action of the message outputted just before this message.

KAPL13003-I

The specified file already exists. Do you want to overwrite it?
[y/n]:

Action

To overwrite the specified file, enter y. To stop execution, enter n.

KAPL13004-W

The entered value is invalid. Re-enter. [y/n]:

Action

Enter either y or n.

KAPL13005-E

The entered value is invalid. The operation will now stop.

Action

To execute dlmmigsts again, re-execute. For details about the dlmmigsts utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13006-I

The user stopped the operation.

Action

To execute dlmmigsts again, re-execute. For details about the dlmmigsts utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13007-W

No parameter has been specified.

Action

Specify the -h option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the dlmmigsts

utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13008-W

A parameter is invalid. parameter = aa...aa

Details

aa...aa: Parameter (character string)

Action

Specify the -h option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13009-W

No parameter value has been specified. parameter = aa...aa

Details

aa...aa: Parameter (character string)

Action

Specify the -h option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13010-W

The specified file does not exist. parameter = aa...aa, Filename = bb...bb

Details

aa...aa: Parameter (character string)

bb...bb: Filename (character string)

Action

If parameter = -odm, specify `odmsetfile` in `dlmmigsts` again, and then re-execute. If parameter = -set, specify `dlmksetfile` in `dlmmigsts` again, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13011-W

The number of parameters is insufficient.

Action

Specify the -h option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13012-W

Too many parameters have been specified.

Action

Specify the -h option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13013-E

The directory for storing the specified file could not be created. Filename = *aa...aa*

Details

aa...aa: Filename (character string)

Action

There is not enough capacity to store the specified file in the directory. Make sure there is enough capacity, and then try again. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM Migration*.

KAPL13014-E

An internal error occurred in the `dlmmigsts` utility. Error Code = *aa...aa* Execute the `DLMgetras` utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the `DLMgetras` utility.

Details

aa...aa: Error Code (decimal number)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL13015-E

There is an invalid character in the file. parameter = *aa...aa*, Filename = *bb...bb*

Details

aa...aa: Parameter (character string)

bb...bb: Filename (character string)

Action

If parameter = -odm, execute `dlmodmset` one after another, or specify the modified `odmsetfile` in `dlmmigsts` again, and then re-execute. For details about the `dlmmigsts` utility, see 7.6 *dlmmigsts Utility for Assisting HDLM*

Migration. For details on the `dlmodmset` utility, see 7.7 *dlmodmset Utility for Setting the HDLM Execution Environment ODM*.

If parameter = `-set`, execute `dlnmgr set` one after another, or specify the modified `dlnksetfile` in `dlmmigsts` again, and then re-execute.

KAPL13016-E

The backup operation cannot be performed because `DLManager.rte` is not installed.

Action

Execute the `dlmmigsts` utility in an environment where `DLManager.rte` is installed.

KAPL13017-E

The restoration operation cannot be performed because `DLManager.mpio.rte` is not installed.

Action

Install `DLManager.mpio.rte`, and then execute the `dlmmigsts` utility again.

KAPL13018-E

The backup operation cannot be performed because there is no `/usr/DynamicLinkManager/config/dlmmgr.xml` file. Execute the `DLMgetras` utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the `DLMgetras` utility.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL13019-E

The same file name was specified for `odmsetfile` and `dlnksetfile`.
Filename = *aa...aa*, *bb...bb*

Details

aa...aa: `odmsetfile` Filename

bb...bb: `dlnksetfile` Filename

Action

Check file name, and then try again.

KAPL13020-E

The file `odmsetfile` was not restored.

Action

Check file name, and then try again.

KAPL13021-E

The file dlknsetfile was not restored.

Action

Check file name, and then try again.

KAPL13101-I

The dlmpreuninst utility completed successfully.

Action

None.

KAPL13102-I

HDLN can now be uninstalled.

Action

None.

KAPL13103-I

HDLN can be uninstalled after rebooting the host.

Action

None.

KAPL13104-I

The settings will be changed so that the HDLN driver is not configured on the hdisk. Is this OK? [y/n]

Action

To execute dlmpreuninst, enter y.

If you do not want to execute dlmpreuninst, enter n.

KAPL13105-W

The entered value is invalid. Re-enter. [y/n]:

Action

Enter either y or n.

KAPL13106-E

The entered value is invalid. The operation will now stop.

Details

The dlmpreuninst utility has been stopped because an invalid response was sent three times consecutively to a request.

Action

To execute dlmpreuninst again, enter either y or n.

KAPL13107-I

The user stopped the operation.

Details

The `dlmpreuninst` utility has been terminated because `n` was sent to a request.

Action

None.

KAPL13108-E

An internal error occurred in the `dlmpreuninst` utility. Error Code = *aa...aa*, *bb...bb* Execute the `DLMgetras` utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the `DLMgetras` utility.

Details

A system-based error, not caused by the user, occurred during `dlmpreuninst` utility processing.

aa...aa: The error number which specifies the performed processing (decimal number)

bb...bb: Return value of the executed processing (decimal number)

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL13109-W

A parameter is invalid. parameter = *aa...aa*

Details

An invalid parameter is specified.

aa...aa: The specified parameter (character string)

Action

With the `-h` parameter specified, execute the HDLM pre-uninstallation utility (`dlmpreuninst`). Make sure that the parameters that should be specified are correct, and then re-execute. For details about the `dlmpreuninst` utility, see *7.10 dlmpreuninst Utility for Executed Before Uninstalling HDLM*.

KAPL13110-E

The `dlmpreuninst` utility cannot be executed because the HDLM driver is running. Execute the `dlmrmddev` utility, and then re-execute the `dlmpreuninst` utility.

