



HiCommand® Dynamic Link Manager (HDLM) for IBM® AIX® Systems

User's Guide

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Referenced Documents

- *Hitachi TagmaStore™ Universal Storage Platform User and Reference Guide*, MK-94RD231
- *Hitachi Lightning 9900™ V Series User and Reference Guide*, MK-92RD100
- *Hitachi Lightning 9900™ V Series IBM® AIX® Configuration Guide*, MK-92RD119
- *Hitachi TagmaStore™ Adaptable Modular Storage 1000 User and Reference Guide*, MP-95DF780
- *Hitachi TagmaStore™ Adaptable Modular Storage 500 User and Reference Guide*, MP-95DF714
- *Hitachi Thunder 9500™ V Series User and Reference Guide*, MK-92DF601
- *Hitachi Thunder 9500™ V Series IBM AIX Host Installation Guide*, MK-92DF617

Preface

The *HiCommand® Dynamic Link Manager (HDLM) for AIX User's Guide* describes and provides instructions for installing and using the HDLM for AIX software for the Hitachi Freedom Storage™ Series disk array subsystems. This document is intended for system administrators who use HDLM to operate and manage storage.

This document assumes that the user:

- has a background in data processing and understands storage subsystems and their basic functions,
- is familiar with the Hitachi Freedom Storage subsystem(s): Hitachi TagmaStore™ Universal Storage Platform, Lightning 9900™ V Series, Thunder 9500™ V Series, array subsystems, and
- is familiar with the AIX operating system, file system, system commands, and utilities.

For further information on the Hitachi storage subsystems, please refer to the user's guide for the subsystem (e.g., *Hitachi Lightning 9900 V Series User and Reference Guide*, MK-92RD100). For further information on Hitachi Data Systems products and services, please contact your Hitachi Data Systems account team, or visit Hitachi Data Systems online at <http://www.hds.com>.

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HDLM for AIX Software Version

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Contents

Chapter 1	Overview of HiCommand® Dynamic Link Manager (HDLM)	1
1.1	About the HiCommand Dynamic Link Manager (HDLM)	2
1.2	Major Features	4
Chapter 2	HDLM Configuration and Operations	5
2.1	Devices Managed by HDLM	6
2.2	System Configuration	7
2.3	LU Configuration	9
2.4	HDLM Program Configuration	11
2.5	HDLM Driver and hdisk	13
2.6	Load Distribution Using Load Balancing	14
2.6.1	Load Balancing Range	15
2.6.2	Algorithms for Load Balancing	17
2.7	Failover and Failback Using Path Switching	19
2.7.1	Automatic Path Switching	19
2.7.2	Manual Path Switching	23
2.7.3	Path Status Transition	24
2.8	Monitoring Intermittent Errors (Auto Failback Used)	27
2.8.1	Checking Intermittent Errors	27
2.8.2	Setting up Intermittent Error Monitoring	27
2.8.3	Actions for Intermittent Error Monitoring	27
2.8.4	When User Operations Change the Intermittent Error Information	31
2.9	Detecting Errors by Using Path Health Checking	32
2.10	Error Management	33
2.10.1	Logs Collected	34
2.10.2	Error Information Filtering	35
2.10.3	Collecting Error Information Using the DLMgetras Utility	36
2.11	Cluster Support	37
Chapter 3	Creating an HDLM Environment	39
3.1	System Requirements	40
3.1.1	Applicable Hardware Models	40
3.1.2	Prerequisite Programs	40
3.1.3	Related Programs	41
3.1.4	Memory and Disk Space Requirements	43
3.1.5	The Number of Paths Guaranteed by HDLM	45
3.2	Flow for Creating an HDLM Environment	46
3.3	Types of HDLM Installation	47
3.4	Notes on Creating an HDLM Environment	48
3.4.1	Notes on installing HDLM	48
3.4.2	Notes on an upgrade installation or re-installation of HDLM	48
3.4.3	Notes on the virtual I/O server	49
3.4.4	Notes on a license key	49
3.4.5	Notes on trace files	49
3.4.6	Notes on storage subsystems	50
3.4.7	Notes on the cluster	50

3.4.8	Notes on the automatic failback	51
3.4.9	Notes on the queue_depth parameter value for an HDLM-managed device..	51
3.5	Installing HDLM	52
3.5.1	Available Installation Methods	52
3.5.2	Preparations for a New Installation of HDLM	54
3.5.3	Performing a New Installation of HDLM	57
3.5.4	Preparations for an Upgrade Installation or Re-Installation of HDLM.....	66
3.5.5	Performing an Upgrade Installation or Re-installation of HDLM.....	67
3.5.6	Migrating HDLM from Version 5.8.1 or earlier to Version 5.9 or later	76
3.5.7	Using the dlmsetup utility for Supporting HDLM Installation and Configuration to Install HDLM.....	79
3.6	Checking the Path Configuration	88
3.7	Setting up HDLM.....	89
3.7.1	Preparations for Setting the HDLM Functionality	89
3.8	Setting Up Integrated Traces.....	90
3.8.1	Displaying the Hitachi Network Objectplaza Trace Library Setup Menu	91
3.8.2	Changing the Size of Integrated Trace Files	92
3.8.3	Changing the Number of Integrated Trace Files	93
3.8.4	Changing the Buffer Size Per Monitoring Interval Duration	94
3.8.5	Adjusting the Number of Messages to be Output per Monitoring Interval	95
3.8.6	Finishing the Hitachi Network Objectplaza Trace Library Settings	97
3.8.7	Applying the Hitachi Network Objectplaza Trace Library Settings	97
3.9	About the Reservation Policy.....	98
3.10	Settings for Using HACMP	99
3.10.1	Storage subsystem Settings.....	99
3.10.2	Registering the HDLM Script for HACMP	99
3.10.3	Setting the Reservation Policy	101
3.11	Settings for Using GPFS + RVSD	102
3.12	Settings for Using Oracle RAC 10g.....	103
3.12.1	Settings for MISSCOUNT and DISKTIMEOUT.....	103
3.12.2	Settings for Reservation Policy	103
3.13	Settings for using VCS	104
3.14	Uninstalling HDLM.....	106
3.14.1	Preparations for HDLM Uninstallation	106
3.14.2	Uninstalling HDLM.....	106
3.14.3	Uninstalling the Hitachi Network Objectplaza Trace Library (HNTRLib2) ..	111
3.14.4	Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib).....	113
3.14.5	Canceling Cluster Software (HACMP) Settings.....	114
Chapter 4	Operating HDLM.....	115
4.1	Important Notes on Using HDLM	116
4.1.1	Displaying Path Information	116
4.1.2	Detecting Path Errors	116
4.1.3	Storage Subsystem	117
4.1.4	Notes on Shutting Down a Host	117
4.1.5	Notes on Errors in a Host	117
4.1.6	Notes on Enabling Both Primary and Secondary Volumes to be Viewed from the Same Server	117
4.1.7	Notes on an LVM Mirror Configuration	118

4.1.8	Notes on when the OS functionality is not available in a boot disk environment.....	118
4.2	HDLM Operations Using Commands	119
4.2.1	Notes on using commands.....	119
4.2.2	Viewing path information	119
4.2.3	Changing the status of paths	119
4.2.4	Viewing LU information	121
4.2.5	Displaying the Correspondences Between hdisks, OS Management Path IDs, and LDEVs	121
4.2.6	Initializing statistical information for paths	122
4.2.7	Viewing and setting up the operating environment	122
4.2.8	Viewing license information	124
4.2.9	Updating the license.....	124
4.2.10	Viewing HDLM version information	124
4.2.11	Viewing HDLM component information	125
4.3	Starting and Stopping the HDLM Manager	126
4.3.1	Starting the HDLM Manager	126
4.3.2	Stopping the HDLM Manager	126
4.4	Checking and Configuring Paths.....	127
4.4.1	Checking Path Information.....	127
4.4.2	Configuring Path Health Checking.....	128
4.5	Changing the Path Configuration.....	129
4.5.1	Replacing a Host Bus Adapter	129
4.5.2	Replacing a Fiber Cable	131
4.5.3	Replacing a Fibre-Channel Switch	132
4.6	Changing the Configuration of the HDLM Operating Environment.....	133
4.6.1	Changing an HDLM Management-Target Device	133
4.6.2	Changing a Path	134
Chapter 5	Using the HDLM dlnkmgr Command	137
5.1	Overview of the dlnkmgr Command	138
5.1.1	dlnkmgr Command Format.....	138
5.1.2	Operations of the dlnkmgr Command	138
5.2	clear Operation	139
5.3	help Operation	140
5.4	offline Operation	142
5.5	online Operation.....	146
5.6	set Operation.....	151
5.7	view Operation.....	163
Chapter 6	Using the HDLM Utilities	197
6.1	HDLM Error Information Collection Utility (DLMgetras)	199
6.2	Utility for Assisting HDLM Migration (dlmmigsts)	204
6.3	Utility for Setting the HDLM Execution Environment (dlmodmset)	206
6.4	Utility for Clearing HDLM Persistent Reservation (dlmpr)	208
6.5	Utility Executed before Uninstalling HDLM (dlmpreuninst, utility executed before uninstalling HDLM)	210
6.6	Utility for Deleting HDLM Drivers (dlmrmdev)	211
6.7	Utility for HDLM Installation Configuration Support (dlmsetup)	212

Chapter 7	Troubleshooting	213
7.1	Error Information Checking	214
7.1.1	Information Collected by the Error Information Collection Utility, DLMgetras (utility for collecting HDLM error information)	214
7.1.2	Information Displayed by the dlkmgr view Command	215
7.1.3	Messages that are Output When an Error Occurs	217
7.2	Actions Taken for a Path Error	218
7.3	Actions Taken for a Program Error	221
7.4	Actions Taken for Other Errors.....	222
7.5	Calling the Hitachi Data Systems Support Center.....	223
Chapter 8	HDLM Messages.....	225
Appendix A	Differences Between HDLM Version 5.9 or later and Versions 5.8.1 or Earlier.....	295
A.1	Add-in HDLM Driver Module.....	295
A.2	Simplifying the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files.....	295
A.3	Changing the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files	298
A.4	Migrating Reservation Control Settings	298
A.5	Support for a Boot Disk Environment	299
A.6	About Settings when Upgrading the OS.....	299
A.6.1	Eliminating Settings when Upgrading the OS	299
A.6.2	Eliminating Settings when Changing the Kernel Mode	299
A.7	Changing a Virtual I/O Server's Method of Recognizing Virtual SCSI Disks	300
Acronyms and Abbreviations	301
Glossary	303
Index	311

List of Figures

Figure 1.1	Connection between Hosts and Storage	3
Figure 2.1	HDLM System Configuration	7
Figure 2.2	LU Configuration of the Host where HDLM is Installed and Correspondence with an hdisk	9
Figure 2.3	HDLM Program Configuration	11
Figure 2.4	Position of the HDLM Driver And hdisk	13
Figure 2.5	I/O Flow without Load Balancing Function	14
Figure 2.6	I/O Flow with Load Balancing Function	15
Figure 2.7	Overview of Load Balancing	17
Figure 2.8	Path Switching	20
Figure 2.9	Path Status Transitions	25
Figure 2.10	Action When an Intermittent Error Occurs in the Path	28
Figure 2.11	Action When an Intermittent Error Does Not Occur in the Path	29
Figure 2.12	Action When the Conditions for the Intermittent Error are Changed During Error Monitoring	30
Figure 2.13	Error Management	33
Figure 3.1	Flow of HDLM Environment Setup	46
Figure 3.2	Execution Result Example of the mount -p Command (Preparations for a New Installation of HDLM)	54
Figure 3.3	Example of Results from Executing the Mount -p Command (Preparations for an upgrade installation or re-installation of HDLM)	66
Figure 3.4	Example of editing the preonline script	105
Figure 4.1	Host Bus Adapter Replacement	130
Figure 4.2	Unconfigure a Device	130
Figure 4.3	Replacing the Host Bus Adapter	131
Figure 5.1	Example of the Clear Command with User Confirmation	139
Figure 5.2	Example of the Clear Command with No User Confirmation	139
Figure 5.3	Example of the Clear Operation Format	139
Figure 5.4	Example of the Help Command for all Operations	140
Figure 5.5	Example of the Help Command for an Operation	140
Figure 5.6	Example of the -help Option for an Operation	141
Figure 5.7	Example of the Offline Operation With the -hba Parameter	144
Figure 5.8	Example of the Offline Operation With the --hbaid Parameter	144
Figure 5.9	Example of the Offline Operation With the -cha Parameter	144
Figure 5.10	Example of the Offline Operation With the chaid CHA-port-ID Parameter	144
Figure 5.11	Example of the Offline Operation With the -pathid Parameter	144
Figure 5.12	Example of the Format of the offline Operation	145
Figure 5.13	Example of the Online Operation With the -hba Parameter	148
Figure 5.14	Example of the Online Operation With the -hbaid Parameter	148
Figure 5.15	Example of the Online Operation With the -cha Parameter	148
Figure 5.16	Example of the Online Operation With the -chaid Parameter	149
Figure 5.17	Example of the Online Operation With No User Confirmation	149
Figure 5.18	Example of the online Operation Format	149
Figure 5.19	Example of Set Operation with User Confirmation	160
Figure 5.20	Example of Updating a License Key (When the License Key File Exists)	161

Figure 5.21	Example of Updating a License Key (When the license key file does not exist)	161
Figure 5.22	Example of Setting Intermittent Error Monitoring	161
Figure 5.23	Example of set Operation Format	162
Figure 5.24	Displaying Information on the HDLM Function Settings	174
Figure 5.25	Displaying Information on the HDLM Manager	176
Figure 5.26	Displaying Information on the HDLM Alert Driver	176
Figure 5.27	Displaying Information on the HDLM Driver	177
Figure 5.28	Displaying Information on the Host Device Path	177
Figure 5.29	Displaying Information about the HDLM License	178
Figure 5.30	Displaying Summary Path Information	184
Figure 5.31	Displaying Specific Items of Path Information	185
Figure 5.32	Displaying LU Information	186
Figure 5.33	Displaying HBA Port Information	186
Figure 5.34	Displaying CHA Port Information	186
Figure 5.35	Displaying Abbreviated LU Information	187
Figure 5.36	Displaying Specific Items of LU Information	191
Figure 5.37	Example of Displaying the LU Information Without Selecting Items to be Displayed	192
Figure 5.38	Example Showing How to Display LU Information Using iLUs as a Sorting Key, and Selecting the Items to be Displayed	193
Figure 5.39	Example Showing How to Display a Summary of the LU Information (Without Selecting Items to be Displayed)	194
Figure 5.40	Example Showing How to Display a Summary of the LU Information by Selecting Items to be Displayed	194
Figure 5.41	To Display the Correspondences Between hdisks, OS Management Path IDs, and LDEVs	195
Figure 5.42	To Display the Format of the View Operation	195
Figure 7.1	Result of Executing the View Operation with the -path Parameter	215
Figure 7.2	Sample Error Message	217
Figure 7.3	Error Location when the KAPL08022-E Message is Output	218
Figure 7.4	Troubleshooting Procedure when a Path Error Occurs	219
Figure A.1	Differences in HDLM Drivers Between HDLM Versions 5.8.1 or Earlier and Version 5.9 or later	295

List of Tables

Table 2.1	HDLM System Components	8
Table 2.2	Host Components.....	10
Table 2.3	Maximum Number of LUs and Paths Supported by HDLM	10
Table 2.4	Functions of HDLM Programs	12
Table 2.5	Algorithms for Load Balancing	17
Table 2.6	Correspondence Between Path Statuses Displayed by the OS and by HDLM.....	25
Table 2.7	When User Operations Change the Intermittent Error Information	31
Table 2.8	Log Descriptions	34
Table 2.9	Error Levels	35
Table 2.10	Error Logging Levels	35
Table 2.11	Trace Levels.....	35
Table 3.1	Applicable OSs for the Host.....	40
Table 3.2	Related Programs when Combining Cluster Configurations.....	41
Table 3.3	Related Programs to Convert Data with Intermediate Volumes Managed by Hitachi RapidXchange	42
Table 3.4	Memory Requirements for the Host	43
Table 3.5	Disk Space Requirements for Hosts.....	44
Table 3.6	The Number of LUs and the Number of Paths Guaranteed by HDLM.....	45
Table 3.7	Combination of Available Installation Methods and Installation Environments..	52
Table 3.8	Combination of Available Migration Methods and Migration Environments	53
Table 3.9	List of Files Inherited During an upgrade installation or re-installation.....	71
Table 3.10	List of Files Inherited During an upgrade installation or re-installation.....	75
Table 3.11	Default and Recommended Values for the Integrated Trace File Settings.....	90
Table 3.12	Reservation Policy Settings	98
Table 3.13	Thunder 9500V Series settings for using HACMP.....	99
Table 3.14	TagmaStore AMS/WMS Series settings for using HACMP.....	99
Table 5.1	HDLM Command Operations and Functions	138
Table 5.2	Default Values and Recommended Values	151
Table 5.3	Relations Between the Setting and Available Operations for Automatic Failback and Intermittent Error Monitoring.....	158
Table 5.4	Displayed Program Information	164
Table 5.5	Items that Can Be Selected by the <code>-path -item</code> Parameter and Parameter Values That Can Be Specified After The <code>-path -item</code> Parameter	168
Table 5.6	Items Displayed by the <code>dlnmgr view -lu -item</code> Command and the Values of the <code>-item</code> Parameter.....	170
Table 5.7	Correspondence Between the Item Displayed by the <code>dlnmgr view -lu -c -item</code> Command and the Value of the <code>-item</code> Parameter.....	172
Table 5.8	Description of HDLM Function Settings	175
Table 5.9	Description of HDLM Manager Information	176
Table 5.10	Description of the HDLM Alert Driver Information	177
Table 5.11	Description of the HDLM Driver Information	177
Table 5.12	Description of the HDLM License Information	178
Table 5.13	Description of the Path Information	179
Table 5.14	Path Status and Contents Displayed in IEP When Intermittent Error Monitoring is Enabled	182

Table 5.15	Path Status and Contents Displayed in IEP when Intermittent Error Monitoring is Enabled	182
Table 5.16	Items Displayed as HBA Port Information	183
Table 5.17	Items Displayed as CHA Port Information	183
Table 5.18	Device Information Using Host LUs as a Sorting Key	187
Table 5.19	Displayed LU information	188
Table 5.20	Items That Can Be Selected with the -item Parameter	191
Table 5.21	Items that can be Selected with the -lu -c -item Parameter	194
Table 5.22	Items Displayed as the Correspondences Between hdisks, OS Management Path IDs, and LDEVs	195
Table 6.1	Examples of the Starting Time of the Host and the Execution Time of the Utilities	198
Table 6.2	Error Information Collected by the DLMgetras Utility.....	200
Table 8.1	Message ID Format	226
Table 8.2	Terms in Messages	226
Table 8.3	HDLM Command Messages (dlnkmgr and operations)	227
Table 8.4	HDLM API Messages	242
Table 8.5	HDLM Manager Messages	244
Table 8.6	HDLM Driver (Filter Component) Messages.....	251
Table 8.7	HDLM Alert Driver Messages	253
Table 8.8	HDLM Driver (Core Logic Component) Messages	257
Table 8.9	HDLM Management Target Messages	257
Table 8.10	HDLM Installation Program Messages	261
Table 8.11	Messages from the Error Information Collection Utility	267
Table 8.12	Messages from the Utility for Deleting HDLM Drivers	274
Table 8.13	Messages from the Utility for Clearing HDLM Persistent Reservation.....	276
Table 8.14	Messages from the Utility for Setting the HDLM Execution Environment ODM	278
Table 8.15	Messages from HDLM remote access interface	280
Table 8.16	Messages from Utility for HDLM Installation Configuration Support	282
Table 8.17	Messages from the Utility for Assisting HDLM Migration	285
Table 8.18	Messages from the Utility Executed before Uninstalling HDLM.....	288
Table 8.19	Return Codes for the HDLM Remote Access Interface.....	289

Chapter 1 Overview of HiCommand® Dynamic Link Manager (HDLM)

This chapter introduces the HiCommand® Dynamic Link Manager software:

- About the HiCommand® Dynamic Link Manager (HDLM) (see section 1.1)
- Major Features (see section 1.2)

1.1 About the HiCommand Dynamic Link Manager (HDLM)

The HiCommand Dynamic Link Manager (HDLM) licensed software manages access paths to storage for the Hitachi Freedom Storage family of disk array subsystems. HDLM uses MPIO functionality supported by AIX 5.2 and 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 illustrates a typical connection between hosts and storage. A server on which HDLM is installed is called a *host*.

HDLM supports the following Hitachi Freedom Storage disk array subsystems:

- Hitachi TagmaStore Universal Storage Platform (USP)
- Hitachi Universal Storage Platform V
- Hitachi Lightning 9900 V Series
- Hitachi TagmaStore AMS/WMS Series
- Hitachi Thunder 9500 V Series

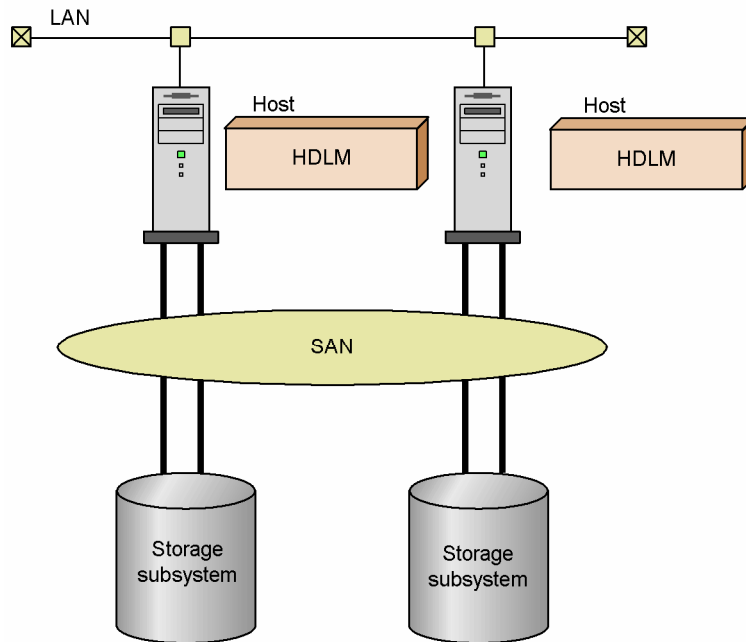


Figure 1.1 Connection between Hosts and Storage

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1.2 Major Features

The major functions of HDLM are:

- **Load balancing:** When multiple paths connect a host and storage, HDLM distributes the load across multiple paths to prevent a heavily loaded path from affecting processing speed.

For details on load balancing, see section 2.6.

- **Path Failover:** When multiple paths connect a host and storage, HDLM switches to an alternate path if a failure occurs on the active path, allowing processing to continue without interruption.

For details on failover, see section 2.7.

- **Failback:** When a previously failed path becomes available, HDLM places the recovered path back online. This ensures that the maximum number of paths is always available for load balancing and failover. Both failover and failback using path switching.

For details on failback, see section 2.7.

- **Path health checking:** HDLM automatically checks the path status at regular intervals specified by the user, eliminating the need to repeatedly perform manual path status checks.

For details on path health checking, see section 2.9.

Chapter 2 HDLM Configuration and Operations

This chapter describes the HDLM configuration and operations. Initially, the HDLM management targets, system configuration, and basic terms are described.

- Devices Managed by HDLM (see section 2.1)
- System Configuration (see section 2.2)
- LU Configuration (see section 2.3)
- HDLM program Configuration (see section 2.4)
- HDLM Driver and hdisk (see section 2.5)
- Load Distribution Using Load Balancing (see section 2.6)
- Failover and Failback Using Path Switching (see section 2.7)
 - Automatic path switching (see section 2.7.1)
 - Manual path switching (see section 2.7.2)
 - Path status transition (see section 2.7.3)
- Monitoring Intermittent Errors (Auto Failback Used) (see section 2.8)
- Detecting Errors by Using Path Health Checking (see section 2.9)
- Error Management (see section 2.10)
 - Log collected (see section 2.10.1)
 - Error information filtering (see section 2.10.2)
- Cluster Support (see section 2.11)

2.1 Devices Managed by HDLM

Devices that can and cannot be managed by HDLM are shown below. The devices that can be managed by HDLM are called *HDLM management-target devices*.

- Devices that HDLM can manage:
 - SCSI devices in Hitachi storage subsystems
 - Boot disks (including boot disks on a client logical partition in a virtual I/O server environment)
 - Hitachi storage subsystem command devices (such as Hitachi RAID Manager command devices)
 - Dump devices
 - Swap devices
- Devices that HDLM cannot manage
 - SCSI devices other than those for Hitachi storage subsystems
 - Built-in disks in a host
 - Devices other than disks (tape devices, etc.)

2.2 System Configuration

HDLM manages routes between a host and a storage subsystem by using the SCSI driver. The host and storage subsystems 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 subsystem is a *port* (P) on a *channel adapter* (CHA).

A *logical unit* (LU) contained in a storage subsystem 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 section 5.7.

Figure 2.1 shows the HDLM system configuration.

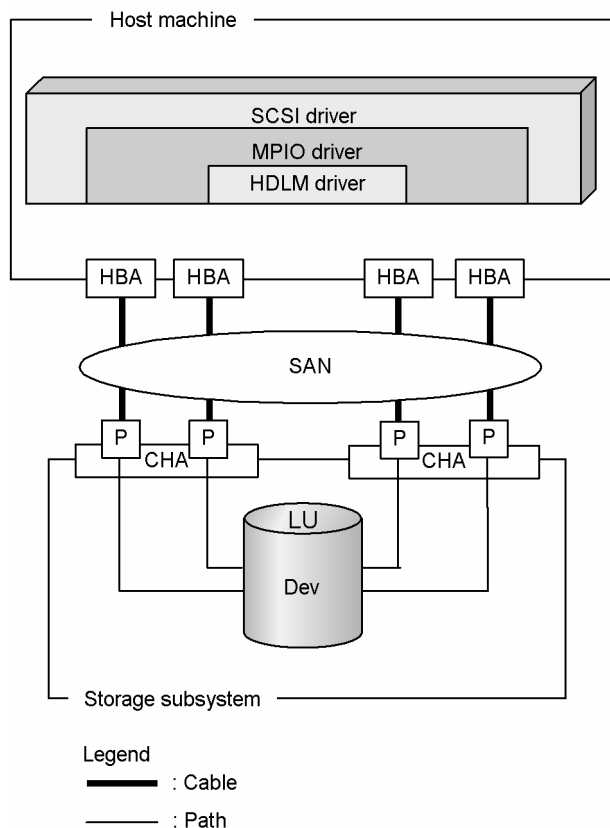


Figure 2.1 HDLM System Configuration

Table 2.1 describes the HDLM system components.

Table 2.1 HDLM System Components

Component	Description
HBA	A host bus adapter. This serves as a cable port on the host. All HBAs on the host must be the same type.
SAN	A dedicated network that is used for data transfer between the host machine and storage subsystems.
CHA	A channel adapter
P	A port on a channel adapter. This serves as a cable port on a storage subsystem.
LU	A logical unit (a logical volume defined on the storage subsystem). This serves as the target of input or output operations from the host.
Dev	An area in an LU.
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 subsystem LU are called *host devices* (HDev).

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

Figure 2.2 shows the LU configuration recognized by the host after HDLM installation.

Table 2.2 shows the components of the host. Table 2.3 specifies the maximum number of LUs and paths that can be managed by HDLM.

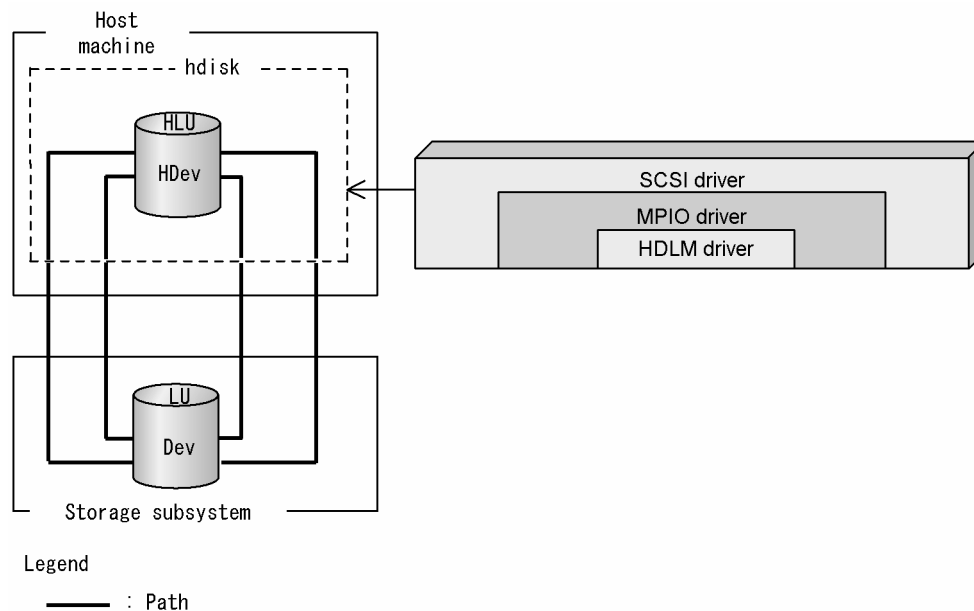


Figure 2.2 LU Configuration of the Host where HDLM is Installed and Correspondence with an hdisk

Table 2.2 Host Components

Component	Description
HDev	Host device, that is, a device within a host LU. (This device is called a <i>physical volume</i> in AIX.) The actual HDev entity is a device in the storage subsystem.
HLU	Host LU, that is, an LU that the host recognizes. The actual HLU entity is an LU in the storage subsystem.

Table 2.3 Maximum Number of LUs and Paths Supported by HDLM

Management Target	Maximum Number
LUs	4096
Paths for one LU	<ul style="list-style-type: none"> ▪ The reservation policy is <code>no_reserve</code>:64 ▪ The reservation policy is <code>PR_exclusive</code>, and storage is Lightning 9900V Series, USP, SVS: 64 ▪ The reservation policy is <code>PR_exclusive</code>, and storage is Thunder 9500V Series, TagmaStore AMS/WMS Series: 32
Total paths	8192

2.4 HDLM Program Configuration

HDLM runs as a combination of programs. Using HDLM requires that these programs be running normally.

Figure 2.3 shows the HDLM program configuration.

Table 2.4 lists and describes the functions of these programs.

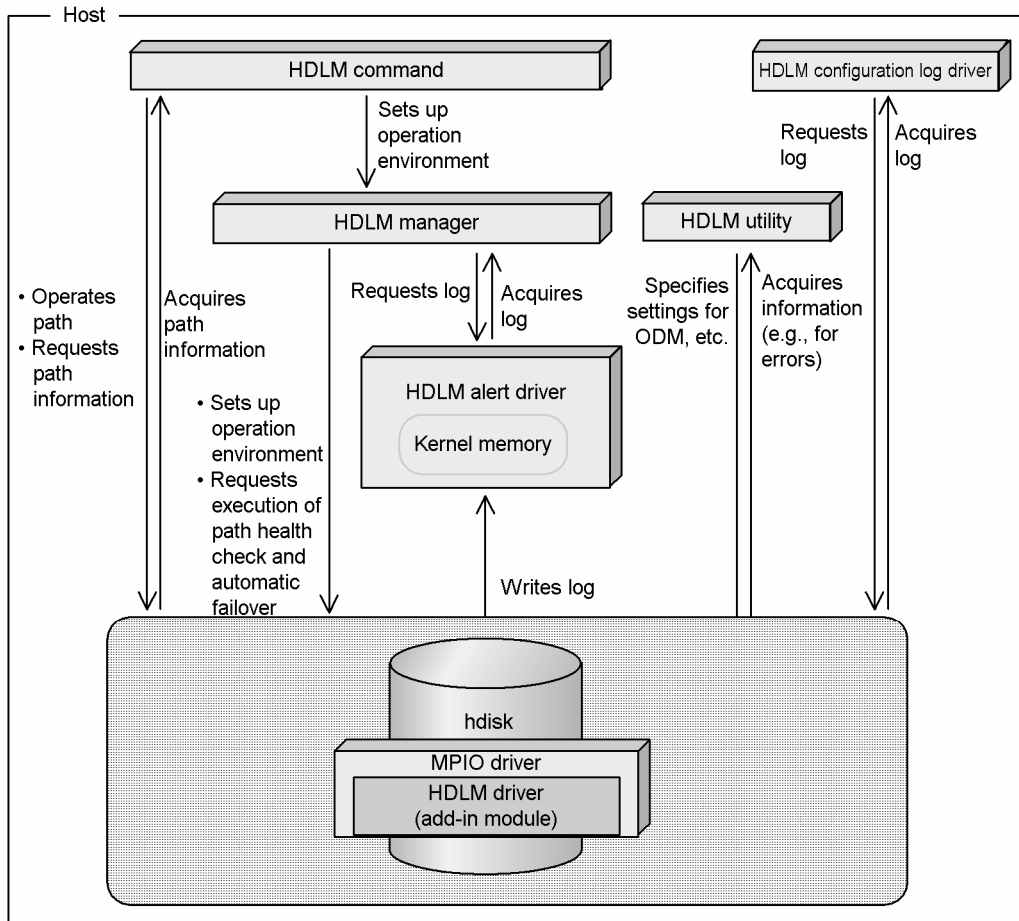


Figure 2.3 HDLM Program Configuration

Table 2.4 Functions of HDLM Programs

Program Name	Function
HDLM Utility	Provides the following functions: <ul style="list-style-type: none"> ▪ Collection of error information ▪ Migration of HDLM ▪ Clear HDLM persistent reservation ▪ Exclude the hdisk recognized as a boot disk from being an HDLM management target ▪ Definition of HDLM operations through ODM settings ▪ Delete the hdisk recognized as an HDLM management-target device ▪ Install HDLM
HDLM command	Provides the dlnkmgr command to manage paths, display error information, and set up the HDLM operating environment
HDLM manager	Configures the HDLM operating environment, requests the execution of path health checks and automatic failback, and collects error log data.
HDLM alert driver	Reports the error information detected by the HDLM driver to the HDLM manager
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 core logic component that controls the HDLM basic functionality and the filter component that sends and receives I/O.
HDLM configuration log driver	Acquires operation logs of the configuration processing for the HDLM driver.

2.5 HDLM Driver and hdisk

The HDLM driver is positioned above the SCSI driver and is an add-in module of MPIO 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 subsystem. Figure 2.4 shows the position of the HDLM driver and hdisk.

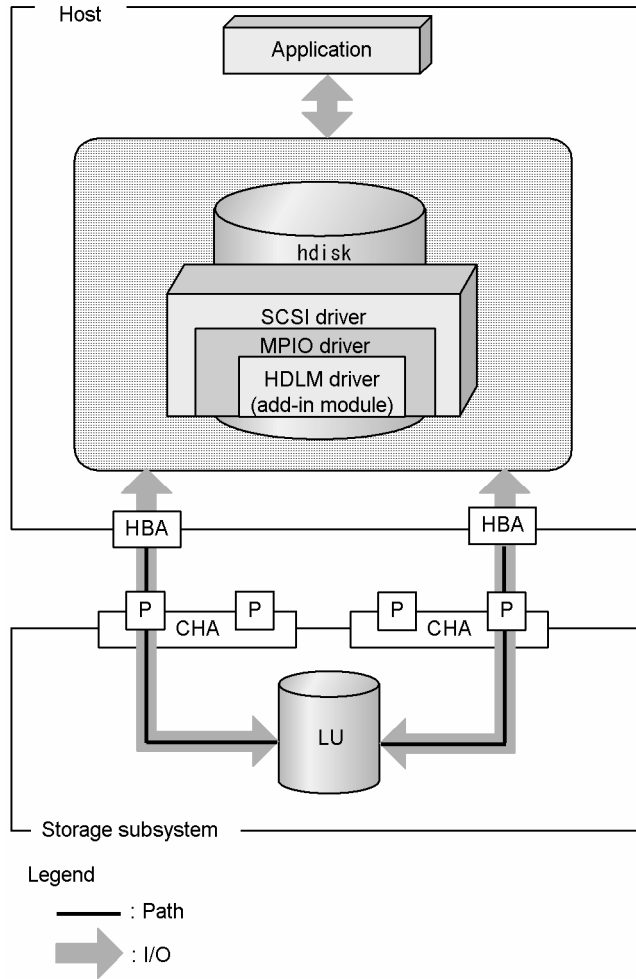
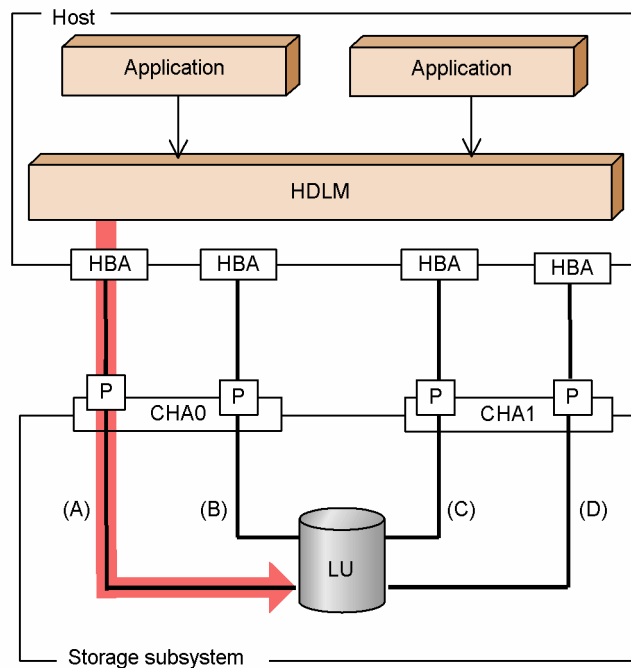


Figure 2.4 Position of the HDLM Driver And hdisk

2.6 Load Distribution Using Load Balancing

When multiple paths are connected to a device to an LU, HDLM can distribute the load across the paths by using multiple paths for I/O. This is called *load balancing* and it prevents a heavily loaded path from affecting the performance of the entire system.

Figure 2.5 shows the I/O flow when the load balancing function is not being used. Figure 2.6 shows the I/O flow when the load balancing function is being used. Both figures show an example of an I/O operation being issued for the same LU from multiple applications.

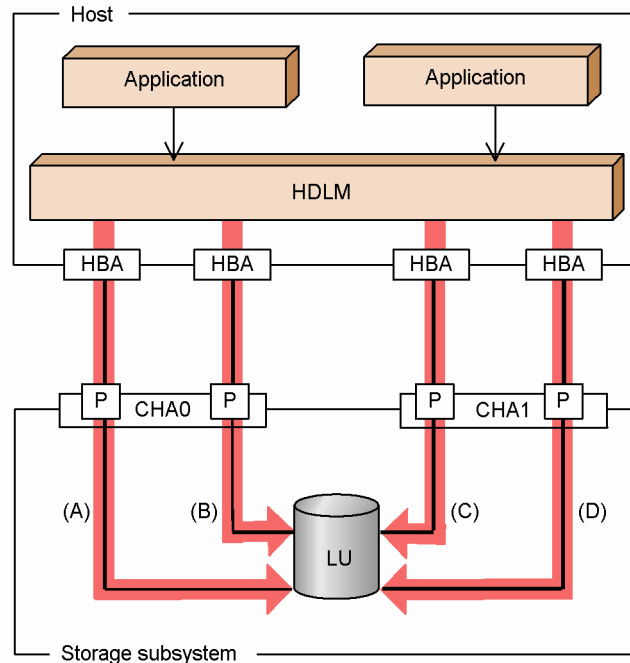


Legend

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

Figure 2.5 I/O Flow without Load Balancing Function

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



Legend

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

Figure 2.6 I/O Flow with Load Balancing Function

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

2.6.1 Load Balancing Range

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

- When Using the Thunder 9500V Series, or TagmaStore AMS/WMS Series:
 - HDLM performs load balancing between owner paths or between non-owner paths. An owner path is a path that passes through the channel adapter. This path is set on the owner controller of the storage subsystem LU. A non-owner path is a path that uses a channel adapter other than the owner controller (a non-owner controller). Since the owner controller varies depending on the LU, the owner path also varies depending on the LU. A path to be used is selected in the order of owner paths and then non-owner paths. To prevent performance in the entire system from deteriorating, HDLM does not perform load balancing between owner paths and non-owner paths. When some owner paths cannot be used due to a problem such as a failure, load balancing is performed among the remaining usable owner paths. When all owner paths cannot be used, load balancing is performed among the non-owner paths.
 - In Figure 2.7, suppose that the Thunder 9500V Series is being used, and the owner controller of LU is CHA0. When a device in LU is accessed, the load is balanced among the paths that access the target device via the paths (A) and (B) (that is, between owner paths). When the path (A) cannot be used due to a problem such as a failure, a device in LU can only be accessed via the path (B). When the paths (A) and (B) cannot be used, the load is balanced among the paths that access the target device via the paths (C) and (D) (that is, between non-owner paths).
- When Using the SVS, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V:
 - All the paths are owner paths. Therefore, HDLM performs load balancing among all the paths accessing the same device. When some paths cannot be used due to a problem such as a failure, load balancing is performed among the remaining usable paths.
 - In Figure 2.7, if the TagmaStore USP, SVS, or Lightning 9900V Series is being used, all the paths are owner paths. Therefore, when a device within LU is accessed, the load is balanced among the paths that access the target device via the paths (A), (B), (C), and (D). When one of the paths cannot be used due to a problem such as a failure, a device in LU can be accessed via the remaining paths.

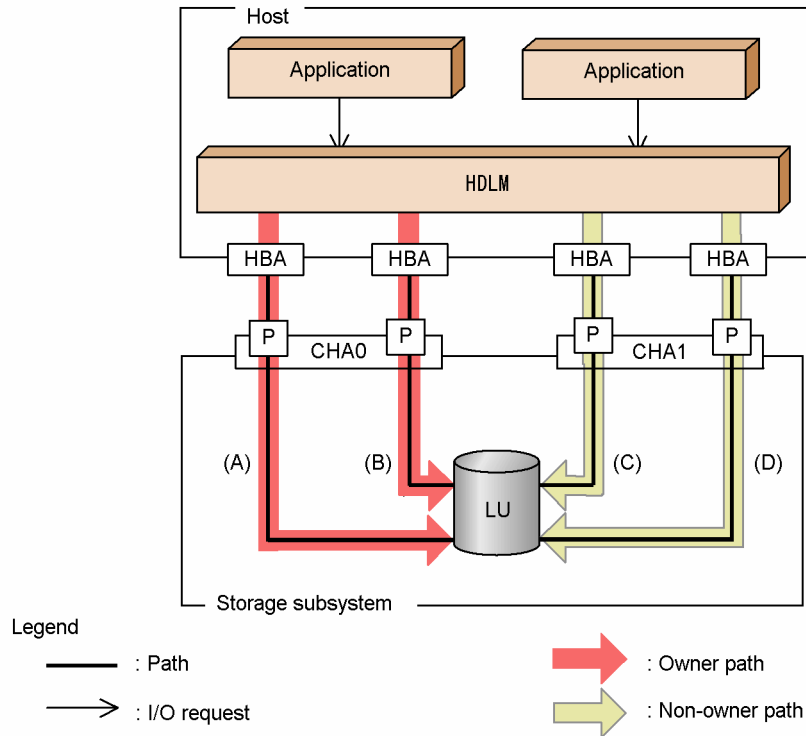


Figure 2.7 Overview of Load Balancing

2.6.2 Algorithms for Load Balancing

HDLM has the following two algorithms for load balancing:

- Round robin
Round robin distributes all I/Os among multiple paths.
- Extended round robin
Extended round robin distributes I/Os to paths depending on the type of the I/O, which can be either sequential access or random access. For sequential access, I/Os are issued to a single path. For random access, I/Os will be distributed to multiple paths.

