

Hitachi Dynamic Link Manager (for Linux®)

8.7.8

User Guide

This document describes how to use the Hitachi Dynamic Link Manager for Linux. The document is intended for storage administrators who use Hitachi Dynamic Link Manager to operate and manage storage systems. Administrators should have knowledge of Linux and its management functionality, storage system management functionality, cluster software functionality, and volume management software functionality.

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Acronyms and abbreviations

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Preface

This document describes how to use the Hitachi Dynamic Link Manager.

- ☐ [Intended audience](#)
- ☐ [Product version](#)
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- ☐ [Document organization](#)
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Intended audience

This document is intended for storage administrators who use Hitachi Dynamic Link Manager (HDLM) to operate and manage storage systems, and assumes that readers have:

- Knowledge of Linux and its management functionality
- Knowledge of Storage system management functionality
- Knowledge of Cluster software functionality
- Knowledge of Volume management software functionality

Product version

This document revision applies to HDLM for Linux v8.7.8 or later.

Release notes

Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document. Release notes are available on Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>.

Document organization

The following table provides an overview of the contents and organization of this document. Click the chapter title in the left column to go to that chapter. The first page of each chapter provides links to the sections in that chapter.

Chapter/Appendix	Description
Chapter 1, Overview of HDLM on page 1-1	Gives an overview of HDLM, and describes its features.
Chapter 2, HDLM functions on page 2-1	Describes management targets and the system configuration of HDLM, and the basic terms and functions for HDLM.
Chapter 3, Creating an HDLM environment on page 3-1	Describes the procedures for building an HDLM environment (including installing and setting up HDLM), and describes for canceling the settings.
Chapter 4, HDLM operation on page 4-1	Describes how to use HDLM by using both the HDLM commands, and how to manually start and stop the HDLM manager. This chapter also describes how to configure an environment to properly operate HDLM, such as changing the HDLM management-target devices that connect paths or replacing the hardware that makes up a path.

Chapter/Appendix	Description
Chapter 5, Troubleshooting on page 5-1	Explains how to troubleshoot a path error, HDLM failure, or any other problems that you might encounter.
Chapter 6, Command reference on page 6-1	Describes all the HDLM commands.
Chapter 7, Utility reference on page 7-1	Describes the HDLM utilities.
Chapter 8, Messages on page 8-1	Provides information for all the possible messages that could be output by HDLM. It also lists and explains the HDLM messages and shows the actions to be taken in response to each message.
Appendix A, Notes on Linux commands and files on page A-1	Gives notes on Linux commands and files.
Appendix B, How to set up the kdump function on page B-1	Explains how to specify the necessary settings for using the kdump function in an environment where an HDLM device is used as a boot disk.
Appendix C, Manually setting a boot disk environment on page C-1	Explains how to set a boot disk environment in a multipath configuration without using the utility for creating an HDLM boot disk environment (dlmbootstart).
Appendix D, HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method on page D-1	Explains the HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method.
Appendix E, Functional differences between versions of HDLM on page E-1	Explains the differences in functionality between HDLM versions.

Related documents

The following Hitachi referenced documents are also available for download from the Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>.

- *Hitachi Global Link Manager User Guide*, MK-92HC214
- *Hitachi Global Link Manager Installation and Configuration Guide*, MK-95HC107
- *Hitachi Global Link Manager Messages*, MK-95HC108
- *Reference Manual File Access Library & File Conversion Utility*
- *HITACHI Gigabit Fibre Channel Board User's Guide*

Document conventions

This document uses the following typographic conventions:

Convention	Description
Bold	<ul style="list-style-type: none"> Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click OK. Indicates a emphasized words in list items.
<i>Italic</i>	<ul style="list-style-type: none"> Indicates a document title or emphasized words in text. Indicates a variable, which is a placeholder for actual text provided by the user or for output by the system. Example: <code>pairdisplay -g group</code> (For exceptions to this convention for variables, see the entry for angle brackets.)
Monospace	Indicates text that is displayed on screen or entered by the user. Example: <code>pairdisplay -g oradb</code>
< > angled brackets	Indicates a variable in the following scenarios: <ul style="list-style-type: none"> Variables are not clearly separated from the surrounding text or from other variables. Example: <code>Status-<report-name><file-version>.csv</code> Variables in headings.
[] square brackets	Indicates optional values. Example: [a b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a b } indicates that you must choose either a or b.
vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a b] indicates that you can choose a, b, or nothing. { a b } indicates that you must choose either a or b.
<u>underline</u>	Indicates the default value. Example: [<u>a</u> b]