Action

Execute the `dlmrmdev` command, and then re-execute the `dlmpreuninst`. For details about the `dlmrmdev` utility, see *7.11 dlmrmdev Utility for Deleting HDLM Drivers*. For details about the `dlmpreuninst` utility, see *7.10 dlmpreuninst Utility for Executed Before Uninstalling HDLM*.

KAPL13601-W

The audit log configuration file does not exist. Restart the HDLM Manager, and execute the `"dlnmgr view -sys -audlog"` command and check the setting.

Details

The audit log configuration file does not exist.

Action

Restart the HDLM manager, execute the `"dlnmgr view -sys -audlog"` command, and then specify any desired settings by using the `"dlnmgr set -audlog"` command or the `"dlnmgr set -audfac"` command as necessary.

KAPL13602-W

The audit log configuration file cannot be opened. Execute the `"dlnmgr view -sys -audlog"` command and check whether a normal result is displayed.

Details

The audit log configuration file cannot be opened.

Action

If the `"dlnmgr view -sys -audlog"` command does not display a normal result, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

KAPL13603-W

The audit log configuration file is invalid. Restart the HDLM Manager, and execute the `"dlnmgr view -sys -audlog"` command and check the setting.

Details

The audit log configuration file is invalid.

Action

Restart the HDLM Manager, and execute the `"dlnmgr view -sys -audlog"` command, and then specify the desired setting by using the `"dlnmgr set -audlog"` or the `"dlnmgr set -audfac"` command as necessary.

KAPL13604-W

An error occurred during processing to read the audit log configuration file.

8. Messages

Details

An internal error occurred during processing to read the audit log configuration file.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL13605-W

An error occurred during processing to output the audit log configuration file.

Details

An internal parameter error occurred during output of the audit log data.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

KAPL13606-W

An error occurred during processing to output the audit log configuration file.

Details

An internal error occurred during output of the audit log data.

Action

Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.

8.13 KAPL15001 to KAPL16000

KAPL15001-I

The registered value of ReserveKey was successfully displayed.
Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15002-E

An attempt to display the registered value of ReserveKey has failed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15005-I

Information of HDLM execution environment ODM was successfully displayed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15008-I

ReserveKey was cleared successfully on *aa...aa* hdisk(s) and failed on *bb...bb* hdisk(s). Command Line = *cc...cc*

Details

aa...aa: Number of hdisks for which ReserveKey was cleared successfully.

bb...bb: Number of hdisks for which ReserveKey was not cleared.

cc...cc: Name of the utility that the user executed

KAPL15009-E

An attempt to clear ReserveKey has failed on *aa...aa* hdisk(s).
Command Line = *bb...bb*

Details

aa...aa: Number of hdisks for which ReserveKey was not cleared.

bb...bb: Name of the utility that the user executed

KAPL15010-W

The HDLM utility was executed by the user who does not have the authority. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15060-I

DLMgetras was invoked. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15061-I

DLMgetras successfully executed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15080-I

The information about the HDLM default configuration ODM was displayed successfully. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15081-E

An attempt to display the information about the HDLM default configuration ODM has failed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15082-I

The information about the HDLM default configuration ODM was changed successfully. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15083-E

An attempt to change the information about the HDLM default configuration ODM has failed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15084-I

dmlmgetrasinst was invoked. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15085-I

dmlmgetrasinst successfully executed. Command Line = *aa...aa*

Details

aa...aa: Name of the utility that the user executed

KAPL15101-I

Clear operation was completed successfully. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15102-E

Clear operation has failed. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15103-I

aa...aa path(s) were successfully placed *bb...bb*. *cc...cc* path(s) were not. Command Line = *dd...dd*

Details

aa...aa: Number of paths that were successfully placed online or offline

bb...bb: Online or Offline (c)

cc...cc: Number of paths that failed to be placed online or offline

dd...dd: Command that the user executed

KAPL15104-W

aa...aa path(s) were failed to place *bb...bb*. Command Line = *cc...cc*

Details

aa...aa: Number of paths that failed to be placed online or offline

bb...bb: Online or Offline (c)

cc...cc: Command that the user executed

KAPL15105-I

Setting up the operating environment succeeded. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15106-E

Setting up the operating environment failed. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15107-I

Program information was successfully displayed. Command Line =
aa...aa

Details

aa...aa: Command that the user executed

KAPL15108-E

An attempt to display program information has failed. Command
Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15109-I

Information about HDLM-management targets was successfully
displayed. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15110-E

An attempt to display information about HDLM-management targets
has failed. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15111-W

The HDLM command was started or stopped by the user who does not
have the authority. Command Line = *aa...aa*

Details

aa...aa: Command that the user executed

KAPL15401-I

HDLM Manager successfully started.

KAPL15402-E

Could not start the HDLM manager.

KAPL15403-I

HDLM Manager successfully stopped.

KAPL15404-W

The HDLM Manager was executed by the user who does not have the
authority.

8.14 Return Codes for Hitachi Command Suite Common Agent Component

When an operation requested of HDLM from Global Link Manager terminates abnormally, or terminates normally with a warning, HDLM outputs one of the return codes described below.

1002

Details

There is no path on which the operation can be performed.

Action

Refresh the host information, check the path status, and then perform the operation again.

1003

Details

No path was detected.

Action

Check whether a path between the host and the storage system is connected. If a path is connected, check whether HDLM is configured correctly.

1004

Details

Memory required for HDLM internal processing could not be allocated.

Action

Terminate unnecessary applications to increase free memory, or restart the host.

1006

Details

An Offline path cannot be placed Online.

Action

Remove the error in the path, and then retry.

1007

Details

The target path of the offline operation is the last, remaining path connected to the device and therefore, cannot be placed in the offline status.