Table 2.5 describes the type of load balancing (round robin and extended round robin) for each I/O operation type.

Table 2.5 Algorithms for Load Balancing

Algorithm	For Sequential Access	For Random Access
Round robin	<ul style="list-style-type: none"> ▪ After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path. ▪ The storage subsystem cache might not be fully usable. ▪ When multiple applications that request sequential access are run concurrently, we recommend that you use the round robin algorithm in order to distribute I/Os across multiple paths. (Note 1) 	

Algorithm	For Sequential Access	For Random Access
Extended round robin	<ul style="list-style-type: none"> ▪ After an I/O operation is issued to a path a certain number of times in succession, the path is switched to the next path. If sequential access is switched to random access before an I/O operation is issued to a path a certain number of times, the path is switched to the next path when sequential access is switched to random access. ▪ The storage subsystem cache can be used. ▪ When you execute only a single application that requests sequential access, such as a batch job running at night, we recommend that you use the extended round robin algorithm. (Note) 	After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path.

Note 1: The recommended algorithm depends on the type of applications, and the operations policy.

You can specify the load balancing function by the `dlnkmgr` command's `set` operation. For details on the `set` operation, see the descriptions of `set` in section 5.6.

Note: Some I/O operations managed by HDLM can be distributed across all paths, and some cannot. Thus, you should be aware that even when you use the load balancing function, I/O operations cannot always be allocated uniformly across all paths.

2.7 Failover and Failback Using Path Switching

When the system contains multiple paths to an LU and an error occurs in the path being used, HDLM can switch to another normal path to allow the system to continue to operate. This functionality is called *failover*.

When the path in which an error occurred recovers from the error, HDLM can switch to the recovered path. This functionality is called *failback*.

Two types of failover and failback are available:

- Automatic path switching
- Manual path switching

Note: When using the 9500V or TagmaStore AMS/WMS Series make sure to set the data share mode to **ON (Used)**. For details on setting the data share mode, see the User's Guide for the array.

Failover and failback change the path statuses and switch the paths. Path statuses are classified into *online* statuses and *offline* statuses. Online statuses allow the path to normally receive I/Os. Offline statuses prevent the path from receiving I/Os for the following reasons:

- An error occurred in the path.
- A user executed the HDLM command's offline operation. For details on the offline operation, see section 5.4.

Note: When using the TagmaStore AMS/WMS Series or Thunder 9500V series ensure that you set the data share mode to **ON (Used)**. For details on setting the data share mode, see the TagmaStore AMS/WMS Series, Thunder 9500V series documentation.

2.7.1 Automatic Path Switching

This section describes the automatic failover and automatic failback functions that are used to automatically switch a path.

2.7.1.1 About Automatic Failover

If you detect an error for a path in use, you can keep operating the system by changing the state to offline, and using other online paths. This functionality is called automatic failover. Automatic failover is applicable to the following levels of errors that occur on a path:

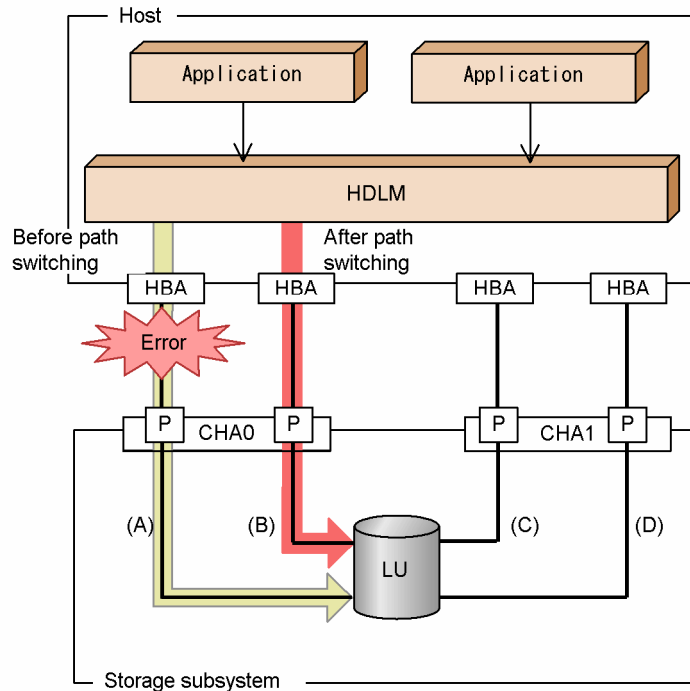
- Critical: A fatal error that may stop the system.
- Error: A high-risk error that can be avoided by using failover or other countermeasures.

For details on error levels, see Table 2.9.

When the TagmaStore AMS/WMS Series or Thunder 9500V Series is being used, HDLM selects the switching destination from the paths that access the same LU, in the order of owner paths and non-owner paths. For example, in Figure 2.8, the owner controller of LU is CHA0, and access to the LU is made only via the path (A). After the access path is placed offline, the first candidate for the switching destination is the path (B) and the second candidate is the path (C) or (D).

When the USP, Universal Storage Platform V, SVS, or 9900V is being used, all the paths are owner paths. This means that all the paths accessing the same device can be possible switching destinations. For example, in Figure 2.8, the LU is accessed using only path (A). After the access path is placed offline, the switching destination is one of paths (B), (C), or (D).

For all of the Hitachi Series listed above, when selecting a switching destination from owner paths or non-owner paths that access the same device, HDLM determines the appropriate destination by selecting the lowest value from the following keys, in order: the slot number, the CHA port number, and AutoPATH_ID. For more information, see section 2.7.1.2.



Legend

— : Path

→ : I/O request



: Path before switching



: Path after switching

Figure 2.8 Path Switching

2.7.1.2 Priority of Switching Destination Paths

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

If the architecture of the machine is CHRP, when selecting a switching destination from among paths that access the same LU, HDLM determines the appropriate destination by selecting paths from the following keys (in order from the lowest values): slot number (first key), CHA port number (second key), and AutoPATH_ID (third key).

If the machine has an architecture other than CHRP, HDLM determines the appropriate destination by selecting paths from the following keys (in order from the lowest values): CHA port number (first key) and AutoPATH_ID (second key).

This sub-section explains these keys.

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`.

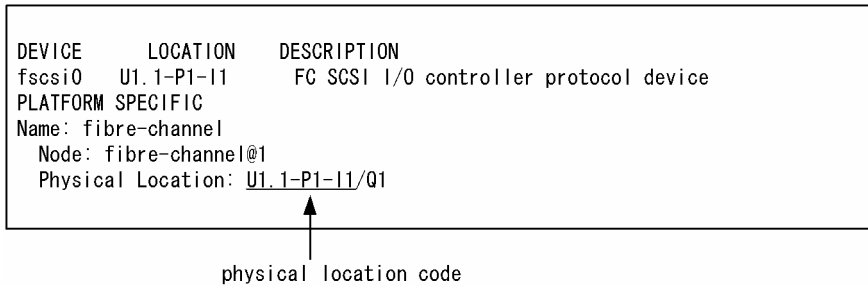
```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName  OSpaThID LDEV
000000 hdisk0    0000     9500V.0051.0005
000001 hdisk1    0000     9500V.0051.0015
000002 hdisk2    0000     9500V.0051.0020
000003 hdisk0    0001     9500V.0051.0005
000004 hdisk1    0001     9500V.0051.0015
000005 hdisk2    0001     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
```



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:

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 step 2 and 3.

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

CHA port number

The port number of the channel adapter.

You can check this number by using the `dlkmgr` command's `view` operation. For details on the `view` operation, see section 5.7.

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 `dlkmgr` command's `view` operation. For details on the `view` operation, see section 5.7.

2.7.1.3 About Automatic Failback

After a path recovers from an error, HDLM automatically places the recovered path online. This functionality is called *automatic failback*.

When using this function, HDLM monitors error recovery on a regular basis.

When using the Thunder 9500V or TagmaStore AMS/WMS Series, HDLM selects the path to use from online owner paths, and then from online non-owner paths. Therefore, if an owner path recovers from an error and HDLM automatically places the recovered path online while any non-owner path is in use, the path to use is switched to the owner path.

When the USP, Universal Storage Platform V, SVS, or 9900V 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 (**Note1**) occur in paths, the path status may frequently alternate between the online and offline status if you are using automatic failback, so the I/O performance might deteriorate. In such a case, if there is a path in which an intermittent error might be occurring, we recommend that you set up intermittent error monitoring to remove that path from those subject to automatic failback.

Note1: An intermittent error means an error that occurs irregularly because of some reason such as a loose cable connection.

You can specify the automatic failback function or the intermittent error by the `dlnkmgr set` command (see section 5.6).

Note: In AIX® 5.2, even if all faulty paths (offline paths) are recovered, and I/O processing is performed, the paths may not be brought online. In this case, make sure to change the paths to online after confirming that the faulty paths have been recovered.

2.7.2 Manual Path Switching

You can switch a path by manually placing a path online or offline. Manually switching a path temporarily is useful for maintenance of the system. You can manually place a path offline in the following ways:

- Execute the `dlnkmgr` command together with the `online` or `offline` operation.

Note: The status of the last path for a specific LU in offline status cannot be manually switched to offline. Also, the status of a path whose error has not been recovered cannot be switched to online.

HDLM selects the switching destination path the same way as for automatic path switching. When using the Thunder 9500V or TagmaStore AMS/WMS Series, HDLM selects the switching destination path from owner paths and then from non-owner paths. When the USP, Universal Storage Platform V, SVS, or 9900V 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 back to `online`. For details on the online operation, see section 5.5. After the path status is changed to online, HDLM selects the path to use in the same way as for automatic path switching, which is described in section 2.7.1. When using the Thunder 9500V Series or TagmaStore AMS/WMS Series HDLM selects the path to use from online owner paths, and then from online non-owner paths. When the USP, Universal Storage Platform V, SVS, or 9900V is being used, the path to use is not switched after changing the path status to online by using the `online` operation.

2.7.3 Path Status Transition

There are two types of path status: *online* and *offline*. Online means the status in which I/O can normally be received. Offline means the status in which I/O cannot be issued to the path for the following reasons:

- An error occurred in the path.
- A user executed the `dlnkmgr` command together with the `offline` operation. For details on the offline operation, see section 5.4.

Each of the online and offline statuses described in 2.7 is further subdivided into two statuses. The following explains the two online path statuses and the two offline statuses.

2.7.3.1 The Online Path Status

The online path statuses are as follows:

- `Online`: I/O can be issued normally.
- `Online(E)`: An error has occurred on the path and, among the paths that access the same LU, none of those are in the Online status.

If none of the paths accessing a single 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, by making sure that all paths are not offline.

The (E) indicates the error attribute, which indicates that an error occurred in the path.

2.7.3.2 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 section 5.4.

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

- `Offline(E)`: The status in which I/O cannot be performed because an error occurred in the path.

The (E) indicates the error attribute, which indicates that an error occurred in the path.

2.7.3.3 Correspondence Between Path Statuses Displayed by the OS and by HDLM

Table 2.6 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 `dlnkmgr` command's `view` operation is executed.

Table 2.6 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)

Figure 2.9 shows the status transitions of a path.

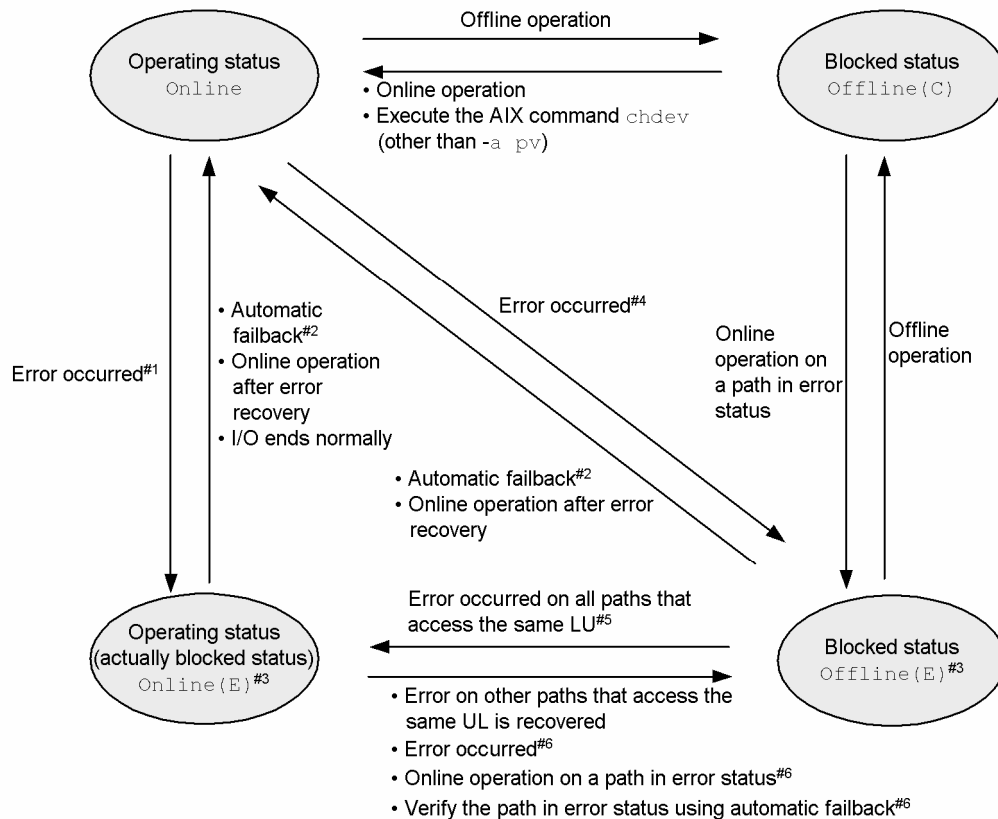


Figure 2.9 Path Status Transitions

Legend:

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

Offline operation: Offline operation performed by executing the `dlnkmgr` 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 hdiskn` 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 section 5.4.

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 made offline by using an HDLM command, `Offline (C)` might change to `Offline (E)`. If an offline operation was performed, wait for a fixed period of time (about 1 minute), check the path status by using an HDLM command, and make sure that the status has changed to `Offline (C)`. If it is `Offline (E)`, retry the offline operation.

2.8 Monitoring Intermittent Errors (Auto Failback Used)

An intermittent error means an error that occurs irregularly because of some reason such as a loose cable connection. I/O performance might decrease when an intermittent error occurs while automatic failback is used, because automatic failback is performed repeatedly. To prevent this phenomenon, HDLM can automatically remove the path where an intermittent error is occurring from those paths subject to automatic failback. This process is called intermittent error monitoring.

It is recommended that intermittent error monitoring be used along with automatic failback.

With intermittent error monitoring, 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 places the path online. Automatic failback is not performed for the path. This status is called *not subject to auto failback*.

2.8.1 Checking Intermittent Errors

You can check the path in which an intermittent error occurs by using the execution result of the HDLM command's view operation.

For details on the view operation, see section 5.7.

2.8.2 Setting up Intermittent Error Monitoring

When you use the intermittent error functionality, you can enable or disable the functionality. If you enable the functionality, specify the monitoring conditions: the error monitoring interval, and the number of times that the error is to occur. If an error occurs in a path the specified number of times within the specified error monitoring interval, the system determines that the path has an intermittent error. For example, if you specify **30** for the error monitoring interval and **3** for the number of times that the error is 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 **dlnkmgr** command's **set** operation.

Intermittent error monitoring can be used only when automatic failback is enabled. The setting value depends on the setting value for automatic failback. For details on how to set up the setting values, see sections 5.6.

2.8.3 Actions for Intermittent Error Monitoring

Intermittent error monitoring is performed for each path, and it starts when a path is recovered from an error by using automatic failback.

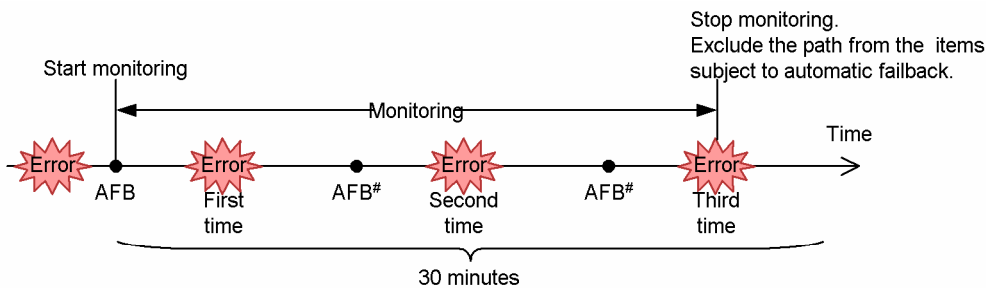
This subsection describes the following actions for intermittent error monitoring:

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

2.8.3.1 When an Intermittent Error Occurs

When an error occurs in a path the specified number of times within the specified interval, the path is determined to have an intermittent error, the error monitoring finishes, and then the path is removed from the items subject to automatic failback. The path that is removed from the paths that are subject to automatic failback has an error status until the online operation is performed properly. However, if the path satisfies certain conditions, it will be subject to automatic failover and change to online (Online). For details on the conditions, see Figure 2.10.

Figure 2.10 shows the action for intermittent error monitoring when an intermittent error occurs. In this example, the path is determined to have an intermittent error when the error occurs 3 or more times in 30 minutes. The event occurred in one path is described on the time arrow.



(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.

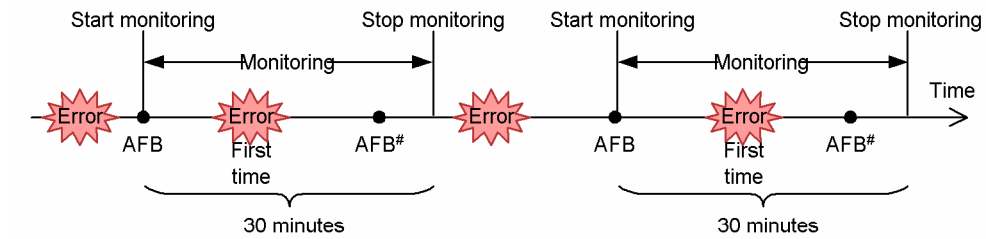
Figure 2.10 Action When an Intermittent Error Occurs in the Path

2.8.3.2 When an Intermittent Error Does Not Occur

If an error does not occur in the path the specified number of times within the specified interval, an intermittent error does not occur. In this case, the error monitoring finishes when the specified error monitoring interval finishes and the number of errors is reset to 0. If an error occurs in the path later, the error monitoring restarts at the time the path is recovered from the error by using automatic failback.

If errors occur after a long interval, an intermittent error can be detected by increasing the error monitoring interval or by decreasing the number of times that the error is to occur (in order for the system to determine that an intermittent error is occurring).

Figure 2.11 shows the action in intermittent error monitoring when an intermittent error does not occur. In this example, the path is determined to have an intermittent error if the error occurs three or more times in 30 minutes. The event occurring in one path is described on the time arrow.



(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.

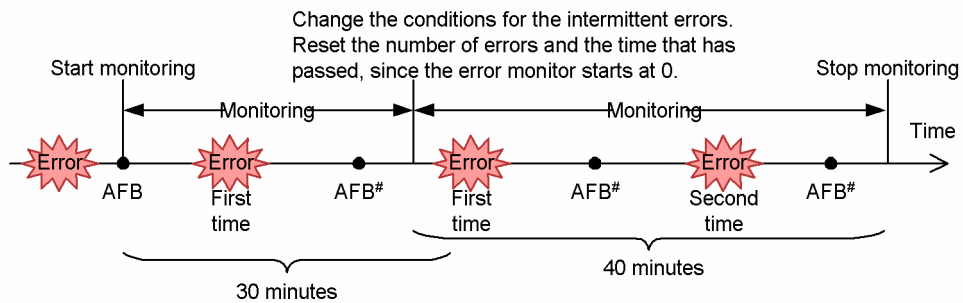
Figure 2.11 Action When an Intermittent Error Does Not Occur in the Path

2.8.3.3 When the Conditions for an Intermittent Error are Changed During Error Monitoring

When the conditions (error monitoring interval and the number of times that the error is to occur) for an intermittent error are changed during error monitoring, the number of errors and the time that has passed since the error monitoring started are reset to 0. The error monitoring does not finish and restarts from the time the conditions are changed.

When you change the conditions outside the error monitoring time, at the time the path is recovered from the error by using automatic failback, the error monitoring starts with the changed conditions.

Figure 2.12 shows the action for intermittent error monitoring when the conditions for an intermittent error are changed during error monitoring. In 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 occurring in one path are written on the time arrow.



(Legend)

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

#

This includes online operation performed by a user.

Figure 2.12 Action When the Conditions for the Intermittent Error are Changed During Error Monitoring

2.8.4 When User Operations Change the Intermittent Error Information

The following might be reset when the user changes the values set for an intermittent error or the path status: the number of errors that are counted during error monitoring, the time that has passed since error monitoring started, and the information about whether an intermittent error occurs (the path has been removed from those paths subject to automatic failback). Table 2.7 shows 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 **dlkmgr** 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 2.7 When User Operations Change 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 setting for intermittent error monitoring	Setting off	Reset	Reset (<i>Note 1</i>)
	Changing the conditions for an intermittent error during intermittent error monitoring	Reset (<i>Note 2</i>)	Inherit
	Setting on during error monitoring by executing the set operation (the conditions for the intermittent error monitoring are not changed)		
	Changing the setting for intermittent error monitoring to outside the error monitoring.	(Not applicable) (Not counted)	Inherit
Changing the automatic failback settings	Setting off	Reset	Reset
Changing the path status	Placing the path Offline(C)	Reset	Reset
	Placing the path Online outside the intermittent error monitoring	(Not applicable) (Not counted)	Reset
	Placing the path Online during the intermittent error monitoring	Inherit	(Not applicable) (If a path has been removed from the paths subject to automatic failback, that path is not monitored.)
Restarting the HDLM manager		Reset (<i>Note 3</i>)	Inherit
Restarting the host		Reset	Reset

Note 1: When you change the intermittent error monitoring functionality to off, information about paths not subject to automatic failback will be reset. When you change the intermittent error monitoring functionality to off and you do not want to reset information about paths not subject to automatic failback, place the target paths Offline(C).

Note 2: The number of errors is reset to 0, and then monitoring restarts in accordance with the changed monitoring conditions.

Note 3: The number of errors is reset to 0, and then monitoring restarts.

2.9 Detecting Errors by Using Path Health Checking

HDLM can check the status of paths at regular intervals and detect errors. This verification is called *path health checking*.

Without path health checking, an error is not detected unless I/O is performed. However, with path health checking, 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 switches the status of that path to **Offline (E)** or **Online (E)**, so you can check the path error using the view operation of the `dlnkmgr` command.

For example, in a normal state, I/O is not performed on the paths of the standby host in the cluster configuration or on the non-owner paths (that is, some of the paths that access the Thunder 9500V Series and TagmaStore AMS/WMS Series storage subsystems). Because of this, for the standby host or 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 recent path-status information when selecting the switching destination.

You can configure path health checking by executing the `dlnkmgr` command's **set** operation. For details on the set operation, see section 6.6.

2.10 Error Management

For troubleshooting, HDLM collects information into log files. The error information can be filtered according to the error level, and collected into the log files.

Figure 2.13 shows the data flow when collecting error information in logs.

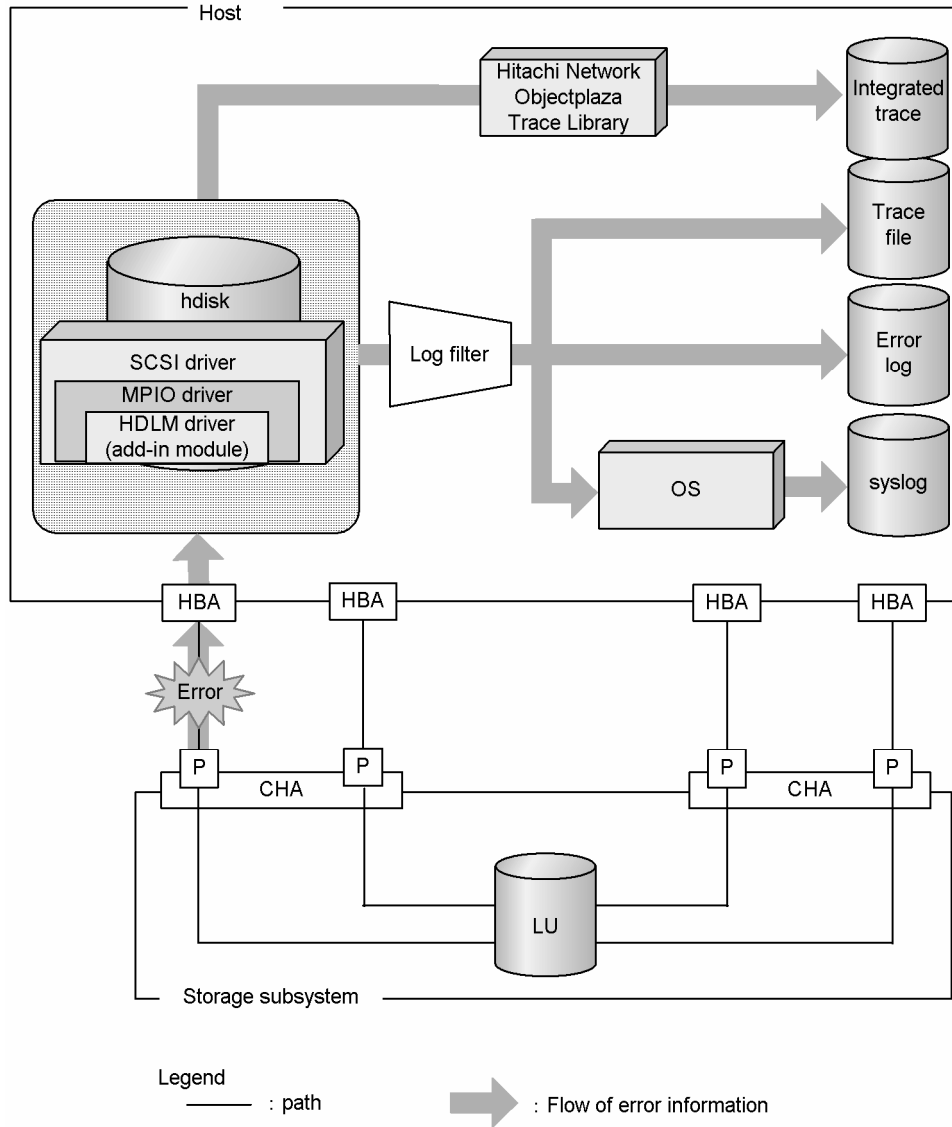


Figure 2.13 Error Management

Logs might be collected in layers lower than HDLM, such as for the HBA driver. For details on the logs, see the documentation that accompanies your AIX system.

2.10.1 Logs Collected

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

Table 2.8 describes the different logs.

Table 2.8 Log Descriptions

Log Name	Description	Output Destination
Integrated trace file	Operation logs of the HDLM command are collected.	The default file path is /var/opt/hitachi/HNTRLib2/spool/hntr2[1-16].log. To specify the output destination directory and the file prefix for the integrated trace file, use a utility of Hitachi Network Objectplaza Trace Library (HNTRLib2).
Trace Files	Trace information on the HDLM manager is collected for the level set by the user. If an error occurs, you might need to change the settings to collect trace information.	The trace file name is /var/DynamicLinkManager/log/hdlmtr[1-64].log
Error log	Error information for the user-defined level is collected from detected errors. By default, HDLM collects all detected error information.	HDLM Manager logs: /var/DynamicLinkManager/log/dlmmgr[1-16].log HDLM remot access interface logs: /var/DynamicLinkManager/log/dlmwebagent[1-N].log The value <i>n</i> depends on the setting in the file <i>dlmwebagent.properties</i> .
Syslog	The HDLM messages on or above the level set by the user with <i>/etc/syslog.conf</i> 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 <i>/etc/syslog.conf</i> . 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. To collect HDLM Inquiry logs, perform the log collection settings by using the <i>dlmodmset</i> utility (the utility for setting the HDLM execution environment ODM).	HDLM Inquiry logs: /var/DynamicLinkManager/log/dlminquiry[1-2].log
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 section 2.10.2.

2.10.2 Error Information Filtering

Errors that HDLM detects are classified into error levels. Table 2.9 shows the error levels, listed in order of adverse effect on the system. Error information collected for a log is filtered according to error level. 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.

Table 2.10 lists and describes the logging levels for the HDLM error log. For details on setting the logging levels, see section 5.7.

HDLM also includes a trace file output function provided by the Hitachi Network Objectplaza Trace Library (HNTRLib) software. Table 2.11 lists and describes the HDLM trace levels.

Note: HDLM has an error information collection utility (DLMgetras) which allows you to collect detailed information, such as trace files, definition files, core files, and libraries, required for analyzing errors (see section 6.1). The collected information is intended for use by the Hitachi Data Systems maintenance personnel.

Table 2.9 Error Levels

Error Level	Meaning
Critical	Fatal errors that may stop the system.
Error	Errors that crucially affect the system. This type of error can be avoided by using failover or other countermeasures.
Warning	Errors that enable the system to continue but, if left, might cause the system to operate improperly.
Information	Information that indicates the operating history when the system operates normally.

Table 2.10 Error Logging Levels

Description
Does not collect an error log
Collects error information at the Error level or higher
Collects error information at the Warning level or higher
Collects error information at the Information level or higher (all levels) (this is the default setting)

Table 2.11 Trace Levels

Description
Does not output any trace. This is the default trace level setting
Outputs error information only
Outputs a summary of program operation
Outputs the details of program operation
Outputs all information (error information, summary of program operation, and details of program operation)

2.10.3 Collecting Error Information Using the DLMgetras Utility

HDLM has a utility for collecting HDLM error information, the DLMgetras utility.

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 section 6.1.

2.11 Cluster Support

HDLM is also available for cluster configurations.

HDLM supports the cluster software listed below.

- GPFS + RVSD
- HACMP
- Oracle Real Application Clusters
- VCS

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

The details of host switching depends on the application.

Important Notes:

- To use HDLM in a cluster configuration, HDLM must be installed on all the hosts that comprise the cluster configuration.
- 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 using HACMP, GPFS, Oracle RAC 10g or VCS, settings such as script registration and the reservation policy settings must be performed. For details on the settings to enable use of clusters, see the following appropriate section:
 - For HACMP, see section 3.10.
 - For GPFS, see section 3.11.
 - For Oracle RAC 10g, see section 3.12.
 - For VCS, see section 3.13.

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: 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 Appendix A.

- System Requirements (section 3.1)
- Flow for creating an HDLM environment (section 3.2)
- Notes on creating an HDLM environment (section 3.3)
- Notes on Creating an HDLM Environment (section 3.4)
- Installing HDLM (section 3.5)
- Checking the path configuration (section 3.6)
- Setting up HDLM (section 3.7)
- Setting up integrated traces (section 3.8)
- About the Reservation Policy (section 3.9)
- Settings for using HACMP (section 3.10)
- Settings for using GPFS + RVSD (section 3.11)
- Settings for using Oracle RAC 10g (section 3.12)
- Settings for using VCS (section 3.13)
- Uninstalling HDLM (section 3.14)

3.1 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 Applicable Hardware Models

3.1.1.1 Applicable Host

You can install HDLM on a host running an OS shown in Table 3.1.

Table 3.1 Applicable OSs for the Host

OS	Kernel
AIX 5.2	Technology Level 09
AIX 5.3	Technology Level 04 and 05
AIX 5.3 (Virtual I/O Server)	ioslevel 1.3.0.0

3.1.1.2 Applicable Host Bus Adapter (HBA)

For details about applicable host bus adapters (HBAs), see *HDLM Release Notes*.

3.1.1.3 Applicable Storage

HDLM supports the following storage subsystems:

Thunder 9500V Series, Lightning 9900V Series, SVS, TagmaStore AMS, TagmaStore NSC 55, TagmaStore USP, TagmaStore WMS, XP128/XP1024/XP10000/XP12000/XP24000, and Hitachi Universal Storage Platform V.

The applicable storage subsystems 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 subsystems.

For details about the micro-programs, see *Release Notes*.

3.1.2 Prerequisite Programs

Before you install HDLM, confirm that one of the following prerequisite programs has been installed:

- VisualAge C++ Runtime 5.0.0.0 or later, or IBM XL C/C++ V7 Runtime 7.0.0.0 to IBM XL C/C++ V8 Runtime 8.0.0.0, 8.0.0.6, 8.0.0.7 (8.0.0.1 to 8.0.0.5 are not supported).

Use the following command to check the Runtime version.

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

- HTC-ODM 5.0.52.1 or later

If you are using any of the following storage subsystems, use HTC-ODM 5.0.52.1 or later:

- Thunder 9500V series
- Lightning 9900V series (excluding XP series)
- TagmaStore AMS/WMS series
- TagmaStore USP (excluding XP series)
- Universal Storage Platform V (excluding XP24000)

- XP-ODM 5.0.52.1 or later

If you are using the following storage subsystem, use XP-ODM 5.0.52.1 or later:

- XP series

3.1.3 Related Programs

3.1.3.1 When Combining Cluster Configurations

Table 3.2 Related Programs when Combining Cluster Configurations

OS	Related Programs
AIX 5.2	<ul style="list-style-type: none"> ▪ HACMP 5.2 ▪ HACMP 5.3 IY56554, IY72649, IY75002 ▪ HACMP 5.4 IY84921
	<ul style="list-style-type: none"> ▪ Oracle RAC 10g 10.2.0.2.0 + HACMP 5.2 ▪ Oracle RAC 10g 10.1.0.5.0 + ASM
	<ul style="list-style-type: none"> ▪ VERITAS Cluster Server 4.0^{#1} ▪ VERITAS Cluster Server 4.0.3^{#1}
	<ul style="list-style-type: none"> ▪ GPFS 2.3 + RVSD IY47306 ▪ GPFS3.1 ▪ GPFS3.1 + RVSD

OS	Related Programs
AIX 5.3	<ul style="list-style-type: none"> ▪ HACMP 5.2 IY58496 ▪ HACMP 5.3 IY75002, IY78404 ▪ HACMP 5.4 IY84920
	<ul style="list-style-type: none"> ▪ Oracle RAC 10g (10.1.0.5.0, 10.2.0.2.0) + HACMP 5.2^{#2} ▪ Oracle RAC 10g 10.1.0.5.0, + ASM^{#2} ▪ Oracle RAC 10g 10.2.0.2.0 without ASM^{#2} ▪ Oracle RAC 10g 10.2.0.2.0 + ASM^{#2}
	<ul style="list-style-type: none"> ▪ VERITAS® Cluster Server 4.0.2^{#1} ▪ VERITAS Cluster Server 4.0.3^{#1}
	<ul style="list-style-type: none"> ▪ GPFS 2.3 IY63969 ▪ GPFS 2.3 + RVSD PTF U801290 ▪ GPFS3.1 ▪ GPFS3.1 + RVSD
AIX 5.3 (Virtual I/O Server)	<ul style="list-style-type: none"> ▪ HACMP 5.2 Client APAR: IY68371, IY68387 Client rsct: rsct.basic.hacmp 2.4.2.1, rsct.basic.rte 2.4.2.2 ▪ HACMP 5.3 Client APAR: IY78404 ▪ HACMP 5.4 Client APAR: IY84920

#1

Does not support VxVM.

#2

When using Technology Level 05, apply IY92037.

3.1.3.2 To Convert Data with Intermediate Volumes Managed by Hitachi RapidXchange (*1)

Table 3.3 Related Programs to Convert Data with Intermediate Volumes Managed by Hitachi RapidXchange

OS	Related Programs
AIX 5.2 AIX 5.3	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

3.1.4 Memory and Disk Space Requirements

3.1.4.1 Memory Requirement

Table 3.4 shows the memory requirements for the host.

Table 3.4 Memory Requirements for the Host

OS	Required Memory
AIX	$50000 \text{ KB} + 0.256 \text{ KB} \times \text{number-of-LUs} + 1.28 \text{ KB} \times \text{number-of-paths}$

3.1.4.2 Disk Space Requirements

Table 3.5 lists the disk space requirements for the host.

Table 3.5 Disk Space Requirements for Hosts

Directory	Disk Space Requirement
/etc	150 KB
/opt	2 MB
/usr	220MB
/var	p MB #1 + 4MB + 2 MB + q MB#2 + 19 MB

#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.

3.1.5 The Number of Paths Guaranteed by HDLM

Table 3.6 shows the number of LUs, the number of paths available to connect to a LU, and the total number of paths whose operations are guaranteed by HDLM.

Table 3.6 The Number of LUs and the Number of Paths Guaranteed by HDLM

Item	Maximum Value
Number of LUs	4,096
Number of paths available to connect to an LU	64 [#]
Number of paths for a boot disk	4
Total number of paths	8,192

#

When the reservation policy is `PR_exclusive`, and the Thunder 9500V Series or TagmaStore AMS/WMS Series is used, the number of paths available to connect to an LU is 32.

For details on reservation policy, see section 3.9.

3.2 Flow for Creating an HDLM Environment

Set up the environment to use HDLM as follows.

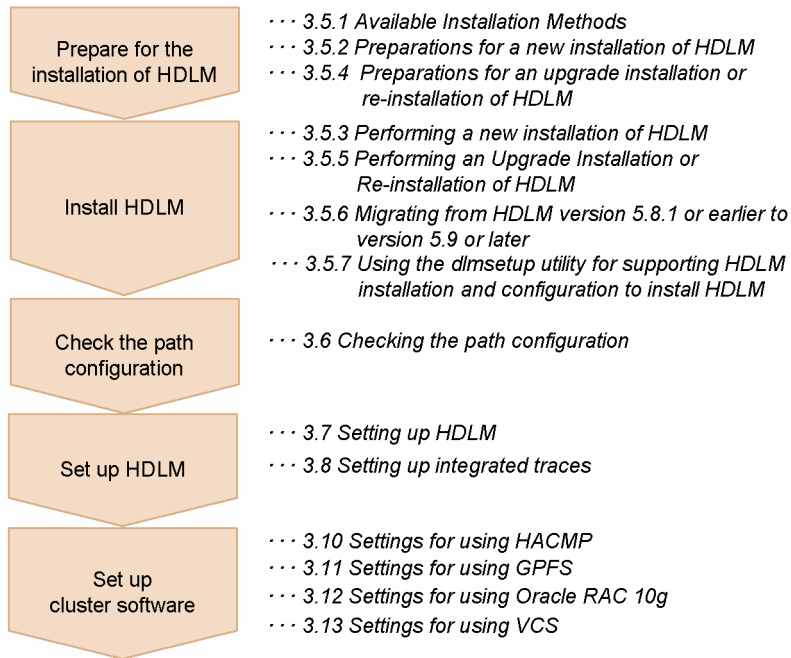


Figure 3.1 Flow of HDLM Environment Setup

3.3 Types of HDLM Installation

This section defines 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 HDLM version 5.9.1 without first uninstalling HDLM version 5.9 is called an *upgrade installation*.

You can perform an upgrade installation only on 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 section 3.5.6, 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 HDLM is called *re-installation* of HDLM.

3.4 Notes on Creating an HDLM Environment

This section gives notes on creating an HDLM environment. For details about notes on operating HDLM, see section 4.1.

3.4.1 Notes on installing HDLM

- Install HDLM on the boot disk.
- A license key is necessary to install HDLM.
- The HDLM-dedicated device files below are created when HDLM is installed. Do not use these device files.

```
/dev/dlmdrv
```

```
/dev/rdlmfdrvio
```

```
/dev/rdlmcldrv
```

- HDLM version 5.9 or later cannot co-exist with Auto-Path, Auto Path XP, Hitachi Path Manager, or HDLM version 5.8.1 or earlier. Before installing HDLM, you must uninstall any installed copies of these products. For details on migrating from HDLM version 5.8.1 or earlier, see section 3.5.6.
- When HDLM is installed, all devices shown under *Devices that HDLM can manage* in section 2.1 are set to be targets for HDLM management.
- When HDLM is installed in a boot disk environment, the HDLM installation configuration support utility (`d1msetup`) cannot be executed.
- When installing HDLM on a host where a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during 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 3.9 in section 3.5.5.
- 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 (`d1mpr`) to release the LU reservation, if necessary.

- Performing an upgrade installation or re-installation might change the physical volume (`hdiskn`). 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 `dlnkmgr view -drv` command to check the correspondence between the `hdisk` and the LU.

3.4.3 Notes on the virtual I/O server

- If you want to use the Virtual I/O server functionality, install HDLM into the Virtual I/O server partition. Installation on the client partition is not supported.
- 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 and follow the installation procedure in section 3.5.3 and 3.5.5.
- 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`.

3.4.4 Notes on a license key

- A license key is required when performing one of the following types of installation:
 - Performing a new installation of HDLM.
 - Migrating from HDLM version 5.8.1 or earlier to version 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 section 5.6.

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 and 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 subsystems

- Do not change the vendor ID or product ID of a storage subsystem. If you do, HDLM will not be able to recognize the storage subsystem.
- Before you connect multiple Thunder 9500V Series devices to the same host, make sure that the devices 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 subsystem 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 subsystem, 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, 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.

For GPFS: 3.11.

For Oracle RAC 10g: 3.12.

For VCS: 3.13.

3.4.8 Notes on the automatic failback

If the automatic failback processing starts before a path failure has been recovered, 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)

= *number-of-paths-to-the-same-LU* x *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.

Important: Before installing HDLM you must connect the storage subsystem (present a LUN) to the server in which you are installing HDLM.

3.5.1 Available Installation Methods

To install HDLM, use one of the following procedures:

- Use the SMIT, or the `installp` command.
You can also copy the contents of the HDLM CD-ROM to a desired directory, and then perform installation from that directory.

Copy the following files from the installation CD-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 CD-ROM have been copied.

- Use the utility for HDLM installation configuration support.
For details about the installation procedure using the `d1msetup` utility, see section 3.5.7.

You can install HDLM in the following environments:

- Host
- 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.

3.5.1.1 When Performing a New Installation, Upgrade Installation, or Re-installation of HDLM

Table 3.7 lists the combinations of available installation methods and installation environments.

Table 3.7 Combination of Available Installation Methods and Installation Environments

Installation Method	Installation Environment			
	Host		Virtual I/O Server	
	Non-Boot Disk Environment	Boot Disk Environment	Non-Boot Disk Environment	Boot Disk Environment

<code>installp</code> command	Yes	Yes	Yes	Yes
SMIT	Yes	Yes	Yes	Yes
<code>dlnsetup</code> utility	Yes	No	Yes	No

Legend:

Yes: Can be executed

No: Cannot be executed

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

`installp` command

Section 3.5.2 and Section 3.5.4.