Conventions for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 kilobyte (KB)	1,000 (10 ³) bytes
1 megabyte (MB)	1,000 KB or 1,000 ² bytes
1 gigabyte (GB)	1,000 MB or 1,000 ³ bytes
1 terabyte (TB)	1,000 GB or 1,000 ⁴ bytes

Physical capacity unit	Value
1 petabyte (PB)	1,000 TB or 1,000 ⁵ bytes
1 exabyte (EB)	1,000 PB or 1,000 ⁶ bytes

Logical capacity values (for example, logical device capacity, cache memory capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems: <ul style="list-style-type: none"> • OPEN-V: 960 KB • Others: 720 KB
1 KB	1,024 (2 ¹⁰) bytes
1 MB	1,024 KB or 1,024 ² bytes
1 GB	1,024 MB or 1,024 ³ bytes
1 TB	1,024 GB or 1,024 ⁴ bytes
1 PB	1,024 TB or 1,024 ⁵ bytes
1 EB	1,024 PB or 1,024 ⁶ bytes

Accessing product documentation

Product documentation is available on Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

[Hitachi Vantara Support Connect](#) is the destination for technical support of products and solutions sold by Hitachi Vantara. To contact technical support, log on to Hitachi Vantara Support Connect for contact information: https://support.hitachivantara.com/en_us/contact-us.html.

[Hitachi Vantara Community](#) is a global online community for Hitachi Vantara customers, partners, independent software vendors, employees, and prospects. It is the destination to get answers, discover insights, and make connections. **Join the conversation today!** Go to community.hitachivantara.com, register, and complete your profile.

Comments

Please send us your comments on this document:
doc.comments@hitachivantara.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Vantara LLC.

Thank you!

Overview of HDLM

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

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

□ [What is HDLM?](#)

□ [HDLM features](#)

What is HDLM?

With the widespread use of data warehousing and increasing use of multimedia data, the need for high-speed processing of large volumes of data on networks has rapidly grown. To satisfy this need, networks dedicated to the transfer of data, such as SANs, are now being used to provide access to storage systems.

HDLM manages the access paths to these storage systems. HDLM provides the ability to distribute loads across multiple paths and switch to another path if there is a failure in the path that is currently being used, thus improving system availability and reliability.

The figure below shows the connections between hosts and storage systems. A server on which HDLM is installed is called a *host*.

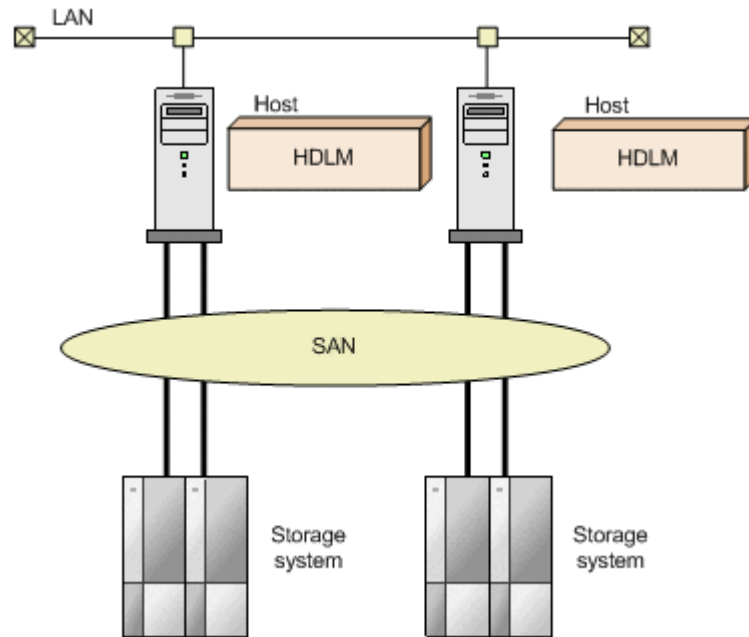


Figure 1-1 Between hosts and storage systems

For details about the storage systems supported by HDLM, see [Storage systems supported by HDLM on page 3-15](#).

HDLM features

HDLM features include the following:

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

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

For details on load balancing, see [Distributing a load using load balancing on page 2-14](#).

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

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

For details on performing failovers, see [*Performing failovers and failbacks using path switching on page 2-19*](#).

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

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

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

For details on performing failbacks, see [*Performing failovers and failbacks using path switching on page 2-19*](#).