Action

Click Refresh to update the host information, check the path status, and then retry the offline operation.

1015

Details

The Offline path cannot be placed Online.

Action

Remove the error in the path, and then retry.

1016

Details

The target path(s) are already Online.

Action

Update the host information, and then check the path status.

1017

Details

The target path(s) are already Offline(C).

Action

Update the host information, and then check the path status.

1019

Details

An error occurred during HDLM internal processing.

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see *7.2 DLMgetras Utility for Collecting HDLM Error Information*.

1020

Details

An unexpected error occurred during HDLM internal processing.

Action

Execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a

maintenance contract for HDLM. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1025

Details

A parameter value is invalid.

Action

Refresh the host information, and then perform the operation again. If the same error occurs again, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1026

Details

The acquisition of path information has been aborted, because the path configuration was changed while the system was attempting to acquire the path information.

Action

Refresh the host information, check the path status, and then perform the operation again.

1027

Details

The error monitoring interval and the number of times that the error needs to occur are conflicting with the automatic failback-checking interval.

Action

Set the intermittent error-monitoring interval to a value that is equal to or greater than (automatic- failback-checking-interval x number-of-times-error-is-to-occur-for-intermittent-error-monitoring).

1033

Details

An attempt to acquire the HDLM version information failed.

Action

Re-execute the command. If the same error occurs again, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see 7.2 *DLMgetras Utility for Collecting*

HDLM Error Information.

1034

Details

An attempt to acquire information about the HDLM version or SP version has failed.

Action

Re-execute the command. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1035

Details

An attempt to acquire information about the HDLM version or SP version has failed.

Action

Re-execute the command. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1036

Details

An attempt to acquire information about the HDLM version or SP version has failed.

Action

Re-execute the command. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1037

Details

A parameter is invalid.

Action

Refresh the host information, and then perform the operation again. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1041

Details

An attempt to communicate with the HDLM manager has failed.

Action

Check whether the HDLM manager is running on the host. If it is not running, start the HDLM manager.

1042

Details

Information about the path configuration on the specified LU does not match the path configuration information held by HDLM.

Action

Refresh the host information, check the path status, and then perform the operation again.

1045

Details

A parameter is invalid.

Action

Refresh the host information, and then perform the operation again. If the same error occurs even again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras` utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information*.

1046

Details

A parameter is invalid.

Action

Refresh the host information, and then perform the operation again. If the same error occurs again, execute the `DLMgetras` utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the `DLMgetras`

utility, see 7.2 *DLMgetras Utility for Collecting HDLM Error Information.*

Appendixes

- A. Functional Differences Between Versions of HDLM
- B. Differences Between HDLM Version 5.9 or Later and Version 5.8.1 or Earlier
- C. Glossary

A. Functional Differences Between Versions of HDLM

This section explains the functional differences between newer and older versions of HDLM.

A.1 Functional Differences Between Version 6.2 and Versions Earlier than 6.2

- In HDLM version 6.1.0 or earlier, when you create a system replication (clone) on another LPAR or host from an `mksysb` image by using the `mksysb` command provided by the OS, you needed to uninstall HDLM before executing the `mksysb` command.

In HDLM version 6.2.0 or later, you do not need to uninstall HDLM before executing the `mksysb` command. You can now execute the HDLM restoration support utility (`dlnpostrestore`) after creating a system replication, so that HDLM information can now be updated according to the destination system's environment.

- For HDLM 6.1.0 or earlier, a physical volume (`hdisk`) might have been changed during an unattended upgrade installation or re-installation of HDLM. For HDLM 6.2.0, a physical volume (`hdisk`) is not changed during an upgrade installation or re-installation of HDLM.

A.2 Functional Differences Between Version 6.1 and Versions Earlier than 6.1

- In a new installation of HDLM, the default load balancing algorithm has been changed from the Round Robin algorithm to the Extended Least I/Os algorithm.

A.3 Functional Differences Between Version 6.0 or Later and Versions Earlier than 6.0

- The HDLM installation function provided by the `dlnmsetup` utility for HDLM installation configuration support has been integrated into the `installhdlm` utility for HDLM installation.
- The way the HDLM version is displayed in execution results of HDLM commands or utilities has been changed.
- In a new installation of HDLM, the default value for the automatic failback function has been changed from `off` to `on`.

B. Differences Between HDLM Version 5.9 or Later and Version 5.8.1 or Earlier

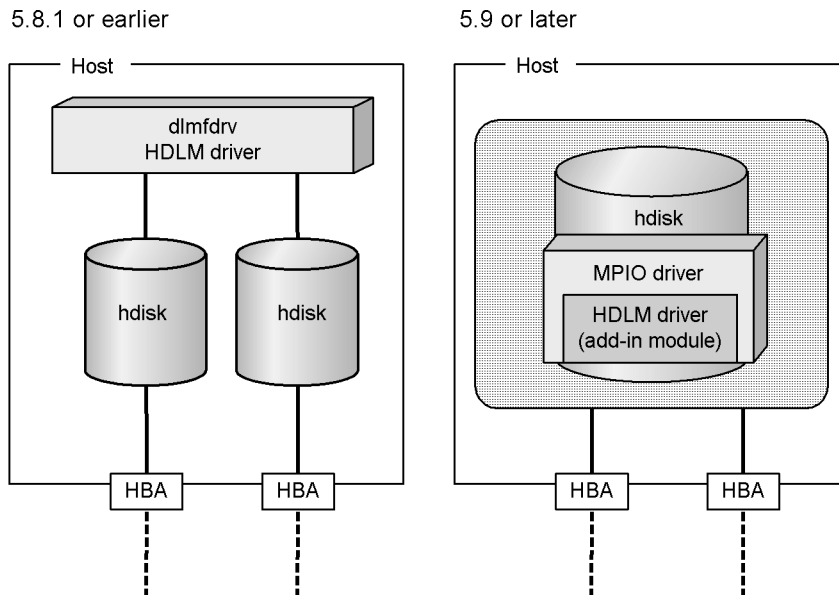
HDLM version 5.9 or later supports MPIO used by AIX 5L V5.2 or later, which has improved compatibility with the OS. The items explained in the following subsections represent the changes from HDLM version 5.8.1 or earlier.