`dlnsetup` utility

Section (3.5.7.1) and (3.5.7.2) in Section 3.5.7

To use SMIT, see the AIX documentation.

3.5.1.2 When Performing a Migration of HDLM

Table 3.8 lists the combinations of available migration methods and target environments.

Table 3.8 Combination of Available Migration Methods and Migration Environments

Migration Method	Migration Environment			
	Host		Virtual I/O server	
	Non-Boot Disk Environment	Boot Disk Environment	Non-Boot Disk Environment	Boot Disk Environment
<code>installp</code> command	Yes	N/A	Yes	N/A
SMIT	Yes	N/A	Yes	N/A
<code>dlnsetup</code> utility	Yes	N/A	Yes	N/A

Legend:

Yes: Can be executed

No: Cannot be executed

N/A: Not applicable

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

`installp` command

Section 3.5.6.

`dlnsetup` utility

(3.5.7.3) in Section 3.5.7

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.

3.5.2.1 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.

```
# mount -p
node      mounted      mounted over  vfs      date      options
-----
/dev/hd4   /            /            jfs      Feb 20 06:07  rw,log=/dev/hd8
/dev/hd2   /usr        /usr        jfs      Feb 20 06:07  rw,log=/dev/hd8
/dev/hd9var /var       /var       jfs      Feb 20 06:07  rw,log=/dev/hd8
/dev/hd3   /tmp       /tmp       jfs      Feb 20 06:07  rw,log=/dev/hd8
/dev/hd1   /home     /home     jfs      Feb 20 06:07  rw,log=/dev/hd8
/proc     /proc     /proc     procfs   Feb 20 06:07  rw
/dev/hd10opt /opt     /opt     jfs      Feb 20 06:07  rw,log=/dev/hd8
/dev/lv02  /mntpt    /mntpt    jfs      Feb 20 12:11  rw,log=/dev/loglv01
#
```

Figure 3.2 Execution Result Example of the mount -p Command (Preparations for a New Installation of HDLM)

The following example manages the device, which is showed in the shaded portion of Figure 3.2, 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
```

3.5.2.2 Set Up the Hardware

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

1. Set up the storage subsystem. For details on how to set up the storage subsystem, see the *Hardware Notes* that come with HDLM and the maintenance documentation for the storage subsystem. If you are using HACMP, see also section 3.10.1.
2. Set up the switches (as applicable). For more on how to set up a switch, please refer to the documentation accompanying the switch.
3. Set up the host bus adapter (HBA). For details on how to set up an HBA, please refer to the documentation accompanying the HBA.

Note: 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 `hdiskn`.

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

3.5.2.3 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:

```
# 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
```

3.5.2.4 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, please refer to the accompanying cluster software documentation.
2. Stop the cluster software services. For details on the installation, please refer to the accompanying cluster software.

3.5.3 Performing a New Installation of HDLM

3.5.3.1 Installing HDLM in a Non-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. 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 3.

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

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

```
# mkdir /cdrom
```

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

4. Mount the CD-ROM.

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

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

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

```
# /cdrom/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 path, 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/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: the `hdlm_license` and `dlm.lic_key` files are deleted after installation finishes successfully.

8. If you have not performed steps 3 to 6, insert the HDLM CD-ROM into the CD-ROM drive. You do not need to mount the CD-ROM. If you install HDLM by using a directory to which the CD-ROM is copied, you do not have to perform this step.

9. Execute the following command:

- When installing HDLM from the CD-ROM

```
# installp -aXgd CD-ROM-special-file-name all
```

- When installing HDLM from a directory copied from the CD-ROM

```
# installp -aXgd directory-copied-from-CD-ROM 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.

10. 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.

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

If you have performed steps 3 to 6, go to step 11.

If you have not performed steps 3 to 6, go to step 13.

11. Unmount the CD-ROM.

```
# umount /cdrom
```

12. Delete the created mount directory.

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

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

For details, see Table 8.14.

14. Execute the following command to configure the `hdisk`:

```
# cfgmgr
```

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

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

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

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

17. 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
```

18. Repeat steps 15 through 17 for each host bus adapter (HBA) being used.

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

```
# cfgmgr
```

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

```
# chdev -l hdiskn -a queue_depth=8 -a rw_timeout=60
```

21. Execute a following command 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 HDLM utility without setting the *PATH* environment variable, specify an absolute path to execute the commands.

22. Make sure that *hdisks* are available.

The following is an example of command execution:

```
# 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 *hdisks* are Available.

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

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

23. Execute the *dlnmgr* command's *view* operation to check the status of each program.

The following is a sample command execution:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version           : xx-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           : off
Intermittent Error Monitor : off
HDLM Manager Ver       WakeupTime
Alive                  xx-xx   yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver   WakeupTime           ElogMem Size
Alive                  xx-xx   yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver        WakeupTime
Alive                  xx-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.

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

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

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

25. From the execution result by 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 29.

26. 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 hdiskn -vadapter virtual-SCSI-server-adapter-name
```

Execute the following command on the virtual I/O server when creating the logical volume as a virtual target device:

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

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

```
# cfigmgr
```

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

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

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

29. Check the path configuration according to the procedure described in 3.8.

3.5.3.2 Installing HDLM in a Boot Disk Environment

To perform a new installation of HDLM:

1. Use a single-path configuration for host and storage subsystems.

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. 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 4.

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

4. If there is no directory for mounting the CD-ROM, make the directory.

```
# mkdir /cdrom
```

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

5. Mount the CD-ROM.

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

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

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

```
# /cdrom/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 path, and then re-execute the above utility.

Note: a `hdisk` recognized as a boot disk will not be deleted.

7. 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
```

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 (`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: the `hdlm_license` and `d1m.lic_key` files are deleted after installation finishes successfully.

- If you have not performed steps 4 to 7, insert the HDLM CD-ROM into the CD-ROM drive. You do not need to mount the CD-ROM. If you install HDLM by using a directory to which the CD-ROM is copied, you do not have to perform this step.

- Execute the following command:

- When installing HDLM from the CD-ROM

```
# installp -aXgd CD-ROM-special-file-name all
```
- When installing HDLM from a directory copied from the CD-ROM

```
# installp -aXgd directory-copied-from-CD-ROM 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.

- 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.

If you have performed steps 4 to 7, go to step 12.

If you have not performed steps 4 to 7, go to step 14.

- Unmount the CD-ROM.

```
# umount /cdrom
```

- Delete the created mount directory.

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

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

Do not execute the `cfgmgr` command.

- Execute the following command to restart the host

```
# shutdown -Fr
```

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

The following shows an example of command execution:

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

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

- Check the current boot disk list.

The following shows an example of command execution:

```
# bootlist -m normal -o
hdisk10 blv=hd5
```

```
hdisk0 blv=hd5
hdisk1 blv=hd5
```

18. Specify boot disks that are suitable for your host environment.

The following shows an example of command execution:

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

19. Make sure that, in the boot disk list, the number of specified boot disks (`hdisk10`) is the same as the number of paths that was checked in step 17.

The following shows an example of command execution:

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

20. Finish defining the parent device (`fscsin`). # `rmdev -l fscsin -R`

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

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

22. 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
```

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

```
# cfgmgr -l fscsin
```

24. Repeat steps 20 through 23 for each host bus adapter (HBA) being used.

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

```
# chdev -l hdiskn -a queue_depth=8 -a rw_timeout=60
```

26. Execute a following command 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 HDLM utility without setting the `PATH` environment variable, specify an absolute path to execute the commands.

27. Make sure that `hdisks` are available.

The following shows an example of command execution:

```
# 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 hdisks are Available.

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

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

After executing the `lspv` command, if there is no `hdisk` other than the one that constitutes `rootvg`, re-execute the procedure starting from step 15.

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

The following is a sample command execution.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version           : xx-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          : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive      xx-xx   yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver  WakeupTime      ElogMem Size
Alive      xx-xx   yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver       WakeupTime
Alive      xx-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.

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

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

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

30. From the execution result by 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 30.

31. 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 hdiskn -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
```

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

```
# cfmgr
```

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

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

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

34. Check the path configuration according to the procedure described in 3.8.

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.

Important: Before installing HDLM you must connect the storage subsystem (present a LUN) to the server in which you are installing HDLM.

3.5.4.1 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.

3.5.4.2 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.
4. 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.

```
# mount -p
node          mounted      mounted over  vfs      date      options
-----
/dev/hd4      /            /            jfs      Feb 20 06:07 rw,log=/dev/hd8
/dev/hd2      /usr        /usr        jfs      Feb 20 06:07 rw,log=/dev/hd8
/dev/hd9var   /var        /var        jfs      Feb 20 06:07 rw,log=/dev/hd8
/dev/hd3      /tmp        /tmp        jfs      Feb 20 06:07 rw,log=/dev/hd8
/dev/hd1      /home       /home       jfs      Feb 20 06:07 rw,log=/dev/hd8
/proc        /proc       /proc       procfs   Feb 20 06:07 rw
/dev/hd10opt  /opt        /opt        jfs      Feb 20 06:07 rw,log=/dev/hd8
/dev/lv02     /mntpt      /mntpt      jfs      Feb 20 12:11 rw,log=/dev/loglv01
#
```

Figure 3.3 Example of Results from Executing the Mount -p Command (Preparations for an upgrade installation or re-installation of HDLM)

This example uses HDLM to manage the devices that are shaded in Figure 3.3.

- Execute the following command to unmount the disk.
umount /mntpt
5. 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 describes how to perform an upgrade installation from HDLM version 5.9, or how to re-install HDLM version 5.9.1.

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 section 3.5.6.

3.5.5.1 Installing HDLM in a Non-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. Specify the `-A` parameter, as required, and execute the `dlmrmdev` utility for removing HDLM drivers.

When you specify the `-A` parameter and execute the `dlmrmdev` utility, steps 4 to 7 are executed in a batch. Unmount the file system used by HDLM to inactivate the volume group used by HDLM. If you specify the `-A` parameter and execute the `dlmrmdev` utility, steps 4 to 7 can be skipped. When `dlmrmdev` 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 was deleted
KAPL09012-I All HDLM drivers were removed.
```

- If you executed this step, proceed to step 8.
- If you did not execute this step, proceed to the following step.

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 following utility to remove, from the running kernel, the `hdisk` recognized as an HDLM management-target device, and then stop the HDLM manager:

```
# /usr/DynamicLinkManager/bin/dlrmdev
```

The `KAPL09012-I` message is displayed.

If the `KAPL09012-I` message is not displayed, the `hdisk` recognized as an HDLM management-target device has not been deleted, or the HDLM manager has not stopped. Make sure that no processes, services, file systems, or volume groups are using any HDLM management-target path, and then re-execute the above utility.

8. 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
```

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 (`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: the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

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

You do not need to mount the CD-ROM. If you install HDLM by using a directory to which the CD-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 CD-ROM

```
# installp --aXgd CD-ROM-special-file-name all
```

- When installing HDLM from a directory copied from the CD-ROM

```
# installp --aXgd directory-copied-from-CD-ROM 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 `KAPL09048-E` message is displayed, the `hdisk` for the device that is managed by HDLM still remains. Re-execute the procedure starting from step 7.

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

- When installing HDLM from the CD-ROM

```
# installp -aXFd CD-ROM-special-file-name all
```

- When installing HDLM from a directory copied from the CD-ROM


```
# installp -aXFd directory-copied-from-CD-ROM 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 KAPL09048-E message is displayed, the `hdisk` for the device that is managed by HDLM still remains. Re-execute the procedure starting from step 7.

- Execute the following command to make sure that the package is installed:

```
# lslpp -L 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.

- Execute the following command to make sure that the `hdisk`:

```
# cfgmgr
```

- Execute the following command to make sure that the `hdisks` 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 all the displayed HDLM-related devices are `Available`.

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

`hdisk 3` and subsequent are the logical device file names that correspond to physical volumes in the storage subsystem.

- Activate the volume group used by HDLM:

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

- Mount the file system used by HDLM:

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

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

The following is a sample command execution:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version           : xx-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          : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive      xx-xx      yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver WakeupTime      ElogMem Size
Alive      xx-xx      yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver      WakeupTime
Alive      xx-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 by the `view` operation, check that the correct version of HDLM is installed.

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

20. From the execution result by 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 3.9.

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 hdiskn -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:

```
# cfgmgr
```

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

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

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

Table 3.9 lists and describes the files that are inherited during an upgrade installation or re-installation of HDLM.

Table 3.9 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	HDLM remote access interface setting 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	HDLM remote access interface log file
/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

3.5.5.2 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 following utility to remove, from the running kernel, the hdisk recognized as an HDLM management-target device, and then stop the HDLM manager:

```
# /usr/DynamicLinkManager/bin/dlrmdev
```

The KAPL09012-I message is displayed.

If the KAPL09012-I message is not displayed, the hdisk recognized as an HDLM management-target device has not been deleted, or the HDLM manager has not stopped. Make sure that no processes, services, file systems, or volume groups are using any HDLM management-target path, and then re-execute the above utility.

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

7. 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
```

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 (`dln.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: the `hdlm_license` and `dlm.lic_key` files are deleted after installation finishes successfully.

9. Insert the HDLM CD-ROM into the CD-ROM drive.

You do not need to mount the CD-ROM. If you install HDLM by using a directory to which the CD-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 CD-ROM

```
# installp --aXgd CD-ROM-special-file-name all
```
- When installing HDLM from a directory copied from the CD-ROM

```
# installp --aXgd directory-copied-from-CD-ROM 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. If an upgrade installation ends with an error, HDLM might be uninstalled. In this case, proceed to step 13.

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

- When installing HDLM from the CD-ROM

```
# installp -aXFd CD-ROM-special-file-name all
```
- When installing HDLM from a directory copied from the CD-ROM

```
# installp -aXFd directory-copied-from-CD-ROM 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. If re-installation ends with an error, HDLM might be uninstalled. In this case, proceed to step 13.

12. 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 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 section 3.5.3.2:

```
# 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 procedure in section 3.5.3:

```
# shutdown -F
```

Execute the following command to shut down the host, and then perform the procedure in section 3.5.3:

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 subsystem'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 13.

16. Execute the `dlnkmgr` command's `view` operation to check the status of each program.

The following is a sample command execution.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version           : xx-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          : off
Intermittent Error Monitor : off
HDLM Manager Ver       WakeupTime
Alive      xx-xx   yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver  WakeupTime      ElogMem Size
Alive      xx-xx   yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver       WakeupTime
Alive      xx-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 by the `view` operation, check that the correct version of HDLM is installed.

If `HDLM Version` is `xx-xx`, the installed version of HDLM is correct. `xx-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 12.

18. From the execution result by 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 on the files to be inherited after the upgrade installation or re-installation of HDLM, see Table 3.10.

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 hdiskn -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:

```
# cfgmgr
```

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

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

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

Table 3.10 lists and describes the files inherited during an upgrade installation or re-installation of HDLM.

Table 3.10 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>	HDLM remote access interface setting 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.mmn	Trace management file
/var/DynamicLinkManager/log/dlmwebagent[1-16].log	HDLM remote access interface log file
/var/DynamicLinkManager/log/dlmutil[1-2].log	HDLM utility's log file
/var/DynamicLinkManager/log/mmap/dlmutil.mmn	HDLM utility's log trace management file

3.5.6 Migrating HDLM from Version 5.8.1 or earlier to Version 5.9 or later

You cannot perform an upgrade installation from HDLM version 5.8.1 or earlier to version 5.9 or later, so perform a migration instead. When you migrate from HDLM version 5.8.1 or earlier to version 5.9 or later, you must first uninstall HDLM version 5.8.1 or earlier. The ODM and HDLM settings can be inherited.

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 (`dlnfdrvn`) to `hdiskn`. 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
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
```

- 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
```

- 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
```

- Execute the following command to unmount the file system in the client logical partition:

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

- Execute the following command to delete the volume group in the client logical partition:

```
# reducevg -df volume-group-name hdiskn
```

- Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdiskn
```

- Execute the following command to delete the virtual target device in the virtual I/O server:

```
$ rmdev -dev vtscsin
```

- Insert the CD-ROM.

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

```
# mkdir /cdrom
```

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

- Mount the CD-ROM.

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

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

- 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
```

- 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 section 6.2.

```
# /cdrom/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.

- 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 2 to 9 of (3.5.3.1) in 3.5.3.

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/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 `dlmmigsts Utility for Assisting HDLM Transitions`.

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 steps 21 to 27 of (3.5.3.1) in 3.5.3.

23. If you performed step 5, restore the volume group you backed up.

```
# restvg -f any-desired-file-name-or-device-name hdiskn
```

24. Check the path configuration according to the steps described in 3.6.

25. Unmount the CD-ROM.

```
# umount /cdrom
```

26. Delete the created mount directory.

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

3.5.7 Using the `d1msetup` utility for Supporting HDLM Installation and Configuration to Install HDLM

If you execute the `d1msetup` utility to perform an installation of HDLM, you can also perform the following setup during installation:

- Setup for HDLM functionality by using the `set` operation
For details, see section 5.6.
- Setup for HDLM operation by using the `d1modmset` utility
For details, see section 6.3.

You can install HDLM from the CD-ROM, or you can copy the contents of the CD-ROM to a chosen directory.

3.5.7.1 Performing a New Installation of HDLM Using `d1msetup`

This section describes the procedures for performing a new installation of HDLM by using the `d1msetup` utility

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. Insert the CD-ROM.

If you are installing HDLM from a directory in which files on the CD-ROM are copied, make sure that the file organization has not been changed. If the file organization has changed, the `d1msetup` utility might not function correctly. The following shows an execution example:

```
# mkdir /cdrom
# mount -r -v cdrfs /dev/cd0 /cdrom
# mkdir /tmp/hdlm
# cp -rp /cdrom/* /tmp/hdlm
```

If you copied the files on the CD-ROM to your desired directory, proceed to step 5.

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

```
# mkdir /cdrom
```

You can change the name indicated by `cdrom`. In the following explanation, `cdrom` is used without change.

4. Mount the CD-ROM.

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

The `/dev/cd0` portion varies depending on the system.

5. From the CD-ROM, copy `d1modmset_sample` file and `dlnkset_sample` file to the directory.

```
# cp -p /cdrom/hdlmtool/d1modmset_sample /tmp/your-desired-directory
# cp -p /cdrom/hdlmtool/dlnkset_sample /tmp/your-desired-directory
```

You can rename the files `dlmodmset_sample` file and `dlmkset_sample` file. In the following explanation, `dlmodmset_sample` file and `dlmkset_sample` file are called *odm-environment-settings-file* and *set-environment-settings-file*, respectively.

6. If you want to change the default settings, edit the *odm-environment-settings-file* and *set-environment-settings-file* by using a text editor.

Only alphanumeric characters, spaces, and hyphens can be used for *odm-environment-settings-file* and *set-environment-settings-file*.

To use `vi`, execute the following commands:

```
# vi /tmp/directory-containing-odm-environment-settings-file/odm-environment-settings-file
# vi /tmp/directory-containing-set-environment-settings-file/set-environment-settings-file
```

The *odm-environment-settings-file* and *set-environment-settings-file* contain the default values for environment settings shown below:

odm-environment-settings-file

```
-r off
-i off
```

set-environment-settings-file

```
-lb on -lbtype rr
-ellv 3
-elfs 9900
-elfn 2
-systflv 0
-systfs 1000
-pchk on -intvl 30
-afb off
-iem off
```

To change values in the environment settings, see section 5.6 and Table 8.14.

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 (`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: the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

8. Execute the `dmlmsetup` utility:

```
# /cdrom/hdlmtool/dmlmsetup -i /cdrom -odm /tmp/directory-containing-odm-environment-  
settings-file/odm-environment-settings-file -set /tmp/ directory-containing-set-  
environment-settings-file/set-environment-settings-file [-s]
```

Enter as follows if the ODM environment settings file is stored under the name `/tmp/usrodm/dlmodmset_sample` and the `set` environment settings file is stored under the name `/tmp/usrset/dlmset_sample`:

```
# /cdrom/hdlmtool/dmlmsetup -i /cdrom -odm /tmp/usrodm/dlmodmset_sample  
-set /tmp/usrset/dlmset_sample
```

To enable the environment settings values in the *odm-environment-settings-file* and *set-environment-settings-file*, specify `--odm` and `-set`.

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

If you have specified the `-s` parameter option to omit a confirmation message, proceed to step 12; if not, proceed to next step.

9. The message shown below is displayed. Enter `y`.

```
KAPL12252-I A new installation of HDLM will now be performed. Is this OK? [y/n]:
```

Entering `n` cancels the installation.

10. The message shown below is displayed. If you specified `-odm /tmp/directory-containing-odm-environment-settings-file/odm-environment-settings-file` in step 8, enter `y`; if not, enter `n`.

```
KAPL12254-I The dlmodmset utility will now be executed. Is this OK?[y/n]:
```

11. The message shown below is displayed. If you specified `-set /tmp/directory-containing-set-environment-settings-file/set-environment-settings-file` in step 8, enter `y`; if not, enter `n`.

```
KAPL12255-I The dlncmgr set command will now be executed. Is this OK? [y/n]:
```

12. Check whether the message for the `cfgmgr` command is displayed.

If the message is displayed, take appropriate action according to the message contents.

13. Unmount the CD-ROM:

```
# umount /cdrom
```

14. Delete the created mount directory:

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

15. Delete the *odm-environment-settings-file* and *set-environment-settings-file*:

```
# rm -r /tmp/directory-containing-odm-environment-settings-file  
# rm -r /tmp/directory-containing-set-environment-settings-file
```

16. Perform the procedure described in section (3.5.3.1) in 3.5.3, starting from step 14.

3.5.7.2 Using the `dmlmsetup` Utility to upgrade or 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 section 3.5.7.3.

To upgrade or re-install HDLM by using the `dmlmsetup` utility:

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 such a 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. Insert the HDLM CD-ROM.

If you are installing HDLM from a directory in which files on the CD-ROM are copied, make sure that the file organization has not been changed. If the file organization has changed, the `dlmsetup` utility might not function correctly. The following shows an execution example:

```
# mkdir /cdrom
# mount -r -v cdrfs /dev/cd0 /cdrom
# mkdir /tmp/hdlm
# cp -rp /cdrom/* /tmp/hdlm
```

If you copied the files on the CD-ROM to your desired directory, proceed to step 6.

4. If there is no directory for mounting the CD-ROM, make the directory.

```
# mkdir /cdrom
```

You can use a name of your choosing for the `cdrom` portion. In the following explanation, `cdrom` is used without change.

5. Mount the CD-ROM.

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

The `/dev/cd0` portion varies depending on the system.

6. From the CD-ROM, copy the `odm-environment-settings-file` and `set-environment-settings-file` to the directory.

```
# cp -p /cdrom/hdlmtool/odm-environment-settings-file /tmp/your-desired-directory
# cp -p /cdrom/hdlmtool/set-environment-settings-file /tmp/your-desired-directory
```

You can rename the `odm-environment-settings-file` and `set-environment-settings-file`.

7. If you want to change the default settings, edit the `odm-environment-settings-file` and `set-environment-settings-file` by using a text editor.

Only alphanumeric characters, spaces, and hyphens can be used for `odm-environment-settings-file` and `set-environment-settings-file`.

To use `vi`, execute the following commands:

```
# vi /tmp/directory-containing-odm-environment-settings-file/odm-environment-settings-file
# vi /tmp/directory-containing-set-environment-settings-file/set-environment-settings-file
```

The *odm-environment-settings-file* and *set-environment-settings-file* contain the default values for environment settings shown below:

odm-environment-settings-file	<pre>-r off -i off</pre>	set-environment-settings-file	<pre>-lb on -lbtype rr -ellv 3 -elfs 9900 -elfn 2 -systflv 0 -systfs 1000 -pchk on -intvl 30 -afb off -iem off</pre>
-------------------------------	--------------------------	-------------------------------	--

To change the default values for the environment settings, see section 6.3.

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: the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

9. Execute the `dmlsetup` utility:

```
# /cdrom/hdlmtool/dmlsetup -i /cdrom -odm /tmp//directory-containing-odm-environment-
settings-file/odm-environment-settings-file -set /tmp/directory-containing-set-
environment-settings-file/set-environment-settings-file [-s]
```

Enter as follows if the ODM environment settings file is stored under the name `/tmp/usrodm/dlmodmset_sample` and the set environment settings file is stored under the name `/tmp/usrset/dmlset_sample`:

```
# /cdrom/hdlmtool/dmlsetup -i /cdrom -odm /tmp/usrodm/dlmodmset_sample
-set /tmp/usrset/dmlset_sample
```

To enable the environment settings values in the *odm-environment-settings-file* and *set-environment-settings-file*, specify `-odm` and `-set`.

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

If you have specified the `-s` parameter option to omit a confirmation message, proceed to step 12; if not, proceed to next step.

10. The message shown below is displayed. Enter `y`.

```
KAPL12253-I An update installation of HDLM will now be performed. Is this OK? [y/n]:
```

Entering `n` cancels the installation.

11. The message shown below is displayed. If you specified `-odm /tmp/directory-containing-odm-environment-settings-file/odm-environment-settings-file` in step 9, enter `y`; if not, enter `n`.

```
KAPL12254-I The dlmodmset utility will now be executed. Is this OK?[y/n]:
```

12. The message shown below is displayed. If you specified `-set /tmp/directory-containing-set-environment-settings-file/set-environment-settings-file` in step 9, enter `y`; if not, enter `n`.

```
KAPL12255-I The dlknmgr set command will now be executed. Is thisOK? [y/n]:
```

13. Check whether the message for the `cfgmgr` command is displayed.

If the message is displayed, take appropriate action according to the message contents.

14. Unmount the CD-ROM:

```
# umount /cdrom
```

15. Delete the created mount directory:

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

16. Delete the `odm-environment-settings-file` and `set-environment-settings-file`:

```
# rm -r /tmp/directory-containing-odm-environment-settings-file
# rm -r /tmp/directory-containing-set-environment-settings-file
```

17. Perform the procedure described in section 3.5.5.1 starting from step 15.

3.5.7.3 Using the `dlmsetup` Utility to Migrate from HDLM version 5.8.1 or earlier to version 5.9 or later

You cannot perform an upgrade installation from HDLM version 5.8.1 or earlier to version 5.9 or later, so perform a migration instead. When you migrate from HDLM version 5.8.1 or earlier to version 5.9 or later, you must first uninstall HDLM version 5.8.1 or earlier. The ODM and HDLM settings can be inherited.

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 `hdiskn`. If the user application uses an LU managed by HDLM, modify the user application appropriately.

To migrate from HDLM version 5.8.1 or earlier to version 5.9 or later by using the `dlmsetup` utility:

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 the virtual I/O server, proceed to step 8.
2. Check the virtual SCSI disk recognition method being used.

Execute the `dlmodmset` utility for setting up the HDLM execution environment ODM 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
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 hdiskn
```

8. Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdiskn
```

9. Execute the following command to delete the virtual target device on the virtual I/O server:

```
$ rmdev -dev vtscsin
```

10. Insert the CD-ROM.

11. If there is no directory for mounting the CD-ROM, make the directory.

```
# mkdir /cdrom
```

`cdrom` is your desired directory name. Hereafter, `cdrom` is used for purposes of explanation.

12. Mount the CD-ROM.

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

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

13. Back up the HDLM settings.

Execute the `dlmmigsts` utility, for assisting HDLM migrations, to save HDLM environment settings and the HDLM execution environment ODMsettings. For details about this utility, see section 6.2.

```
# /cdrom/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.

14. Uninstall HDLM.

See the HDLM manual for the version you are going to uninstall.

Because HDLM version 5.9 or later requires the deletion of `hdisk`, do not attempt to perform device configuration (`cfgmgr` command) before performing step 16.

15. 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 (`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: the `hdlm_license` and `dml.lic_key` files are deleted after installation finishes successfully.

16. Execute the `dmlsetup` utility.

```
# /cdrom/hdlmtool/dmlsetup -i /cdrom -odm /tmp/directory-containing-odm-environment-  
settings-file/odm-environment-settings-file -set /tmp/directory-containing-set-  
environment-settings-file/set-environment-settings-file [-s]
```

Enter as follows if the `odm` environment settings file is stored under the name `/tmp/usrodm/dlmodmset_sample` and the `set` environment settings file is stored under the name `/tmp/usrset/dlmset_sample`:

```
# /cdrom/hdlmtool/dmlsetup -i /cdrom -odm /tmp/usrodm/dlmodmset_sample  
-set /tmp/usrset/dlmset_sample
```

Specify the file names saved using the `dlmmigsts` utility for *odm-environment-setting-file* and *set-environment-settings-file*. For details about the `dlmmigsts` utility, see section 7.3.

If you have specified the `-s` parameter option to omit a confirmation message, proceed to step 20; if not, proceed to next step.

17. The message shown below is displayed. Enter `y`.

```
KAPL12252-I A new installation of HDLM will now be performed. Is this OK? [y/n]:
```

Entering `n` cancels the installation.

18. The message shown below is displayed. If you specified `-odm /tmp/directory-containing-odm-environment-settings-file/odm-environment-settings-file` in step 16, enter `y`; if not, enter `n`.

```
KAPL12254-I The dlmodmset utility will now be executed. Is this OK?[y/n]:
```

19. The message shown below is displayed. If you specified `-set /tmp/directory-containing-set-environment-settings-file/set-environment-settings-file` in step 16, enter `y`; if not, enter `n`.

```
KAPL12255-I The dlknmgr set command will now be executed. Is this OK? [y/n]:
```

20. Check whether the message for the `cfgmgr` command is displayed.

If the message is displayed, take appropriate action according to the message contents.

21. Unmount the CD-ROM.

```
# umount /cdrom
```

22. Delete the created mount directory.

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

23. Delete the `odm-environment-settings-file` and `set-environment-settings-file`.

```
# rm -r /tmp/directory-containing-odm-environment-settings-file
# rm -r /tmp/directory-containing-set-environment-settings-file
```

24. Perform the procedure described in section (3.5.3.1) in 3.5.3, starting from step 15.

25. If you have performed step 5, restore the volume group you backed up.

```
# restvg -f any-desired-file-name-or-device-name hdiskn
```

3.6 Checking the Path Configuration

HDLM functionalities, such as load balancing and failover, are available only for devices that have more than one active path. After you install HDLM or change the hardware configuration, check the structure and statuses of these paths.

To check the path information, use the `dlnmgr` command's `view` operation.

The following describes how to check path information by using the `dlnmgr` command's `view` operation. For details about the `view` operation, see section 5.7.

Specify the `-path` parameter and check the output information:

Execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnmgr 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 displayed in the `PathName` column) are different.
The two-digit number from the left of the numbers displayed for `PathName` indicates an HBA adapter number. The numbers displayed between the period to the right of the HBA adapter number and the next period indicate a bus number.
- Make sure that different HBA adapter numbers and bus 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:

Execute the following command:

```
# lsdev -Cc disk > redirect-destination-file-2
```

Open both *redirect-destination-file-1* and *redirect-destination-file-2*.

Make sure that all `hdiskn` displayed in the `HDevName` column in *redirect-destination-file-1* are the same with `hdiskn` displayed on the `Hitachi Disk Array (Fibre)` row in *redirect-destination-file-2*.

3.7 Setting up HDLM

HDLM has load balancing, automatic failback, error logging, and other functions. You can set up these functions by using the `dlnmgr` command's `set` operation.

3.7.1 Preparations for Setting the HDLM Functionality

For setting the HDLM functionality, this chapter describes how to check the settings before the change by using the `dlnmgr` command's `set` operation.

3.7.1.1 Checking the New Settings (when using the `dlnmgr` command)

When you change these settings, you can display information about all HDLM functionality settings. The following shows an example of executing the command:

```
# /usr/DynamicLinkManager/bin/dlnmgr view -sys -sfunc
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
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 =
yyyymm/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.

3.8 Setting Up Integrated Traces

When HDLM is used, `dlnkmgr` commands 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 there is a significant amount of integrated trace information output, information may end up deleted in a short amount of time. Also, if a large amount of integrated trace information is output at once, the integrated trace information that overflowed the buffer might not be saved in 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: specifying the values too large places a heavy load on the system. When determining these values, consider these operational tradeoffs.

Table 3.11 shows the default and recommended values for the integrated trace file settings.

Table 3.11 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	Buffer size per monitoring interval	64 (KB)	256 (KB)
	Monitoring cycle	10 (seconds)	5 (seconds)
Number of messages to be output per monitoring interval	Monitoring interval	0 (seconds)	0 (seconds)

If Hitachi Network Objectplaza Trace Library is already installed, the existing settings will be inherited. When changing these settings, keep in mind that they are used by programs other than HDLM.

The following section explain how to change these settings.

3.8.1 Displaying the Hitachi Network Objectplaza Trace Library Setup Menu

The following procedure shows how to display the Hitachi Network Objectplaza Trace Library setup menu.

To display the Hitachi Network Objectplaza Trace Library setup menu:

1. Log in 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 section explains how to modify each setting.

3.8.2 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 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 3.8.4. 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.

3.8.3 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/HNTRLlib2/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.

3.8.4 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 section 3.8.2. 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.

3.8.5 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: 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 HNTRLlib setup menu appears again.

3.8.6 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 wish to save the new settings.

```
Save or not? (Yes/No)>
```

2. To save the new settings, click `Yes`, otherwise, click `No`.

3.8.7 Applying the Hitachi Network Objectplaza Trace Library Settings

After you change the amount of integrated trace information by using Hitachi Network Objectplaza Trace Library, use the following procedure to apply the settings.

1. Log in as a root user.
2. Execute the following command to stop the integrated trace collection process:

```
# /opt/hitachi/HNTRLib2/bin/hntr2kill
```

3. Execute the following command to delete the memory mapped file:

```
# rm /opt/hitachi/HNTRLib2/mmap/hntr2mmap.mm
```

4. Execute the following command to start the integrated trace collection process:

```
# /opt/hitachi/HNTRLib2/bin/hntr2mon -d &
```

3.9 About the Reservation Policy

The reservation policy settings are explained in the following table.

Table 3.12 Reservation Policy Settings

Setting	Description
<code>no_reserve</code>	Ignores a reservation request and does not reserve an LU. This setting is used when any of the following are applicable: <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▪ The ASM function of Oracle RAC 10g is used together with HDLM
<code>PR_exclusive</code>	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 hdiskn
cfgmgr
```

3.10 Settings for Using HACMP

To use HACMP, install HDLM on all of the hosts that comprise the cluster, configure hdisks, set up the storage subsystem (for using Thunder 9500V), 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 subsystem Settings

3.10.1.1 Setting up a Thunder 9500V Series device

To use a Thunder 9500V Series device as the storage subsystem, perform the setup shown in Table 3.13. For details about setting up a Thunder 9500V Series device, see the manual for Thunder 9500V Series.

Table 3.13 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

3.10.1.2 Setting up a TagmaStore AMS/WMS Series device

To use a Thunder 9500V Series device as the storage subsystem, perform the setup shown in Table 3.14. For details about setting up a TagmaStore AMS/WMS Series device, see the manual for TagmaStore AMS/WMS Series.

Table 3.14 TagmaStore AMS/WMS Series settings 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 HACMP5.3 is used. For details about the setup procedure and setup for other versions of HACMP, see the HACMP manual.

3.10.2.1 Adding Custom Disk Methods

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:

- When a Fibre Channel connection is used with HACMP

Change the custom disk method settings as described below. The description includes information about the items and contents of the settings.

Disk Type (PdDvLn field from CuDv)

- When a XP series is used:

```
disk/fcp/HP
```

- When a Thunder 9500V series, Lightning 9900V series (excluding XP series), TagmaStore USP (excluding XP series), Universal Storage Platform V (excluding XP24000), or TagmaStore AMS/WMS series is used:

```
disk/fcp/Hitachi
```

Method to identify ghost disks

```
SCSI3
```

Method to determine if a reserve is held

```
/usr/DynamicLinkManager/cluster/dlm_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 hdiskn -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 hdiskn -a reserve_policy=no_reserve
```

7. Confirm that the setting was changed to `no_reserve`.

```
# lsattr -El hdiskn -a reserve_policy
reserve_policy  no_reserve                N/A TRUE
```

3.11 Settings for Using GPFS + RVSD

To use GPFS + RVSD, carry out the following procedure before starting GPFS + RVSD:

1. To use GPFS+RVSD, add the following lines to the last line in the `/etc/vsd/oemdisktypes.lst` file:
 - When a XP series is used
`disk/fcp/HP fscsi disk/fcp`
 - When a Thunder 9500V series, Lightning 9900V series (excluding XP series), TagmaStore USP (excluding XP series), Universal Storage Platform V (excluding XP24000), or TagmaStore AMS/WMS series is used
`disk/fcp/Hitachi fscsi disk/fcp`
2. 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. Set the reservation level for each host to 2.

Execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -rsv on 2
```

3.12 Settings for Using Oracle RAC 10g

3.12.1 Settings for MISSCOUNT and DISKTIMEOUT

When a host and an Oracle RAC 10g 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 10g, Oracle RAC 10g 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 10g voting disk, change the following settings according to your version of Oracle RAC 10g:

- When using Oracle RAC 10g version 10.1.0.3.0 or later
 - Change the value of `MISSCOUNT` to the following value or greater: (*number-of-paths-connected-to-the-voting-disk* x 60 seconds).
- When using Oracle RAC 10g version 10.2.0.2.0 or later
 - Change the value of `MISSCOUNT` to the following value or greater: (*number-of-paths-connected-to-the-voting-disk* x 60 seconds).
 - If four or more paths are connected to a voting disk, change `DISKTIMEOUT`, which is the I/O timeout threshold value for a voting disk, to the following value or greater: (*number-of-paths-connected-to-the-voting-disk* x 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

If you specify use of the `hdisk` recognized as an HDLM management-target device when an Oracle RAC 10g environment is set up, 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 hdiskn -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
```

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 hdiskn -a reserve_policy=no_reserve
```

7. Confirm that the setting was changed to `no reserve`.

```
# lsattr -El hdiskn -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
# hagrpl -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.

```

@(#)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];

```

Figure 3.4 Example of editing the preonline script

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 a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during 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 section 15 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.

3.14.2.1 Uninstalling HDLM in a Non-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. 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
```

- Execute the following command to unmount the file system in the client logical partition:

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

- Execute the following command to delete the volume group in the client logical partition:

```
# reducevg -df volume-group-name hdiskn
```

- Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdiskn
```

- Execute the following command to delete the virtual target device on the virtual I/O server:

```
$ rmdev -dev vtscsin
```

- 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.

- Specify the `-A` parameter, as required, and execute the `dlmrmdev` utility for removing HDLM drivers.

When you specify the `-A` parameter and execute the `dlmrmdev` utility, steps 11 to 14 are executed in a batch. Unmount the file system used by HDLM to inactivate the volume group used by HDLM. If you specify the `-A` parameter and execute the `dlmrmdev` utility, steps 11 to 14 can be skipped. When `dlmrmdev` 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 was 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.

- Execute the following command to unmount the file system used by HDLM:

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

- Execute the following command to display all the activated volume groups:

```
# lsvg -o
```

- Among the displayed volume groups in step 12, execute the following command to inactivate the volume groups used by HDLM:

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

- Execute the following command to remove the `hdisk` recognized as an 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 `hdisk` recognized as the device to be managed by HDLM has been deleted:

```
# lsdev -Cc disk
```

16. If GPFS + RVSD was used, delete the setting information from `/etc/vsd/oemdisktypes.lst`

– If XP series was used, delete the following line:

```
disk/fcp/HP fscsi disk/fcp
```

– If Thunder 9500V series, Lightning 9900V series (excluding XP series), TagmaStore USP (excluding XP series), Universal Storage Platform V (excluding XP24000), or TagmaStore AMS/WMS 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 DLManager.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 `hdisk` for the device that is managed by HDLM still remains. 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 hdiskn -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 `hdiskn`:

```
# 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 -hdiskn
```

3.14.2.2 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.

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 hdiskn
```

7. Execute the following command to delete the virtual SCSI disk in the client logical partition:

```
# rmdev -dl hdiskn
```

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 subsystem so that only a single path connects the host to the storage subsystem (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 `hdisk` recognized as an HDLM management-target device 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 XP series is used, delete the following line:

```
disk/fcp/HP fscsi disk/fcp
```

– If Thunder 9500V series, Lightning 9900V series (excluding XP series), TagmaStore USP (excluding XP series), Universal Storage Platform V (excluding XP24000), or TagmaStore AMS/WMS 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
# hagr -modify service-group PreOnline 0
# haconf -dump -makero
```

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

23. Execute the following command:

```
# installp -u DLManager.mpio
```

24. 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.

25. 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 hdiskn -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
```

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 check that the physical volume has been recognized as `hdiskn`:

```
# lsdev -Cc disk
```

Make sure that the following execution result is displayed:

```
ilable Virtual SCSI Disk Drive
```

28. Execute the following command to restore the backed up volume group:

```
# restvg -f any-desired-file-name-or-device-name -hdiskn
```

3.14.3 Uninstalling the 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 Hitachi Data Systems technical representative.

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 4.1 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 `/opt/hitachi` 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 describes how to delete a custom disk method. This procedure assumes that HACMP5.3 is used. For details about the setup procedure and setup for other versions of HACMP, see the HACMP manual.

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 XP series is used
disk/fcp/HP
 - When Thunder 9500V series, Lightning 9900V series(excluding XP series), TagmaStore USP (excluding XP series), Universal Storage Platform V (excluding XP24000), or TagmaStore AMS/WMS series is used
disk/fcp/Hitachi

Chapter 4 Operating HDLM

This chapter describes operating procedures for HDLM for AIX, including how to operate HDLM and the HDLM manager, and how to change the configuration of the operating environment.

- Important Notes on using HDLM (section 4.1)
- Starting and stopping the HDLM manager (see section 4.2)
- Starting and Stopping the HDLM Manager (see section 4.3)
 - Starting the HDLM Manager (see section 4.3.1)
 - Stopping the HDLM Manager (see section 4.3.2)
- Checking and Configuring Paths (see section 4.4)
- Changing the Path Configuration (see section 4.5)
- Changing the Configuration of the HDLM Operating Environment (see section 4.6)

Note: Some of the cautionary notes in section 4.1, and the contents of section 4.6 have changed; for details see Appendix A.

4.1 Important Notes on Using HDLM

This section contains important procedural information.

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 Detecting Path Errors

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 section 4.4.2.

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 Subsystem

- Start up the storage subsystem before you start up the hosts, so that AIX can detect the storage subsystem.
- To delete an LU from the storage subsystem, you must delete the hdisk first, and then you can delete the LU.

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 `dlnmpr` utility to clear the HDLM persistent reservation.

For details about the `dlnmpr` utility, see section *8.15 Messages from the 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 `dlnmpr` 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 section 6.3.

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 6.4.

4.2 HDLM Operations Using Commands

This section explains how to use the HDLM commands to utilize HDLM functions. For details on commands, see Chapter 5.

4.2.1 Notes on using commands

Execute the command as a user with root privileges.

To specify a value containing a space in a parameter, enclose the entire value in double quotation marks ("").

4.2.2 Viewing path information

This subsection explains how to display path information by using an HDLM command.

To display path information, execute the `dlnkmgr` command's `view` operation with the `-path` parameter specified. The following example shows how to execute the command:

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

To display information only for the paths accessing the specified host device, execute the `dlnkmgr` command's `view` operation with the `-path` and `-hdev` parameters specified. The following example shows how to execute the command:

```
# /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 08.11.000000000000000E2.0001 HITACHI .OPEN-3 .15001
0005      1H      Online Own      0          0      0 hdisk1
000013 08.1D.000000000000000E3.0001 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 section 5.7.

4.2.3 Changing the status of paths

This subsection explains how to change the status of paths.

4.2.3.1 When changing the status of a path to online

To change the status of a path to online:

1. Check the current status of the path.

To change the status of the path for each HBA port, channel adapter port, or path to online, check the path name or AutoPATH_ID.

The following example shows how to execute the command:

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

2. To change the status of a path to online, execute the `dlnkmgr` command's `online` operation.

You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. For details on how to specify a path, see 5.5.

For example, if you want to place all 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) could not be placed
online. Operation name = online
#
```

3. Check the changed status of the path.

The following example shows how to execute the command:

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

4.2.3.2 When changing the status of a path to Offline(C)

To change the status of a path to Offline(C):

1. Check the current status of the path.

To change the status of the path for each HBA port, channel adapter port, or path to Offline(C), check the path name or AutoPATH_ID.

The following example shows how to execute the command:

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

2. To change the status of the path to Offline(C), execute the `dlnkmgr` command's `offline` operation.

You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. For details on how to specify a path, see 5.4.

For example, if you want to place all 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) could not be
placed offline(C). Operation name = offline
#
```

3. Check the changed status of the path.

The following example shows how to execute the command:

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

4.2.4 Viewing LU information

This subsection 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    0000     000000 Online
      0001     000001 Online
003B hdisk1    0000     000002 Online
      0001     000003 Online
003C hdisk2    0000     000004 Online
      0001     000005 Online
003D hdisk3    0000     000006 Online
      0001     000007 Online
003E hdisk4    0000     000008 Online
      0001     000009 Online
003F hdisk5    0000     000010 Online
      0001     000011 Online
0040 hdisk6    0000     000012 Online
      0001     000013 Online
0041 hdisk7    0000     000014 Online
      0001     000015 Online
0042 hdisk8    0000     000016 Online
      0001     000017 Online
0043 hdisk9    0000     000018 Online
      0001     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 5.7.

4.2.5 Displaying the Correspondences Between hdisks, OS Management Path IDs, and LDEVs

This subsection 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 5.7. 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  OSPathID  LDEV
000000 hdisk0    0000     9500V.0051.0005
000001 hdisk1    0000     9500V.0051.0015
000002 hdisk2    0000     9500V.0051.0020
```

```
000003 hdisk0 0001 9500V.0051.0005
000004 hdisk1 0001 9500V.0051.0015
000005 hdisk2 0001 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 5.7.

4.2.6 Initializing statistical information for paths

This subsection explains how to initialize statistical information (I/O counts and I/O errors) for all paths managed by HDLM.

This procedure is useful when you wish to check the number of I/O hits and I/O errors that have occurred since the last time the I/O counts and I/O errors were initialized to the value 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 (I/O counts and I/O errors) for all 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 whether the statistical information for 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 subsection explains how to display and set up the HDLM operating environment.

4.2.7.1 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          : xx-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              : off
Intermittent Error Monitor : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymm/dd hh:mm:ss
#

```

For details on the displayed items and their descriptions, see 5.7.

4.2.7.2 Setting up the operating environment

To set up the HDLM operating environment, execute the `dlnkmgr` command's `set` operation. This operation allows you to set 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

For details on how to set each function, see 5.6.

For example, to set up the error log collection level, execute the `dlnkmgr` 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/dlnkmgr 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 =
yyyymm/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 subsection explains how to display license information.

To display license information, execute the `dlnkmgr` 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/dlnkmgr view -sys -lic
License Type Expiration
Permanent -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymm/dd hh:mm:ss
#
```

4.2.9 Updating the license

This subsection explains how to update the license.

To update the license, execute the `dlnkmgr` 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 use the `dlnkmgr` command's `set` operation with the `-lic` parameter to install the license, you can only execute one command at a time. If you attempt to execute more than one `dlnkmgr` 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 `dlnkmgr` 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/dlnkmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01071-I A permanent license was installed.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time
= yyyymm/dd hh:mm:ss
#
```

4.2.10 Viewing HDLM version information

This subsection explains how to display HDLM version information.

To display HDLM version information, execute the `dlnkmgr` 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           : xx-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          : off
Intermittent Error Monitor : off
HDLM Manager Ver       WakeupTime
Alive      xx-xx   yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver   WakeupTime       ElogMem Size
Alive      xx-xx   yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver        WakeupTime
Alive      xx-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 subsection explains how to display HDLM component information.

To display HDLM component information, execute the `dlnkmgr` 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           : xx-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          : off
Intermittent Error Monitor : off
HDLM Manager Ver       WakeupTime
Alive      xx-xx   yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver   WakeupTime       ElogMem Size
Alive      xx-xx   yyyy/mm/dd hh:mm:ss 4000
HDLM Driver Ver        WakeupTime
Alive      xx-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 -adv
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv
```

4.3 Starting and Stopping the HDLM Manager

To use HDLM, you need to start the HDLM manager. This section describes how to start and stop the HDLM manager.

4.3.1 Starting the HDLM Manager

The HDLM manager is started using the startup script that was set up when HDLM was installed. This means that when AIX starts, the HDLM manager also starts automatically.

If, for some reason, the HDLM manager has not started or has stopped, log in to AIX as a user with root privileges, and then execute the following command. You can use lower-case characters (**dlnmanager**):

```
# startsrc -s DLManager
```

This starts the startup script that was set up when HDLM was installed.

4.3.2 Stopping the HDLM Manager

When you uninstall HDLM, the HDLM manager automatically stops.

If, for some reason, the HDLM manager does not automatically stop, log in to AIX as a user with root privileges, and then execute the following command. You can use lower-case characters (**dlnmanager**):

```
# stopsrc -s DLManager
```

This starts the stop script that was set up when HDLM was installed.

4.4 Checking and Configuring Paths

4.4.1 Checking Path Information

Some HDLM functions, such as load balancing and failover, are available only when a device has multiple online paths. You need to check the path information including the path configuration and status after installing HDLM or after changing the hardware configuration.

Note: HDLM reads the hardware configuration that AIX recognized during startup. If you changed the hardware configuration of the system, make sure to restart the management-target host. This enables HDLM to recognize the changes to the hardware configuration.

Note: Make sure to start the storage subsystem before starting the management-target host. This enables AIX to detect the storage subsystem.

To check the path information, you can use any of the following:

- The `dlnkmgr view` command (see section 4.4.1.1)

4.4.1.1 Checking Path Information by Using the `dlnkmgr view` Command

To check the path information by using the `dlnkmgr` command together with the `view` operation:

1. Execute the `dlnkmgr view` command to display the path information.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path >pathinfo.txt
```

where `pathinfo.txt` is the redirection-output file name. Use a file name that matches your environment. Executing this command displays information about all the paths.

2. Open the redirection-output file (`pathinfo.txt` in step 1), and then check the following:

- **Logical unit (LU) that the path accesses:**

You can identify the path by the `PathName` display. The combination of the `DskName` and `iLU` display identifies the LU that the path accesses.

- **Whether the paths are accessing the same LU via different HBAs:**

In the `PathName` displays for the paths accessing the same LU, make sure that the numbers to the left of the second period (i.e., `HBA-adapter-number.path-number`) are different.

Make sure that the number of `HBA-adapter-number.path-number` combinations is the same as the number of physical HBAs.

- **Whether the paths are accessing the same LU use different channel adapters:**

Make sure that multiple channel adapters are physically mounted.

Make sure that the `ChaPort` number for each path accessing the same LU is different.

- **Path status:**

Make sure that the `Status` display contains `Online` only.

For details on the items displayed by the **dlnkmgr view** command, see section 5.7.

4.4.2 Configuring Path Health Checking

HDLM provides the path health checking functionality for checking the path status at regular intervals. Path health checking checks paths that have the **Online** status. When an error occurs in a path that is in the **Online** status, the path health checking places the path in the **Offline(E)** or **Online(E)** status.

Path health checking is ON by default in HDLM for AIX version 5.0 and later. If path health checking is disabled, HDLM does not detect errors in paths in which no I/O occurs. The path health checking functionality enables the system to detect errors in paths in which no I/O occurs, such as non-owner paths and paths in the standby host in a cluster configuration (i.e., passive node paths).

You can set up the path health checking functionality by executing the **dlnkmgr set** command (see section 5.6).

Caution: In previous versions of HDLM, path health checking was performed by executing a batch file that defined the **online** operation. Do not execute this batch file. With the current version, executing the **set** operation performs path health checking.

Notes for the USP, SVS, and 9900V subsystems:

- If load balancing is ON, all paths send I/O signals, so HDLM can detect all online and offline events immediately. Path health checking is therefore not needed.
- For cluster configurations: passive node paths do not send I/O signals. In this case, it is advantageous to enable the path health checking function, so HDLM can immediately detect any problem on those paths. In addition, if the automatic failback function is also enabled, HDLM will change the path status to **Online** automatically.
- If load balancing is ON and automatic failback is also ON, the total number of working paths will not change after a path fails. If automatic failback is ON, a failed path is automatically set to ONLINE, and total number of working paths increases. The interval time set will depend upon your individual system configuration and your current storage workload.

Notes for the 9500V subsystem:

- When path health checking is ON, HDLM can detect non-owner path errors.
- When automatic failback is ON, I/O signals are sent through a non-owner path when an error occurs on an owner path. Once the owner path recovers from the error, the I/O signals are sent back to an owner path automatically.

4.5 Changing the Path Configuration

This section describes the procedures for changing the path configuration, such as by replacing hardware (host bus adapter, fiber cable, fibre-channel switch) that constitutes a path or changing a management-target disk that is accessed by paths.

The following section contain information on:

- Replacing a host bus adapter
- Replacing a fiber cable
- Replacing a fibre-channel switch
- Changing the configuration of HDLM management-target disks

4.5.1 Replacing a Host Bus Adapter

If there are multiple active paths for a device in a logical unit, you can replace a desired host bus adapter while running your applications by placing offline only the path that goes through the host bus adapter to be replaced and using other paths to continue accesses.

The following explains the HBA replacement procedure. In this example, an HBA whose HBA adapter number is 08 and bus number is 11 is replaced. This HBA is referred to hereafter as *hba08.11*.

To replace a host bus adapter:

1. Place in Offline (C) status the path that goes through the host bus adapter to be replaced. To place the path that goes through the host bus adapter with adapter number 08 and bus number 11 in Offline (C) status, execute the following command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 08.11
```

2. Execute the following command to search for 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 these examples, 11 in 11-08-02 is the bus number and 08 is the HBA adapter number. `fscsi1` is the `fscsi` that corresponds to *hba08.11*.

3. 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 searched for in step 2 is 1, the result is as follows:

```
# rmpath -p fscsi1 -d
```

4. If LUN security has been set up for the storage subsystem, add the world wide name (WWN) of the new host bus adapter to the LUN security.

- Execute the following command:

```
# diag
```

Note: The operations after executing the `diag` command depend on the procedures for the OS version. Steps 6 to 13 below describe an example execution procedure for AIX 5.2 (TL09).

- From the displayed menu, choose **Task Selection**.
The Task Selection List window appears.
- Choose **Hot Plug Task**.
The Hot Plug Task window appears.
- Choose **PCI Hot Plug Manager**.
The PCI Hot Plug Manager window appears.
- Select List **PCI Hot Plug Slots** to check the PCI to be replaced (Figure 4.1):

# Slot	Description	Device(s)
P1-13	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-14	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-15	PCI 64 bit, 66MHz, 3.3 volt slot	fcs0
P1-16	PCI 64 bit, 50MHz, 5 volt slot	Empty
P1-17	PCI 64 bit, 50MHz, 5 volt slot	mg20
P1-18	PCI 64 bit, 66MHz, 3.3 volt slot	fcs1
P1-19	PCI 64 bit, 66MHz, 3.3 volt slot	scsi2 scsi3
P1-110	PCI 64 bit, 66MHz, 3.3 volt slot	Empty
P1-111	PCI 64 bit, 50MHz, 5 volt slot	pci12 ent1 ent2 ent3 ent4
P1-112	PCI 64 bit, 50MHz, 5 volt slot	Empty

Figure 4.1 Host Bus Adapter Replacement

The shading indicates the host bus adapter to be replaced.

- 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	+

Figure 4.2 Unconfigure a Device

- Go back to the PCI Hot Plug Manager window, select **Replace/Remove a PCI Hot Plug Adapter**.

Select the host bus adapter to be replaced.

- Select **Replace** in the input field.

- When the following message is displayed, replace the host bus adapter (Figure 4.3):

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.

Figure 4.3 Replacing the Host Bus Adapter

When you finish replacing the host bus adapter, connect the cable and press Enter.

14. 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 host bus adapter was replaced (`fcs` device); `n` indicates the instance number of the `fcs` device.

15. If LUN security has been set up for the storage subsystem, delete the world wide name (WWN) of the previous host bus adapter from the LUN security.
16. Execute the following command to check the path information:

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

For details about path information, see section 4.4.

4.5.2 Replacing a Fiber Cable

If there are multiple active paths for a device in a logical unit, 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 accesses.

The following procedure is only for replacing a fiber cable.

To replace a fiber cable:

1. Place the path that goes through the cable to be replaced in the Offline (C) status:

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 01.01
```

2. Replace the cable.

Note: If you change the port on the switch or on the storage subsystem, the path configuration changes. Delete the hdisk associated with the cable to be replaced and then reconfigure the device.

3. Place the path that goes through the replaced cable in the Online status.
4. Place the path that goes through the host bus adapter to which the replaced cable is connected in the Online status:

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -hba 01.01
```

5. Execute the following command to check the path information:

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

For details about path information, see Chapter 5.

4.5.3 Replacing a Fibre-Channel Switch

If there are multiple active paths for a device in a logical unit, you can replace a desired switch while running your applications by placing offline only the path that goes through the switch to be replaced and using other paths to continue accesses.

The fibre channel switch replacement procedure is explained below. In this example, an HBA whose HBA adapter number is 08 and bus number is 11 is replaced. This HBA is referred to hereafter as *hba08.11*.

The following procedure is only for replacing a fibre-channel switch.

To replace a fibre-channel switch:

1. Place in Offline (C) status the path that goes through the switch to be replaced (path that goes through the host bus adapter to which the switch is connected).

```
# /usr/DynamicLinkManager/bin/dlnkmgr offline -hba 08.11
```

2. Execute the following command to search for the `fscsi` number that corresponds to the path that goes through the switch 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 these examples, 11 in 11-08-02 is the bus number and 08 is the HBA adapter number. `fscsi1` is the `fscsi` that corresponds to *hba08.11*.

3. Specify the `fscsi` number obtained in step 2 when executing the following command that deletes the path that goes through the switch that is to be replaced.

```
# rmpath -p fscsin -d
```

Because the `fscsi` number searched in step 2 is 1, the result is as follows:

```
# rmpath -p fscsi1 -d
```

Specify the device name (`fscsi` device) of the HBA connected to the switch that is to be replaced (where *n* is the instance number of the `fscsi` device).

4. Execute the following command to acquire the name of the parent device:

```
# lsdev -C -l fscsin -F parent
```

5. Delete the HBA device associated with the switch to be replaced:

```
# rmdev -dl fscsin -R
```

6. Replace the switch.

7. Execute the following command to reconfigure the device:

```
# cfgmgr -l fcsn
```

`fcsn` indicates the instance number of the device; *n* indicates the instance number of the `fcs` device.

8. Execute the following command to check the path information:

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

For details about path information, see section 5.7.

4.6 Changing the Configuration of the HDLM Operating Environment

This section describes the procedures for changing the configuration of an HDLM operating environment.

4.6.1 Changing an HDLM Management-Target Device

This subsection explains how to add and delete HDLM management-target devices and how to change their attributes.

4.6.1.1 Adding an HDLM Management-Target Device

Connect the device to the system and execute the following command:

```
# cfgmgr
```

4.6.1.2 Deleting an HDLM Management-Target Device

1. Execute the following command to check the device (*hdiskn*) 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 hdiskn
```

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 (*hdiskn*) is no longer displayed.

4.6.1.3 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 hdiskn -a queue_depth=8 -a rw_timeout=60
```

3. Inactivate the volume group used by HDLM.

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

4.6.2 Changing a Path

This subsection explains how to add and delete paths.

4.6.2.1 Adding a Path

Connect the path to the system and execute the following command:

```
# cfgmgr
```

4.6.2.2 Deleting a Path

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 (`hdiskn`) connected to the path.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName  OSpaHID LDEV
000000 hdisk5     0000    USP.0014050.0065
000001 hdisk5     0001    USP.0014050.0065
000002 hdisk5     0002    USP.0014050.0065
000003 hdisk10    0000    9500V.5457.0102
000004 hdisk10    0001    9500V.5457.0102
000005 hdisk10    0002    9500V.5457.0102
```

For each path ID (PathID column), check the entries in the HDevName and OSpaHID columns. In the following steps, *device-name* and *OS-management- path-ID* refer to the HDevName and OSpaHID 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:

```
# 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
```


Chapter 5 Using the HDLM dlnkmgr Command

This chapter describes the HDLM **dlnkmgr** command and its options, which are called *operations* in HDLM.

- Overview of the **dlnkmgr** command (see section 5.1)
 - **dlnkmgr** command format (see section 5.1.1)
 - Operations of the **dlnkmgr** command (see section 5.1.2)
- Clear operation (see section 5.2)
- Help operation (see section 5.3)
- Offline operation (see section 5.4)
- Online operation (see section 5.5)
- Set operation (see section 5.6)
- View operation (see section 5.7)

Note: the term *HDLM command* can refer to the **dlnkmgr** command together with an operation (e.g., the **dlnkmgr set** command).

5.1 Overview of the `dlnkmgr` Command

5.1.1 `dlnkmgr` Command Format

When you are using HDLM for AIX systems, execute the command as a user with root permissions. Enter the `dlnkmgr` command using the following format:

```
dlnkmgr operation-name [parameter[parameter-value]]
```

dlnkmgr: The command name

operation-name: The type of HDLM operation to be performed (see Table 5.1)

parameter: The value/setting required for an operation

parameter-value: The value/setting required for a parameter

Note: To specify a value which contains a space, enclose the entire value in double quotes (“”).

5.1.2 Operations of the `dlnkmgr` Command

Table 5.1 shows the operations of the HDLM `dlnkmgr` command and their functions.

Table 5.1 HDLM Command Operations and Functions

Operation	Function	Section
clear	Clears the statistics (I/O counts and I/O errors) of all paths managed by the HDLM system to the initial value (0).	5.2
help	Displays the format of the operation used for HDLM.	5.3
offline	Places an online path offline.	5.4
online	Places one or all offline paths online.	5.5
set	Sets the HDLM operating environment.	5.6
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.	5.7

5.2 clear Operation

- **Format**

To set the path statistics to 0:

```
/usr/DynamicLinkManager/bin/dlnkmgr clear -pdst [-s]
```

To display the format of the clear operation:

```
/usr/DynamicLinkManager/bin/dlnkmgr clear -help
```

- **Description**

The `dlnkmgr` command's `clear` operation clears the statistics (I/O count and I/O errors) of all paths that are managed by HDLM to the initial value.

- **Parameters to set the path statistics to 0**

`-pdst`: Clears statistics (such as the path error count) to the initial value (0).

`-s`: Executes the command without displaying user confirmation message. Specify this parameter if you want to skip the user confirmation message for a shell script or batch file.

- **Parameters to display the format of the clear operation**

`-help`: Displays the format of the `clear` operation.

- **Examples**

Figure 5.1 shows how to clear the statistics to the initial value (0) after asking for confirmation of command execution from the user. Figure 5.2 shows how to clear the statistics to the initial value (0) without asking for confirmation of command execution from the user. Figure 5.3 shows how to display the format of the `clear` operation.

```
# /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
#
```

Figure 5.1 Example of the Clear Command with User Confirmation

```
# /usr/DynamicLinkManager/bin/dlnkmgr clear -pdst -s
KAPL01001-I The HDLM command completed normally. Operation name = clear,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.2 Example of the Clear Command with No User Confirmation

```
# /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
#
```

Figure 5.3 Example of the Clear Operation Format

5.3 help Operation

- **Format**

```
/usr/DynamicLinkManager/bin/dlnkmgr help [operation-name] [operation-name] ...
```

- **Description**

The `dlnkmgr` command's `help` operation displays the list of operations available for the HDLM command, or the format of individual operations.

- **Parameter**

operation-name: Specify the name of the HDLM operation. You can check the format of multiple operations at one time by entering multiple operation names. When you enter multiple operation names, the operations are displayed in the order that you entered them. If you do not specify an operation name, HDLM displays all operations.

- **Examples**

Figure 5.4 shows how to display the names of all operations available in HDLM. Figure 5.5 shows how to display the format of the `online` and `offline` operations.

Note: Typing `-help` following the operation name will display the format of that operation (see Figure 5.6).

```
# /usr/DynamicLinkManager/bin/dlnkmgr help
dlnkmgr:
  Format
  dlnkmgr { clear | help | offline | online | set | view }
KAPL01001-I The HDLM command completed successfully. Operation name = help,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.4 Example of the Help Command for all Operations

```
# /usr/DynamicLinkManager/bin/dlnkmgr help online offline
online:
  Format
  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]
  Valid value
  AutoPATH_ID { 000000 - 999999 } (Decimal)
  HBA_ID { 00000 - 99999 } (Decimal)
  CHA_ID { 00000 - 99999 } (Decimal)
offline:
  Format:
  dlnkmgr offline [-path] { -hba HBAPortNumber.BusNumber | -hbaid HBA_ID } [-s]
  dlnkmgr offline { -cha -pathid AutoPATH_ID | -chaid CHA_ID } [-s]
  dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
  Valid value
  AutoPATH_ID { 000000 - 999999 } (Decimal)
  HBA_ID { 00000 - 99999 } (Decimal)
  CHA_ID { 00000 - 99999 } (Decimal)
KAPL01001-I The HDLM command completed successfully. Operation name = help,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.5 Example of the Help Command for an Operation

```
# /usr/DynamicLinkManager/bin/dlnkmgr clear -help
clear:
  Format
    dlnkmgr clear -pdst [-s]
KAPL01001-I The HDLM command completed successfully. Operation name = help,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.6 Example of the *-help* Option for an Operation

5.4 offline Operation

■ Format

To place the path offline:

```
/usr/DynamicLinkManager/bin/dlnkmgr offline
[-path]
{-hba HBA-adapter-number.bus-number
|-hbaid HBA-port-ID
|-cha -pathid AutoPATH_ID
|-chaid CHA-port-ID
|-pathid AutoPATH_ID}
[-s]
```

To display the format of the offline operation:

```
/usr/DynamicLinkManager/bin/dlnkmgr offline -help
```

■ Description

The `dlnkmgr` command's **offline** operation places online paths offline. Specify the paths you want to place offline by specifying a HBA port or channel adapter port to which the target paths are connected, or by specifying a single path.

The last path accessing each LU cannot be placed offline.

Placing too many paths offline may prevent path switching 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 section 5.7.

■ Parameters to place the path offline

-path: Specifies that the target of the operation is a path managed by HDLM. This parameter is optional because the offline operation is only effective on paths. Make sure, however, that you specify the target path in the subsequent parameter (**-hba**, **-hbaid**, **-cha**, **-chaid**, or **-pathid**).

-hba: *HBA-adapter-number.bus-number*: Use this parameter to place offline at one time all paths that pass through a specific HBA port. This command will place offline all paths connected to the HBA port that has the specified HBA adapter number and bus number.

The HBA adapter number and bus number of an HBA port are found in the **PathName** field displayed by using the **view** operation. Enter a period between these two values. The *HBA-adapter-number.bus-number* string is case-sensitive.

-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 *To display the HBA port information* in section 5.7.

-cha -pathid *AutoPATH_ID*: Use this parameter to place offline at one time all paths that pass through a specific channel adapter port. This command will place offline all paths that pass through the channel adapter 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. Leading zeros can be omitted; however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

Because the *AutoPATH_IDs* are reassigned every time the host or the HDLM manager is rebooted, always make sure that you find the current *AutoPATH_ID* of the target path using the **view** operation, before executing the **offline** operation.

-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 *To display the CHA port information* in section 5.7.

-pathid AutoPATH_ID: Use this parameter to place a single path offline. Specify the current *AutoPATH_ID* of the path, which is displayed using the **view** operation. Leading zeros can be omitted; however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

Because the *AutoPATH_IDs* are reassigned to each path of the LU when you execute the **cfgmgr** command. Always make sure that you find the current *AutoPATH_ID* of the target path using the **view** operation, before executing the **offline** operation.

-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.

- **Parameters to display the format of the offline operation**

-help: Displays the format of the **offline** operation.

- **Examples**

Figure 5.7 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. Figure 5.8 shows how to place offline all paths connected to the HBA port whose *HBA-port-ID* is 00001. Figure 5.9 shows how to place offline all paths connected to the channel adapter port 0A. In this example, a path whose *AutoPATH_ID* is 000001 is connected to the target channel adapter port. When the confirmation message is displayed, the user enters **y** to continue, or **n** to cancel the operation. Figure 5.10 shows how to place offline all paths connected to the CHA port whose *CHA-port-ID* is 00001.

Figure 5.11 shows how to place a path, whose *AutoPATH_ID* is 000001, offline without asking for confirmation of command execution from the user. Figure 5.12 shows how to display the format of the **offline** 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) could not
be placed offline(C). Operation name = offline
#

```

Figure 5.7 Example of the Offline Operation With the -hba Parameter

```

# /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) could not
be placed offline(C). Operation name = offline
#

```

Figure 5.8 Example of the Offline Operation With the --hbaid Parameter

```

# /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 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) could not
be placed offline(C). Operation name = offline
#

```

Figure 5.9 Example of the Offline Operation With the -cha Parameter

```

# /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) could not
be placed offline(C). Operation name = offline
#

```

Figure 5.10 Example of the Offline Operation With the chaid CHA-port-ID Parameter

```

# /usr/DynamicLinkManager/bin/dlnkmgr offline -pathid 1 -s
KAPL01061-I 1 path(s) were successfully placed offline. 0 path(s) could not be
placed offline. Operation name = offline
#

```

Figure 5.11 Example of the Offline Operation With the -pathid Parameter

```

# /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]
Valid value
AutoPATH_ID      { 000000 - 999999 } (Decimal)
HBA_ID           { 00000 - 99999 } (Decimal)
CHA_ID           { 00000 - 99999 } (Decimal)
KAPL01001-I The HDLM command completed normally. Operation name = offline,
completion time = yyyy/mm/dd hh:mm:ss
#

```

Figure 5.12 Example of the Format of the offline Operation

- **Reference**

Using the **view** operation together with standard UNIX® commands enables you to filter the path information listed for a specific HBA port or channel adapter port. Before you execute the offline operation to place offline all paths connected to a specific HBA port or channel adapter port, we recommend that you use the following command and verify the information on the target paths.

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.

```
# 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 channel adapter port 0A of the Thunder 9500V Series (product identifier = DF600F).

The following commands differentiate upper and lower case:

```
# dlnkmgr view -path | grep DF600F | grep 0A
```

The following commands do not differentiate upper and lower case:

```
# dlnkmgr view -path | grep -i df600f | grep -i 0a
```

The above commands will display information pertaining to only those paths that pass through the specified channel adapter port.

5.5 online Operation

■ Format

To place the path online:

```
/usr/DynamicLinkManager/bin/dlnkmgr online
[-path]
[-hba HBA-adapter-number.bus-number]
|-hbaid HBA-port-ID
|-cha -pathid AutoPATH_ID
|-chaid CHA-port-ID
|-pathid AutoPATH_ID]
[-s]
```

To display the format of the online operation:

```
/usr/DynamicLinkManager/bin/dlnkmgr online -help
```

■ Description

The `dlnkmgr` command's **online** operation places offline paths online. You can specify the paths you want to place online by specifying a HBA port or channel adapter port to which the target paths are connected, or by specifying a single path.

Note: If an error exists in two or more paths or if path health checking or automatic failback is running, response to the `dlnkmgr online` command may be slow.

■ Parameters to place the path online

-path: Specifies that the target of the operation is a path managed by HDLM. This parameter is optional because the **online** operation is only effective on paths. You can specify the target path in a subsequent parameter: **-hba**, **-hbaid**, **-cha**, **-chaid** or **-pathid**. If you do not specify any of these parameters, the command places 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*: Use this parameter to place online at one time all paths that pass through a specific HBA port. This command will place online all paths connected to the HBA port that has the specified HBA adapter number and bus number.

The HBA adapter number and bus number of an HBA port are found in the **PathName** field displayed by using the **view** operation. Enter a period between these two values. The *HBA-adapter-number.bus-number* string is case-sensitive.

-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 *To display the HBA port information* in section 5.7.

-cha -pathid *AutoPATH_ID*: Use this parameter to place online at one time all paths that pass through a specific channel adapter port. This command will place online all paths that pass through the channel adapter 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. Leading zeros can be omitted; 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.

-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 *To display the CHA port information* in section 5.7.

-pathid *AutoPATH_ID*: Use this parameter to place a single path online. Specify the current *AutoPATH_ID* of the path, which is displayed using the **view** operation. Leading zeros can be omitted; however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

Because the *AutoPATH_ID*s are reassigned to each path of the LU when you execute the `cfgmgr` command, always make sure that you find the current *AutoPATH_ID* of the target path using the **view** operation, before executing the **online** operation.

-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.

- **Parameters To display the format of the online operation**

-help: Displays the format of the **online** operation.

- **Examples**

Figure 5.13 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. Figure 5.14 shows how to place online all paths connected to the HBA port whose *HBA-port-ID* is 000001. Figure 5.15 shows how to place online the paths connected to the channel adapter port 0A. In this example, a path whose *AutoPATH_ID* is 000002 is connected to the target channel adapter port. When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation. Figure 5.16 shows how to place online all paths connected to the CHA port whose *CHA-port-ID* is 000001. Figure 5.17 shows how to place a path, whose *AutoPATH_ID* is 000002, online without asking for confirmation of command execution from the user. Figure 5.18 shows how to display the format of the **online** 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) could not be
placed online. Operation name = online
#
```

Figure 5.13 Example of the Online Operation With the -hba Parameter

```
# /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) could not
be placed offline(C). Operation name = offline
#
```

Figure 5.14 Example of the Online Operation With the -hbaid Parameter

```
# /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) could not be
placed online. Operation name = online
#
```

Figure 5.15 Example of the Online Operation With the -cha Parameter

```
# /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) could not
be placed offline(C). Operation name = offline
#
```

Figure 5.16 Example of the Online Operation With the -chaid Parameter

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -pathid 2 -s
KAPL01061-I 1 path(s) were successfully placed online. 0 path(s) could not be
placed online. Operation name = online
#
```

Figure 5.17 Example of the Online Operation With No User Confirmation

```
# /usr/DynamicLinkManager/bin/dlnkmgr online -help
online:
Format
  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]
Valid value
  AutoPATH_ID      { 000000 - 999999 } (Decimal)
  HBA_ID           { 00000 - 99999 } (Decimal)
  CHA_ID           { 00000 - 99999 } (Decimal)
KAPL01001-I The HDLM command completed normally. Operation
name = online, completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.18 Example of the online Operation Format

■ Reference

Using the **view** operation together with standard UNIX commands enables you to filter the path information listed for a specific HBA port or channel adapter port. Before you execute the offline operation to place offline all paths connected to a specific HBA port or channel adapter port, we recommend that you use the following command and verify the information on the target paths.

Example 1: The following example shows how to filter and display the information on all paths that pass through the HBA port whose adapter number is 04 and bus number is 01:

```
# 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 channel adapter port 0A of the Thunder 9500V Series (product identifier = DF600F).

The following commands differentiate upper and lower case:

```
# dlnkmgr view -path | grep DF600F | grep 0A
```

The above commands will display information pertaining to only those paths that pass through the specified channel adapter port.

Note: Response may become slow when the `dlnkmgr online` command is executed. This can happen for the following reasons.

- An error exists in two or more paths.
- Path health checking and/or automatic failback is running.

5.6 set Operation

- **Format**

To set up the HDLM operating environment:

```
/usr/DynamicLinkManager/bin/dlnkmgr set
      {-lb {on [-lbtype {rr|exrr}]|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}
      [-s]
```

To display the format of the set operation:

```
/usr/DynamicLinkManager/bin/dlnkmgr set -help
```

- **Description**

The `dlnkmgr` command's `set` operation sets the HDLM operating environment.

- **Parameters to set up the HDLM operating environment**

Table 5.2 shows the defaults and recommended values for each setting. If you change the value of the `set` operation, the new value takes effect immediately. You can install HDLM 5.6.3 over HDLM 4.0 or later. When you perform an update installation from HDLM 04-00 or later, the settings for the operating environment are inherited.

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`.

Table 5.2 Default Values and Recommended Values

Item Name	Default Value	Recommended Setting
Load balancing	<code>on</code> Algorithm is round robin	<code>on</code> The recommended algorithm depends on the operating environment.
Error log collection level	3: Collect error information for the Information level and higher.	3: Collect error information for the Information level and higher.
Error log file size	9900 (KB)	9900 (KB)
Number of error log files	2	2
Trace level	0: Do not output any trace.	0: Do not output any trace.
Trace file size	1000 (KB)	1000 (KB)
Number of trace files	4	4
Path health checking	<code>On</code> (Interval is 30 minutes.)	<code>on</code> (Interval is 30 minutes.) The recommended checking interval depends on the operating environment.
Automatic failback	<code>off</code>	<code>off</code>

Item Name	Default Value	Recommended Setting
Intermittent Error Monitor	off	off

-lb {on[-lotype {rr|exrr}]|off}: Enables (on) or disables (off) load balancing.

-lotype {rr|exrr}: Specify the algorithm to be used for load balancing.

rr: Round robin: All I/Os will be distributed across multiple paths.

exrr: Extended round robin

The type of I/O determines how I/Os will be distributed among paths. For sequential access, after an I/O or a set number of I/Os are issued to a path, the system switches to the next path, in order. If the access method is changed to random access before the number of issued I/Os reaches the set number, the system switches to the next path. The storage subsystem cache can be used. For random access, after an I/O or a set number of I/Os are issued to a path, the system switches to the next path in turn.

When multiple applications that request sequential access are performed concurrently and all of those applications use the same HBA as the most preferred HBA, we recommend that you use the round robin algorithm in order to distribute I/Os across multiple paths.

When you execute only a single application that requests sequential access, such as a batch job running at night, we recommend that you use the extended round robin algorithm.

The type of algorithm specified by the **-lotype** parameter remains stored in the system, even when you disable load balancing function by specifying **-lb off**. Therefore, when you re-enable load balancing without specifying an algorithm, load balancing will be executed according to the setting stored in the system.

-ellv error-log-collection-level: Specifies the level of error information you want to collect for an error log. The HDLM manager log (`dldmgr[1-16].log`) contains log files in which an error log collection level can be set (refer to Table 5.8). The default and recommended value is 3.

The following shows the log files in which an error log collection level can be set:

HDLM manager logs:

`dldmgrn.log` (*n* indicates a file number from 1 to 16)

If an error occurs, you may have to set the error log collection level to 1 or higher to collect log information. As the amount of log information to be output increases, the amount of time before existing information is overwritten becomes shorter.

-elfs error-log-file-size: Specify a value from 100 to 2000000 (in kilobytes) for the size of the error log files (`d1mmgrn.log` (n indicates a file number from 1 to 16)). The specified value is applied for HDLM manager logs.

By specifying both the log file size and the number of log files, you can collect up to 32,000,000 KB (approximately 30 GB) of error logs in total.

When the size of all log files in a log file group reaches a specified value, new log data overwrites existing log data (the oldest log file is overwritten first).

-elfn number-of error-log-files: Specify the number of error log files (`d1mmgrn.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 32,000,000 KB (approximately 30 GB) of error logs in total.

-systflv trace-level: specify the trace output level (refer to Table 2.11).

As the amount of log information that is output increases, the amount of time before existing information is overwritten becomes shorter.

The file used in this case is a Hitachi Network Objectplaza Trace Library (HNTRLib2) file, which is a trace file common to all Hitachi products.

Note: the history and results of user-issued commands are output to the trace files regardless of the trace level.

If an error occurs, you may have to set the trace level to 1 or higher to collect log information.

-systfs trace-file-size: Specify the size of the trace file in kilobytes. Specify a value of 100 to 16000.

When combined with the specification for the number of trace files, the maximum total size of the trace files that can be collected is 1024000 KB.

If a value smaller than the setting value is specified, an execution confirmation message KAPL01097-W is displayed and the trace file is once deleted.

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 fixed. When trace data is written to all trace files, new trace data overwrites old trace data (the oldest file is overwritten first).

-systfn number-of-trace-files: Specify the number of trace files. Specify a value of 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 1024000 KB.

If a value smaller than the setting value is specified, an execution confirmation message KAPL01097-W is displayed and the trace file is once deleted.

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 *execution-interval*] | off}: Enables (on) or disables (off) path health checking.

For a standby host, or a host connected to the Thunder 9500V Series or TagmaStore AMS/WMS Series storage subsystem, we recommend that you activate path health checking to enable detection of errors in paths where I/Os do not occur.

When you specify **on**, specify the execution 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 interval used in the last time

The explanation for the following sub-parameter describes how to specify the checking interval.

-intvl *execution-interval*: Specify the interval between path health checks (in minutes). Use a value between 1 and 1440.

When you change the checking interval, the new interval takes effect immediately. If you decrease the checking interval and the new interval has already elapsed (from the end of the previous path health check until the time you change the interval), the path health check will start immediately.

After you change the checking interval, the new interval remains in effect even if you turn path health checking OFF and then later turn it back ON. When the specified interval has elapsed (starting from the time you turn path health checking ON), the path health check will start.

Caution: In previous versions of HDLM, path health checking was performed by executing a batch file that defined the **online** operation. Do not execute this batch file. With the current version, executing the **set** operation performs path health checking.

-afb {on [-intvl *execution-interval*] | off}: Enables (on) or disables (off) automatic failback.

Automatic failback is executed in the following paths:

Paths where an error occurred and the KAPL08022-E message was displayed, and
Paths where an error occurred at the startup of the HDLM manager.

To prevent an intermittent error from deteriorating I/O performance, we recommend that you also enable intermittent error monitoring when enabling automatic failback. You can specify intermittent error monitoring only when automatic failback is enabled. See section 2.7.1.3 for the relationship between automatic failback and intermittent error monitoring.

When you specify `on`, specify the checking interval of path status by specifying the parameter immediately following `on`. If you do not specify a checking interval, path status is checked in the following interval:

When the checking interval has not been specified before: Every 60 minutes (default setting)

When the checking interval has been specified before: The interval used in the last time.

-intvl *execution-interval*: Specify the interval between path status checks (in minutes). Use a value between 1 and 1440. The default is 60.

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:

error-monitoring-interval >= *checking-interval-for-automatic-failback* x *number-of-times-error-is-to-occur-during-intermittent-error-monitoring*

If this condition is not satisfied, a message (KAPL01080-W) is output and an error occurs. In such a case, 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.

When you change the checking interval, the new interval takes effect immediately. If you decrease the checking interval and the new interval has already elapsed (from the end of the previous path status check until the time you change the interval), the path status check will start immediately.

After you change the checking interval, the new interval remains in effect even if you turn auto failback OFF and then later turn it back ON. When the specified interval has elapsed (starting from the time you turn path status checking ON), the path status check will start.

-iem { on [-intvl *error-monitoring-interval*] [-iemnum *number-of-times-error-is-to-occur*] | off } : Enables (on) or disables (off) intermittent error monitoring.

Intermittent error monitoring can be set 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, in the subsequent parameters 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 (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring is performed on individual paths. Intermittent error monitoring starts when a path is recovered from the error by using 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 the last time are set.

When a value of 2 or more is specified in Number of times, the following condition must be satisfied:

error-monitoring-interval >= *checking-interval-for-automatic-failback* x *number-of-times-error-is-to-occur-during-intermittent-error-monitoring*

If this condition is not satisfied, the KAPL01080-W message is output and an error occurs. In such a case, 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 to specify the error monitoring interval and the number of times that the error is to occur (in order for the system to determine that an intermittent error is occurring):

-intvl *error-monitoring-interval*: Specify the monitoring interval for an intermittent error (in minutes). Use a value from 1 to 1440. The default is 30.

During intermittent error monitoring, 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 error count and the elapsed time measured since monitoring starts are set to 0, and monitoring starts by using the new settings.

Outside the duration of intermittent error monitoring, 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 take effect after the next time automatic failback succeeds. Because the errors and elapsed time are not counted or measured while intermittent errors are not monitored, those values do 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 the monitoring interval is not specified, error monitoring will be executed for the stored monitoring interval.

-iemnum *number-of-times-error-is-to-occur*: Specify the number of times the error is to occur. Use a value 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 starts are reset to 0. Then, the changed setting takes effect and intermittent error monitoring starts.

Outside the duration of 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, from the next time automatic failback finishes normally, the changed values takes effect. Outside the duration of intermittent error monitoring, the number of errors that determine an intermittent error is not counted and this value is not changed.

The number of times that the error is to occur specified in this parameter is stored even though specifying **-iem off** disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and the number of times is not specified, the error monitoring will be executed using the stored number of times.

When the **set -iem on** operation is executed during error monitoring, even though you do not change the conditions for intermittent error, the number of errors and the time that has passed since the error monitoring starts are reset to 0. Then, intermittent error monitoring resumes with the changed settings.

If you set automatic failback to off while intermittent error monitoring is on, intermittent error monitoring becomes disabled. Note, however, that if you use the **view -sys** operation to display the HDLM functionality configuration, Intermittent Error Monitor shows on. When automatic failback is returned to on, intermittent error monitoring becomes enabled.

The executable operations for automatic failback and intermittent error monitoring depend on the setting status for those functions. Table 5.3 shows the relationship between the setting status for automatic failback and intermittent error monitoring and the executable operations for those functions.

Table 5.3 Relations Between the Setting and Available Operations for Automatic Failback and Intermittent Error Monitoring

Settings		Available Operation	Result of Operation	
AFB (Automatic Failback)	IEM (Intermittent Error Monitoring)			
ON	ON	Set AFB to ON.	The operations of AFB and IEM do not change.	
		Change the AFB setting.	AFB operates using new settings. (<i>Note 2</i>)	
		Set AFB to OFF.	AFB and IEM are disabled. The error count, elapsed time, and information about paths not subject to automatic failback are cleared.	
		Set IEM to ON.	When a path is being monitored (in the 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 restarts. When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.	
		Change the IEM settings.	When a path is being monitored (in the 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 restarts according to the conditions for intermittent error after change. (<i>Note 2</i>) When a path is not being monitored (outside the period of conditional intermittent error monitoring), the IEM settings will take effect when the path is recovered from the error status by performing automatic failback.	
		Set IEM to OFF.	IEM is disabled. The error count, elapsed time, and information about paths not subject to automatic failback are cleared.	
	OFF	OFF	Set AFB to ON.	The operations of AFB and IEM do not change.
			Change the AFB setting.	AFB operates using new settings.
			Set AFB to OFF.	AFB is disabled.
			Set IEM to ON.	IEM is enabled. (<i>Note 2</i>)
OFF	ON (<i>Note 1</i>)	Set AFB to ON.	AFB and IEM are enabled. (<i>Note 2</i>)	
		Set AFB to OFF.	The operations of AFB and IEM do not change.	

	OFF	Set AFB to ON.	AFB is enabled.
		Set AFB to OFF.	The operations of AFB and IEM do not change.

Note 1: Since automatic failback is OFF, intermittent error monitoring is disabled, and the settings of Intermittent Error Monitor are not specifiable.

Note 2: When the following condition is not satisfied, a message (KAPL01080-W) is output and an error occurs. When a message (dlnkmgr command: KAPL01080-W, HDLM GUI : KAPL02064-W, HDLM Web GUI : KAPL11144-W) is output and an error occurs, the status of the intermittent error monitoring is not changed at that time.

- 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
= 2006/06/30 12:00:00
#
```

Condition required when intermittent error monitoring (-iem parameter) is ON:

error-monitoring-interval >= checking-interval-for-automatic-failback x number-of-times-error-is-to-occur-during-intermittent-error-monitoring

-lic: Updates the license. Specify this option when a license key is installed. The HDLM license is provided by a license key or a license key file. A license key file is a file that stores an HDLM license key. When using the license key file:

Directly under `/var/tmp`, save the license key file as `hdlm_license`, and then execute the `set -lic` operation. A message appears depending on the type of the license key specified in the license key file, notifying you that the license has been registered. For a temporary or emergency license, the expiration date is also displayed (KAPL01071-I or KAPL01072-I).