B.1 Add-in HDLM Driver Module

HDLM version 5.9 or later supports MPIO used by AIX 5L V5.2 or later. This has improved compatibility with the OS because users can use standard OS commands to manage paths on HDLM management-target devices. As compared to HDLM version 5.8.1 or earlier, HDLM version 5.9 or later differs in terms of the HDLM driver structure, environment configuration, and HDLM operation procedures.

Figure B-1: Differences in the HDLM drivers between HDLM version 5.8.1 or earlier and HDLM version 5.9 or later shows the differences in the HDLM drivers between HDLM version 5.8.1 or earlier and HDLM version 5.9 or later.

Figure B-1: Differences in the HDLM drivers between HDLM version 5.8.1 or earlier and HDLM version 5.9 or later



B.2 Simplifying the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files

- The logical device files that can be controlled by the HDLM driver have been unified from HDLM devices (`d1mfdrv`) to the `hdisk` provided by the OS. Therefore, logical device files controlled by HDLM can be configured by AIX's standard `cfgmgr` command.

Both the file that defines non-HDLM-managed disks (`/usr/DynamicLinkManager/drv/d1mfdrv.unconf`) and the file that defines the HDLM driver configuration (`/usr/DynamicLinkManager/drv/d1mfdrv.conf`) are no longer used. After installing HDLM, all devices shown in *Devices that HDLM can manage* in 2.1 *Devices Managed by HDLM* will be managed. You cannot exclude physical volumes from HDLM-managed targets.

Accompanying these changes, the following deletions have been made from the manual *HiCommand Dynamic Link Manager User's Guide (for AIX(R))* (3000-3-926-50(E)):

- 2.5.1 *Logical Device Files for HDLM Devices*
- 3.3.4 *Notes on HDLM devices*
- 3.3.10 *Notes on the system configuration change*
- 3.8 *Setting up volume groups*
- 3.9.4 *Setting the `clconraid.dat` file*
- 3.9.5 *Notes on HACMP*
 - (1) *When executing HACMP C-SPOC (Cluster-Single Point of Control) commands*
 - (3) *Disk heartbeat*
- 3.10 *Settings for using GPFS*
- 3.15.7 *Deleting the HACMP settings*
 - (1) *Deleting a user-defined cluster event*
- 4.1.6 *Error checking for physical volume (`hdisk`) specification operations*
- 4.1.7 *Changing the attributes of HDLM management-target devices*
- 4.1.8 *Notes on configuring an HDLM device*
- 4.1.9 *Notes when the physical volume and HDLM device are placed in a defined state*
- 4.1.10 *Notes on changing the disk configuration*
- 4.1.13 *Notes when the SMIT window is used*

- 4.6.1 Notes on changing the configuration of the HDLM operating environment
 - 4.6.6 Changing the configuration of an HDLM device
 - 4.6.7 Reconfiguring an HDLM device without changing its name
- Eliminating the `rc.shutdown` file
- HDLM version 5.8.1 or earlier provided an `rc.shutdown` file in order to avoid having physical volumes already defined when a host is started. Because this situation does not occur in HDLM version 5.9 or later, the `rc.shutdown` file is no longer provided. For this reason, the manual has been changed as follows:
- Section 3.3.13 Notes on Starting a Host in the manual *HiCommand Dynamic Link Manager User's Guide (for AIX(R)) (3000-3-926-50(E))* has been deleted because it explained the editing method for the `rc.shutdown` file.
 - The portion of the procedure related to the `rc.shutdown` file has been deleted from the explanation of uninstalling HDLM.
 - The `rc.shutdown` file has been deleted from the files collected by the `DLMgetras` utility for collecting HDLM error information.
- The content displayed for `HDevName` in the HDLM `view` command operation has been changed from the HDLM device (`d1mfdrv`) to `hdisk`. Accompanying this change, `Device` for displaying `hdisk` name when `view -lu` or `view -drv` is executed in HDLM version 5.8.1 or earlier has been removed.
- Because `d1mfdrv` was deleted, the following HDLM utilities are no longer provided and the descriptions related to them have been deleted from the manual:

- Utilities for operating HDLM volume groups

HDLM version 5.9 or later uses standard AIX commands that correspond to the commands for utilities for operating HDLM volume groups. Table *Table B-1: Commands of the utilities for operating HDLM volume groups, and corresponding AIX commands* lists the correspondence between the commands for operating utilities for HDLM volume groups and the standard AIX commands.

Table B-1: Commands of the utilities for operating HDLM volume groups, and corresponding AIX commands

Commands of the utilities for operating HDLM volume groups	Corresponding AIX commands
<code>d1mchvg</code>	<code>chvg</code>
<code>d1mexportvg</code>	<code>exportvg</code>
<code>d1mextendvg</code>	<code>extendvg</code>

Commands of the utilities for operating HDLM volume groups	Corresponding AIX commands
dlmimportvg	importvg
dlmlistvgbackup	listvgbackup
dlmlsvg	lsvg
dlmmirrorvg	mirrorvg
dlmmkvg	mkvg
dlmrecreatevg	recreatevg
dlmreducevg	reducevg
dlmreorgvg	reorgvg
dlmrestorevgfiles	restorevgfiles
dlmrestvg	restvg
dlmsavevg	savevg
dlmsyncvg	syncvg
dlmunmirrorvg	unmirrorvg
dlmvaryoffvg	varyoffvg
dlmvaryonvg	varyonvg

- dlmcfgmgr utility for managing the HDLM configuration
In HDLM version 5.9 or later, the AIX `cfgmgr` command is used.
- dlmchkdev utility for checking the HDLM device configuration
- dlmHBAdel utility for changing the HDLM HBA

Also, the execution target of the `dlmrmdev` utility for removing HDLM drivers has been changed from `dlmfdrv` to `hdisk`.