When not using the license key file:

The `set -lic` operation displays a message (KAPL01068-I) prompting you to enter a license key. Enter the license key. A message appears depending on the type of the license key specified in the license key file, notifying you that the license has been registered. For a temporary or emergency license, the expiration date is also displayed (KAPL01071-I or KAPL01072-I).

-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.

- Parameters to display the format of the set operation

-help: Displays the format of the set operation.

- Examples

Set the log level. Figure 5.19 shows how to set the log level after asking for confirmation of command execution from the user.

```
# /usr/DynamicLinkManager/bin/dlnkmgr 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
#
```

Figure 5.19 Example of Set Operation with User Confirmation

Update the license key (when the license key file exists). Figure 5.20 shows how to update the license key (when the license key file exists).

```
# /usr/DynamicLinkManager/bin/dlnkmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]:
Y
KAPL01071-I A permanent license was installed.
KAPL01001-I The HDLM command completed normally. Operation name = set,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.20 Example of Updating a License Key (When the License Key File Exists)

Update the license key (when the license key file does not exist). Figure 5.21 shows how to update the license key (when the license key file does not exist).

```
# /usr/DynamicLinkManager/bin/dlnkmgr 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.
KAPL01001-I The HDLM command completed normally. Operation name = set,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.21 Example of Updating a License Key (When the license key file does not exist)

When the confirmation is displayed, enter **y** to continue or **n** to cancel the operation. When a message prompts you to enter a license key, enter the license key.

Set the intermittent error monitoring. Figure 5.22 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
#
```

Figure 5.22 Example of Setting Intermittent Error Monitoring

Figure 5.23 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 } ]
              | -lb off
              | -ellv ElogLevel
              | -elfs ElogFileSize
              | -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
              }
  [-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)
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time
= yyyy/mm/dd hh:mm:ss
#

```

Figure 5.23 Example of set Operation Format

5.7 view Operation

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.

■ Format

To display program information:

```
/usr/DynamicLinkManager/bin/dlnkmgr view -sys  
[-sfunc|-msrv|-adr|-pdrv|-lic]  
[-t]
```

To display path information:

```
/usr/DynamicLinkManager/bin/dlnkmgr view -path  
[-hdev host-device-name]  
[-stname]  
[-iem]  
[-srt {pn|lu|cp}]  
[-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]  
[-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]
```

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]
```

To display HBA port information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -hba [-srt pb] [-t]
```

To display CHA port information

```
/usr/DynamicLinkManager/bin/dlnkmgr view -cha [-srt cp] [-t]
```

Correspondences Between hdisks, OS Management Path IDs, and LDEVs

```
/usr/DynamicLinkManager/bin/dlnkmgr view -drv [-t]
```

To display the format of the view operation:

```
/usr/DynamicLinkManager/bin/dlnkmgr view -help
```

■ **Description**

The `dlnkmgr` command's `view` operation displays HDLM program information, path information, LU information, and the correspondences between hdisks, OS management path IDs, and LDEVs.

■ **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

■ **Parameters to display program information**

`-sys [-sfunc | -msrv | -adv | -pdrv | -lic]`: Displays the HDLM program information. Use one of the subsequent parameters (following `-sys`) to specify the program information you want to display. If you do not specify the subsequent parameter, the command displays all program information.

Table 5.4 describes the specifiable parameters, displayed information, displayed items, and a corresponding description.

`-t`: Does not display the title for each information item.

Table 5.4 Displayed Program Information

Parameter and Program Information	Item	Description
-sfunc Information about the HDLM function settings	HDLM Version	HDLM version number.
	Service Pack Version	HDLM service pack version number. This item is blank if a service pack is not installed.
	Load Balance	Setting 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, the type of algorithm used for load balancing is displayed after the on.</p> <ul style="list-style-type: none"> rr: Round robin extended rr: Extended round robin
	Support Cluster	Blank (Note)

Parameter and Program Information	Item	Description
-sfunc Information about the HDLM function settings	Elog Level	<p>Error logging level</p> <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 or higher level (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	<p>Trace output level</p> <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.
	Path Health Checking	<ul style="list-style-type: none"> ▪ Setting 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, (), after on. The time is in minutes.
	Auto Failback	<ul style="list-style-type: none"> ▪ Setting for 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, (), after on. The time is in minutes.

Parameter and Program Information	Item	Description
	Intermittent Error Monitor	<ul style="list-style-type: none"> Setting for intermittent error monitoring <ul style="list-style-type: none"> on: Enabled off: Disabled <p>When automatic failback is <i>off</i>, intermittent error monitoring is disabled although <i>Intermittent Error Monitor</i> shows <i>on</i>. When automatic failback becomes <i>on</i>, intermittent error monitoring becomes enabled.</p> <ul style="list-style-type: none"> Intermittent error monitoring interval and number of times that the error is to occur <p>When intermittent error monitoring is set to <i>on</i>, the specified intermittent error monitoring interval and number of times that the error is to occur are displayed in parentheses, (), following <i>on</i>. The format is <i>number-of-times-error-is-to-occur/monitoring-interval</i>. The time is in minutes.</p>
-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
-adv 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
	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 view <i>-sys -lic</i> 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)

Note: 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.

- **Parameters to display path information**

When displaying path information, if the **-item** parameter or the **-c** parameter is specified at the same time as 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.

-path: When you specify the **-path** parameter and do not specify either the **-c** or **-item** parameter, the command displays information about the paths without abbreviating or selecting items.

In the subsequent sub-parameters (following **-path**), you can filter the paths to be listed (**-hdev**) and sort the list (**-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 5.13.

The sub-parameters for the **-path** parameter are:

-hdev *host-device-name*: Filters the information only for the paths accessing the specified host device. Specify `hdiskn` for *host-device-name*.

-stname: Use this parameter to display the model ID of the storage subsystem in the product ID part of the **DskName** field. When this parameter is omitted, the command displays the product identifier or emulation type of the subsystem instead.

-iem: Use this parameter to add IEP to path information and display information about intermittent errors. For more information pertaining to IEP, see Table 5.18.

-srt {pn|lu|cp}: Use this parameter to sort the list of 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 subsystem (**DskName**), the second sorting key is the value that you specify with the **-srt** parameter, and the third sorting key is the AutoPATH_ID.

The values that you can specify for the second sorting key are:

pn: Path name

lu: LU number of the storage subsystem

cp: Port number of the channel adapter

When the **-srt** parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

-t: Does not display the title for each information item

- **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 5.5 shows the items that can be selected by using the **-item** parameter and the parameter values that can be specified after the **-item** parameter.

In the subsequent sub-parameters (following **-path -item**), you can filter the paths to be listed (**-hdev**) and sort the list (**-srt**). When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

The subsequent sub-parameters (following **-path -item**) are:

-hdev *host-device-name*: Filters the information only for the paths accessing the specified host device.

Specify *hdiskn* 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 subsystem in the product ID part of the **DskName** field. When this parameter is omitted, the command displays the product identifier or emulation type of the subsystem instead.

When you use the **-stname** 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 list of 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 subsystem (**DskName**), the second sorting key is the value that you specify with the **-srt** parameter, and the third sorting key is the **AutoPATH_ID**.

The values that you can specify for the second sorting key are:

pn: Path name

lu: LU number of the storage subsystem

cp: Port number of the channel adapter

When the **-srt** parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

When you use the **-srt** 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: Does not display the title for each information item

Table 5.5 Items that Can Be Selected by the **-path -item** Parameter and Parameter Values That Can Be Specified After The **-path -item** Parameter

Parameter values that can be specified after the -path -item parameter	Selectable Items
<i>None</i>	PathID*
<i>None</i>	Status*
Pn	PathName
Dn	DskName
Lu	iLU
Cp	ChaPort

Parameter values that can be specified after the <code>-path -item</code> parameter	Selectable Items
Type	Type
lc	IO-Counts
le	IO-Errors
Dnu	DNum
Hd	HDevName
lep	IEP

* Because both **PathID** and **Status** are always displayed, they do not require any parameters to be specified.

- **Parameters 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 from the path information managed by HDLM. The displayed contents are shortened so that each instance of path information 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 in each item, see Table 5.13.

When you use the `-c` parameter, the number of characters that can be displayed in the product ID part of the **DskName** field is limited to 10. Therefore, when there are 11 or more characters in the product ID, the 8th and following characters are abbreviated to ellipses (...).

The subsequent sub-parameters (following `-path -c`) are:

-stname: Use this parameter to display the model ID of the storage subsystem in the product ID part of the **DskName** field. When this parameter is omitted, the command displays the product identifier or emulation type of the subsystem instead.

-srt {lu | cp}: Use this parameter to sort the list of 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 subsystem (**DskName**), the second sorting key is the value that you specify with the `-srt` parameter, and the third sorting key is the **AutoPATH_ID**.

The values that you can specify for the second sorting key are:

lu: LU number of the storage subsystem

cp: Port number of the channel adapter

When the `-srt` parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

-t: Does not display the title for each information item

- **Parameters 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.

-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 display item, see Table 5.19.

The subsequent parameters are:

-hdev *host-device-name*: Displays only the information about the LU corresponding to the specified host device name.

Specify `hdiskn` 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 to which the path with the specified *AutoPATH_ID* is connected.

-t: Does not display the title for each information item.

- **Parameters to display LU information (displaying a summary)**

-lu -c: When the **-c** parameter is specified with the **-lu** parameter, a summary of LU configuration information is displayed on a line. The total number of paths recognized by HDLM and the number of online paths are displayed for each LU.

Note: You cannot specify the **-c** parameter together with the **-hdev** or **-pathid** parameter.

For details on the contents of each display item, see Table 5.19.

-t: Does not display the title for each information item.

- **Parameters to display LU information (selecting items to be displayed)**

-lu -item: The items specified with the **-item** option are added to the items to be displayed by the **-lu** option and displayed.

Note: When the value of the **-item** parameter is omitted or all is specified, all the items that can be displayed are displayed.

Table 5.6 shows the correspondence between the items that can be displayed by the **dlnkmgr view -lu -item** command and the parameter values for displaying each item.

Table 5.6 Items Displayed by the `dlnkmgr view -lu -item` Command and the Values of the **-item** Parameter

Items Displayed by the <code>dlnkmgr view -lu -item</code> Command	Values Specified after the -item
SLPR	slpr
PathName	pn

Items Displayed by the <code>dlnkmgr view -lu -item</code> Command	Values Specified after the <code>-item</code>
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 subsequent sub-parameters (`-hdev` or `-pathid`), you can filter the LU information to be displayed. When 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 5.20.

The subsequent sub-parameters are:

`-hdev host-device-name`: Displays only the information about the LU corresponding to the specified host device name.

Specify `hdiskn` 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 to which the path with the specified `AutoPATH_ID` is connected.

`-t`: Does not display the title for each information item.

- **Parameters to display a summary of LU information (without selecting items to be displayed)**

`-lu -c`: When the `-c` parameter is specified with the `-lu` parameter, a summary of LU configuration information is displayed on a 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 5.6.

`-t`: Does not display the title for each information item.

- **Parameters to display a summary of LU information (by selecting items to be displayed)**

`-lu -c -item`: The items specified with the `-item` option are added to the items to be displayed by the `-lu -c` option and displayed.

If no value is specified or `all` is specified for the `-item` parameter, the command displays all of the items that can be displayed.

Table 5.7 shows the correspondence between the items that can be displayed by the `dlnkmgr view -lu -c -item` command and the value specified after the `-item` parameter.

Table 5.7 Correspondence Between the Item Displayed by the `dlnkmgr view -lu -c -item` Command and the Value of the `-item` Parameter

Item Displayed by the <code>dlnkmgr view -lu -c -item</code> Command	Value Specified after the <code>-item</code> Parameter
SLPR	slpr
VG	vg
All items	all

The subsequent sub-parameter is:

`-t`: Does not display the title for each information item.

- **Parameters 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.

The subsequent sub-parameters are:

`-srt pb`: Sorts the HBA port information by the HBA adapter number (`Port`) and bus numbers (`Bus`).

`-t`: Does not display the title for each information item.

- **Parameters 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 `monitor` operations, and can also be used in `Offline` and `Online` operations.

The subsequent sub-parameters are:

`-srt cp`: Sorts the CHA port information by the storage subsystem model IDs (`Product`), storage subsystem serial numbers (`S/N`), and CHA port numbers (`ChaPort`).

`-t`: Does not display the title for each information item.

- **Parameters to Display the Correspondences Between `hdisks`, OS Management Path IDs, and LDEVs**

`-drv`: Use this parameter to display the `PathIDs`, `hdiskn`, OS management path IDs, and information about the LDEVs in a storage subsystem (identified by the storage subsystem model ID, serial number, and LU number, separated by periods).

`-t`: Does not display the title for each information item.

- **Parameters to display the format of the view operation**

`-help`: Use this parameter to display the `view` operation format.

- **Examples**

HDLM function settings. Figure 5.24 shows how to display information about the HDLM function settings. Table 5.8 describes the displayed items.

HDLM manager. Figure 5.25 shows how to display information about the HDLM manager. Table 5.9 describes the displayed items.

HDLM alert driver. Figure 5.26 shows how to display information about the HDLM alert driver. Table 5.10 describes the displayed items.

HDLM driver. Figure 5.27 shows how to display information about the HDLM driver. Table 5.11 describes the displayed items.

Paths that access a host device. Figure 5.28 shows how to display information about the paths that access a host device `hdisk1`. Table 5.13 describes the displayed items.

Summary path information. Figure 5.30 shows how to display a summary of the path information in order of iLUs. For details on the displayed items, refer to Table 5.13.

Specifying path info. In Figure 5.31 `IO-Count` is selected as the display item and the path information is sorted in ascending order of the LUs. For details on the displayed items, refer to Table 5.13.

LU information. Figure 5.32 shows how to display LU information. Table 5.19 describes the displayed items.

Abbreviated LU information. Figure 5.35 shows how to abbreviate the display of the LU information. Table 5.19 describes the displayed items.

Specifying device information. Figure 5.36 shows how to specify the items to display in an execution result ordered by iLU. In this example, the user specified `PathName`, `ChaPort`, `Type`, `IO-Counts`, `IO-Errors`, `DskName`, `IEP`, and `VG`. For details on the displayed items, refer to Table 5.19.

Displaying LU Information:

Without Selecting Items to be Displayed. Figure 5.37 shows how to display LU information without selecting specific items to be displayed.

Using iLUs as a Sorting Key, and Selecting the Items to be Displayed. Figure 5.38 shows how to add SLPR, PathName, ChaPort, CLPR, Type, IO-Count, IO-Errors, DNum, IEP, and VG.

Display a Summary of the LU Information (Without Selecting Items to be Displayed): Figure 5.39 shows how to display a summary of LU information without selecting specific items to be displayed.

Displaying a Summary of the LU Information by Selecting Items to be Displayed. Figure 5.40 shows how to display a summary of LU information by selecting specific items to be displayed.

HDLM driver instances and disk devices. shows how to display information about the correspondence between each instance of an HDLM driver and a physical volume.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : xx-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            : 1
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : off
Intermittent Error Monitor : off
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.24 Displaying Information on the HDLM Function Settings

Note: The HDLM version is shown in screen captures as 05-40. This is equivalent to version 5.4.

Table 5.8 Description of HDLM Function Settings

Function Setting	Description
HDLM Version	HDLM version number
Service Pack Version	HDLM service pack version number. This item is blank if a service pack is not installed.
Load Balance	Setting for load balancing: on: Enabled off: Disabled
Support Cluster	The dlnkmgr view -sys command displays nothing in this field. However, HDLM operates normally in both cluster and non-cluster configurations.
Elog Level	Error Logging level: 0: Do not collect an error log. 1: Collect error information for the Error or higher level. 2: Collect error information for the Warning or higher level. 3: Collect error information for the Information or higher level (that is, all levels). 4: Collects error information at the Information or higher level (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: 0: Do not output any trace. 1: Only output error information. 2: Output a summary of program operation. 3: Output details of program operation. 4: Output all information.
Trace File Size (KB)	Trace file size in kilobytes
Number of Trace Files	Number of trace files
Path Health Checking	Setting for path health checking: on: Enabled off: Disabled When path health checking is on , the execution interval (in minutes) of path health checking is displayed in parentheses (refer to Figure 5.24).
Auto Failback	Setting for automatic failback: on: Enabled off: Disabled When automatic failback is on , the execution interval (in minutes) of automatic failback is displayed in parentheses (refer to Figure 5.24).
Intermittent Error Monitor	Setting for intermittent error monitoring on: Enabled off: Disabled When automatic failback is off, intermittent error monitoring is disabled although Intermittent Error Monitor shows on. When automatic failback becomes on, intermittent error monitoring becomes enabled. Intermittent error monitoring interval and number of times that the error is to occur: When intermittent error monitoring is set to on, the specified intermittent error monitoring interval and number of times that the error is to occur are displayed in parentheses, (), following on. The format is number-of-times-error-is-to-occur/monitoring-interval. The time is in minutes.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive      xx-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
#
```

Figure 5.25 Displaying Information on the HDLM Manager

Note: The HDLM version is shown in screen captures as 05-40. This is equivalent to version 5.4.

Table 5.9 Description of HDLM Manager Information

Item	Description
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

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -adv
HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      xx-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
#
```

Figure 5.26 Displaying Information on the HDLM Alert Driver

Note: The HDLM version is shown in screen captures as 05-40. This is equivalent to version 5.4.

Table 5.10 Description of the HDLM Alert Driver Information

Item	Description
HDLM Alert Driver	Status of the HDLM alert driver: Alive: Normal Dead: Stopped
Ver	Version number of the HDLM alert driver
WakeupTime	Startup time of the HDLM alert driver
Elog Mem Size	Size of error log memory for the HDLM alert driver

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv
HDLM Driver Ver      WakeupTime
Alive      xx-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
#
```

Figure 5.27 Displaying Information on the HDLM Driver

Note: The HDLM version is shown in screen captures as 05-40. This is equivalent to version 5.4.

Table 5.11 Description of the HDLM Driver Information

Item	Description
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

```
# /usr/DynamicLinkManager/bin/dlnkmgr 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
#
```

Note: The column headings in this figure have been modified for improved readability: bold has been applied, spacing has been adjusted, and the headings are repeated for each path. The actual display is different than this figure.

Figure 5.28 Displaying Information on the Host Device Path

Figure 5.29 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
#
```

Figure 5.29 Displaying Information about the HDLM License

Table 5.12 Description of the HDLM License Information

Item	Description
LicenseType	License types are one of the following: Permanent Temporary Emergency
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: YYYY/MM/DD(ndays after). When the view -sys -lic operation is executed, (ndays after) appears if there are n days left until the license period expires. When there are 100 days left until the license period (2005/08/21) expires 2005/08/21(100days after)

Table 5.13 describes the displayed path information. The following explains the table headings:

- No summary displayed: The user specifies the **-path** parameter or **-path -item** parameter.
- Summary displayed: The user specifies the **-path -c** parameter.

Table 5.13 Description of the 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 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.
PathStatus		Status of the displayed paths. The displayed status indicates the following: <ul style="list-style-type: none"> ▪ Online: All paths are available. ▪ Reduced: Some paths are not available. Reduced means that some paths might have an error status, in which case you should check the status of individual paths and take appropriate action for any paths that have an error status.
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		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.
PathName (Note)	-	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. <code>Path name</code> consists of the following four elements, separated by periods: <ul style="list-style-type: none"> ▪ HBA adapter number (character string) ▪ Bus number (character string) ▪ Target ID (hexadecimal number) ▪ Host LU number (hexadecimal number)

DskName (Note)	DskName	<p>Storage subsystem name, which identifies the storage subsystem that is accessed by a path.</p> <p>A storage subsystem name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> ▪ Vendor ID: The name of the storage subsystem vendor (for example, <code>HITACHI</code>). ▪ Product ID: Indicates the storage subsystem product ID, emulation type, or model name (for example, <code>OPEN-3</code>). ▪ Serial number: The serial number of the storage subsystem (for example, <code>15001</code>). <p>You can identify an actual storage subsystem by referencing the above information from the storage subsystem management program.</p>
iLU (Note)	iLU	<p>LU number of the storage subsystem.</p> <p>This number combined with the storage subsystem 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, TagmaStore USP, and SVS, 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 the Thunder 9500V Series and TagmaStore AMS/WMS Series, indicated by a decimal number. The entire value of <code>iLU</code> is the internal LU number within the storage subsystem. You can identify an actual LU by referencing <code>iLU</code> from the storage subsystem management program. ▪ For Universal Storage Platform V, 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.
ChaPort (Note)	CP	<p>Port number of the channel adapter, which identifies the CHA port that is mounted on the storage subsystem.</p> <p>You can identify an actual CHA port by referencing this number from the storage subsystem management program.</p> <p>For the Lightning 9900V Series, the port number of the channel adapter is the same as the number shown by the SVP.</p>
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 <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 7.2.</p>
Type (Note)	Type	<p>Attribute of the path</p> <ul style="list-style-type: none"> ▪ Own: Owner path ▪ Non: Non-owner path <p>When connecting to the Lightning 9900V Series, TagmaStore USP, Universal Storage Platform V, or SVS, all paths are owner paths.</p>
IO-Count (Note)	-	<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 is reset, and the count is re-started from 0.</p> <p>To reset the <code>IO-Count</code> value to zero, execute the <code>dlkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (<code>IO-Errors</code>) to zero. For details about the <code>clear</code> operation, see section 5.2.</p>

IO-Errors (Note)	-	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 is reset, and the count is re-started from 0. To reset the IO-Errors value to zero, execute the <code>dlkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to zero. For details about the <code>clear</code> operation, see section 5.2.
DNum (Note)	-	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.
HDevName (Note)	-	Host device name. <code>hdiskn</code> is displayed.
IEP (Note)	-	Information about the intermittent error. 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: <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).

Legend:

- : Not displayed

Note: The path information is displayed only when a value is specified for the `-path -item` parameter.

Table 5.14 Path Status and Contents Displayed in IEP When Intermittent Error Monitoring is Enabled

Model Names of Storage Subsystems	Product ID	
	Without the <code>-stname</code> Parameter	With the <code>-stname</code> Parameter (Displays the Following for the Model Name)
Thunder 9500V Series	product identifier (Note)	9500V
TagmaStore AMS		AMS
TagmaStore WMS		WMS
Lightning 9900V Series	Emulation type (Note)	9970/9980
SVS		SVS
<ul style="list-style-type: none"> ▪ Hitachi TagmaStore™ Universal Storage Platform 100 ▪ Hitachi TagmaStore™ Universal Storage Platform 600 ▪ Hitachi TagmaStore™ Universal Storage Platform 1100 ▪ TagmaStore NSC55 		USP
Hitachi Universal Storage Platform V		USP_V
XP128		XP128
XP1024		XP1024
XP10000		XP10000
XP12000		XP12000
XP24000		XP24000

Note: When a summary is displayed by specifying the `-path -c` parameter and there are more than 11 characters in the summary string, characters after the 9th character are displayed as an ellipsis (...).

Table 5.15 shows the path status and contents displayed in IEP when intermittent error monitoring is enabled.

Table 5.15 Path Status and Contents Displayed in IEP when Intermittent Error Monitoring is Enabled

Contents Displayed in IEP	Status of the Intermittent Error Monitoring	Path Status
*	The path is assumed to be an intermittent error and is removed from items subject to automatic failback.	Online(E) Offline(E)
Numerical value 0 or more	Inside the period of intermittent error monitoring	Online(E) Offline(E) Online

Contents Displayed in IEP	Status of the Intermittent Error Monitoring	Path Status
Not applicable.	Outside the period of intermittent error monitoring	Online(E) Offline(E) Online Offline(C)

Table 5.16 lists and describes the displayed HBA port information.

Table 5.16 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) separated by a period
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.

Table 5.17 lists and describes the displayed CHA port information.

Table 5.17 Items Displayed as CHA Port Information

Item	Description
ChaID	CHA port ID
Product	Model ID of the storage subsystem
S/N	Serial number of the storage subsystem
ChaPort	Port number of the channel adapter, which identifies the CHA port that is mounted on the storage subsystem. You can identify an actual CHA port by referencing this number from the storage subsystem 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

Item	Description
	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.

```
# /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
#
```

Figure 5.30 Displaying Summary Path Information

```

# /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
#

```

Figure 5.31 Displaying Specific Items of Path Information

```

# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : USP
SerialNumber : 0014010
LUs          : 10

iLU  HDevName  OSPathID  PathID  Status
003A hdisk0   0000     000000 Online
      0001     000001 Online
003B hdisk1   0000     000002 Online
      0001     000003 Online
003C hdisk2   0000     000004 Online
      0001     000005 Online
003D hdisk3   0000     000006 Online
      0001     000007 Online
003E hdisk4   0000     000008 Online
      0001     000009 Online
003F hdisk5   0000     000010 Online
      0001     000011 Online
0040 hdisk6   0000     000012 Online
      0001     000013 Online
0041 hdisk7   0000     000014 Online
      0001     000015 Online
0042 hdisk8   0000     000016 Online
      0001     000017 Online
0043 hdisk9   0000     000018 Online
      0001     000019 Online
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#

```

Figure 5.32 Displaying LU Information

```

# /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
#

```

Figure 5.33 Displaying HBA Port Information

```

# /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 =
yyyy/mm/dd hh:mm:ss
#

```

Figure 5.34 Displaying CHA Port Information

Table 5.18 Device Information Using Host LUs as a Sorting Key

Item	Description
Product	Model name of the storage subsystem
Serial number	Serial number of the storage subsystem
LUs	Total number of LUs managed by HDLM among the LUs in the storage subsystem
iLU	LU number in the storage subsystem
HDevName	hdisk <i>n</i> (where <i>n</i> is the driver's instance number) is displayed.
Device	Physical volume name that corresponds to each instance of an HDLM driver
PathID	AutoPATH_ID indicated by a decimal number
Status	Status of the path Online: Online Offline(C): Placed offline by a command Offline(E): Offline due to an error Online(E): Failure has occurred (If none of the paths accessing a device is in the Online status, one of the paths is changed to the Online(E) status.)

```
# /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 = 2005/06/01 12:00:00
#
```

Figure 5.35 Displaying Abbreviated LU Information

Table 5.19 Displayed LU information

Displayed Item		Description
No Summary Displayed	Summary Displayed	
Product		Model ID of the storage subsystem
Serial number	S/N	Serial number of the storage subsystem
LUs		Total number of LUs managed by HDLM among the LUs in the storage subsystem
iLU		<p>LU number in the storage subsystem</p> <p>This number combined with the storage subsystem 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, TagmaStore USP, and SVS, 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 the Thunder 9500V Series and TagmaStore AMS/WMS Series, indicated by a decimal number. The entire value of <code>iLU</code> is the internal LU number within the storage subsystem. You can identify an actual LU by referencing <code>iLU</code> from the storage subsystem management program. ▪ For Universal Storage Platform V, 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 (<i>Note 1</i>)	SLPR (<i>Note 2</i>)	The number of the SLPR to which the LU belongs, indicated by a decimal number from 0 to 31. A hyphen (-) is displayed if the storage logical partition functionality for the storage subsystem for the target LU is not supported.
HDevName (<i>Note 1</i>)	-	Host device name. <code>hdiskn</code> is displayed.
OSPathID	-	OS management path ID.
PathID	-	<p>AutoPATH_ID indicated by a decimal number.</p> <p>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>
PathName (<i>Note 1</i>)	-	<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. <code>Path name</code> consists of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> ▪ HBA adapter number (character string) ▪ Bus number (character string) ▪ Target ID (hexadecimal number) ▪ Host LU number (hexadecimal number)

ChaPort (Note 1)	-	<p>Port number of the channel adapter, which identifies the CHA port that is mounted on the storage subsystem.</p> <p>You can identify an actual CHA port by referencing this number from the storage subsystem management program.</p> <p>For the Lightning 9900V Series, the port number of the channel adapter is the same as the number shown by the SVP.</p>
CLPR (Note 1)	-	<p>The number of the CLPR to which the CHA belongs, indicated by a decimal number from 0 to 31. A hyphen (-) is displayed if the cache logical partition functionality for the storage subsystem for the target CHA is not supported.</p>
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 7.2.</p>
Type (Note 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, TagmaStore USP, Universal Storage Platform V, or SVS, all paths are owner paths.</p>
IO-Count (Note 1)	-	<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 is reset, and the count is re-started from 0.</p> <p>To reset the IO-Count value to zero, execute the <code>dlnkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (IO-Errors) to zero. For details about the <code>clear</code> operation, see section 5.2.</p>
IO-Errors (Note 1)	-	<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 is reset, and the count is re-started from 0.</p> <p>To reset the IO-Errors value to zero, execute the <code>dlnkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to zero.</p> <p>For details about the <code>clear</code> operation, see section 5.2.</p>
DNum (Note 1)	-	<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>
IEP (Note 1)	-	<p>The displayed paths are assumed to be in an intermittent error status and checked whether those paths are to be operated for automatic failback.</p> <p>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 failback does not check the path).

VG (Note 1)	VG (Note 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, indicated by a decimal number
-	OnlinePaths	Number of available 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 paths that have an error status.

Legend:

- : Not displayed

Note 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.

Note 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.

```
# /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  -          0000      000000 08.11.0000000000660B00.0000
2B      1 Online   Own        0          0          0  0 -
          0001      000001 08.1D.0000000000660C00.0000
3B      1 Online   Own        0          0          0  0 -
0151  12  hdisk1  samplevg001 0000      000002 08.11.0000000000660B00.0001
2B      1 Online   Own        0          0          0  0 -
          0001      000003 08.1D.0000000000660C00.0001
3B      1 Online   Own        0          0          0  0 -
0152  12  hdisk2  samplevg002 0000      000004 08.11.0000000000660B00.0002
2B      1 Online   Own        0          0          0  0 -
          0001      000005 08.1D.0000000000660C00.0002
3B      1 Online   Own        0          0          0  0 -
0153  12  hdisk3  -          0000      000006 08.11.0000000000660B00.0003
2B      1 Online   Own        0          0          0  0 -
          0001      000007 08.1D.0000000000660C00.0003
3B      1 Online   Own        0          0          0  0 -
0154  12  hdisk4  -          0000      000008 08.11.0000000000660B00.0004
2B      1 Online   Own        0          0          0  0 -
          0001      000009 08.1D.0000000000660C00.0004
3B      1 Online   Own        0          0          0  0 -
0155  12  hdisk5  -          0000      000010 08.11.0000000000660B00.0005
2B      1 Online   Own        0          0          0  0 -
          0001      000011 08.1D.0000000000660C00.0005
3B      1 Online   Own        0          0          0  0 -
```

```

0156 12 hdisk6 - 0000 000012 08.11.0000000000660B00.0006
2B 1 Online Own 0 0 0 -
0001 000013 08.1D.0000000000660C00.0006
3B 1 Online Own 0 0 0 -
0157 12 hdisk7 - 0000 000014 08.11.0000000000660B00.0007
2B 1 Online Own 0 0 0 -
0001 000015 08.1D.0000000000660C00.0007
3B 1 Online Own 0 0 0 -
0158 12 hdisk8 - 0000 000016 08.11.0000000000660B00.0008
2B 1 Online Own 0 0 0 -
0001 000017 08.1D.0000000000660C00.0008
3B 1 Online Own 0 0 0 -
0159 12 hdisk9 - 0000 000018 08.11.0000000000660B00.0009
2B 1 Online Own 0 0 0 -
0001 000019 08.1D.0000000000660C00.0009
3B 1 Online Own 0 0 0 -
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#

```

Figure 5.36 Displaying Specific Items of LU Information

Table 5.20 Items That Can Be Selected with the -item Parameter

Item	Description
PathName	Path name that consists of the following four elements, separated by periods: <ul style="list-style-type: none"> Host port number (hexadecimal number) Bus number (hexadecimal number) Target ID (hexadecimal number) Host LU number (hexadecimal number)
ChaPort	Port number of the channel adapter. For the Lightning 9900V Series, the port number of the channel adapter is the same as the number shown by the SVP.
Type	Attribute of the path Own: Owner path Non: Non-owner path
IO-Count	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 is reset, and the count is re-started from 0.
IO-Errors	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 is reset, and the count is re-started from 0.
DNum	A device number, which is equivalent to a logical volume number in AIX. A device number beginning from 0 is assigned to the device in the LU. In AIX, this value is fixed to 0 because one LU contains one device.
IEP	The displayed paths are assumed to be in an intermittent error status and checked whether those paths are to be operated for automatic failback. -: Indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. Numerical value larger than 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	Volume group name

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : USP
SerialNumber : 0014010
LUs         : 10

iLU  HDevName  OSPathID  PathID  Status
003A hdisk0   0000      000000 Online
      0001      000001 Online
003B hdisk1   0000      000002 Online
      0001      000003 Online
003C hdisk2   0000      000004 Online
      0001      000005 Online
003D hdisk3   0000      000006 Online
      0001      000007 Online
003E hdisk4   0000      000008 Online
      0001      000009 Online
003F hdisk5   0000      000010 Online
      0001      000011 Online
0040 hdisk6   0000      000012 Online
      0001      000013 Online
0041 hdisk7   0000      000014 Online
      0001      000015 Online
0042 hdisk8   0000      000016 Online
      0001      000017 Online
0043 hdisk9   0000      000018 Online
      0001      000019 Online
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.37 Example of Displaying the LU Information Without Selecting Items to be Displayed

```

# /usr/DynamicLinkManager/bin/dlnkgr 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
-----
0150  12  hdisk0   -          0000     000000 08.11.0000000000660B00.0000         2B      1
Online   Own          0          0          0 -
0150  12  hdisk0   -          0001     000001 08.1D.0000000000660C00.0000         3B      1
Online   Own          0          0          0 -
0151  12  hdisk1   samplevg001 0000     000002 08.11.0000000000660B00.0001         2B      1
Online   Own          0          0          0 -
0151  12  hdisk1   -          0001     000003 08.1D.0000000000660C00.0001         3B      1
Online   Own          0          0          0 -
0152  12  hdisk2   samplevg002 0000     000004 08.11.0000000000660B00.0002         2B      1
Online   Own          0          0          0 -
0152  12  hdisk2   -          0001     000005 08.1D.0000000000660C00.0002         3B      1
Online   Own          0          0          0 -
0153  12  hdisk3   -          0000     000006 08.11.0000000000660B00.0003         2B      1
Online   Own          0          0          0 -
0153  12  hdisk3   -          0001     000007 08.1D.0000000000660C00.0003         3B      1
Online   Own          0          0          0 -
0154  12  hdisk4   -          0000     000008 08.11.0000000000660B00.0004         2B      1
Online   Own          0          0          0 -
0154  12  hdisk4   -          0001     000009 08.1D.0000000000660C00.0004         3B      1
Online   Own          0          0          0 -
0155  12  hdisk5   -          0000     000010 08.11.0000000000660B00.0005         2B      1
Online   Own          0          0          0 -
0155  12  hdisk5   -          0001     000011 08.1D.0000000000660C00.0005         3B      1
Online   Own          0          0          0 -
0156  12  hdisk6   -          0000     000012 08.11.0000000000660B00.0006         2B      1
Online   Own          0          0          0 -
0156  12  hdisk6   -          0001     000013 08.1D.0000000000660C00.0006         3B      1
Online   Own          0          0          0 -
0157  12  hdisk7   -          0000     000014 08.11.0000000000660B00.0007         2B      1
Online   Own          0          0          0 -
0157  12  hdisk7   -          0001     000015 08.1D.0000000000660C00.0007         3B      1
Online   Own          0          0          0 -
0158  12  hdisk8   -          0000     000016 08.11.0000000000660B00.0008         2B      1
Online   Own          0          0          0 -
0158  12  hdisk8   -          0001     000017 08.1D.0000000000660C00.0008         3B      1
Online   Own          0          0          0 -
0159  12  hdisk9   -          0000     000018 08.11.0000000000660B00.0009         2B      1
Online   Own          0          0          0 -
0159  12  hdisk9   -          0001     000019 08.1D.0000000000660C00.0009         3B      1
Online   Own          0          0          0 -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymm/dd hh:mm:ss
#

```

Figure 5.38 Example Showing How to Display LU Information Using iLUs as a Sorting Key, and Selecting the 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
#
```

Figure 5.39 Example Showing How to Display a Summary of the LU Information (Without Selecting Items to be Displayed)

```
# /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
#
```

Figure 5.40 Example Showing How to Display a Summary of the LU Information by Selecting Items to be Displayed

Table 5.21 describes the items that can be selected by using the `-lu -c -item` parameter.

Table 5.21 Items that can be Selected with the `-lu -c -item` Parameter

Item	Description
SLPR	The number of the SLPR to which the LU belongs, indicated by a decimal number from 0 to 31. A hyphen (-) is displayed if the storage logical partition functionality for the storage subsystem for the target LU is not supported.
VG	The name of a volume group to which an LU is registered. A hyphen (-) is displayed if no LU is registered to the volume group.

Table 5.22 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. <code>hdiskn</code> is displayed.
OSPathID	OS management path ID.
LDEV	The model ID, serial number, and iLU number for the storage subsystem, separated by periods. The information about an LDEV can physically identify an LU.

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName OSPathID LDEV
000000 hdisk0 0000 9500v.0051.0005
000001 hdisk1 0000 9500v.0051.0015
000002 hdisk2 0000 9500v.0051.0020
000003 hdisk0 0001 9500v.0051.0005
000004 hdisk1 0001 9500v.0051.0015
000005 hdisk2 0001 9500v.0051.0020
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Figure 5.41 To Display the Correspondences Between hdisks, OS Management Path IDs, and LDEVs

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -help
view:
Format
dlnkmgr view -sys [ -sfunc | -msrv | -adrv | -pdrv | -lic ] [-t]
dlnkmgr view -path [ -hdev HostDeviceName ] [-stname] [-iem]
[-srt {pn | lu | cp}] [-t]
dlnkmgr view -path
-item [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
[ -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] [-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
#
```

Figure 5.42 To Display the Format of the View Operation

Chapter 6 Using the HDLM Utilities

This chapter describes the HDLM for AIX utilities. Users who have root privileges can execute the HDLM utilities:

- HDLM Error Information Collection Utility (DLMgetras) (see section 6.1)
- Utility for assisting HDLM migration (dlmmigsts) (see section 6.2)
- Utility for Setting the HDLM Execution Environment (dlmodmset) (see section 6.3)
- Utility for Clearing HDLM Persistent Reservation (dlmpr) (see section 6.4)
- Utility Executed before Uninstalling HDLM (dlmpreuninst) (see section 6.5)
- Utility for Deleting HDLM Drivers (dlmrmddev) (see section 6.6)
- Utility for HDLM Installation Configuration Support (dlmsetup) (see section 6.7)

Table 6.1 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 (see Note 1)	Execution time (see Note 2 and Note 3)
Execution time of the device configuration on starting the host	4/1024	42 seconds
(when HDLM is installed)	Aug-48	42 seconds
	16/4096	43 seconds
Execution time of the device configuration on starting the host	4/1024	32 seconds
(when HDLM is not installed)	Aug-48	38 seconds
	16/4096	1 minutes 37 seconds
Executing <code>cfgmgr</code>	4/1024	53 seconds
	Aug-48	1 minutes 14 seconds
	16/4096	1 minutes 51 seconds
Executing <code>dlnrmdev</code>	4/1024	1 minutes 15 seconds
	Aug-48	1 minutes 27 seconds
	16/4096	1 minutes 51 seconds
Executing <code>view -path</code>	4/1024	0.42 seconds
	Aug-48	1.51 seconds
	16/4096	3.41 seconds

Note 1: The number of LUs is 256.

Note 2: 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 switches)
- The number of hdisk created under the `/dev` directory

Note 3: The execution environment is as follows:

Machine Spec : CPU : Power4 1200MHz x 2

6.1 HDLM Error Information Collection Utility (DLMgetras)

Important: Execute DLMgetras immediately after an error occurs, since restarting the machine may delete information collected by DLMgetras.

■ Format

```
# /usr/DynamicLinkManager/bin/DLMgetras {destination-directory-for-collected-  
information [-f file-for-defining-the-information-to-be-collected] | -h}
```

Note: You can also use lower-case characters (**dlmgetras**).

■ Description

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:

1. *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.

2. *hbsa.tar.Z*

This file contains compressed error information of the HiCommand products other than HDLM.

This file is output only when using the HiCommand product that is the target for collecting error information.

3. *getras.tar.Z*

This file contains compressed HDLM information and system information.

For details about the information that is stored in each file, see Table 6.2.

When you want to collect information other than that in Table 6.2, 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.

■ Parameters

destination-directory-for-collected-information: Specify the directory to which the collected information is output. The directories to be output are created in the specified directory, and error information is collected in the created directories.

-f file-for-defining-the-information-to-be-collected: Specify this parameter when you want to specify the directories or the files to be collected. Specify the directories or the files in the file for defining the information to be collected, and then specify this parameter. Use an absolute path to specify the *file-for-defining-the-information-to-be-collected*.

-h: Displays the format of the issued command

Note: DLMgetras compresses files other than the OS crash dump and directories and saves them to the **getras.tar.Z** file in the specified directory.

Note: If the specified output directory already exists, a message confirming the overwrite of the directories and files is displayed. If you enter **y**, the file is overwritten. If you enter **n**, the utility is terminated without being executed.

Note: 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
```

Table 6.2 Error Information Collected by the DLMgetras Utility

Directory	File	Description
Directly under the directory to which collected information is output	getras.log	Log file generated when DLMgetras is executed
/opt/Hitachi/Hamon/etc	Sysdef	File to define HA monitor environment
	Servers	File to define HA monitor server
/var/DynamicLinkManager/log	dlimmgr[1-16].log	HDLM Manager log (including the driver log)
	dlmwebagent[1-16].log	HDLM remote access interface log file
	dlminquiry[1-2].log	Inquiry log
	dlmguiinst.log	Installation linkage script log used when linking with HiCommand products other than HDLM
	hdlmtr[1-64].log	Trace file
	dlimconfig[1-2].log	HDLM configuration log
	dlmutil[1-2].log	HDLM utility's log file
var/DynamicLinkManager/log/mmap	hdlmtr.mm	Trace management file
	dlmutil.mm	HDLM utility's log trace management file
/opt/hitachi/HNTRLlib2/mmap	hntr2mmap.mm	Memory mapped file
<i>integrated-trace-file-output-directory-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> (Default: var/opt/hitachi/HNTRLlib2/spool)	<i>integrated-trace-file-prefix-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility2[1-64].log</i> (Note 2) (default prefix: hntr)	
/opt/hitachi/HNTRLlib/mmap	hntrmmap.mm	Memory mapped file (HNTRLlib) output for HDLM 04-00 or earlier
<i>integrated-trace-file-output-directory-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> (Default: opt/hitachi/HNTRLlib/spool)	hntr[1-16].log	Integrated trace file (HNTRLlib) output for HDLM 04-00 or earlier

Directory	File	Description
/var/opt/hitachi/HNTRLib2/spool	hntr2*.log (* = 1-16) (e.g., hntr21.log , hntr22.log , hntr23.log , hntr24.log , etc.)	Trace files (Note 2)
usr/DynamicLinkManager/config	dlimmgr.xml	dlimmgr setting file
	dlimwebagent.properties	HDLM remote access interface settings file
etc	syslog.conf	File for defining the directory for the output destination of syslog
	filesystems	Mount information of the file system
	inittab	inittab file
<i>error-log-file</i>	<i>error-log-file</i>	Error log file obtained by /usr/lib/errdemon -1
<i>/OS-crash-file-directory</i> (The directory that is output as the copy directory value when the sysdumpdev -l command is executed)	<i>OS-crash-file-name</i>	Outputs the OS crash dump file to the copy directory whose value is returned by the sysdumpdev -l command. (Note 1)
<i>/directory-for-the-output-destination-of-syslog</i>	<i>syslog-name</i>	syslog and backup files defined in /etc/syslog.conf file
<i>directory-to-which-the-collected-information-is-output/getrasinfo</i>	(Not applicable)	Directory for collecting the command execution results
	disk.txt	List of disks that are treated as block devices
	rdisk.txt	List of disks that are treated as character devices
	env.txt	Environment variable file
	lsvg.txt	Information of volume groups
	lscfg.txt	Firmware version of FC6227 Fibre HBA
	mount.txt	Mount information
	pagesize.txt	Memory page size
	oslevel.txt	OS level information, output when the oslevel or oslevel -g command was executed
	ulimit-a.txt	Limit value of the system resources (data segment, stack segment, and file descriptor) available for the processes
	lspp.txt	List of installed packages
	lspath.txt	MPIO path information
	bootinfo-r.txt	Physical memory size
	lsdev-proc.txt	CPU information
	lsdev-C.txt	Kernel parameter value
lsps-a.txt	Swap area, usage of swap	

Directory	File	Description
	genkex.txt	Information of loaded drivers
	alog.txt	System diagnosis message
	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	Path information of HDLM
	dlmmgr-path-iem.txt	HDLM path information (including the number of times an intermittent error occurred)
	dlmmgr-sys.txt	System setting information of HDLM
	dlmpr-k.txt	Persistent reservation key information
	Maintenance-Level.txt	Maintenance level of information, displayed when <code>instfix -i grep ML</code> was executed
	bootlist-v.txt	List of boot devices
	Config_Rules.txt	Information of Object Database Manager
	crontab.txt	crontab information
	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
	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
	unix	UNIX file
	kbd_64 kdb_mp kdb_up	Kernel debugger
	iotool.txt	Driver information
	uname-a.txt	Information on the AIX version
	bootinfo.txt	Information on the operation mode of the kernel (32/64 bit) and multi-CPU support
	ps-ef.txt	Information on the executing process
	lspv.txt	Physical volume information

Directory	File	Description
	lsfs.txt	File system information
	hacmp.txt	Information on the HACMP configuration
	errpt-a.txt	Error log edit file
	dlmls-la.txt	HDLM directory information file
	dlmmgr-cha.txt	CHA port information
	dlmmgr-driv.txt	hdisk information
	dlmmgr-hba.txt	HBA port information
	whatlist.txt	Information output by the what command
	dlmgetomtrace.dmp	HDLM function trace
etc/VRTSvcs/conf/config	main.cf	VCS configuration definition file
opt/VRTSvcs/bin/triggers	preonline	VCS trigger file
var/VRTSvcs/log	<i>/var/VRTSvcs/all-files-under-log</i>	VCS log file
<i>hacmp.out-output-directory</i>	hacmp.out	HACMP execution log
etc/vsd	oemdisktypes.lst	RVSD setting file
var/adm/csd	vsd.log	RVSD execution log

Note 1: An output directory is created in the specified directory when you open the `getras.tar.Z` file.

Note 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`. The number 2 that follows the trace file prefix does not represent a file number.

6.2 Utility for Assisting HDLM Migration (dlmmigsts)

■ Format

```
# CD-ROM drive-directory/hdlmtool/dlmmigsts
{{-b | -r}} -odm odm-environment-settings-file-name -set set-environment-settings-file-
name [-s]}
| -h
}
```

■ Description

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 or later. Execute this utility from the HDLM version 5.9 or later installation CD-ROM.

■ 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 CD-ROM drive directory is cdrom:

```
# cdrom/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 CD-ROM drive directory is cdrom:

```
# cdrom/hdlmtool/dlmmigsts -h
Usage :dlmmigsts {{{-b | -r} -odm odmsetfile -set dlnksetfile [-s]} | -h}
```

6.3 Utility for Setting the HDLM Execution Environment (dlmodmset)

■ Format

```
/usr/DynamicLinkManager/bin/dlmodmset
{ {-r {on | off}
| -i {on | off }} [-s]
| -h
| -o }
```

■ Description

This utility sets ODM to define HDLM operations.

■ Parameters

-r { on | off }: Enables or disables the LUN RESET parameter. To use GPFS+RVSD, specify On. On: Enable, Off: Disable

The default is `off`.

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.

-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
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}
          }
          [ -s ]
          | -o
          | -h
```

6.4 Utility for Clearing HDLM Persistent Reservation (dlmpr)

- **Format**

```
/usr/DynamicLinkManager/bin/dlmpr {-k | -c} [hdiskn] | -h
```

- **Description**

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.

- **Parameters**

-k: Specify this parameter to display the Reservation Key. The utility displays an asterisk (*) 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: When you want to clear the Reservation Key for the hdisks that makes up rootvg, specify the hdisks in the `hdiskn` parameter.

When the `hdiskn` 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.

hdiskn: 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 `hdisk`.

-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 subsystem does not support the persistent reservation or if a hardware error occurs.

■ **Examples**

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`, `hdisk5`, and `hdisk6`.

```
# /usr/DynamicLinkManager/bin/dlmpr -k hdisk1 hdisk2 hdisk3 hdisk4 hdisk5 hdisk6
self Reservation Key: [0xaaaaaaaaaaaaaaaa]
hdisk1 Reservation Key: [0xaaaaaaaaaaaaaaaa]
      Regist Key : [0xaaaaaaaaaaaaaaaa], Key Count : 1
hdisk2 Reservation Key: [0xbbbbbbbbbbbbbbbbbbb]*
      Regist Key : [0xaaaaaaaaaaaaaaaa], Key Count : 2
      Regist Key : [0xbbbbbbbbbbbbbbbbbbb], Key Count : 2
hdisk3 Reservation Key: [0xbbbbbbbbbbbbbbbbbbb]*
      Regist Key : [0xbbbbbbbbbbbbbbbbbbb], Key Count : 4
hdisk4 Reservation Key: [0xaaaaaaaaaaaaaaaa]
      Regist Key : [0xaaaaaaaaaaaaaaaa], Key Count : 4
hdisk5 Reservation Key: [0x0000000000000000]
hdisk6 Reservation Key: [0x0000000000000000]
      Regist Key : [0xaaaaaaaaaaaaaaaa], Key Count : 1
      Regist Key : [0xbbbbbbbbbbbbbbbbbbb], Key Count : 1
```

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/dlmpr -h
Usage : dlmpr {{ -k | -c } [hdiskN...]} [-a] | -h}
```

6.5 Utility Executed before Uninstalling HDLM (dlmpreuninst, utility executed before uninstalling HDLM)

Utility for Clearing HDLM Persistent Reservation (dlmpr)

- **Format**

```
/usr/DynamicLinkManager/bin/dlmpreuninst [-h | -s]
```

- **Description**

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.

- **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]
```

6.6 Utility for Deleting HDLM Drivers (dlmrmdev)

- **Format**

```
/usr/DynamicLinkManager/bin/dlmrmdev [[-f] [-A [-s]] | -h]
```

- **Description**

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.

Note: the hdisk recognized as a boot disk will not be deleted.

- **Parameters**

When no parameters are specified, the utility only performs deletion of the HDLM drivers and HDLM alert drivers.

-f: Deletes all the hdisks recognized as HDLM management-target devices and deletes all the hdisks 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.

-s: Does not display a confirmation message for unmounting and deactivating the volume group, 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.

- **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 [[-f] [-A [-s]] | -h]
```

6.7 Utility for HDLM Installation Configuration Support (dlmsetup)

- **Format**

```
/directory-where-cd-rom-is-mounted-or-copied/hdlmtool/dlmsetup {-i install-filepath [-odm odm-settings-file] [-set dlnk-settings-file] [-s] | -h}
```

- **Function**

This utility usually performs HDLM installation, the `set` operation, and environment setup using the `dlmodmset` utility, in one operation. However, if you install HDLM in a boot disk environment, you cannot execute the `dlmsetup` utility. You must first specify the settings in another file. For details about how to perform an installation of HDLM using the `dlmsetup` utility, see section 3.5.7.

- **Parameters**

`-i install-filepath`: Specifies the directory on which the CD-ROM is mounted or to which the CD-ROM has been copied.

`-odm odm-settings-file`: Specifies the name of the file in which odm environment settings are defined. Specify the file path.

`-set dlnk-settings-file`: Specifies the name of the file in which environment settings for the `set` operation are defined. Specify the file path.

`-s`: Prevents the confirmation message from being displayed when the utility is executed.

`-h`: Displays the format of the `dlmsetup` utility.

- **Example**

In the following example, the utility displays Help:

```
#!/usr/DynamicLinkManager/bin/dlmsetup -h
Usage : dlmsetup {-i instfilepath [-odm odmsetfile] [-set dlnksetfile] [-s] | -h}
```

Chapter 7 Troubleshooting

This chapter describes the troubleshooting procedures for HDLM:

- Error Information Checking (see section 7.1)
- Actions you should take when HDLM detects a path error (see section 7.2)
- Actions you should take when an error occurs in an HDLM program (see section 7.3)
- Actions taken for other errors (see section 7.4)
- How to call the Hitachi Data Systems Support Center (see section 7.5)

For details on HDLM usage precautions, see the HDLM **Release Notes** document.
For details on hardware setup and maintenance, contact your Hitachi Data Systems representative or the Hitachi Data Systems Support Center.

7.1 Error Information Checking

You can use the following information to check for an error:

- Information collected by the error information collection utility, **DLMgetras** (utility for collecting HDLM error information)
- Information displayed by the **dlnkmgr view** command, and/or
- Messages that are output when an error occurs.

7.1.1 Information Collected by the Error Information Collection Utility, DLMgetras (utility for collecting HDLM error information)

Immediately after an error occurs, execute the error information collection utility **DLMgetras**, since restarting the machine may delete information collected by **DLMgetras**.

7.1.2 Information Displayed by the dlnkgr view Command

You can use the `dlnkgr` command together with the `view` operation to check for error information. For example, specify `-path` parameter of the `view` operation to display the path information. Figure 7.1 shows an example of the results of executing the `dlnkgr` command's `view` operation.

```
>dlnkgr view -path -hdev f
Paths:000002 OnlinePaths:000002
PathStatus IO-Count IO-Errors
Online 1486 0

PathID PathName DskName iLU ChaPort Status Type IO-Count IO-Errors DNum HDevName
000000 0004.0001.0000000000000000.0001 HITACHI.DF600F .0051 0005 0A Online Own 1427 0 0 F
000003 0005.0001.000000000000007A.0001 HITACHI.DF600F .0051 0005 1A Online Non 59 0 0 F
KAPL01001-I HDLM command completed successfully. Operation name = view
>
```

Figure 7.1 Result of Executing the View Operation with the `-path` Parameter

Note:

- Equipment that is not mounted is also displayed when the `-hdev` parameter is not used.

Check the following items in the display for path errors:

- **PathID:** ID that HDLM assigned to the path at system startup, also called *AutoPATH_ID*.
- **PathName:** Name that identifies a physical path. A path name consists of the following four items separated by periods: HBA adapter number, bus number, target ID, and host LUN. Obtain information about the path name items as follows:

- **HBA adapter number.** Execute the following command to display the HBA number:

```
# lsdev -Cc disk
```

- **Bus number.** Execute the following command to display the parent bus number:

```
# lsdev -Cc disk
```

- **Target ID.**

For fibre channel, execute the following command to display the target ID, which is the value of `scsi_id`:

```
# lsattr -El device-name
```

For SCSI, execute the following command to display the target ID, which is the leftmost value of `connwhere`:

```
# odmget CuDv device-name
```

- **Host LU number.** For fibre channel, execute the following command to display the host LU number (value of `lun_id`):

```
# lsattr -El device-name
```

For SCSI, execute the following command to display the host LU number, which is the second value from the left of `connwhere`:

```
# odmget -q "name=physical-volume-name" CuDv
```

- **DskName:** Name identifying the storage subsystem. A storage subsystem name consists of the following three items separated by periods:

- Vendor ID: The name of the storage subsystem vendor (e.g., HITACHI).
- Product ID: The emulation type, product identifier, or model name of the storage subsystem (e.g., OPEN-3).

If you specify the **-stname** parameter with the **view** operation, the model name of the storage subsystem is displayed (refer to Table 5.14).

If you do not specify the **-stname** parameter for the 9900V, the product ID displays the emulation type of the storage subsystem (e.g., 3990, 2105).

If you do not specify the **-stname** parameter for the 9500V, the product ID displays the product identifier specified for the storage subsystem.

- Serial number: The serial number of the storage subsystem (e.g., 15001).

Note: To physically identify the storage subsystem, use the management program for the storage subsystem to reference these information items.

- **iLU:** The number assigned to the LU that is managed within the storage subsystem. This number combined with the subsystem name (indicated in **DskName**) identifies the LU that is accessed by a path. Use the management program for the subsystem to physically identify the LU.

For the 9900V, the **iLU** indicates the LDEV ID: the first two digits are the CU number, and last two digits are the LDEV number within the CU. For the 9500V, the entire **iLU** indicates the internal LU number in the subsystem.

- **ChaPort:** Port number of CHA mounted on the storage subsystem. (ChaPort is abbreviated as “CP”.) To physically identify the channel adapter, use the management program for the subsystem to reference this port number.

- **Status:** Status of the path:

- Online: Path is online.
- Offline(C): Path is offline due to a user-issued command.
- Offline(E): Path is offline due to an error.
- Online(E): An error occurred in the last online path to the device.

- **I/O-Count:** Total number of times path I/O occurred (decimal).

- **I/O-Errors:** Total number of path I/O errors (decimal).

- **Dnum:** A device number, which is equivalent to a logical volume number in AIX. A device number beginning from 0 is assigned to each device in the LU. In AIX, this value is fixed to 0 because one LU contains one device. This name is the same as the DNum displayed by the view operation.

- **HdevName:** The name of the host device. `hdiskn` (where n is the driver's instance number) is displayed.

7.1.3 Messages that are Output When an Error Occurs

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
```

Examining the output message in the OS log allows you to check the information about the error.

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 section 5.7.

Figure 7.2 shows an error message that is output if a path error occurs.

```
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
```

Note: `%d` is a decimal number, `%x` is a hexadecimal number, and `%s` is a character string.

Figure 7.2 Sample Error Message

Check the following items in the display for path errors:

- **ErrorCode:** The error number when the OS detected the path error.
- **PathID:** The ID assigned to a path. This ID is called the `AutoPATH_ID`. `AutoPATH_IDs` 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_IDs` 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 `dlkmgr` command's `view` operation.

For details on this operation, see section 5.7.

- **PathName:** Name of the physical path. A path name consists of the HBA number, bus number TID, and LUN. This name is the same as `PathName` displayed by the `dlkmgr` command's `view` operation.
- **Dnum:** Device number, which is equivalent to a logical volume number in AIX. A device number beginning from 0 is assigned to each device in the LU. In AIX, this value is fixed to 0 because one LU contains one device. This is the same as `DNum` displayed by the `view` operation.
- **HdevName:** Host device name. `hdiskn` is displayed. This is the same as `HDevName` displayed by the `view` operation. For details on this operation, see section 5.7.

7.2 Actions Taken for a Path Error

When a path error is detected, HDLM performs failover for 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 7.3 indicates these components.

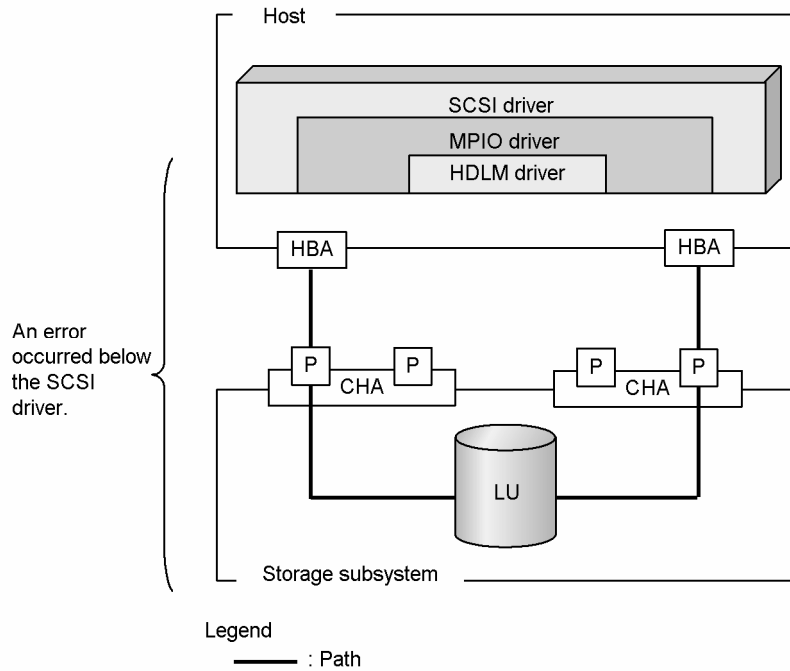


Figure 7.3 Error Location when the KAPL08022-E Message is Output

Figure 7.4 shows the troubleshooting procedure when the KAPL08022-E message is output.

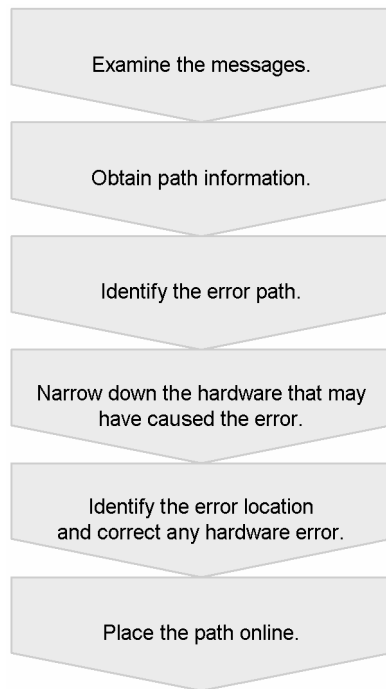


Figure 7.4 Troubleshooting Procedure when a Path Error Occurs

The following shows the procedure for using the HDLM command (`dlnkmgr`) to handle a path error.

1. **Examine the messages:** See the KAPL08022-E message that is output to syslog in the management-target host by using applications or tools for monitoring messages. For details about the contents of the message, see section 7.1.3 and 0.

2. **Obtain path information:** You can obtain the path information by executing the following command:

```
# /usr/DynamicLinkManager/bin/dlnkmgr view -path -iem> pathinfo.txt
```

Where `pathinfo.txt` is the redirection-output file name. Use a file name that matches your environment. For details on the path information, refer to section 5.7.

3. **Identify the error path:** Check the path information to find the error path. The path whose status indication is **Offline(E)** or **Online(E)** is the error path.
4. **Narrow down the hardware that may have the error:**
When using the `view` command, check the **DskName**, **iLU**, and **ChaPort** of the error path 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 management program for the storage subsystem (e.g., 9900V Remote Console - Storage Navigator).
5. **Identify the error location and correct the error:** Use the AIX and hardware management tools to identify the error location, and then take corrective action.
6. **Place the offline path(s) online:** After recovery from the error, place the path(s) online that were offline due to the error. For instructions on using the `dlnkmgr online` command to place offline path(s) online, see section 5.5.

Note: When you attempt to place all paths online, the KAPL01039-W message is displayed if any path cannot be placed online. To ignore the path that cannot be placed online and continue processing, type **y**. To cancel the processing, type **n** or another character.

Note: If you have difficulty placing an Offline(E) path online, first change the path status to Offline(C) (using the **dlnmgr online** command), and then place the path online. HDLM automatically checks whether the target paths are available, and puts available paths in the Online status and unavailable paths in the Offline(E) status. The paths in the Offline(E) status have not yet recovered from an error. Take appropriate corrective action for the error, and place the paths online.

Note: If an error exists in two or more paths or if path health checking or automatic failback is running, response to the **dlnmgr online** command may be slow.

7.3 Actions Taken for a Program Error

You can troubleshoot HDLM program errors using the HDLM command (`dlnkmgr`).

To perform troubleshooting for a program error using the HDLM command (`dlnkmgr`):

1. **Examine the message:** If an error occurs in the HDLM program, a message whose message ID is other than KAPL08xxx is output to syslog in the host. Check the output message. Messages with error level E (Error) or higher require corrective action.
2. **Actions to Take for Program Errors:** Take the action recommended for the message in 0. If the same error occurs again after you take the corrective action, check the status of the HDLM program using the `dlnkmgr view` command line, as shown below:

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

Note: One of two error messages may appear after executing the command: KAPL01012-E or KAPL01013-E.

```
KAPL01012-E Could not connect the HDLM manager. Operation name = view
```

- The KAPL01012-E message indicates that a connection could not be established with the HDLM manager. If this message appears, start the HDLM manager. See section 4.3.1.