B.3 Changing the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files

For the same reason explained in *B.2 Simplifying the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files*, the following HDLM environment configuration and operation procedures have been changed:

- New installation and update installation of HDLM[#]

- Settings when GPFS is used
- Replacement of HBA
- Changing HDLM management-target devices
- Replacement of fiber cables
- Replacement of fibre channel switches

#

An *update installation* refers to upgrading HDLM whose version is 5.9 or later. Therefore, it does not include a migration from HDLM version 5.8.1 or earlier to HDLM version 5.9 or later. It also does not include a migration from HDLM version 5.9 or later to HDLM version 5.8.1 or earlier. For such installations, you must first uninstall the existing HDLM and then install HDLM version 5.9 or later. To migrate from HDLM version 5.8.1 or earlier to HDLM version 5.9 or later, you can use the `dlmmigsts` utility for assisting HDLM transitions to inherit the existing HDLM settings. For details, see 3.5.6 *Migrating from HDLM Version 5.8.1 or Earlier to Version 5.9 or Later*.

B.4 Migrating Reservation Control Settings

In HDLM version 5.8.1 or earlier, the *reservation control setting* is called the *reservation level* and is specified by using the `set` operation with the `-rsv on` parameter. The target of the reservation level was every LU in an HDLM management-target device. However, you can set the reservation policy specification on each LU if the AIX version is AIX 5L V5.2 or later. The reservation control setting is specified by using the `chdev` command in HDLM version 5.9 or later. Therefore, the `-rsv on` parameter for the `set` operation is no longer provided.

Table B-2: The correspondence of the setting values between the reservation level and reservation policy shows the correspondence of the setting values between the reservation level and the reservation policy.

Table B-2: The correspondence of the setting values between the reservation level and reservation policy

Reservation Level	Reservation Policy
0: Ignoring the reservation	<code>no_reserve</code>
2: Persistent reservation	<code>PR_exclusive</code>

B.5 Support for a Boot Disk Environment

A storage system disk can now be used for the boot disk. Accompanying this, the `dlmpreuninst` utility that is executed before uninstalling HDLM has been provided.

The `dlmpreuninst` utility excludes, before you uninstall HDLM, the `hdisk` recognized as a boot disk from being an HDLM management-target device.

B.6 About Settings when Upgrading the OS

(1) *Eliminating Settings when Upgrading the OS*

There is no required procedure in HDLM for when the OS is upgraded, so the explanation in *(1) Settings for an OS Upgrade* in 4.6.2 *Settings for an OS Upgrade* in the manual *HiCommand Dynamic Link Manager User's Guide (for AIX(R))* (3000-3-926-50(E)) is no longer necessary and has been deleted from this manual.

(2) *Eliminating Settings when Changing the Kernel Mode*

In HDLM version 5.9 or later, both 32-bit and 64-bit versions are installed. When the 32-bit kernel is in use, the 32-bit version of HDLM is used automatically, and when the 64-bit kernel is in use, the 64-bit HDLM is used automatically. Because of this change, the following sections have been deleted from the manual *HiCommand Dynamic Link Manager User's Guide (for AIX(R))* (3000-3-926-50(E)):

- 3.4.1 *Preparations for a New Installation of HDLM*

(4) *Switch the kernel mode*

- 4.6.2 *Settings for an OS Upgrade*

(2) *Settings when the kernel mode is changed*

Because of the changes explained in *(1) Eliminating Settings when Upgrading the OS* and *(2) Eliminating Settings when Changing the Kernel Mode*, the `dlmchenv` utility for modifying the HDLM execution environment is no longer necessary and has been deleted.

B.7 Changing a Virtual I/O Server's Method of Recognizing Virtual SCSI Disks

In HDLM version 5.8.1 or earlier, either `PVID` or `unique_id` can be selected as the method used by a virtual I/O server for recognizing virtual SCSI disks. In HDLM version 5.9 or later, only `unique_id` can be used because of the MPIO specification. Because of this change, the explanation in 4.1.11 *Switching the recognition method for virtual SCSI disks when the virtual I/O server is used* in the manual *HiCommand Dynamic Link Manager User's Guide (for AIX(R))* (3000-3-926-50(E)) has been deleted because it is no longer necessary. Also, the `-u` and the `-e` parameters of the `dlmodmset` utility for setting the HDLM execution environment ODM are no longer provided because they are also not necessary.

C. Glossary

This glossary explains the terms used in this manual.

A

automatic failback

A function for checking the status of paths at regular intervals, and automatically placing the status of a path recovered from an error into the Online status.

If a path with an Offline(E) or Online(E) status recovers from an error, an automatic failback will place the path Online.

Automatic failbacks check the status of paths that were placed in the Offline(E) or Online(E) status because of an error, but do not check the status of paths that were placed in the Offline(C) status by executing an `offline` operation. For details on `offline` operations, see 6.4 *offline (Places Paths Offline)*.

AutoPATH_ID

An ID which HDLM assigns to a path when the system is started or when path configuration is performed. Every path has a unique AutoPATH_ID.

(See also: *path*)

B

boot disk environment

An environment in which the startup disk is in a storage system instead of in the host.