```
KAPL01013-E An error occurred in internal processing of the HDLM command. Operation name = view, details = aa...aa
```

- The KAPL01013-E message indicates that an error occurred in the internal processing of the HDLM command. If this message appears, restart the management-target host.

If the same error occurs again after you take the above action, obtain the information necessary for contacting maintenance personnel (see section 7.4).

3. **Check the HDLM program status:**

When using the command line, execute the following command:

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

- If the KAPL01012-E message is displayed in response to the `dlnkmgr view -sys` command, start the HDLM manager (see section 4.3.1).
4. If the KAPL01013-E message is displayed in response to the `dlnkmgr view -sys` command, restart the host

If the same error occurs again after you take the above action, obtain the information necessary for contacting maintenance personnel.

5. **Obtain program information:** Obtain the information you should report to maintenance personnel. For AIX systems, HDLM provides the `DLMgetras` utility for collecting error information that should be reported to maintenance personnel (see section 6.1).
6. **Contact maintenance personnel:** Contact maintenance personnel, and report the obtained information (see section 7.4).

7.4 Actions Taken 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 for collecting HDLM error information, and then report the collected information to the HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details about the DLMgetras utility and the information it collects (see section 6.1).

7.5 Calling the Hitachi Data Systems Support Center

If you need to call the Hitachi Data Systems Support Center, make sure to provide as much information about the problem as possible, including:

- The circumstances surrounding the error or failure,
- The exact content of any error messages displayed on the host system(s),
- The HDLM program information collected as described in section 7.1, and
- For 9900V, the remote service information messages (R-SIMs) logged on the Remote Console PC and the reference codes and severity levels of the recent R-SIMs.

The Hitachi Data Systems customer support staff is available 24 hours/day, seven days a week. If you need technical support, please call:

- United States: (800) 446-0744
- Outside the United States: (858) 547-4526

Chapter 8 HDLM Messages

Table 8.3 - Table 8.16 list the HDLM messages by message ID and provide information about viewing messages output by HDLM. They also list and explain the HDLM messages and shows the actions to be taken in response to each message. Table 8.19 describes the meanings and actions to be taken of return codes output by HDLM when the HDLM remote access interface sends a request to HDLM.

HDLM issues the following types of messages:

- Message ID Format (see Table 8.1)
- Terms in Messages (see Table 8.2)
- HDLM command messages (see Table 8.3)
- HDLM API messages (see Table 8.4)
- HDLM manager messages (see Table 8.5)
- HDLM driver (filter component) messages (see Table 8.6)
- HDLM alert driver messages (see Table 8.7)
- HDLM driver (core logic component) messages (see Table 8.8)
- HDLM Management Target Messages (see Table 8.9)
- HDLM installation program messages (see Table 8.10)
- Messages from the error information collection utility (see Table 8.11)
- Messages from the utility for deleting HDLM drivers (see Table 8.12)
- Messages from the utility for clearing HDLM persistent reservation (see Table 8.13)
- Messages from the utility for setting the HDLM execution environment ODM (see Table 8.14)
- Messages from HDLM remote access interface (see Table 8.15)
- Messages from Utility for HDLM Installation Configuration Support (see Table 8.16)
- Messages from the utility for assisting HDLM transitions (see Table 8.17)
- Messages from the utility executed before uninstalling HDLM (see Table 8.18)

Message ID. Each message has a message ID. The format of the message ID is: **KAPLmmnnnl**.

Note: The term “HDLM” in Table 8.2 below may be replaced by “DLM” or “Dynamic Link Manager” in the actual message displayed by HDLM.

Table 8.1 Message ID Format

Format	Meaning
KAPL	Indicates that the message is an HDLM message
<i>Mnn</i>	<p>Number of the HDLM module that issued the message</p> <p>01: HDLM command 03: HDLM API 04: HDLM manager 05: HDLM driver (filter component) 06: HDLM alert driver 07: HDLM driver (core logic component) 08: HDLM management target 09: HDLM installation program 10: The following utilities: HDLM error information collection utility (KAPL100nn) Utility for deleting HDLM drivers (KAPL105nn) HDLM persistent reservation clearance utility (KAPL106nn) HDLM execution environment ODM setting utility (KAPL108nn)</p> <p>11: HDLM remote access interface</p> <p>12: <code>dlimsetup</code> utility</p> <p>13: The following utilities: Utility for Assisting HDLM Transitions (KAPL130nn) Utility Executed Before Uninstalling HDLM (KAPL131nn)</p>
<i>Nnn</i>	Message serial number for the module
<i>L</i>	<p>Message level</p> <p>C: Critical E: Error W: Warning I: Information</p>

Table 8.2 Terms in Messages

Term	Description
<code>%d</code>	Decimal number
<code>%s</code>	Character string
<code>%x</code>	Hexadecimal number
<code>aa...aa</code>	Variable (if there are multiple variables in a message, <code>aa...aa</code> is followed by <code>bb...bb</code> , <code>cc...cc</code> , and so on)
CS	Cluster support
FO	Failover
LB	Load balancing
Operation name	Type of the operation that is entered after <code>dlnkmgr</code> in the command.
Service status	Running status of the service
Mounted drive	A drive that the file system recognizes

Table 8.3 HDLM Command Messages (dlnkmgr and operations)

Message ID	Message	Recommended Action
KAPL01001-I	The HDLM command completed normally. Operation name = <i>aa...aa</i> , completion time = <i>bb...bb</i>	<p>Details</p> <p>The HDLM command completed successfully.</p> <p><i>aa...aa</i>: clear, help, offline, online, set, view</p> <p><i>bb...bb</i>: Year /month/day hour:minute:second</p> <p>Action</p> <p>None.</p>
KAPL01002-I	The HDLM command started. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The HDLM command was executed.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p>Action</p> <p>None.</p>
KAPL01003-W	No operation name is specified.	<p>Details</p> <p>The operation name is missing.</p> <p>Action</p> <p>Specify the operation name, and then retry.</p>
KAPL01004-W	The operation name is invalid. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The specified operation name is invalid.</p> <p><i>aa...aa</i>: Specified operation name</p> <p>Action</p> <p>Execute the <code>help</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the operation name, and then retry. For details on the <code>help</code> operation, see section 5.3.</p>
KAPL01005-W	A parameter is invalid. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p>The specified parameter is invalid.</p> <p><i>aa...aa</i>: clear, set, online, offline, view</p> <p><i>bb...bb</i>: Specified parameter</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter, and then retry. For details on the <code>help</code> operation, see section 5.3.</p>

Message ID	Message	Recommended Action
KAPL01006-W	A necessary parameter is not specified. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The specified operation does not contain the necessary parameter.</p> <p><i>aa...aa</i>: clear, set, offline, view</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter. Specify the correct parameter, and then retry. For details on the <code>help</code> operation, section 5.3.</p>
KAPL01007-W	A duplicate parameter is specified. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p>A duplicate parameter is specified.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p><i>bb...bb</i>: Duplicate parameter</p> <p>Action</p> <p>Delete the duplicate parameter, and then retry.</p>
KAPL01008-W	A necessary parameter value is not specified. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p>The necessary parameter value is not specified.</p> <p><i>aa...aa</i>: offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p>Action</p> <p>Specify the parameter value, and then retry.</p>
KAPL01009-W	A parameter value is invalid. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter value = <i>cc...cc</i> , Valid value = <i>dd...dd</i>	<p>Details</p> <p>The parameter value is invalid.</p> <p><i>aa...aa</i>: offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Specified parameter value</p> <p><i>dd...dd</i>: Specifiable parameter value range</p> <p>Action</p> <p>Specify the correct value for the parameter, and then retry.</p>

Message ID	Message	Recommended Action
KAPL01012-E	Could not connect the HDLM manager. Operation name = aa...aa	<p>Details</p> <p>In the <code>view -sys -sfunc</code> operation, information must be collected from the HDLM manager but the manager cannot be accessed.</p> <p>aa...aa: view</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) 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 <code>view</code> operation, see section 5.7.</p>
KAPL01013-E	An error occurred in internal processing of the HDLM command. Operation name = aa...aa details = bb...bb	<p>Details</p> <p>An error whose cause does not seem to be a user operation occurred during command processing.</p> <p>aa...aa: clear, offline, online, set, view</p> <p>bb...bb: Function name and contents of error</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, 6.1.</p>
KAPL01014-W	No authority to execute the HDLM command. Operation name = aa...aa	<p>Details</p> <p>You are not authorized to execute the HDLM command as the administrator.</p> <p>aa...aa: clear, offline, online, set, view</p> <p>Action</p> <p>Execute the command as a user with root privileges.</p>
KAPL01015-W	The target HBA was not found. Operation name = aa...aa	<p>Details</p> <p>The path having the port number and path number specified in the <code>-hba</code> parameter could not be found.</p> <p>aa...aa: offline, online</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) and check the value displayed in <code>PathName</code>. Specify the two leftmost digits of <code>PathName</code> for the relevant HBA port, and then retry.</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the specification, and then retry.</p>

Message ID	Message	Recommended Action
KAPL01016-W	The target CHA port was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The path ID indicated by <code>-pathid</code> and required by the <code>-cha</code> parameter is not an object of HDLM management.</p> <p><i>aa...aa</i>: offline, online</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) and then check the value displayed in <code>ChaPort</code>. Specify the PathID of a path that passes through the relevant CHA port, and then retry.</p> <p>For details on the <code>view</code> operation, see section 5.7.</p>
KAPL01018-W	The target device was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The specified host device name could not be found.</p> <p><i>aa...aa</i>: view</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) to check the value displayed in <code>HDevName</code>. Specify the value of <code>HDevName</code> for the host device to be operated and then retry. For details on the <code>view</code> operation, see section 5.7.</p>
KAPL01019-W	The target path was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The path to be operated could not be found.</p> <p><i>aa...aa</i>: offline, online, view</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the specification, and then retry. For details on the <code>view</code> operation, see section 5.7.</p>
KAPL01021-E	Cannot execute the HDLM command due to insufficient memory.	<p>Details</p> <p>Memory required for HDLM command processing could not be allocated.</p> <p>Action</p> <p>Terminate unneeded applications to increase the amount of free memory, and then retry.</p>

Message ID	Message	Recommended Action
KAPL01023-W	The last Online path for the device cannot be placed Offline(C).	<p>Details</p> <p>The path specified in the <code>offline</code> operation cannot be placed in the <code>Offline(C)</code> status because it is the last path for the applicable logical unit.</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the status of the path. For details on the <code>view</code> operation, see section 5.7.</p>
KAPL01024-W	The specified parameters cannot be specified at the same time. Operation name = <code>aa...aa</code> , parameters = <code>bb...bb</code>	<p>Details</p> <p>The specified parameters cannot be specified at the same time.</p> <p><code>aa...aa</code>: <code>offline</code>, <code>online</code>, <code>set</code>, <code>view</code></p> <p><code>bb...bb</code>: Parameters cannot be specified at the same time</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter that can be specified, and then retry. For details on the <code>help</code> operation, see section 5.3.</p>
KAPL01036-E	The Offline path cannot be placed online. PathID = <code>aa...aa</code>	<p>Details</p> <p>The path could not be recovered.</p> <p><code>aa...aa</code>: Path ID(decimal number)</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
KAPL01039-W	During the online operation processing of the HDLM command, a path that cannot be placed in the Online status was detected. PathID = <code>aa...aa</code> Would you like to continue the processing of the online operation? [y/n]:	<p>Details</p> <p>A path that cannot be placed Online was detected during multipath online processing.</p> <p>To ignore this path and perform online processing for the next path, enter <code>y</code>.</p> <p>To cancel processing, enter <code>n</code>.</p> <p><code>aa...aa</code>: Path ID(decimal number)</p> <p>Action</p> <p>If you want to continue processing of the <code>online</code> operation of the HDLM command for other paths, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>online</code> operation, see section 5.5.</p>
KAPL01040-W	The entered value is invalid. Re-enter [y/n]:	<p>Details</p> <p>A value other than <code>y</code> and <code>n</code> was entered. Enter <code>y</code> or <code>n</code>.</p> <p>Action</p> <p>Enter <code>y</code> or <code>n</code>.</p>

Message ID	Message	Recommended Action
KAPL01041-E	The entered value is invalid. The operation stops. Operation name = aa...aa	<p>Details</p> <p>Command processing will be aborted because an incorrect response was made three times in reply to the request.</p> <p>aa...aa: clear, offline, online, set</p> <p>Action</p> <p>To execute the operation, re-execute the HDLM command.</p>
KAPL01044-W	A duplicate parameter value is specified. Operation name = aa...aa, parameter = bb...bb, parameter value = cc...cc	<p>Details</p> <p>The same parameter value is specified two or more times.</p> <p>aa...aa: view</p> <p>bb...bb: Parameter name</p> <p>cc...cc: Duplicated parameter value</p> <p>Action</p> <p>Delete the duplicate parameter value name, and then retry.</p>
KAPL01045-W	Too many parameter values are specified. Operation name = aa...aa, parameters = bb...bb, parameter value = cc...cc	<p>Details</p> <p>There are too many parameter values.</p> <p>aa...aa: offline, online, set, view</p> <p>bb...bb: Parameter name</p> <p>cc...cc: Parameter value</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgcr</code>) to check the parameter value, and then retry.</p>
KAPL01048-W	Help information cannot be found. Operation name = aa...aa.	<p>Details</p> <p>The specified operation is not an operation of the HDLM command.</p> <p>aa...aa: Specified operation name</p> <p>Action</p> <p>Use the <code>help</code> operation of the HDLM command (<code>dlnkmgcr</code>) to check the operation name. And then retry.</p>
KAPL01049-I	Would you like to execute the operation? Operation name = aa...aa [y/n]:	<p>Details</p> <p>The <code>clear/set</code> operation will be started. To continue the operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>aa...aa: clear, set</p> <p>Action</p> <p>If you want to execute operation of the HDLM command, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>

Message ID	Message	Recommended Action
KAPL01050-I	The currently selected paths will be changed to the Online status. Is this OK? [y/n]:	<p>Details</p> <p>The <code>online</code> operation will be started. To continue the <code>online</code> operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the online processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
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]:	<p>Details</p> <p>All the paths will be placed Online because the path selection parameter is not specified in the <code>online</code> operation. To place all the paths Online, enter <code>y</code>. To not place them online, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the online processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01052-I	The currently selected paths will be changed to the Offline(C) status. Is this OK? [y/n]:	<p>Details</p> <p>The <code>offline</code> operation will be started. To continue the <code>offline</code> operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the offline processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01053-I	If you are sure that there would be no problem when the path is placed in the Offline(C) status, enter <code>y</code> . Otherwise, enter <code>n</code> . [y/n]:	<p>Details</p> <p>The <code>offline</code> operation will be started. To continue the <code>offline</code> operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the offline processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
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 = <code>aa...aa</code> Would you like to continue the processing of the offline operation? [y/n]:	<p>Details</p> <p>A path that cannot be placed Offline(C) was detected during multipath offline processing. To ignore this path and perform offline processing for the next path, enter <code>y</code>. To cancel offline processing, enter <code>n</code>.</p> <p><code>aa...aa</code>: Path ID(decimal number)</p> <p>Action</p> <p>If you want to continue processing of the <code>offline</code> operation of the HDLM command for other paths, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>

Message ID	Message	Recommended Action
KAPL01055-I	All the paths which pass the specified <i>aa...aa</i> will be changed to the Offline(C) status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively placed Offline(C) because the <code>-hba</code> or <code>-cha</code> parameter was specified. To collectively place multiple paths Offline(C), enter <code>y</code>. To not collectively place them Offline(C), enter <code>n</code>.</p> <p><i>aa...aa</i>: CHA port, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths that pass the specified target, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01056-I	If you are sure that there would be no problem when all the paths which pass the specified <i>aa...aa</i> are placed in the Offline(C) status, enter <code>y</code> . Otherwise, enter <code>n</code> . [y/n]:	<p>Details</p> <p>This message re-asks the user whether to place all the paths Offline(C). To place all the paths Offline(C), enter <code>y</code>. To not place them Offline(C), enter <code>n</code>.</p> <p><i>aa...aa</i>: CHA port, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths that pass the specified target, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01057-I	All the paths which pass the specified <i>aa...aa</i> will be changed to the Online status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will all be placed in Online status because the <code>-hba</code> or <code>-cha</code> parameter was specified. To continue the operation, enter <code>y</code>; to cancel the operation, enter <code>n</code>.</p> <p><i>aa...aa</i>: CHA, port HBA</p> <p>Action</p> <p>If you want to execute the online processing for the paths that pass the specified target, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01058-W	The specified parameter value is not needed. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter value = <i>cc...cc</i>	<p>Details</p> <p>A parameter value was specified in a parameter that does not need any parameter value.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Parameter value</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter and parameter value, and then retry.</p>

Message ID	Message	Recommended Action
KAPL01059-W	Cannot specify the parameter <i>aa...aa</i> at the same time if you specify parameter <i>bb...bb</i> and parameter value <i>cc...cc</i> . Operation name = <i>dd...dd</i>	<p>Details</p> <p>A parameter value conflicts with the specification of another parameter.</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Parameter value</p> <p><i>aa...aa</i>: Parameter name</p> <p><i>dd...dd</i>: view, set</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter and parameter value, and then retry.</p>
KAPL01060-I	The user terminated the operation. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The command processing will be aborted because n was entered in reply to the acknowledgment.</p> <p><i>aa...aa</i>: online, offline, set, clear</p> <p>Action</p> <p>None.</p>
KAPL01061-I	<i>aa...aa</i> path(s) were successfully placed <i>bb...bb</i> ; <i>cc...cc</i> path(s) were not. Operation name = <i>dd...dd</i>	<p>Details</p> <p>This message indicates the number of the paths processed in the <code>online/offline</code> operation.</p> <p><i>aa...aa</i>: Number of paths where <code>online/offline</code> operation is successful(decimal number)</p> <p><i>bb...bb</i>: Online or Offline(C)</p> <p><i>cc...cc</i>: Number of paths where <code>online/offline</code> is unsuccessful(decimal number)</p> <p><i>dd...dd</i>: online, offline</p> <p>Action</p> <p>None.</p>
KAPL01063-I	The target path(s) are already <i>aa...aa</i> .	<p>Details</p> <p>As a result of executing the <code>online/offline</code> operation, the specified path is already placed Online/Offline(C).</p> <p><i>aa...aa</i>: Online or Offline(C)</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the status of the path.</p>
KAPL01068-I	Enter a license key:	<p>Details</p> <p>The license key will now be renewed. Enter a license key.</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL01069-W	The entered license key is invalid.	<p>Details</p> <p>The entered license key is invalid.</p> <p>Action</p> <p>Enter a valid license key.</p>
KAPL01070-E	The entered license key is invalid. Renewal of the license key will now stop.	<p>Details</p> <p>The license key renewal will be aborted because an invalid license key was entered three times.</p> <p>Action</p> <p>Obtain a valid license key, and then retry.</p>
KAPL01071-I	The permanent license was installed.	<p>Details</p> <p>The license was renewed into a permanent license.</p> <p>Action</p> <p>None.</p>
KAPL01072-I	The emergency license was installed. The license expires on aa...aa.	<p>Details</p> <p>A license was renewed into the emergency license.</p> <p>aa...aa: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install a permanent license by the expiration day.</p>
KAPL01073-E	The temporary license expired.	<p>Details</p> <p>The temporary license expired. Register a permanent license.</p> <p>Action</p> <p>Register a permanent license.</p>
KAPL01074-E	The emergency license expired.	<p>Details</p> <p>The emergency license expired. Register a permanent license.</p> <p>Action</p> <p>Register a permanent license.</p>
KAPL01075-E	A fatal error occurred in HDLM. The system environment is invalid.	<p>Details</p> <p>The license information file is missing.</p> <p>Action</p> <p>Re-install HDLM.</p>
KAPL01076-I	The permanent license has been installed.	<p>Details</p> <p>You need not install a license because a permanent license has already been installed.</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL01078-W	The operation terminated because the path configuration changed during execution of the HDLM command. Operation name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i> : offline, online, view</p> <p>Action</p> <p>After the processing to change the path configuration has finished, retry.</p>
KAPL01079-W	The intermittent error monitoring function cannot be set up because automatic failback is disabled.	<p>Details</p> <p>The intermittent error monitoring function cannot be set up because automatic failback is disabled.</p> <p>Action</p> <p>Enable automatic failback, and then re-execute.</p>
KAPL01080-W	The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.	<p>Details</p> <p>An intermittent error cannot be detected by using the values specified for the following: the checking interval for automatic failback, the error monitoring interval, and the number of times the error is to occur.</p> <p>Action</p> <p>Set the intermittent error monitoring interval to a value that is equal to or more than (<i>automatic-failback-checking-interval x number-of-times-error-is-to-occur-for-intermittent-error-monitoring</i>).</p>
KAPL01081-E	The license key file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>The format of the license key file is invalid.</p> <p><i>aa...aa</i>: /var/tmp/hdlm_license</p> <p>Action</p> <p>Save the correct license key file in the designated, and then re-execute.</p> <p>/var/tmp/hdlm_license</p>
KAPL01082-E	There is no installable license key in the license key file. File name = <i>aa...aa</i>	<p>Details</p> <p>There is no HDLM-installable license key in the license key file.</p> <p><i>aa...aa</i>: /var/tmp/hdlm_license</p> <p>Action</p> <p>Make sure that the license key file is correct, and then re-execute.</p> <p>/var/tmp/hdlm_license</p>

Message ID	Message	Recommended Action
KAPL01083-I	There is no license key file. File name = aa...aa	<p>Details</p> <p>There is no license key file in the designated directory:</p> <p>aa...aa: /var/tmp/hdlm_license</p> <p>Action</p> <p>When the message that prompts you to enter the license key is displayed, enter the license key.</p> <p>Alternatively, cancel the HDLM command, save the correct license key file in the designated directory, and then re-execute the HDLM command.</p> <p>aa...aa: /var/tmp/hdlm_license</p>
KAPL01084-W	An attempt to delete the license key file has failed. File name = aa...aa	<p>Details</p> <p>An attempt to delete the license key file has failed.</p> <p>aa...aa: /var/tmp/hdlm_license</p> <p>Action</p> <p>If a license key file exists, delete it.</p> <p>aa...aa: /var/tmp/hdlm_license</p>
KAPL01088-W	The specified parameter values cannot be specified at the same time. Operation name = aa...aa, parameter = bb...bb, parameter values = cc...cc	<p>Details</p> <p>The specified parameter values cannot be specified at the same time.</p> <p>aa...aa: view</p> <p>bb...bb: Parameter name</p> <p>cc...cc: Parameter values cannot be specified at the same time</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlmkmgr</code>) to check the parameter that can be specified, and then retry.</p>
KAPL01089-E	One of the following was executed at the same time as an HDLM command <code>set -lic</code> operation: another <code>set -lic</code> operation, or an update of the license for an update installation.	<p>Action</p> <p>Check the license by using the HDLM command's <code>view -sys -lic</code> operation. Then, if necessary, re-execute the HDLM command's <code>set -lic</code> operation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>Do not perform the following operations:</p> <ul style="list-style-type: none"> ▪ Simultaneous executions of the HDLM command's <code>set -lic</code> operation ▪ Execution of the HDLM command's <code>set -lic</code> operation simultaneously with an update of the license for an upgrade installation or re-installation

Message ID	Message	Recommended Action
KAPL01095-E	An attempt to acquire the HDLM version information has failed. details = aa...aa	<p>Details</p> <p>The HDLM version information could not be acquired correctly.</p> <p>aa...aa: Code showing reason for error</p> <p>Action</p> <p>Re-execute. If the same error occurs again, execute the <code>DLMgetras</code> 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.</p>
KAPL01096-E	An attempt to acquire the Service Pack version information has failed. details = aa...aa	<p>Details</p> <p>The Service Pack version information could not be acquired correctly.</p> <p>aa...aa: Code showing reason for error</p> <p>Action</p> <p>Re-execute. If the same error occurs again, execute the <code>DLMgetras</code> 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.</p>
KAPL01097-W	All the current trace files will be deleted. Is this OK? [y/n]	<p>Details</p> <p>If you set a value 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 <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute operation of the HDLM command, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>
KAPL01100-I	aa...aa	<p>Details</p> <p>This message indicates the executed command line.</p> <p>Action</p> <p>None.</p>
KAPL01101-W	The target HBA port was not found. Operation name = aa...aa	<p>Details</p> <p>The HBA having the HBA_ID specified in the <code>-hbaid</code> parameter could not be found.</p> <p>aa...aa : offline, online</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -hba</code>) 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.</p>

Message ID	Message	Recommended Action
KAPL01102-I	All the paths which pass the specified <i>aa...aa</i> port will be changed to the Offline status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively placed Offline because the <code>-hbaid</code> or <code>-chaid</code> parameter was specified. To collectively place multiple paths Offline, enter <i>y</i>. To not collectively place them Offline, enter <i>n</i>.</p> <p><i>aa...aa</i> : CHA, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths which pass the specified target, enter <i>y</i>. If you want to terminate the processing, enter <i>n</i>.</p>
KAPL01103-I	If you are sure that there would be no problem when all the paths which pass the specified <i>aa...aa</i> port are placed in the Offline status, enter <i>y</i> . Otherwise, enter <i>n</i> . [y/n]:	<p>Details</p> <p>This message re-asks the user whether to place all the paths Offline. To place all the paths Offline, enter <i>y</i>. To not place them Offline, enter <i>n</i>.</p> <p><i>aa...aa</i> : CHA, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths which pass the specified target, enter <i>y</i>. If you want to terminate the processing, enter <i>n</i>.</p>
KAPL01104-I	All the paths which pass the specified <i>aa...aa</i> port will be changed to the Online status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively placed Online because the <code>-hbaid</code> or <code>-chaid</code> parameter was specified. To collectively place multiple paths Online, enter <i>y</i>. To not collectively place them Online, enter <i>n</i>.</p> <p><i>aa...aa</i> : CHA, HBA</p> <p>Action</p> <p>If you want to execute the Online processing for the paths which pass the specified target, enter <i>y</i>. If you want to terminate the processing, enter <i>n</i>.</p>

Message ID	Message	Recommended Action
KAPL01112-E	An attempt to connect to the HDLM driver has failed. Operation name = aa...aa	<p>Details</p> <p>HDLM driver information must be collected for the executed HDLM command, but the HDLM driver cannot be accessed.</p> <p>aa...aa: clear, offline, online, set, or view</p> <p>Action</p> <p>Perform one of the following procedures.</p> <p>When performing an installation</p> <p>See section 3.5, and then complete the installation.</p> <p>When performing an uninstallation</p> <p>See section 3.14.2, and then complete the uninstallation.</p> <p>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.</p> <p>For details on the DLMgetras utility, see section 6.1.</p>

Table 8.4 HDLM API Messages

Message ID	Message	Recommended Action
KAPL03001-I	HDLM API information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : Trace information</p> <p>Action</p> <p>None.</p>
KAPL03003-E	HDLM API Error information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL03004-C	A critical error occurred in the HDLM API. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL03006-E	An access to the HDLM driver causes an error. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Message ID	Message	Recommended Action
KAPL03007-E	An error occurred during communication with the HDLM manager. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL03008-E	An error occurred during log input to the HDLM alert driver. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL03999-E	An unexpected error occurred.	<p>Details</p> <p>A conflict occurred in the versions of the modules that HDLM uses internally.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Table 8.5 HDLM Manager Messages

Message ID	Message	Recommended Action
KAPL04001-I	HDLM manager started.	<p>Details</p> <p>HDLM manager has started successfully.</p> <p>Action</p> <p>None.</p>
KAPL04002-E	Could not start the HDLM manager.	<p>Details</p> <p>HDLM manager failed to start because the environment is incorrect for the manager to run properly.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04003-E	The startup parameter is invalid.	<p>Details</p> <p>The parameter held internally by the HDLM manager is incorrect.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04004-I	HDLM manager will now terminate.	<p>Details</p> <p>HDLM manager will be terminated.</p> <p>Action</p> <p>None.</p>
KAPL04008-E	Cannot open the option definition file (<code>aa...aa</code>).	<p>Details</p> <p>HDLM manager cannot start normally (unable to open the option definition file).</p> <p><code>aa...aa</code>: Option definition file name</p> <p>Action</p> <p>Check whether another program is using the file (or has opened the file with Notepad), or whether the file has been deleted inadvertently.</p>

Message ID	Message	Recommended Action
KAPL04009-E	The option definition is invalid.	<p>Details</p> <p>HDLM manager cannot start normally (some of the definition in the option definition file is invalid).</p> <p>Action</p> <p>If the KAPL04033-W message is output after this message, execute <code>dlmkmgr view -sys -sfunc</code> and check the option settings.</p> <p>For options with setting values that have returned to default values, use the <code>dlmkmgr set</code> operation to reset the values.</p> <p>If the KAPL04033-W message is not output, restart HDLM Manager.</p> <p>If the same error occurs, re-install HDLM.</p>
KAPL04010-E	Could not open the error log file.	<p>Details</p> <p>HDLM manager cannot start normally (unable to open the error log file <code>/var/DynamicLinkManager/log/dlmmgr[1-16].log</code>).</p> <p>Action</p> <p>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.</p>
KAPL04011-E	Could not output the error log file.	<p>Details</p> <p>The log information could not be output to the error log file <code>/var/DynamicLinkManager/log/dlmmgr[1-16].log</code>.</p> <p>Action</p> <p>Check that the disk has sufficient free space.</p>
KAPL04012-E	Could not create a communication pipe. RC = <code>aa...aa</code>	<p>Details</p> <p>HDLM manager cannot start normally (unable to create a pipe file to be used in communication with HDLM commands).</p> <p><code>aa...aa</code>: OS error code(decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Message ID	Message	Recommended Action
KAPL04013-E	Input is impossible via the communication pipe. RC = aa...aa	<p>Details</p> <p>Data could not be read from the pipe file during the communication with the HDLM command.</p> <p>aa...aa: OS error code(decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04014-E	Output is impossible via the communication pipe. RC = aa...aa	<p>Details</p> <p>Data could not be written to the pipe file during the communication with the HDLM command.</p> <p>aa...aa: OS error code(decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04019-E	Could not collect the error information. RC = aa...aa	<p>Details</p> <p>An attempt to read the log information from the alert driver failed.</p> <p>aa...aa: API return code(decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04021-I	HDLM manager information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa: HDLM manager trace information</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL04022-W	HDLM manager warning information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><i>aa...aa</i>: HDLM manager trace warning information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04023-E	HDLM manager error information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><i>aa...aa</i>: HDLM manager trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04024-C	A critical error occurred in the HDLM manager. (<i>aa...aa</i>)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><i>aa...aa</i>: HDLM manager trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL04025-C	A memory shortage occurred in the HDLM manager.	<p>Details</p> <p>Sufficient memory to process the HDLM manager could not be obtained.</p> <p>Action</p> <p>Increase the amount of memory available for the process.</p>
KAPL04026-I	The temporary license is valid. The license expires in <i>aa...aa</i> days on (<i>bb...bb</i>).	<p>Details</p> <p>The temporary license is valid.</p> <p><i>aa...aa</i>: Expiration day</p> <p><i>bb...bb</i>: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>

Message ID	Message	Recommended Action
KAPL04027-I	The emergency license is valid. The license expires in <i>aa...aa</i> days on (<i>bb...bb</i>).	<p>Details</p> <p>The emergency license is valid.</p> <p><i>aa...aa</i>: Expiration day</p> <p><i>bb...bb</i>: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the emergency license by the expiration day.</p>
KAPL04028-E	The temporary license expired.	<p>Details</p> <p>The temporary license expired.</p> <p>Action</p> <p>Install the permanent license.</p>
KAPL04029-E	The emergency license expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04030-E	The temporary license has already expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04031-E	The emergency license has already expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04032-C	A fatal error occurred in HDLM. The system environment is invalid	<p>Details</p> <p>A part of the HDLM configuration file is missing.</p> <p>Action</p> <p>Re-install HDLM.</p>
KAPL04033-W	The option definition file was re-created.	<p>Details</p> <p>An option definition file was re-created using the default values. The specified values are set when some of the options have been read.</p> <p>Action</p> <p>As for the options other than the defaults, use the <code>dlmkmgr set</code> operation to set the options again.</p>
KAPL04034-E	An attempt to create the option definition file has failed.	<p>Details</p> <p>An attempt to re-create an option definition file (<code>/usr/DynamicLinkManager/config/dlmngr.xml</code>) using the default values has failed.</p> <p>Action</p> <p>Remove unnecessary files to secure free space on the file system, or check the write permissions for the directory and file.</p>

Message ID	Message	Recommended Action
KAPL04035-I	The path health check will now start. Total number of paths = <i>aa...aa</i>	<p>Details</p> <p>The path health check will now start. <i>aa...aa</i>: Total number of paths</p> <p>Action</p> <p>None.</p>
KAPL04036-I	The path health check for the path <i>aa...aa</i> was executed. Number of error paths = <i>bb...bb</i>	<p>Details</p> <p>The path health check has completed normally. <i>aa...aa</i>: Number of paths targeted for the path health check. <i>bb...bb</i>: Number of error paths by the path health check.</p> <p>Action</p> <p>None.</p>
KAPL04037-I	The path health check completed normally. Path ID = <i>aa...aa</i>	<p>Details</p> <p>There were no error paths as a result of executing the path health check. <i>aa...aa</i>: PathID for executing the path health check.</p> <p>Action</p> <p>None.</p>
KAPL04042-I	HDLM SNMP TRAP information - <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Start or Stop</p> <p>Action</p> <p>None.</p>
KAPL04045-I	HDLM SNMP TRAP was sent. Trap ID = <i>aa...aa</i> , IP Address = <i>bb...bb</i> , Port Number= <i>cc...cc</i> , Community = <i>dd...dd</i> , Trap Data = <i>ee...ee</i>	<p>Details</p> <p><i>aa...aa</i>: Trap ID <i>bb...bb</i>: Destination IP address of the trap <i>cc...cc</i>: Destination port number of the trap <i>dd...dd</i>: Community Name given to the trap <i>ee...ee</i>: Send data</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL04046-E	An attempt to connect to the HDLM alert driver has failed. RC = aa...aa. The HDLM manager will now terminate.	<p>Details</p> <p>An attempt to connect to the HDLM alert driver during HDLM manager startup has failed. The HDLM manager will now terminate.</p> <p>aa...aa : OS error code (decimal number)</p> <p>Action</p> <p>See section 3.5, 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 section 6.1.</p>

Table 8.6 HDLM Driver (Filter Component) Messages

Message ID	Message	Recommended Action
KAPL05003-I	The HDLM driver (filter component) was successfully attached to Disk (<i>aa...aa</i>), Partition (<i>bb...bb</i>).	<p>Details</p> <p>The path corresponding to <code>Disk</code> (<i>aa...aa</i>: SCSI device decimal sequence number) and <code>Partition</code> (<i>bb...bb</i>: Fixed at 0) was successfully registered in the core logic.</p> <p>Action</p> <p>None.</p>
KAPL05008-E	Could not allocate memory. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>The OS memory allocation function was started but an error was returned from the memory allocation function.</p> <p><i>aa...aa</i>: Number of program lines (Hexadecimal number)</p> <p><i>bb...bb</i>: Memory capture size (Hexadecimal number)</p> <p>Action</p> <p>Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL05011-E	Could not attach the HDLM driver (filter component) to Disk (<i>aa...aa</i>), Partition (<i>bb...bb</i>). (<i>cc...cc:dd...dd</i>)	<p>Details</p> <p>Registration of the path corresponding to <code>Disk</code> (<i>aa...aa</i>: SCSI device decimal sequence number) and <code>Partition</code> (<i>bb...bb</i>: Partition decimal number) failed in the core logic.</p> <p><i>cc...cc</i>: Error code (Hexadecimal number)</p> <p><i>dd...dd</i>: Filter driver management table address (Hexadecimal number)</p> <p>Action</p> <p>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.</p>

Message ID	Message	Recommended Action
KAPL05014-I	The device object (<i>aa...aa</i>) was registered as the path (<i>bb...bb</i>).	<p>Details</p> <p>The path (<i>bb...bb</i>: Core logic path identifier (Hexadecimal number)) of the device object (<i>aa...aa</i>: Filter driver management table address (Hexadecimal number)) was successfully registered in the core logic.</p> <p>Action</p> <p>None.</p>
KAPL05018-W	The FO processing in the path (<i>aa...aa</i>) failed. (<i>bb...bb:cc...cc</i>)	<p>Details</p> <p>FO processing failed in the path (<i>aa...aa</i>: Identifier of the core logic path where FO processing failed (Hexadecimal number)).</p> <p><i>bb...bb</i>: Error code (Hexadecimal number)</p> <p><i>cc...cc</i>: Fixed at 0</p> <p>Action</p> <p>The I/O being processed is discarded. Check the status of the device path and take an appropriate action.</p>
KAPL05021-I	Processing of IOCTL(<i>aa...aa</i>) completed normally.	<p>Details</p> <p>The processing for the requested IOCTL operation was successful.</p> <p><i>aa...aa</i>: IOCTL code (hexadecimal number)</p> <p>Action</p> <p>None.</p>
KAPL05023-E	Could not process the IOCTL(<i>aa...aa</i>). (<i>bb...bb:cc...cc</i>)	<p>Details</p> <p>Processing corresponding to the requested IOCTL (<i>aa...aa</i>: IOCTL code (Hexadecimal number)) is unsuccessful.</p> <p><i>bb...bb</i>: Fixed at 0</p> <p><i>cc...cc</i>: Fixed at 0</p> <p>Action</p> <p>Check the message of the HDLM command (<code>dlnkmgr</code>) or the HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the <code>DLMgetras</code> 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.</p>

Message ID	Message	Recommended Action
KAPL05501-E	The path could not be created. (<i>aa...aa, bb...bb, cc...cc</i>)	<p>Details</p> <p>The driver instance could not be registered in the kernel side.</p> <p><i>aa...aa</i>: HDLM driver instance name</p> <p><i>bb...bb</i>: Logical device file name of <code>hdisk</code></p> <p><i>cc...cc</i>: Error code(decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM.</p>
KAPL05819-I	Data for maintenance: <i>aa...aa bb...bb cc...cc dd...dd</i> .	<p>Details</p> <p>The filter driver outputs this message for maintenance.</p> <p><i>aa...aa</i>: Device minor number(decimal number)</p> <p><i>bb...bb</i>: Message output location information(decimal number)</p> <p><i>cc...cc</i>: Detailed information 1(decimal number)</p> <p><i>dd...dd</i>: Detailed information 2(decimal number)</p> <p>Action</p> <p>None.</p>

Table 8.7 HDLM Alert Driver Messages

Message ID	Message	Recommended Action
KAPL06003-I	Initialization of the HDLM alert driver (<i>aa...aa</i>) was successful.	<p>Details</p> <p>Initialization of the alert driver (<i>aa...aa</i>: alert driver management table address (Hexadecimal number)) completed normally.</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL06004-E	Could not allocate memory. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>An attempt to reserve memory to save alert information has failed.</p> <p><i>aa...aa</i>: Program line (Hexadecimal number)</p> <p><i>bb...bb</i>: Target memory size (Hexadecimal number)</p> <p>Action</p> <p>Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the <code>DLMgetras</code> 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.</p>
KAPL06009-I	Invalid IOCTL (<i>aa...aa</i>) was received. The processing is canceled.	<p>Details</p> <p>A request having an invalid IOCTL code (<i>aa...aa</i>: IOCTL code (Hexadecimal number)) was issued to the alert driver.</p> <p>Action</p> <p>None.</p>
KAPL06010-E	Could not process the IOCTL(<i>aa...aa</i>). (<i>bb...bb:cc...cc</i>)	<p>Details</p> <p>Although the IOCTL request (<i>aa...aa</i>: 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.</p> <p><i>bb...bb</i>: error code (Hexadecimal number)</p> <p><i>cc...cc</i>: 0 (fixed)</p> <p>Action</p> <p>Check the message of the HDLM command (<code>dlnkmgx</code>) or HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the <code>DLMgetras</code> 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.</p>

Message ID	Message	Recommended Action
KAPL06013-E	Could not write log information into the log buffer. (aa...aa:bb...bb)	<p>Details</p> <p>When a log output request was made from the filter driver, the log information was discarded because of a memory allocation failure. Alternatively, although a 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.</p> <p>aa...aa: log message code (Hexadecimal number)</p> <p>bb...bb: log area size (Hexadecimal number)</p> <p>Action</p> <p>Check whether any other error occurred. The information that could not be written is discarded.</p> <p>Review the actual memory size when another error does not occur.</p> <p>When the actual memory size is insufficient, increase the actual memory size.</p> <p>When the actual memory size is sufficient, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Message ID	Message	Recommended Action
KAPL06014-E	Could not write emergency information into the emergency information buffer. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>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.</p> <p><i>aa...aa</i>: Message code (Hexadecimal number)</p> <p><i>bb...bb</i>: Buffer size (Hexadecimal number)</p> <p>Action</p> <p>Check whether any other error occurred. The information that could not be written is discarded.</p> <p>Review the actual memory size if another error does not occur.</p> <p>If the actual memory size is insufficient, increase the actual memory size.</p> <p>If the actual memory size is sufficient, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Table 8.8 HDLM Driver (Core Logic Component) Messages

Message ID	Message	Recommended Action
KAPL07819-I	Data for maintenance: <i>aa...aa bb...bb cc...cc dd...dd</i> .	<p>Details</p> <p>This message is generated by the core logic for maintenance.</p> <p><i>aa...aa</i>: Detailed information 1(decimal number)</p> <p><i>bb...bb</i>: Internal function number of the core logic(decimal number)</p> <p><i>cc...cc</i>: Detailed information 2(decimal number)</p> <p><i>dd...dd</i>: Detailed information 3(decimal number)</p> <p>Action</p> <p>None.</p>

Table 8.9 HDLM Management Target Messages

Message ID	Message	Recommended Action
KAPL08019-E	The path (<i>aa...aa</i>) detected an error (<i>bb...bb</i>). (<i>cc...cc</i>)	<p>Details</p> <p>An error occurred in the path because of a condition such as a disconnection.</p> <p><i>aa...aa</i>: Path identifier (Hexadecimal number)</p> <p><i>bb...bb</i>: Error code (Hexadecimal number)</p> <p>When the path error was detected by a path health checking or the online operation:</p> <p>Displays 0x000F0000(Fixed).</p> <p>When the path error was detected through an I/O error:</p> <p>Displays the OS error code.</p> <p><i>cc...cc</i>: 0x00000000 (fixed)</p> <p>Action</p> <p>Check the path in which the error was detected.</p>

Message ID	Message	Recommended Action
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	<p>Details</p> <p>A physical or logical error occurred in the path.</p> <p>aa...aa: Error code (hexadecimal number)</p> <p>When the path error was detected by a path health checking or the online operation:</p> <p>Displays 0x000F0000(Fixed).</p> <p>When the path error was detected through an I/O error:</p> <p>Displays the OS error code.</p> <p>bb...bb: Path ID (same as PathID of view -path)(decimal number)</p> <p>cc...cc : HBA adapter number (same as PathName of view -path) (Character string)</p> <p>dd...dd: Bus number (Character string)</p> <p>ee...ee: Target ID (Hexadecimal number)</p> <p>ff...ff: Host LU number (same as PathName of view -path) (Hexadecimal number)</p> <p>gg...gg: Dev number (same as DNum of view -path)(decimal number)</p> <p>hh...hh: Host device name</p> <p>Action</p> <p>There could be an error in the path. Restore the path displayed in the message to running status.</p>

Message ID	Message	Recommended Action
KAPL08023-I	A path was recovered. PathID = aa...aa, PathName = bb...bb.cc...cc.dd...dd.ee...ee, DNum = ff...ff, HDevName = gg...gg	<p>Details</p> <p>The path was recovered from the error.</p> <p>aa...aa: Path ID (same as PathID of view -path)(decimal number)</p> <p>bb...bb : HBA adapter number (same as PathName of view -path) (Character string)</p> <p>cc...cc: Bus number(same as PathName of view -path) (Character string)</p> <p>dd...dd: Target ID(same as PathName of view -path) (Hexadecimal number)</p> <p>ee...ee: Host LU number (same as PathName of view -path) (Hexadecimal number)</p> <p>ff...ff: Device number (same as DNum of view -path)</p> <p>gg...gg: Host Dev name(same as HDevName of view -path)</p> <p>Action</p> <p>None.</p>
KAPL08026-E	An error occurred on all the paths of the LU. PathID = aa...aa	<p>Details</p> <p>An error occurred in the last path of one LU because of a condition such as a disconnection.</p> <p>aa...aa: Path ID (same as PathID of view -path)(decimal number)</p> <p>Action</p> <p>Errors are detected in all the paths connected to the LUs. Make the path shown in the error message or the paths connected to the target LU.</p>
KAPL08027-E	A path was excluded from the items subject to automatic failback. PathID = aa...aa	<p>Details</p> <p>A path was excluded from the items subject to automatic failback because the system judged that an intermittent error was occurring in that path.</p> <p>aa...aa: Path ID (same as PathID of view -path)(decimal number)</p> <p>Action</p> <p>An intermittent error was occurring. The path may have a problem. Switch the path shown in the message into Online.</p>

Message ID	Message	Recommended Action
KAPL08028-I	A message corresponding to the automatic error information collection was detected. Error information will now be collected.	<p>Details</p> <p>Automatic error information collection will now start because a message corresponding to the automatic error information collection was detected.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Table 8.10 HDLM Installation Program Messages

Message ID	Message	Recommended Action
KAPL09003-E	Cannot install in this system.	<p>Details</p> <p>HDLM cannot be installed on this system.</p> <p>Action</p> <p>See section 3.1.1.1 and install HDLM in a supported OS system</p>
KAPL09011-E	Cannot find a license key file "/var/DLM/dlm.lic_key".	<p>Details</p> <p>The license key file /var/DLM/dlm.lic_key is not in the specified directory.</p> <p>Action</p> <p>Create a license key file, and re-execute the installation program.</p>
KAPL09012-I	All HDLM drivers were removed.	<p>Details</p> <p>All the HDLM drivers were successfully removed, the HDLM manager was successfully stopped, and HDLM was stopped.</p> <p>Action</p> <p>None.</p>
KAPL09013-E	Some HDLM drivers could not be removed.	<p>Details</p> <p>The <code>dlmrmdev</code> command was run, but HDLM drivers could not be removed.</p> <p>Action</p> <p>Check the HDLM driver status and remove the drivers.</p>
KAPL09019-E	An attempt to cancel the registration of the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	<p>Action</p> <p>Manually cancel the registration of the bundle PP name and uninstall Hitachi Network Objectplaza Trace Library 2. If the attempt to cancel the registration of the bundle 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.</p>
KAPL09020-E	An attempt to uninstall Hitachi Network Objectplaza Trace Library 2 failed.	<p>Details</p> <p>An attempt to uninstall HNTRLib2 has failed.</p> <p>Action</p> <p>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.</p>

Message ID	Message	Recommended Action
KAPL09021-E	An attempt to register the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	<p>Details</p> <p>An attempt to register the PP name of HNTRLib 2 has failed.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL09022-E	HDLM cannot be uninstalled. aa...aa is running.	<p>Details</p> <p>HDLM cannot be uninstalled because the HDLM manager, HDLM driver is running.</p> <p>aa...aa: HDLM manager, HDLM driver</p> <p>Action</p> <p>Execute the <code>dlnrmdev</code> utility, and then re-execute the uninstallation program.</p>
KAPL09023-E	A file or directory related to HDLM could not be found.	<p>Details</p> <p>A target file to copy to the directory of HiCommand products other than HDLM could not be found among the files related to HDLM</p> <p>Action</p> <p>Re-execute the HDLM installation program.</p>
KAPL09024-E	An attempt to copy a file or directory related to HDLM has failed.	<p>Details</p> <p>An attempt to copy a file related to HDLM to the directory of HiCommand products other than HDLM has failed.</p> <p>Action</p> <p>If this message is output while installing HDLM, re-install HDLM.</p> <p>If this message is output while installing a HiCommand product other than HDLM, re-install that product.</p>
KAPL09025-W	An attempt to delete a file or directory has failed.	<p>Details</p> <p>An attempt to delete a file related to HDLM from the directory of HiCommand products other than HDLM has failed.</p> <p>Action</p> <p>If the following files or directories are on the host, remove them manually.</p> <pre> /usr/HDVM/agent/classes/com /Hitachi/soft/HiCommand/DVM /agent/module/HDLMWebAgent.class /usr/HDVM/agent/classes/jp /usr/HDVM/agent/classes/com /Hitachi/soft/HiCommand/DVM /agent/module/hdlm /usr/HDVM/HBaseAgent/agent/ </pre>

Message ID	Message	Recommended Action
		<pre>classes/com/Hitachi/soft/Hi Command/DVM/agent/module/HD LMWebAgent.class /usr/HDVM/HBaseAgent/agent/ classes/jp /usr/HDVM/HBaseAgent/agent/ classes/com/Hitachi/soft/Hi Command/DVM/agent/module/hd lm</pre>
KAPL09028-E	An attempt to install Hitachi Network Objectplaza Trace Library 2 failed.	<p>Details</p> <p>An attempt to install HNTRLlib2 failed.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL09029-E	This version of HDLM cannot be updated by installation. Uninstall the already installed version of HDLM.	<p>Action</p> <p>Uninstall the HDLM that has already been installed.</p>
KAPL09047-E	Downgrading from aa...aa to bb...bb is not supported.	<p>Details</p> <p>Downgrade installation is not supported.</p> <p>aa...aa : DLManager. mpio.rte Level-of-the-fileset</p> <p>bb...bb : DLManager. mpio.rte Level-of-the-fileset</p> <p>Action</p> <p>Uninstall HDLM, and then re-execute the installation program.</p>
KAPL09048-E	HDLM cannot installed. aa...aa is running.	<p>Details</p> <p>An attempt to install HDLM failed because either of aa...aa is running.</p> <p>aa...aa = HDLM manager, HDLM driver</p> <p>Action</p> <p>Execute the <code>dlnrmdev</code> utility, and then re-execute the installation program.</p>
KAPL09076-I	The permanent license was installed.	<p>Details</p> <p>The permanent license was installed.</p> <p>Action</p> <p>None.</p>
KAPL09077-I	The temporary license was installed. The license expires on aa...aa.	<p>Details</p> <p>The temporary license was installed.</p> <p>aa...aa: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>

Message ID	Message	Recommended Action
KAPL09078-I	The emergency license was installed. The license expires on aa...aa.	<p>Details</p> <p>The emergency license was installed.</p> <p>aa...aa: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09079-I	The permanent license has been installed.	<p>Action</p> <p>None.</p>
KAPL09080-I	The temporary license has been installed. The license expires on aa...aa.	<p>Details</p> <p>The temporary license has been installed.</p> <p>aa...aa: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09081-I	The emergency license has been installed. The license expires on aa...aa.	<p>Details</p> <p>The emergency license has been installed.</p> <p>aa...aa: Year (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09082-W	The temporary license expired.	<p>Action</p> <p>Enter the permanent license key.</p>
KAPL09083-W	The emergency license expired.	<p>Action</p> <p>Enter the permanent license key.</p>
KAPL09087-E	The entered license key is invalid. Renewal of the license key will now stop.	<p>Details</p> <p>The renewal of the license key will be aborted because an invalid license key was entered three times.</p> <p>Action</p> <p>Obtain a valid license key, and then retry.</p>
KAPL09088-E	The entered license key is invalid. The HDLM installation will now terminate.	<p>Action</p> <p>Obtain a valid license key, and then retry.</p>
KAPL09090-W	This operation will now be continued without updating the license.	<p>Details</p> <p>This operation will be continued without updating the license.</p> <p>Action</p> <p>Install the permanent license later.</p>
KAPL09091-E	A fatal error occurred in HDLM. The system environment is invalid.	<p>Details</p> <p>A part of the HDLM configuration file is</p>