C

CHA (Channel Adapter)

An adapter for controlling the channels of a storage system.

CLPR(Cache Logical Partition)

A function supported by the Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, and Hitachi AMS2000/AMS/WMS/SMS series for logically splitting up a cache. This function can split up a cache into parity groups in the storage system, so that other parity groups do not affect the cache performance.

cluster

A system of connecting multiple hosts with the same OS or platform (essentially, an environment in which the same application can run) and treating them as one system.

D

Dev (Device)

A logical division of an LU that HDLM controls and operates. A Dev is equivalent to a *logical volume* in AIX.

In an AIX environment, each LU has only one Dev.

Each Dev has a *Dev number*.

Depending on the access method, Devs are classified into two types: block devices and character devices.

(See also: *Dev number*)

Dev number

A number that is assigned to a device within an LU. The device numbers are assigned sequentially from 0. A Dev number is called a *logical volume number* in AIX.

HDLM operates assuming that one LU has one Dev, so the device number is fixed to 0.

(See also: *Dev*)

E

emulation type

An LU type that is accessible from a host. Since an HDLM management-target host is an open-system host such as a PC or a UNIX computer, the HDLM management-target host can access only the LUs that have open-system emulation types.

For details on emulation types supported by a storage system, see the maintenance manual for that particular storage system.

F

failback

A function for placing the status of a path recovered from an error into the Online status, and then switching the access path to the path that was just recovered.

failover

A function for switching to another normal path if there is an error in the current access path, thereby enabling the system to continue to operate.

H

HBA (Host Bus Adapter)

Device that functions as an interface connecting a host with external devices.

In this manual, the term *HBA* refers to an interface card installed in a host, in

configurations where the host and storage units are connected via a FC connection.

HDLM alert driver

A program that receives information about an error detected by the HDLM driver, and then reports the error information to the HDLM manager.

HDLM driver

A program that controls all the HDLM functions, manages paths, and detects errors.

HDLM manager

A program that manages error information. The HDLM manager receives error information from the HDLM alert driver and then collects error logs.

host

A generic term for both servers and clients.

host device

A logical area in a host LU.

(See also: *host LU*, *host device name*)

host device name

A name assigned to a host device. The hdisk is assigned.

(See also: *host device*)

host LU

An LU that a host recognizes. The actual HDev entity is a Dev in the storage system.

Each host LU has a *host LU number*.

(See also: *LU*, *host LU number*, *host device*)

host LU number

A number assigned to a host LU. The host LU number is part of a path name.

(See also: *host LU*, *path name*)

I

intermittent error

An error that occurs irregularly due to, for example, a loose cable connection.

L

LDEV (Logical Device)

A combination of the storage system's product name, serial number, and an internal

LU. HDLM uses this value to identify a particular LU.

load balancing

A function for distributing the load across all the paths that are accessing the logical areas within an LU. To distribute the load, load balancing uses multiple paths to perform I/O operations.

HDLM uses the following six algorithms for load balancing:

- The Round Robin algorithm
- The Extended Round Robin algorithm
- The Least I/Os algorithm
- The Extended Least I/Os algorithm
- The Least Blocks algorithm
- The Extended Least Blocks algorithm

logical device file

`/dev/hdiskn`, and `/dev/rhdiskn`. A *logical device* of this term is not an LDEV. The logical device file name can be changed by using the `rendev` command.

LU (Logical Unit)

A logical unit that is a logical volume defined in the storage system, and with which the host can perform input or output operations.

(See also: *host LU*)

N

node

A server in a cluster.

non-owner controller

A controller other than an owner controller.

Non-owner controllers exist only in when the Thunder 9500V series, or Hitachi AMS/WMS series.

(See also: *owner controller*, *non-owner path*)

non-owner path

A path that passes through a non-owner controller.

Non-owner paths exist only in when the Thunder 9500V series, or Hitachi AMS/WMS series.

(See also: *owner path*, *non-owner controller*)

O

ODM (Object Data Manager)

An AIX-dedicated database for managing system information. HDLM uses ODM to add or delete drivers.

owner controller

A controller that has been set as an owner controller for an LU. Owner controllers are only in the Thunder 9500V series, or Hitachi AMS/WMS series. A controller other than an owner controller is called a *non-owner controller*.

When using the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS, all controllers are owner controllers.

(See also: *owner path*, *non-owner controller*)

owner path

A path that passes through an owner controller for an LU in the Thunder 9500V series, or Hitachi AMS/WMS series. A path that passes through a controller other than an owner controller is called a *non-owner path*.

When using the Lightning 9900V series, Hitachi USP, Universal Storage Platform V/VM, Virtual Storage Platform, Hitachi AMS2000 series, or Hitachi SMS, all paths are owner paths.

(See also: *owner controller*, *non-owner path*)

P

path

An access path from a host to a storage system. Access to a logical area within an LU in a storage system is made via a cable connecting the HBA on the host and the CHA on the storage system. This cable is a path. Each path has an `AutoPATH_ID`.

(See also: *AutoPATH_ID*)

path health checking

A function for checking the status of paths at regular intervals.

When an error occurs on a path that was in the Online status, path health checking changes the status of the path to the Offline(E) status.

Path health checking checks only those paths that have the Online status.

path name

The path name consisting of the following four elements, separated by periods:

- HBA adapter number or adapter type (character string)
- Bus number or adapter number (character string)
- Target ID (hexadecimal number)
- Host LU number (hexadecimal number)

A path name is used to identify a path.

(See also: *host LU number*)

persistent reservation

Similar to *reservations*, persistent reservations enable a server to declare that it has exclusive rights to use an LU, and prevents other servers from accessing that LU. Note, however, that while *reservations* allows a server to have exclusive use of only one path to the LU, persistent reservations allow a server to have exclusive rights to use multiple paths.

If persistent reservations are used in HDLM, a host can have exclusive use of multiple paths to an LU, so that load balancing among these paths is possible.

(See also: *reservation*)

R

reservation

The reservation function enables a host to declare that it has exclusive rights to use a particular LU, and prevents other hosts from accessing that LU. Access permission for an LU that has been reserved is given only to the host that issued the reservation, so the LU cannot be accessed from multiple paths (coming from multiple hosts) simultaneously. However, because of this, load balancing is not possible.

(See also: *persistent reservation*)

S

SAN (Storage Area Network)

A high-speed network connecting hosts to and storage systems. This network is independent of a LAN and is dedicated to data transfers. A SAN provides faster access to storage systems, and prevents the transfer of high-volumes of data from deteriorating LAN performance.

SCSI device

A SCSI disk device

slot number

A value indicating the location of a slot on which a HBA is mounted.

SLPR (Storage Logical Partition)

A function supported by Hitachi USP, Universal Storage Platform V/VM, and Virtual Storage Platform for logically splitting up a storage system. This function splits up the resources, such as ports, CLPR, and volumes, in the storage system, so that the user can manage each resource independently.

Index

A

- abbreviations defined ii
- active host 55
- adapter number 285
- adapter type 285
- adapter number 72
- adapter type 72
- audit log
 - categories and audit events that HDLM can
 - output 45
 - collecting data 44
 - data format 50
- automatic failback 26, 254, 475
- automatic failover 21
- automatic path switching 21
- AutoPATH_ID 7, 475

B

- base 10 281
- boot disk environment 475
- buffer size 147
 - changing the buffer size per monitoring
 - interval duration 150
- bus number 285

C

- CHA 8
- CHA (Channel Adapter) 475
- changing HDLM default settings 316
- channel adapter 7
- checking
 - error information in messages 219
- clear 230
- CLPR(Cache Logical Partition) 475
- cluster 475
 - support 55
- cluster software 55
 - setup 82

- Cluster Software (HACMP)

- Canceling Settings 176

- coding file that defines information to be collected
 - rules for 309

- collecting

- error info. with HDLM utility (dlmgetras) 43
 - error info. with HDLM utility (dlmgetrasinst) 43

- command

- format 228
 - operation 228
 - Overview 228

- command devices 6

- commands of HDLM (dlmkmgr)

- clear 230
 - help 232
 - offline 235
 - online 242
 - set 249
 - view 266

- components

- HDLM system components 8

- conventions

- abbreviations ii
 - diagrams vii
 - fonts and symbols viii
 - KB, MB, GB and TB x

- core logic component 13

- Critical 42

- CS 350

D

- decimal number, meaning 281
- default and recommended values 250
- Dev 7, 8, 476
- Dev number 476
- diagram conventions vii
- directory to which collected information is
- output 308, 319

Displayed program information 268
displaying
 information 266
 LU information 287
 path information 266, 274
 path information (by selecting a display item) 266
 program information 266, 268
 summary of path information 266
dlmchpdattr 316
DLMgetras 224, 226
dlmgetras 308
dlmgetrasinst 319
dlminstcomp 323
dlmmigsts 324
dlmodmset 326
dlmpostrestore 329
dlmpr 330
dlmpreuninst 333
dlmrmddev 334
dlmkmgr 227
DNum 220

E

emulation type 476
Error 42
error information 41, 43
 checking in messages 219
 collecting with dlmgetras 308
 filtering 42
error levels 42
 Critical 42
 Error 42
 Information 42
 Warning 42
error log 41
error logging level 251
error path
 identifying 223
error-log-file-size 252
ErrorCode 219
errors
 management 39
 that HDLM detects 42

examining
 message 222, 224

F

failback 4, 21, 476
failover 4, 21, 476
features of HDLM 4
fiber cable
 replacing 211
Fibre Channel switch
 replacing 213
file for defining information to be collected 309
file that defines information to be collected
 notes and coding example 309
filter 42
filter component 13
filtering of error information 42
finishing
 Hitachi Network Objectplaza Trace Library settings 153
FO 350
font conventions viii
for using GPFS
 settings 159
for Using HACMP
 settings 156
for using VCS
 settings 163
format and meaning of the message ID 350
function
 HDLM program 13
functions of HDLM 5

G

GB meaning x
Global Link Manager 53
glossary 475

H

HACMP
 installing HDLM, in an HACMP environment 121
handling

- path error 221
 - HBA 8
 - host bus adapter
 - replacing 205
 - HBA (Host Bus Adapter) 476
 - HBA adapter number 285
 - HDev 11
 - HDevName 220
 - HDLM
 - features 4
 - functions 5
 - installing 75
 - Migrating 117
 - migration of 69
 - new installation 82
 - new installation of 69
 - overview 1
 - preparations for an upgrade installation or re-installation of 95
 - preparations for new installation of 79
 - program information 268
 - re-installation of 69
 - setup 136
 - system configuration 7
 - type of installation 69
 - uninstalling 165
 - upgrade installation of 69
 - Upgrade Installation or Re-installation 97
 - HDLM alert driver 13, 477
 - HDLM command 13
 - HDLM driver 13, 477
 - HDLM environment
 - creating 57
 - HDLM management-target devices 6
 - HDLM manager 13, 477
 - starting 192
 - stopping 192
 - HDLM resident processes 194
 - HDLM script for HACMP
 - registering 156
 - HDLM utility 13
 - help 232
 - Hitachi Network Objectplaza Trace Library
 - applying the settings 153
 - Displaying setup menu 148
 - Notes 147
 - Hitachi Network Objectplaza Trace Library (HNTRLib2)
 - Uninstalling 174
 - Hitachi Network Objectplaza Trace Library (HNTRLib)
 - uninstalling 175
 - Hitachi Network Objectplaza Trace Library settings
 - finishing 153
 - HLU 11
 - host 179, 477
 - host bus adapter 7
 - host device 10, 477
 - host device name 477
 - host LU 10, 477
 - host LU number 285, 477
 - host, supported 58
- I**
- identifying
 - error part 223
 - error path 223
 - Information 42
 - installation 75
 - installation error information 43
 - collecting with dlmgetrasinst 319
 - installation, new 69
 - installation-information settings file
 - Items to be defined 336
 - installhdlm 336
 - installing
 - HDLM in an HACMP environment 121
 - unattended installation of HDLM 125
 - installlux.sh 347
 - integrated HDLM management 53
 - integrated trace file 41
 - changing the number 149
 - changing the size 148
 - integrated trace information files 147
 - integrated traces
 - setup 147
 - intended readers i
 - intermittent error 477