Message ID	Message	Recommended Action
		missing. Action Re-install HDLM.
KAPL09100-E	Installation is not possible because aa...aa is already installed.	Details Installation is not possible because the files set that was output in the message is installed. aa...aa: DLManager.rte or AutoPath.rte (character string) Action Re-install after uninstalling the files set that was output in the message.
KAPL09112-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 directory, and then re-execute. /var/tmp/hdlm_license
KAPL09113-E	There is no installable license key in the license key file. File name = aa...aa	Details There is no HDLM-installable license key in the license key file. aa...aa: /var/tmp/hdlm_license Action In the license key file, store a license key that is available to install HDLM, and then re-install HDLM.
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 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.

Message ID	Message	Recommended Action
		<code>/var/tmp/hdlm_license</code>
KAPL09116-W	The command could not be installed. (command = <code>aa...aa</code>)	<p>Details</p> <p>The output HDLM command cannot be used.</p> <p><code>aa...aa</code>: Command name</p> <p>Action</p> <p>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.</p>
KAPL09135-E	One of the following was executed at the same time as an HDLM command set <code>-lic</code> operation: another set <code>-lic</code> operation, or an update of the license for an update installation.	<p>Action</p> <p>Check the license by using the HDLM command's <code>view -sys -lic</code> operation. Then, if necessary, update the license by using the <code>set -lic</code> 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.</p> <p>Do not perform the following operation:</p> <p>Execution of the HDLM command's <code>set -lic</code> operation simultaneously with an update of the license for an upgrade installation or re-installation</p>
KAPL091742-E	HDLM <code>aa...aa</code> cannot be performed. Wait a while, and then perform <code>aa...aa</code> again. Error Code = <code>bb...bb</code>	<p>Details</p> <p>HDLM cannot be installed or uninstalled.</p> <p><code>aa...aa</code> : "installation" or "uninstallation"</p> <p><code>bb...bb</code> : Internal code (decimal number)</p> <p>Action</p> <p>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.</p>
KAPL09143-E	HDLM <code>aa...aa</code> cannot be performed. Error Code = <code>bb...bb</code>	<p>Details</p> <p>HDLM cannot be installed or uninstalled.</p> <p><code>aa...aa</code>: "installation" or "uninstallation"</p> <p><code>bb...bb</code>: Internal code (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09171-E	An internal error occurred in the installation of the HDLM. Error Code = <code>aa...aa bb...bb</code>	<p>Details</p> <p>A system-based error, not caused by the user, occurred during installation of</p>

Message ID	Message	Recommended Action
		<p>HDLM processing.</p> <p><i>aa...aa</i> :The error number which specifies the performed processing (decimal number)</p> <p><i>bb...bb</i> :Return value of the executed processing (decimal number)</p> <p>Action</p> <p>If the error code is 3, <i>nnnn</i>:</p> <p>ODM is being used. Wait a while, and then try again.</p> <p>If any other error code is output:</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09172-E	Installation is not possible because an hdisk exists.	<p>Action</p> <p>Delete the hdisk, and then re-execute the installation program.</p>
KAPL09504-E	The language environments of HDLM and the Service Pack are different.	<p>Details</p> <p>The Japanese Service Pack was applied to the English edition of HDLM, or vice versa.</p> <p>Action</p> <p>Acquire the Service Pack that has the same language as the installed HDLM, and then try again.</p>

Table 8.11 Messages from the Error Information Collection Utility

Message ID	Message	Recommended Action
KAPL10001-W	No parameter has been specified.	<p>Details</p> <p>No parameter (directory to which collected information is output) has been specified.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>
KAPL10002-W	Too many parameters have been specified.	<p>Details</p> <p>Four or more parameters have been specified.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>

Message ID	Message	Recommended Action
KAPL10003-W	The first parameter has not been set to a directory. Value = aa...aa	<p>Details</p> <p>The first parameter must be set to a directory to which collected information is output.</p> <p>aa...aa: First parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>
KAPL10004-W	The parameter contains an incorrect value. Value = aa...aa	<p>Details</p> <p>The first parameter must be a directory. The second parameter must be <code>-f</code>.</p> <p>aa...aa: Invalid parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>
KAPL10005-W	The number of parameters is insufficient.	<p>Details</p> <p>The <code>-f</code> parameter exists but the file for defining the information to be collected does not exist.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>
KAPL10006-W	The file for defining the information to be collected does not exist, or cannot be read. Value = aa...aa	<p>Details</p> <p>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.</p> <p>aa...aa: Name of the file for defining the information to be collected</p> <p>Action</p> <p>Check whether the specified file for defining the information to be collected exists, and check whether you have access permission for the specified file.</p>
KAPL10007-W	A directory has been specified in the third parameter. Value = aa...aa	<p>Details</p> <p>The <code>-f</code> parameter is specified to a directory.</p> <p>aa...aa: Third parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry.</p>

Message ID	Message	Recommended Action
KAPL10008-W	You lack write permission for the specified directory. Value = aa...aa	<p>Details</p> <p>You do not have write permission for the specified directory, or the creation of a subdirectory of the specified directory failed.</p> <p>aa...aa: first parameter</p> <p>Action</p> <p>Check the following.</p> <ol style="list-style-type: none"> 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 free space.
KAPL10009-W	The specified directory already exists. Do you want to overwrite it? [y/n]:	<p>Details</p> <p>The specified directory already exists. Select <i>y</i> to overwrite it or <i>n</i> to cancel.</p> <p>Action</p> <p>The specified directory already exists. Enter <i>y</i> to overwrite the existing file. Enter <i>n</i> or press any other key to terminate the <i>DLMgetras</i> utility for collecting HDLM error information without executing it.</p>
KAPL10010-W	A root directory has been specified. Line = aa...aa	<p>Details</p> <p>The root "/" has been specified as a directory to be collected in the file for defining the information to be collected.</p> <p>aa...aa: Line number of the file for defining information to be collected(decimal number)</p> <p>Action</p> <p>Delete the coding of the root directory from the specified file. The displayed directory will be ignored and the <i>DLMgetras</i> utility for collecting HDLM error information will continue.</p>

Message ID	Message	Recommended Action
KAPL10011-W	More than one file or directory has been specified on one line. Line = <i>aa...aa</i> , Value = <i>bb...bb</i>	<p>Details</p> <p>Two or more file names or directory names exist in the file for defining the information to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining information to be collected(decimal number)</p> <p><i>bb...bb</i>: Indicated contents in a line</p> <p>Action</p> <p>After the <i>DLMgetras</i> 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 <i>DLMgetras</i> utility for collecting HDLM error information will ignore the specified file or directory and continue processing.</p>
KAPL10012-W	The specified file or directory does not exist. Line = <i>aa...aa</i> , Value = <i>bb...bb</i>	<p>Details</p> <p>The specified file or directory does not exist in the file for defining the information to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining information to be collected(decimal number)</p> <p><i>bb...bb</i>: Indicated contents in a line</p> <p>Action</p> <p>After the <i>DLMgetras</i> 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 <i>DLMgetras</i> utility will ignore the specified file or directory and continue processing.</p>

Message ID	Message	Recommended Action
KAPL10013-W	You lack read permission for the specified file. Line = <i>aa...aa</i> , Value = <i>bb...bb</i>	<p>Details</p> <p>You lack read permission for the specified file in the file for defining information to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining information to be collected(decimal number)</p> <p><i>bb...bb</i>: Indicated contents in a line</p> <p>Action</p> <p>After the <code>DLMgetras</code> 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 <code>DLMgetras</code> will ignore the specified file and continue processing.</p>
KAPL10014-W	You lack read permission for the specified directory. Line = <i>aa...aa</i> , Value = <i>bb...bb</i>	<p>Details</p> <p>You lack read permission for the specified directory in the file for defining information to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining information to be collected(decimal number)</p> <p><i>bb...bb</i>: Indicated contents in a line</p> <p>Action</p> <p>After the <code>DLMgetras</code> 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 <code>DLMgetras</code> will ignore the specified file and continue processing.</p>
KAPL10015-W	The file format is invalid. Value = <i>aa...aa</i>	<p>Details</p> <p>The file format in the file for defining information to be collected is not a text file.</p> <p><i>aa...aa</i>: Third parameter</p> <p>Action</p> <p>After the <code>DLMgetras</code> 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.</p>

Message ID	Message	Recommended Action
KAPL10016-W	The root directory has been specified in the first parameter.	<p>Details</p> <p>A root "/" cannot be specified in a directory to which collected information is output.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then re-execute.</p>
KAPL10017-W	You lack privileges for executing the utility for collecting HDLM error information.	<p>Details</p> <p>The <code>DLMgetras</code> utility for collecting HDLM error information must be executed by a user with root privileges.</p> <p>Action</p> <p>Re-execute as a user with root privileges.</p>
KAPL10020-I	The file has been obtained successfully. File = <code>aa...aa</code> , Collection time = <code>bb...bb</code> (GMT: <code>bb...bb</code>)	<p>Details</p> <p>The file to be collected has been obtained.</p> <p><code>aa...aa</code>: Collected file name</p> <p><code>bb...bb</code>: : Year/month/day hour:minute:second</p> <p>Action</p> <p>None.</p>
KAPL10021-I	Processing terminated before completion because a signal was received.	<p>Details</p> <p>The process has been terminated by an operation such as Ctrl+C.</p> <p>Action</p> <p>The utility for collecting HDLM error information terminated before completion. If the directory is unnecessary, delete directory.</p>
KAPL10022-I	The utility for collecting HDLM error information completed normally.	<p>Details</p> <p>Error information has been collected.</p> <p>Action</p> <p>None.</p>
KAPL10030-I	A user terminated the utility for collecting HDLM error information.	<p>Details</p> <p>Processing of the <code>DLMgetras</code> utility has been terminated because <code>n</code> was sent as a confirmation reply.</p> <p>Action</p> <p>None.</p>
KAPL10031-W	The entered value is invalid. Continue operation ? [y/n]:	<p>Details</p> <p>A value other than <code>y</code> or <code>n</code> has been entered for a [y/n] request. Enter <code>y</code> or <code>n</code>.</p> <p>Action</p> <p>Enter <code>y</code> or <code>n</code>.</p>

Message ID	Message	Recommended Action
KAPL10032-W	The entered value is invalid. The utility for collecting HDLM error information stops.	<p>Details</p> <p>Processing of the <code>DLMgetras</code> utility for collecting HDLM error information will terminate because an invalid response was sent three times to a request.</p> <p>Action</p> <p>Re-execute the <code>DLMgetras</code> utility.</p>
KAPL10033-W	The file does not exist. Filename = <code>aa...aa</code>	<p>Details</p> <p>The file to collect does not exist. <code>aa...aa</code>: File to collect</p> <p>Action</p> <p>None.</p>
KAPL10034-E	The file could not be copied. Filename = <code>aa...aa</code> , Details = <code>bb...bb</code>	<p>Details</p> <p>Execution of the <code>cp</code> command failed. <code>aa...aa</code>: File name you tried to copy <code>bb...bb</code>: <code>cp</code> output message</p> <p>Action</p> <p>An error occurred while the file to be collected was being copied. The user environment may be unstable. Check the system configuration.</p>
KAPL10035-E	An attempt to archive the error information failed. Details = <code>aa...aa</code>	<p>Details</p> <p>Execution of the <code>tar</code> command failed. <code>aa...aa</code>: <code>tar</code> output message</p> <p>Action</p> <p>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.</p>
KAPL10036-E	An attempt to compress the error information failed. Details = <code>aa...aa</code>	<p>Details</p> <p>Execution of the <code>compress</code> command failed. <code>aa...aa</code>: <code>compress</code> output message</p> <p>Action</p> <p>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.</p>

Table 8.12 Messages from the Utility for Deleting HDLM Drivers

Message ID	Message	Recommended Action
KAPL10521-W	A parameter is invalid. (parameter = aa...aa)	<p>Details</p> <p>Specified parameter is invalid. aa...aa : invalid parameter</p> <p>Action</p> <p>Execute help of the <code>d1mrmdev</code> utility to check the parameters that can be specified, and then retry.</p>
KAPL10523-E	An attempt to unmount the file system has failed. (file system = aa...aa)	<p>Details</p> <p>An attempt to unmount the file system has failed. aa...aa : failed file system</p> <p>Action</p> <p>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.</p>
KAPL10524-E	An attempt to inactivate the volume group has failed. (volume group = aa...aa)	<p>Details</p> <p>An attempt to inactivate the volume group has failed. aa...aa : failed volume group</p> <p>Action</p> <p>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.</p>
KAPL10525-E	An internal error occurred in the <code>d1mrmdev</code> utility. (error code = aa...aa)	<p>Details</p> <p>In the <code>d1mrmdev</code> utility an error not caused by a user occurred. aa...aa: error code (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL10526-I	An attempt to unmount the file system has succeeded. (file system = aa...aa)	<p>Details</p> <p>Unmount of the output file system succeeded. aa...aa : file system succeeded</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL10527-I	An attempt to inactivate the volume group has succeeded. (volume group = aa...aa)	<p>Details</p> <p>Inactivation of the output volume group succeeded.</p> <p>aa...aa : volume group succeeded</p> <p>Action</p> <p>None.</p>
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]:	<p>Details</p> <p>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.</p> <p>Action</p> <p>Type in "y" to continue the operation, or type "n" to stop the operation.</p>
KAPL10529-I	All hdisks to be deleted were deleted successfully.	<p>Details</p> <p>All hdisks for deletion were successfully removed. If the HDLM driver was configured, the HDLM manager has successfully stopped, and HDLM has stopped.</p> <p>Action</p> <p>None.</p>
KAPL10530-E	Some hdisks could not be deleted.	<p>Details</p> <p>The <code>d1mrmdev</code> command was executed, but some hdisks could not be deleted.</p> <p>Action</p> <p>Check the hdisk status and re-execute the <code>d1mrmdev</code> utility.</p>

Table 8.13 Messages from the Utility for Clearing HDLM Persistent Reservation

Message ID	Message	Recommended Action
KAPL10641-I	Reservation Key will now be cleared. Is this OK? [y/n]:	<p>Details</p> <p>Enter <i>y</i> to clear and <i>n</i> to not clear the Reservation Key.</p> <p>Action</p> <p>Enter <i>y</i> or <i>n</i>.</p>
KAPL10642-I	Reservation Key of <i>aa...aa</i> was cleared.	<p>Details</p> <p>The Reservation Key has been cleared.</p> <p><i>aa...aa</i>: logical device file name for the HDLM management-target device</p> <p>Action</p> <p>None.</p>
KAPL10643-W	A necessary parameter is not specified.	<p>Details</p> <p>A parameter is not specified for the <code>d1mpr</code> utility.</p> <p>Action</p> <p>Execute the <code>d1mpr -h</code> utility to check the parameter, and then retry execution.</p>
KAPL10644-W	The specified parameters cannot be specified at the same time. parameter = <i>aa...aa</i>	<p>Details</p> <p>The specified parameters cannot be specified for the <code>d1mpr</code> utility at the same time.</p> <p><i>aa...aa</i>: specified parameter</p> <p>Action</p> <p>Execute the <code>d1mpr -h</code> utility to check the parameter, and then retry execution.</p>
KAPL10645-W	A parameter value is invalid. parameter = <i>aa...aa</i>	<p>Details</p> <p>An invalid parameter value has been specified for the <code>d1mpr</code> utility.</p> <p><i>aa...aa</i>: specified parameter</p> <p>Action</p> <p>Specify the correct value for the parameter, and then retry.</p>
KAPL10646-W	A parameter is invalid. parameter = <i>aa...aa</i>	<p>Details</p> <p>An invalid parameter has been specified for the <code>d1mpr</code> utility.</p> <p><i>aa...aa</i>: specified parameter</p> <p>Action</p> <p>Execute help of the <code>d1mpr</code> utility to check the parameters that can be specified, and then retry.</p>

Message ID	Message	Recommended Action
KAPL10648-E	An internal error occurred in the <code>dlmpr</code> utility. Error Code = <code>aa...aa</code>	<p>Details</p> <p>An error not caused by the user has occurred in the <code>dlmpr</code> utility.</p> <p><code>aa...aa</code>: error number(decimal number)</p> <p>Action</p> <p>If the message displays <code>Error Code = 35</code> or <code>Error Code = 36</code>, check the path for any errors. 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.</p>
KAPL10649-E	<code>aa...aa</code> : An attempt to perform Reservation Key clear processing has failed.	<p>Details</p> <p>An attempt to perform Reservation Key clear processing has failed.</p> <p><code>aa...aa</code>: <code>hdiskn</code></p> <p>Action</p> <p>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.</p>
KAPL10650-I	<code>aa...aa</code> : NO RESERVATION	<p>Details</p> <p>A LU has not been reserved.</p> <p><code>aa...aa</code>: <code>hdiskn</code></p> <p>Action</p> <p>None.</p>
KAPL10651-I	The user terminated the operation.	<p>Details</p> <p>The <code>dlmpr</code> utility has been terminated because <code>n</code> was sent to a request.</p> <p>Action</p> <p>None.</p>
KAPL10652-E	The entered value is invalid. The operation stops.	<p>Details</p> <p>An invalid response was sent three times consecutively to a request.</p> <p>Action</p> <p>Re-execute the <code>dlmpr</code> utility.</p>
KAPL10653-W	The entered value is invalid. Please re-enter it [y/n]:	<p>Details</p> <p>A value other than <code>y</code> or <code>n</code> has been entered for a [y/n] request.</p> <p>Action</p> <p>Enter <code>y</code> or <code>n</code>.</p>

Message ID	Message	Recommended Action
KAPL10665-I	The dlmp _r utility completed.	<p>Details</p> <p>The dlmp_r utility completed normally.</p> <p>Action</p> <p>None.</p>
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.	<p>Details</p> <p>aa...aa : hdisk_n</p> <p>Action</p> <p>If you want to clear the Reservation Key of the HDLM driver's hdisk, which is the boot disk, specify and execute the dlmp_r utility to clear the HDLM persistent reservation.</p>

Table 8.14 Messages from the Utility for Setting the HDLM Execution Environment ODM

Message ID	Message	Recommended Action
KAPL10800-I	The dlmodmset utility completed normally.	<p>Details</p> <p>The dlmodmset utility completed normally.</p> <p>Action</p> <p>None.</p>
KAPL10801-W	No parameter has been specified. operation = aa...aa	<p>Details</p> <p>No parameter has been specified.</p> <p>aa...aa : Specified operation</p> <p>Action</p> <p>Execute help of the dlmodmset utility to check the parameters that can be specified, and then retry.</p>
KAPL10802-W	A parameter is invalid. operation = aa...aa, parameter = bb...bb	<p>Details</p> <p>The specified parameter is invalid.</p> <p>aa...aa : Specified operation</p> <p>bb...bb : invalid parameter</p> <p>Action</p> <p>Execute help of the dlmodmset utility to check the parameters that can be specified, and then retry.</p>
KAPL10804-E	An internal error occurred in the dlmodmset utility. Error Code = aa...aa	<p>Details</p> <p>An error not caused by the user has occurred in the dlmodmset utility.</p> <p>aa...aa : Error Code (Character string)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>

Message ID	Message	Recommended Action
KAPL10805-I	The setup of the HDLM execution environment ODM will be changed. <i>aa...aa = bb...bb</i> . Is this OK? [y/n]:	<p>Details</p> <p>We recommend that you report the setup of the HDLM execution environment ODM that you want to change to the user for confirmation.</p> <p><i>aa...aa</i> : Lun Reset, Online(E) IO Block (character string)</p> <p><i>bb...bb</i> : on/off (character string)</p> <p>Action</p> <p>Enter y to execute setup, or enter n to cancel.</p>
KAPL10806-W	The entered value is invalid. Re-enter [y/n]:	<p>Details</p> <p>A value other than y or n has been entered for a [y/n] request. Enter [y/n].</p> <p>Action</p> <p>Enter y or n.</p>
KAPL10807-E	The entered value is invalid. The operation stops.	<p>Details</p> <p>An invalid response was sent three times consecutively to a request.</p> <p>Action</p> <p>Re-execute the <code>d1modmset</code> utility.</p>
KAPL10808-I	The user terminated the operation.	<p>Details</p> <p>The utility has been terminated because n was sent to a request.</p> <p>Action</p> <p>None.</p>
KAPL10809-W	No operation has been specified.	<p>Details</p> <p>No operation has been specified.</p> <p>Action</p> <p>Execute help of the <code>d1modmset</code> utility to check the operations that can be specified, and then retry.</p>
KAPL10810-W	An operation is invalid. operation = <i>aa...aa</i>	<p>Details</p> <p>The specified operation is invalid.</p> <p><i>aa...aa</i> : invalid operation</p> <p>Action</p> <p>Execute help of the <code>d1modmset</code> utility to check the operations that can be specified, and then retry.</p>

Table 8.15 Messages from HDLM remote access interface

Message ID	Message	Recommended Action
KAPL11901-I	<i>aa...aa</i> has started.	<p>Details</p> <p>The operation has started on the host.</p> <p><i>aa...aa</i> : Operation (character string)</p> <p>Get Path Information</p> <p>Get Option Information</p> <p>Set Option Information</p> <p>Clear Data</p> <p>Get HDLM Manager Status</p> <p>Get HDLM Driver Status</p> <p>Get HDLM Alert Driver Status</p> <p>Action</p> <p>None.</p>
KAPL11902-I	<i>aa...aa</i> has started. PathID = <i>bb...bb</i>	<p>Details</p> <p>The operation has started on the host.</p> <p><i>aa...aa</i>: Operation (character string)</p> <p>Online</p> <p>Offline</p> <p><i>bb...bb</i>: The Path ID of the target path for the operation. (decimal number)</p> <p>Action</p> <p>None.</p>
KAPL11903-I	<i>aa...aa</i> has completed normally.	<p>Details</p> <p>Operation has completed normally on the host.</p> <p><i>aa...aa</i>: Operation (character string)</p> <ul style="list-style-type: none"> ▪ 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 <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL11904-E	aa...aa has completed abnormally. Error status = bb...bb	<p>Details</p> <p>Operation has completed abnormally on the host.</p> <p>aa...aa: Operation (character string)</p> <ul style="list-style-type: none"> ▪ 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 <p>bb...bb: Error-status-returned-from-API (character string)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see section 6.1.</p>
KAPL11905-E	An unexpected error occurred.	<p>Details</p> <p>An exception occurred during processing in the host.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> 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.</p>
KAPL11906-I	GUI information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : Trace information (character string)</p> <p>Action</p> <p>None.</p>
KAPL11907-I	XML reception - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : XML information (character string)</p> <p>Action</p> <p>None.</p>

Message ID	Message	Recommended Action
KAPL11908-I	XML transmission - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : XML information (character string)</p> <p>Action</p> <p>None.</p>

Table 8.16 Messages from Utility for HDLM Installation Configuration Support

Message ID	Message	Recommended Action
KAPL12252-I	A new installation of HDLM will now be performed. Is this OK? [y/n]:	<p>Action</p> <p>To execute a new installation of HDLM, enter "y". To stop without executing, enter "n".</p>
KAPL12253-I	An update installation of HDLM will now be performed. Is this OK? [y/n]:	<p>Action</p> <p>To execute an upgrade installation or re-installation of HDLM, enter "y". To stop without executing, enter "n".</p>
KAPL12254-I	The dlmmodmset utility will now be executed. Is this OK? [y/n]:	<p>Action</p> <p>To execute the utility for setup of the HDLM execution ODM, enter "y". To stop without executing, enter "n".</p>
KAPL12255-I	The dlnkmgr set command will now be executed. Is this OK? [y/n]:	<p>Action</p> <p>To execute the HDLM operation setup command, enter "y". To stop without executing, enter "n".</p>
KAPL12256-I	The dlmmdev utility will now be executed. Is this OK? [y/n]:	<p>Action</p> <p>To execute the release of the hdisk configuration, enter "y". To stop without executing, enter "n".</p>
KAPL12257-W	The entered value is invalid. Re-enter. [y/n]:	<p>Action</p> <p>Enter either "y" or "n".</p>
KAPL12258-I	The entered value is invalid. The operation will now stop.	<p>Action</p> <p>To execute dlmsetup again, re-execute. . For details about the dlmsetup utility, see section 6.7.</p>
KAPL12259-I	The user stopped the operation.	<p>Action</p> <p>To execute dlmsetup again, re-execute. For details about the dlmsetup utility, see section 6.7.</p>

Message ID	Message	Recommended Action
KAPL12260-W	No parameter has been specified.	<p>Action</p> <p>Specify the <code>-h</code> parameter in the utility for HDLM installation configuration support, confirm the option that should be specified, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p>
KAPL12261-W	A parameter is invalid. parameter = <i>aa...aa</i>	<p>Details</p> <p>An invalid parameter is specified. <i>aa...aa</i>: The specified parameter</p> <p>Action</p> <p>Specify the <code>-h</code> parameter in the utility for HDLM installation configuration support, confirm the option that should be specified, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p>
KAPL12262-W	No parameter value has been specified. parameter = <i>aa...aa</i>	<p>Details</p> <p>No parameter value has been specified. <i>aa...aa</i>: Parameter</p> <p>Action</p> <p>Specify the <code>-h</code> parameter in the utility for HDLM installation configuration support, confirm the option that should be specified, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p>
KAPL12263-E	The specified file does not exist. parameter = <i>aa...aa</i> , Filename = <i>bb...bb</i>	<p>Details</p> <p>A file that does not exist is specified. <i>aa...aa</i>: Parameter <i>bb...bb</i>: The specified file name</p> <p>Action</p> <p>If <code>-odm</code> is set for the parameter: Execute <code>dlmodmset</code>, and then <code>dlmkmgr set</code> one after another, or specify <code>odm-settings-file</code> in <code>dlmsetup</code> again, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p> <p>If <code>-set</code> is set for the parameter: Specify the desired parameters, and then execute the <code>dlmkmgr set</code> command.</p>

Message ID	Message	Recommended Action
KAPL12264-E	An attempt to read the file has failed. parameter = <i>aa...aa</i> , Filename = <i>bb...bb</i>	<p>Details</p> <p>An attempt to read the file has failed. <i>aa...aa</i>: Parameter <i>bb...bb</i>: The specified file name</p> <p>Action</p> <p>If <code>-odm</code> is set for the parameter: Execute <code>dlmodmset</code>, and then <code>dlnkmgr set</code> one after another, or specify an <i>odm-settings-file</i> that can be read in <code>dlmsetup</code> again, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p> <p>If <code>-set</code> is set for the parameter: Specify the desired parameters, and then execute the <code>dlnkmgr set</code> command.</p>
KAPL12265-E	There is an invalid character in the file. parameter = <i>aa...aa</i> , Filename = <i>bb...bb</i>	<p>Details</p> <p>An invalid character was discovered in the file. <i>aa...aa</i>: Parameter <i>bb...bb</i>: The specified file name</p> <p>Action</p> <p>If <code>-odm</code> is set for the parameter: Execute <code>dlmodmset</code>, and then <code>dlnkmgr set</code> one after another, or specify the modified <i>odm-settings-file</i> in <code>dlmsetup</code> again, and then re-execute. For details about the <code>dlmsetup</code> utility, see section 6.7.</p> <p>If <code>-set</code> is set for the parameter: Specify the desired parameters, and then execute the <code>dlnkmgr set</code> command.</p>
KAPL12266-E	The <i>aa...aa</i> does not exist.	<p>Details</p> <p>The utility or the command that you tried to execute was not in the expected location. <i>aa...aa</i>: <code>dlmodmset</code>, <code>dlnkmgr</code> or <code>dlmrmdev</code>.</p> <p>Action</p> <p>The utility that you attempted to execute or the command was not in the expected location. If the utility or command that you tried to execute is <code>dlmodmset</code>, or <code>dlnkmgr</code>, the expected location is <code>/usr/DynamicLinkManager/bin</code>. If the utility that you tried to execute is <code>dlmrmdev</code>, the expected location is the directory in which the <code>dlmsetup</code> was executed.</p>
KAPL12268-I	The <code>dlmsetup</code> utility completed successfully.	<p>Action</p> <p>none.</p>

Message ID	Message	Recommended Action
KAPL12269-I	The dlmsetup utility ended abnormally.	Action Check the error message output before this message, and then perform the action indicated in that error message.
KAPL12270-W	An error occurred during processing of the dlmsetup utility.	Details Although processing the dlmsetup utility ended, an error occurred during processing of it. Action Check the error message output before this message, and then perform the action indicated in that error message.

Table 8.17 Messages from the Utility for Assisting HDLM Migration

Message ID	Message	Recommended Action
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 <i>y</i> . To stop execution, enter <i>n</i> .
KAPL13004-W	The entered value is invalid. Re-enter. [y/n]:	Action Enter either <i>y</i> or <i>n</i> .
KAPL13005-E	The entered value is invalid. The operation will now stop.	Action To execute <code>dlmmigsts</code> again, re-execute For details about the <code>dlmmigsts</code> utility, see section 6.2.
KAPL13006-I	The user stopped the operation.	Action To execute <code>dlmmigsts</code> again, re-execute For details about the <code>dlmmigsts</code> utility, see section 6.2.
KAPL13007-W	No parameter has been specified.	Action Specify the <code>-h</code> option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.

Message ID	Message	Recommended Action
KAPL13008-W	A parameter is invalid. parameter = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Parameter (character string)</p> <p>Action</p> <p>Specify the <code>-h</code> option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>
KAPL13009-W	No parameter value has been specified. parameter = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i> : Parameter (character string)</p> <p>Action</p> <p>Specify the <code>-h</code> option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>
KAPL13010-W	The specified file does not exist. parameter = <i>aa...aa</i> , Filename = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Parameter (character string)</p> <p><i>bb...bb</i>: Filename (character string)</p> <p>Action</p> <p>If parameter = <code>-odm</code>, specify <code>odmsetfile</code> in <code>dlmmigsts</code> again, and then re-execute. If parameter = <code>-set</code>, specify <code>dlmksetfile</code> in <code>dlmmigsts</code> again, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>
KAPL13011-W	The number of parameters is insufficient.	<p>Action</p> <p>Specify the <code>-h</code> option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>
KAPL13012-W	Too many parameters have been specified.	<p>Action</p> <p>Specify the <code>-h</code> option in the HDLM migration support utility, confirm the option that should be specified, and then re-execute. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>
KAPL13013-E	The directory for storing the specified file could not be created. Filename = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Filename (character string)</p> <p>Action</p> <p>There is not enough space to store the specified file in the directory. Make sure there is enough space, and then try again. For details about the <code>dlmmigsts</code> utility, see section 6.2.</p>

Message ID	Message	Recommended Action
KAPL13014-E	An internal error occurred in the dlmmigsts utility. Error Code = aa...aa	<p>Details</p> <p>aa...aa: Error Code (decimal number)</p> <p>Action</p> <p>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.</p>
KAPL13015-E	There is an invalid character in the file. parameter = aa...aa, Filename = bb...bb	<p>Details</p> <p>aa...aa: Parameter (character string)</p> <p>bb...bb: Filename (character string)</p> <p>Action</p> <p>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 section 6.2. For details on the dlmodmset utility, see section 6.3.</p> <p>If parameter = -set, execute dlkmgr set one after another, or specify the modified dlknsetfile in dlmmigsts again, and then re-execute.</p>
KAPL13016-E	The backup operation cannot be performed because DLManager.rte is not installed.	<p>Action</p> <p>Perform the backup operation in an environment where DLManager.rte is installed.</p>
KAPL13017-E	The restoration operation cannot be performed because DLManager.mpio.rte is not installed.	<p>Action</p> <p>Install DLManager.mpio.rte, and then try again.</p>
KAPL13018-E	The backup operation cannot be performed because there is no /usr/DynamicLinkManager/config/dlmmgr.xml file.	<p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL13019-E	The same file name was specified for odmsetfile and dlknsetfile. Filename = aa...aa, bb...bb	<p>Details</p> <p>aa...aa: odmsetfile Filename</p> <p>bb...bb: dlknsetfile Filename</p> <p>Action</p> <p>Check file name, and then try again.</p>
KAPL13020-E	The file odmsetfile was not restored.	<p>Action</p> <p>Check file name, and then try again.</p>
KAPL13021-E	The file dlknsetfile was not restored.	<p>Action</p> <p>Check file name, and then try again.</p>

Table 8.18 Messages from the Utility Executed before Uninstalling HDLM

Message ID	Message	Recommended Action
KAPL13101-I	The dlmpreuninst utility completed successfully.	Action None.
KAPL13102-I	HDLM can now be uninstalled.	Action None.
KAPL13103-I	HDLM can be uninstalled after rebooting the host.	Action None.
KAPL13104-I	The settings will be changed so that the HDLM 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 To execute dlmpreuninst again, re-execute.
KAPL13108-E	An internal error occurred in the dlmpreuninst utility. Error Code = aa...aa, bb...bb	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.

Message ID	Message	Recommended Action
KAPL13109-W	A parameter is invalid. parameter = aa...aa	<p>Details</p> <p>An invalid parameter is specified.</p> <p>aa...aa : The specified parameter (character string)</p> <p>Action</p> <p>With the <code>-h</code> parameter specified, execute the HDLM pre-uninstallation utility (<code>dlnpreuninst</code>). Make sure that the parameters that should be specified are correct, and then re-execute. For details about the <code>dlnpreuninst</code> utility, see section 6.5.</p>
KAPL13110-E	The <code>dlnpreuninst</code> utility cannot be executed because the HDLM driver is running.	<p>Action</p> <p>Execute the <code>dlnrmdev</code> command, and then re-execute the <code>dlnpreuninst</code>. For details about the <code>dlnrmdev</code> utility, see Table 8.12. For details about the <code>dlnpreuninst</code> utility, see section 6.5.</p>

Table 8.19 Return Codes for the HDLM Remote Access Interface

The HDLM remote access interface is an interface used by other HiCommand products to access hosts. HDLM outputs a return code when the operation that the HDLM remote access interface requested to HDLM terminates abnormally, or when there is a warning while the operation terminates normally.

Message ID	Message	Recommended Action
1002		<p>Details</p> <p>There is no path on which the operation can be performed.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>
1003		<p>Details</p> <p>No path was detected.</p> <p>Action</p> <p>Check whether a path between the host and the storage subsystem is connected. If a path is connected, check whether HDLM is configured correctly.</p>
1004		<p>Details</p> <p>Memory required for HDLM internal processing could not be allocated.</p> <p>Action</p> <p>Terminate unnecessary applications to increase free memory, or restart the host.</p>

Message ID	Message	Recommended Action
1006		<p>Details</p> <p>The Offline path cannot be placed Online.</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
1007		<p>Details</p> <p>The target path of the offline operation is the last path of the device and cannot be placed in the offline status.</p> <p>Action</p> <p>Click Refresh to update the host information, check the path status, and then retry the offline operation.</p>
1015		<p>Details</p> <p>The Offline path cannot be placed Online.</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
1016		<p>Details</p> <p>The target path(s) are already Online.</p> <p>Action</p> <p>Update the host information, and then check the path status.</p>
1017		<p>Details</p> <p>The target path(s) are already Offline(C).</p> <p>Action</p> <p>Update the host information, and then check the path status.</p>
1019		<p>Details</p> <p>An error occurred during HDLM internal processing.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1020		<p>Details</p> <p>An unexpected error occurred during HDLM internal processing.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>

Message ID	Message	Recommended Action
1025		<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1026		<p>Details</p> <p>The getting Path Information has been stopped because the configuration of paths was changed during the processing of the getting Path Information.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>
1027		<p>Details</p> <p>The getting PathInformation has been stopped because the configuration of paths was changed during the processing of the getting PathInformation.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>
1033		<p>Details</p> <p>The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.</p> <p>Action</p> <p>Set the monitoring interval to a value that is equal to or more than (auto failback checking interval x number of times).</p>
1034		<p>Details</p> <p>An attempt to acquire the HDLM version information failed.</p> <p>Action</p> <p>Re-execute. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>

Message ID	Message	Recommended Action
1035		<p>Details</p> <p>An attempt to acquire information about the HDLM version or SP version has failed.</p> <p>Action</p> <p>Re-execute. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1036		<p>Details</p> <p>An attempt to acquire information about the HDLM version or SP version has failed.</p> <p>Action</p> <p>Re-execute. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1037		<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1041		<p>Details</p> <p>An attempt to communicate with the HDLM Manager has failed.</p> <p>Action</p> <p>Check whether the HDLM Manager is running on the host. If it is not running, start the HDLM Manager.</p>
1042		<p>Details</p> <p>Information about the path configuration on the specified LU does not match the path configuration information held by HDLM.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>

Message ID	Message	Recommended Action
1045		<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>
1046		<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> 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 <code>DLMgetras</code> utility, see 6.1.</p>

Appendix A Differences Between HDLM Version 5.9 or later and Versions 5.8.1 or Earlier

HDLM version 5.9 or later supports MPIO used by AIX 5.2 and later, which has improved compatibility with the OS. The items explained in the following subsection represent the changes from HDLM version 5.8.1 or earlier.

A.1 Add-in HDLM Driver Module

HDLM version 5.9 or later supports MPIO used by AIX 5.2 and 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 versions 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 A.1 shows the differences in the HDLM drivers between HDLM versions 5.8.1 or earlier and HDLM version 5.9 or later.

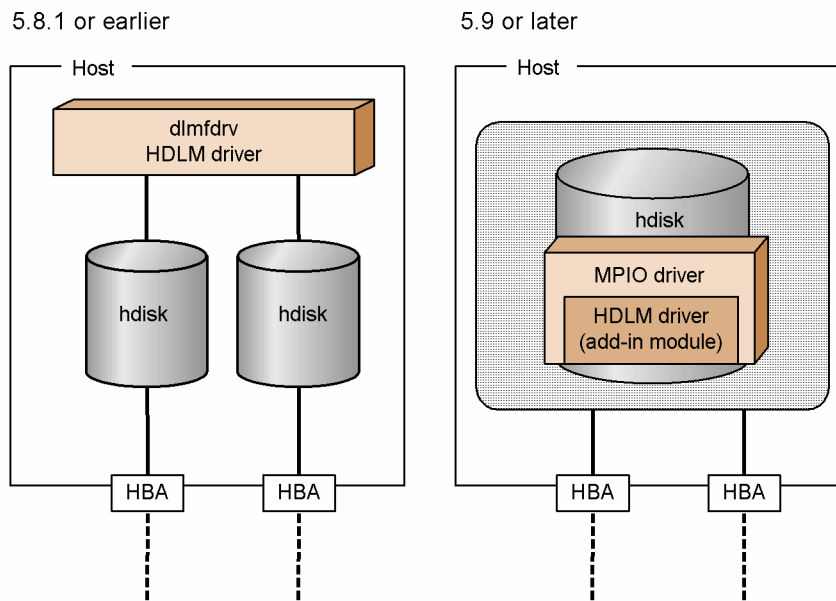


Figure A.1 Differences in HDLM Drivers Between HDLM Versions 5.8.1 or Earlier and Version 5.9 or later

A.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 (`dlmfdrv`) 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/dlmfdrv.unconf`) and the file that defines the HDLM driver configuration (`/usr/DynamicLinkManager/drv/dlmfdrv.conf`) are no longer used. After installing HDLM, all devices shown in *Devices that HDLM can manage* in 2.1 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) (MK-92DLM111-08)*:

- 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*
 - (2) *Disk heartbeat*
- 3.11 *Settings for using GPFS*
- 3.15.7 *Deleting the HACMP settings*
 - (1) *Deleting a user-defined cluster event*
- 4.1.6 *Notes on and error checking for operations specifying physical volumes (`hdisk`)*
- 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) (MK-92DLM111-08)* 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 `hdiskn`. Accompanying this change, `Device` for displaying `hdiskn` 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 A.1 lists the correspondence between the commands for operating utilities for HDLM volume groups and the standard AIX commands.

See Appendix A.1.

Table A.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>
<code>D1mimportvg</code>	<code>importvg</code>
<code>D1mlistvgbackup</code>	<code>listvgbackup</code>
<code>D1mlsvg</code>	<code>lsvg</code>
<code>D1mmirrorvg</code>	<code>mirrorvg</code>
<code>D1mmkvg</code>	<code>mkvg</code>
<code>D1mrecreatevg</code>	<code>recreatevg</code>
<code>D1mreducevg</code>	<code>reducevg</code>
<code>D1mreorgvg</code>	<code>reorgvg</code>
<code>D1mrestorevgfiles</code>	<code>restorevgfiles</code>
<code>D1mrestvg</code>	<code>restvg</code>
<code>D1msavevg</code>	<code>savevg</code>
<code>D1msyncvg</code>	<code>syncvg</code>
<code>D1munmirrorvg</code>	<code>unmirrorvg</code>
<code>D1mvaryoffvg</code>	<code>varyoffvg</code>
<code>D1mvaryonvg</code>	<code>varyonvg</code>

- `d1mcfgmgr` utility for managing the HDLM configuration

In HDLM version 5.9 or later, the AIX `cfgmgr` command is used.

- `d1mchkdev` utility for checking the HDLM device configuration
- `d1mHBAdel` utility for changing the HDLM HBA

Also, the execution target of the `d1mrmdev` utility for removing HDLM drivers has been changed from `d1mfdrv` to `hdisk`.

A.3 Changing the HDLM Environment Configuration and Operation Procedures by Changes to the Logical Device Files

For the same reason explained in A.2, the following HDLM environment configuration and operation procedures have been changed:

- New installation and update installation of HDLM[#]
- Settings when GPFS is used
- Settings when VCS 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 `d1mmigsts` utility for assisting HDLM transitions to inherit the existing HDLM settings. For details, see section 3.5.7.3.

A.4 Migrating Reservation Control Settings

In HDLM version 5.8.1 or earlier, the *reservation control setting* is called *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 5.2 or later. The reserve control setting is specified by using the `chdev` command in HDLM 5.9 or later. Therefore, the `-rsv on` parameter for the `set` operation is no longer provided.

Table A.2 shows the correspondence of the setting values between the reservation level and the reservation policy.

Table A.2 The Correspondence of the Setting Values between the Reservation Level and Reservation Policy

Reservation Level	Reservation Policy
0: Ignoring the reservation	no_reserve
2: Persistent reservation	PR_exclusive

A.5 Support for a Boot Disk Environment

A storage subsystem disk can now be used for the boot disk. Accompanying this, the `dlnpreuninst` utility that is executed before uninstalling HDLM has been provided. The `dlnpreuninst` utility excludes, before you uninstall HDLM, the hdisk recognized as a boot disk from being an HDLM management-target device.

A.6 About Settings when Upgrading the OS

A.6.1 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 (MK-92DLM111-08))* is no longer necessary and has been deleted from this manual.

A.6.2 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 section have been deleted from the manual *HiCommand Dynamic Link Manager User's Guide (for AIX (MK-92DLM111-08))*:

- 3.5.2 *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 (A.6.1) and (A.6.2), the `dlnmchenv` utility for modifying the HDLM execution environment is no longer necessary and has been deleted.

A.7 Changing a Virtual I/O Server's Method of Recognizing Virtual SCSI Disks

In HDLM versions 5.8.1 or earlier, PVID or `unique_id` could be selected as the method used by a virtual I/O server for recognizing virtual SCSI disks. With 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 (MK-92DLM111-08))* 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.

Acronyms and Abbreviations

AL	arbitrated loop
API	application program interface
Cha, CHA	channel adapter
CLPR	Cache Logical Partition
CS	Cluster support
FC	fibre channel
FO	Failover
GUI	graphical user interface
HACMP	High Availability Cluster Multi-Processing
HBA	host bus adapter
HDev	host device
HDLM	HiCommand Dynamic Link Manager
HLU	host Logical Unit
HMDE	Hitachi Multiplatform Data Exchange (also called HRX)
HRX	Hitachi RapidXchange (also called HMDE)
LDEV	Logical device
LU	logical unit
LUN	logical unit number
LVM	Logical Volume Manager
MPIO	<u>M</u> ultipath <u>I/O</u>
ODM	Object Data Manager
OS	operating system
RAC	Real Application Clusters
RVSD	<u>R</u> ecoverable <u>V</u> irtual <u>S</u> hared <u>D</u> isk
SAN	storage-area network
SCSI	small computer system interface
SLPR	Storage Logical Partition
SMIT	System Management Interface Tool
TID	target ID
USP	Universal Storage Platform
VCS	VERITAS Cluster Server™
WMS	Workgroup Modular Storage

Glossary

automatic failback	<p>Functionality for checking the status of paths at regular intervals, and automatically placing the status of a path recovered from an error into Online status.</p> <p>If a path with Offline(E) or Online(E) status recovers from an error, automatic failback places the path Online.</p> <p>Automatic failback checks the status of paths that were placed in Offline(E) or Online(E) status because of an error, but does not check the status of paths that were placed in Offline© status by executing the <code>offline</code> operation. For details on the <code>offline</code> operation, see 5.4.</p>
AutoPATH_ID	<p>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.</p> <p>(See also: path)</p>
boot disk environment	<p>An environment in which the startup disk is in a storage subsystem instead of in the host.</p>
CHA (Channel Adapter)	<p>An adapter for controlling a channel of a storage subsystem.</p>
CLPR(Cache Logical Partition)	<p>A function, supported by the TagmaStore USP and Universal Storage Platform V, for logically splitting a cache. This function splits the cache by array groups in the storage subsystem, so that other array groups do not affect cache performance.</p>
cluster	<p>A system that connects multiple hosts having the same OS or platform (that is, an environment in which the same application can run) and treats them as one system.</p>
Dev (Device)	<p>A logical division of an LU that HDLM controls and operates. A Dev is equivalent to a logical volume in AIX.</p> <p>In an AIX environment, each LU has only one Dev.</p> <p>Each Dev has a Dev number.</p> <p>Depending on the access method, Devs are classified into two types: block devices and character devices.</p> <p>(See also: Dev number)</p>

Dev number	<p>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.</p> <p>HDLM operates assuming that one LU has one Dev, so the device number is fixed to 0.</p> <p>(See also: Dev)</p>
emulation type	<p>An LU type accessible from a host. Since an HDLM management-target host is an open-system host such as a PC or a UNIX machine, the HDLM management-target host can access only the LUs that have open-system emulation types.</p> <p>For details on emulation types supported by a storage subsystem, see the maintenance manual for that storage subsystem.</p>
failback	<p>Functionality for placing the status of a path recovered from an error into Online status, and switching the access path to the recovered path.</p>
failover	<p>Functionality for switching to another normal path if there is an error in a path, thereby enabling the system to continue to operate.</p>
HBA (Host Bus Adapter)	<p>Device that functions as an interface connecting a host with external devices.</p> <p>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 Fibre Channel connection.</p>
HDLM alert driver	<p>A program that receives information about an error detected by the HDLM driver, and then reports the error information to the HDLM manager.</p>
HDLM driver	<p>A program that controls the HDLM functionality, manages paths, and detects errors.</p>
HDLM manager	<p>A program that manages error information. The HDLM manager receives the error information from the HDLM alert driver and then collects error logs.</p>
host	<p>A generic term for both servers and clients.</p>
host device	<p>A logical area within a host LU.</p> <p>(See also: host LU, host device name)</p>

host device name	A name assigned to a host device. The hdisk is assigned. (See also: host device)
host LU	An LU that the host recognizes. The actual HDev entity is a Dev in the storage subsystem. 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 a part of a path name. (See also: host LU, path name)
intermittent error	An error that occurs irregularly due to reasons such as a loose cable connection.
LDEV (Logical Device)	The value that identifies an LDEV consists of a combination of the storage subsystem's product name, serial number, and internal LU. HDLM uses this value to identify an LU.
load balancing	Functionality for distributing the load across the paths that access each logical area within an LU. To distribute loads, load balancing uses multiple paths to perform I/O operations. Two types of algorithms are available: round-robin and extended round-robin.
logical device file	/dev/hdiskn, and /dev/rhdiskn. A logical device of this term is not an LDEV.
LU (Logical Unit)	A logical unit that is a logical volume defined in the storage subsystem, and with which the host can perform input or output operations.
node	A server of cluster members.
non-owner controller	A controller other than an owner controller. Non-owner controllers exist only when the Thunder 9500V Series, or TagmaStore AMS/WMS Series is in use. (See also: owner controller, non-owner path)

non-owner path	<p>A path that passes through a controller other than an owner controller.</p> <p>Non-owner paths exist only when the Thunder 9500V Series, or TagmaStore AMS/WMS Series is in use.</p> <p>(See also: owner path, non-owner controller)</p>
ODM (Object Data Manager)	<p>An AIX-dedicated database for managing system information. HDLM uses ODM to add or delete drivers.</p>
owner controller	<p>A controller that has been set as an owner controller for an LU on the storage subsystem when using the Thunder 9500V Series, or TagmaStore AMS/WMS Series. A controller other than an owner controller is called a non-owner controller.</p> <p>When using the Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, all controllers are owner controllers.</p> <p>(See also: owner path, non-owner controller)</p>
owner path	<p>A path that passes through a controller that has been set as an owner controller for an LU on the storage subsystem when using the Thunder 9500V Series, or TagmaStore AMS/WMS Series. A path that passes through a controller other than an owner controller is called a non-owner path.</p> <p>When using the Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, all paths are owner paths.</p> <p>(See also: owner controller, non-owner path)</p>
path	<p>An access path from a host to storage subsystem. Access to a logical area within an LU in a storage subsystem is made via a cable connecting the host bus adapter on the host and the channel adapter on the storage subsystem. Each path has an AutoPATH_ID.</p> <p>(See also: AutoPATH_ID)</p>
path health checking	<p>Functionality for checking the status of paths at regular intervals.</p> <p>When an error occurs at a path that was in the Online status, path health checking changes the status of the path to the Offline(E) status.</p> <p>Path health checking checks only those paths that have Online status.</p>

path name	<p>The name consisting of the following four elements, separated by periods:</p> <p>HBA adapter number (character string)</p> <p>Bus number (character string)</p> <p>Target ID (hexadecimal number)</p> <p>Host LU number (hexadecimal number)</p> <p>A path name is used to identify a path.</p> <p>(See also: host LU number)</p>
persistent reservation	<p>Similar to reservation, persistent reservation enables a host to declare that it has exclusive use of an LU, and prevents other hosts from accessing that LU. Note, however, that reservation allows a host to have exclusive use of only one path to the LU, but persistent reservation allows a host to have exclusive use of more than one path.</p> <p>If HDLM applies persistent reservation, a host can have exclusive use of multiple paths to an LU, so load balancing among these exclusively used paths is possible.</p> <p>(See also: reservation)</p>
reservation	<p>The reservation functionality enables a host to declare that it has exclusive use of an 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 simultaneously. As a result, load balancing is not possible.</p> <p>(See also: persistent reservation)</p>
SAN (Storage Area Network)	<p>A high-speed network connecting hosts and storage subsystems. This network is independent of a LAN and is dedicated to data transfer. A SAN provides faster accesses to storage subsystems, and prevents the transfer of high-volumes of data from deteriorating LAN performance.</p>
SCSI device	<p>A SCSI disk device</p>
slot number	<p>A value indicating the location of a slot on which a host bus adapter is mounted.</p>

SLPR(Storage
Logical Partition)

A function, supported by the TagmaStore USP and Universal Storage Platform V, for logically splitting a storage subsystem. This function splits the resources (ports, CLPR, and volumes) in the storage subsystem, so that the user can manage each resource independently.

Index

A

AutoPATH_ID..... 7

B

base 10 179

buffer size 90

 changing the buffer size per monitoring
 interval duration 94

C

channel adapter..... 7

clear 139

cluster software..... 37

 canceling (HACMP) settings 114

 setup..... 56

command devices..... 6

D

decimal number, meaning..... 179

Dev 7

DkcPort 216

dlmmigsts 204

dlmodmset 206

dlmpreuninst 210

dlmrmdev 211

dlmsetup 212

E

ErrorCode 217

extended round robin 17

F

finishing

 Hitachi Network Objectplaza Trace Library
 settings 97

for using GPFS + RVSD

 settings..... 102

for using HACMP

 settings..... 99

for using VCS

 settings..... 104

G

glossary 303

H

HDevName 216, 217

HDLM

 installing 52

 migration..... 47

 new installation 47, 57

 performing an upgrade installation or re-
 installation of 67

 preparations for a new installation of..... 54

 preparations for an upgrade installation or
 re-installation of..... 66

 re-installation of 47

 setup..... 89

 type of installation 47

 uninstalling 106

 upgrade installation 47

HDLM environment

 creating 39

HDLM management-target devices..... 6

HDLM script for HACMP

 registering 99

help 140

Hitachi Network Objectplaza Trace Library

 applying the settings 97

 displaying the setup menu 91

Hitachi Network Objectplaza Trace Library

 (HNTRLib)

 uninstalling 113

Hitachi Network Objectplaza Trace Library

 (HNTRLib2)

 Uninstalling 111

Hitachi Network Objectplaza Trace Library

 settings

 finishing 97

host..... 117

host bus adapter 7

host device..... 9

host LU..... 9

I

I/O

 count..... 139

 errors 139

identifying the error section and taking

 corrective action for the hardware 219

iLU..... 216

installation 52

integrated trace file

 changing the number..... 93

 changing the size 92

integrated trace information files 90

integrated traces

 setup..... 90

K

kernel mode

switching 55

M

message
 adjusting the number of messages to be
 output 95
messages
 from HDLM remote access interface 280
Migrating 76

N

new installation of 47
number of error log files 153

O

offline 142
online 146
operating environment 151

P

path 7
 checking the configuration 88
placing the path online 219
port 7
product ID 180, 216

R

registering
 HDLM script for HACMP 99
re-installation 47
reservation policy 98
 setting 101
round robin 17

S

SAN 8
serial number 180
set 151
setting
 reservation policy 101
setting for using
 VCS 104
settings for using
 GPFS + RVSD 102
 HACMP 99
setup
 cluster software 56
 HDLM 89
 integrated traces 90
slot number 21
State 216
statistics 139
switching
 kernel mode 55

switching destination path, priority of 21

U

uninstallation
 HDLM 106
uninstalling
 Hitachi Network Objectplaza Trace Library
 (HNTRLlib) 113
 Hitachi Network Objectplaza Trace Library
 (HNTRLlib2) 111
Using the dlmsetup utility for supporting HDLM
 installation and configuration to install HDLM
 79
utilities
 dlmsetup, for HDLM installation
 configuration support 212
utility 204, 206, 210, 211
 dlmmigsts, for assisting HDLM migrations 204
 dlmodmset, for setting the HDLM execution
 environment 206
 dlmpreuninst, for executed before
 uninstalling HDLM 210
 dlmrmdev, for deleting HDLM drivers 211

V

vendor ID 180, 216
view 164

W

working environment
 view (view operation) 172