definition 27

I/O

- count 230
- errors 230

K

KB meaning x

kernel mode

- switching 81

L

LB 350

LDEV (Logical Device) 477

load balancing 4, 15, 250, 478

load balancing algorithms 18

load distribution using load balancing 15

log filter 42

logging level

- values 251

logical device file 478

logical unit 7

logical unit ID 285

logical volume number 476

LU 8

- configuration 10

LU (Logical Unit) 478

LUN 285

M

manual path switching 27

MB meaning x

message

- examining 222, 224

message level 350

Messages 349

messages

- adjusting the number of messages to be output 151
- checking contained error information 219

migration 69

monitoring interval 151

N

narrowing down

- hardware causing error 223

node 478

non-owner controller 17, 478

non-owner path 17, 478

Notes

- Using Hitachi Network Objectplaza Trace Library 147

Notes on creating an HDLM environment

- Notes on a license key 72
- Notes on an upgrade installation or re-installation of HDLM 70
- Notes on installing HDLM 70
- Notes on storage systems 73
- Notes on the automatic failback 74
- Notes on the cluster 73
- Notes on the queue_depth parameter value for an HDLM-managed device 74
- Notes on the virtual I/O server 71
- Notes on trace files 72

number of error log files 252

number of trace files 253

O

obtaining

- path information 222
- program information 224

ODM (Object Data Manager) 479

offline 21, 235

offline(C) status 28

offline(E) status 29

online 21, 242

online status 28

online(E) status 28

operating environment 249

- setting 249

operation name 350

operations 228

- displaying format 232
- of the HDLM command 228

organization of this manual i

OS, supported 58

overview

- commands 228
- HDLM 1
- owner controller 17, 479
- owner path 17, 479

P

- P 8
- path 7, 479
 - checking the configuration 134
- path error
 - handling 221
- path health checking 4, 38, 253, 479
- path information
 - obtaining 222
- path name 480
- path priority number 24
- path status transition 28
- path switching
 - automatically 21
 - manually 27
- PathID 219
- PathName 219
- Paths to which load balancing is applied 16
- PCI bus number 285
- Performing Failovers and Failbacks Using Path Switching 21
- persistent reservation 480
- placing a path or paths offline 235
- placing a path or paths online 242
- placing online
 - path 223
- port 7
- position of the HDLM driver and hdisk 14
- product ID 282
- Product ID displayed by the view -path operation 286
- program error
 - taking actions for 224, 225
- program information
 - obtaining 224

R

- re-installation 69
- registering
 - HDLM script for HACMP 156

- related publications ii
- replacing
 - fiber cable 211
 - Fibre Channel switch 213
 - HBA 205
- reservation 480
- reservation policy 155
 - setting 158
- RVSD 159

S

- SAN 8
- SAN (Storage Area Network) 480
- script for VCS
 - registering 163
- SCSI device 480
- serial number 282
- set 249
- setting
 - reservation policy 158
- settings for using
 - GPFS 159
 - HACMP 156
 - VCS 163
- setup
 - cluster software 82
 - HDLM 136
 - integrated traces 147
- slot number 25, 481
- SLPR(Storage Logical Partition) 481
- starting
 - HDLM manager 192
- statistics 230
 - clearing to the initial value 230
- status transitions 30
- stopping
 - HDLM manager 192
- storage systems 2
- switching
 - kernel mode 81
- switching destination path, priority of 23
- symbol conventions viii
- syntax conventions ix
- syslog 41

system configuration 7

T

taking actions for

- hardware error 223
- program error 224, 225

target ID 285

TB meaning x

trace file 41

trace file size 253

trace level values 252

types of collected logs 41

types of error information 41

U

unattended installation

- installation-information settings file 336
- log file 345

uninstallation

- HDL 165

uninstalling

- Hitachi Network Objectplaza Trace Library (HNTRLib) 175
- Hitachi Network Objectplaza Trace Library (HNTRLib2) 174

upgrade installation 69

utilities

- dlmmigsts Utility for Assisting HDLM Migration 324
- dlmodmset Utility for Setting the HDLM Execution Environment ODM 326
- dlmpostrestore Utility for HDLM Restoration Support 329
- dlmpr, for clearing HDLM persistent reservation 330
- dlmpreuninst, Utility for Executed Before Uninstalling HDLM 333
- dlmrmddev, Utility for Deleting HDLM Drivers 334
- installhdlm, Utility for Installing HDLM 336
- installux.sh, Utility for HDLM Common Installer 347
- overview of 304

Utility for HDLM Component

Installation 323

utility 316

Utility for HDLM Component Installation 323

V

vendor ID 282

W

Warning 42

what is HDLM? 2

working environment

view (view operation) 272