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

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

For details on setting up and performing path health checking, see [*Detecting errors by using path health checking on page 2-31*](#).

HDLM functions

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

- ☐ [Devices managed by HDLM](#)
- ☐ [System configuration](#)
- ☐ [LU configuration](#)
- ☐ [Program configuration](#)
- ☐ [Position of the HDLM driver and HDLM device](#)
- ☐ [Logical device files for HDLM devices](#)
- ☐ [Distributing a load using load balancing](#)
- ☐ [Performing failovers and failbacks using path switching](#)
- ☐ [Monitoring intermittent errors \(functionality when automatic failback is used\)](#)
- ☐ [Detecting errors by using path health checking](#)
- ☐ [Distributing a load by using the dynamic I/O path control function](#)
- ☐ [Error management](#)

- ☐ [Collecting audit log data](#)
- ☐ [Integrated HDLM management using Global Link Manager](#)
- ☐ [Cluster support](#)

Devices managed by HDLM

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

HDLM management-target devices:

The following devices of the storage systems listed in Section [What is HDLM? on page 1-2](#):

- SCSI devices
- Boot disks

Non-HDLM management-target devices:

- SCSI devices other than those of the storage systems listed in Section [What is HDLM? on page 1-2](#)
- Devices other than disks (such as tape devices)
- Command devices of the storage systems listed in Section [What is HDLM? on page 1-2](#) (For example, Hitachi RAID Manager command devices.)

System configuration

HDLM manages routes between a host and a storage system by using the SCSI driver. A host and a storage system are connected via an FC-SAN or an IP-SAN. Note that an FC-SAN and an IP-SAN cannot be combined and connected to the same environment.

System configuration using an FC-SAN

In an FC-SAN, fiber cables connect hosts to storage systems. The cable port on the host is a *host bus adapter* (HBA). The cable port on the storage system is a *port* (P) on a *channel adapter* (CHA).

A *logical unit* (LU) contained in a storage system is the target of input to, or output from, the host. You can divide an LU into multiple areas. Each area after the division is called a *Dev*. The Dev is equivalent to a partition. A route that connects a host and an LU is called a *physical path*, and a route that connects a host and a Dev is called a *path*. When an LU has been divided into multiple Devs, the number of paths set to the LU is equal to the number that is found by multiplying the number of physical paths by the number of Devs in the LU.

HDLM assigns an ID to a physical path and manages the paths on a physical-path basis. When you use HDLM, there is no need to consider the difference between a physical path and a path. Thus, hereafter both physical paths and paths might be called *paths*, without a distinction being made between the two. The ID that HDLM assigns for each physical path is called an *AutoPATH_ID*. Also, a path might be called a *management target*.

The following figure shows the configuration of an HDLM system using an FC-SAN.

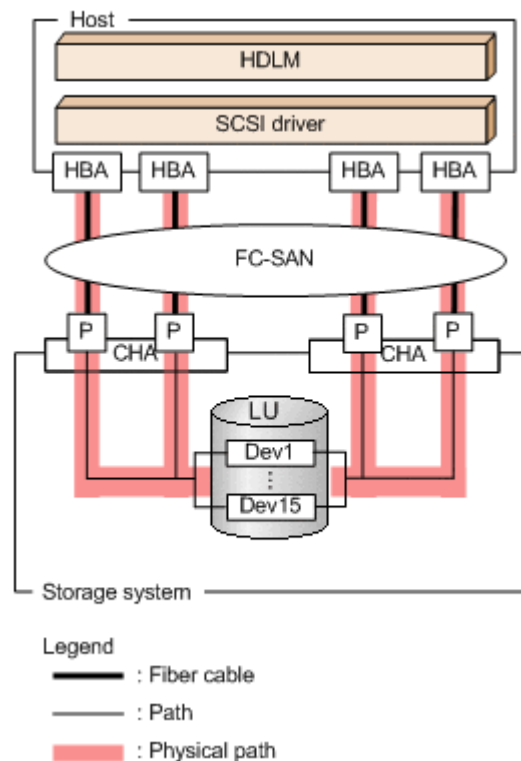


Figure 2-1 Configuration of an HDLM system when using an FC-SAN

The following table lists the HDLM system components when using an FC-SAN.

Table 2-1 HDLM system components when using an FC-SAN

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

System configuration using an IP-SAN

In an IP-SAN, LAN cables are used to connect hosts to storage systems. The cable port on the host is called a *network interface card* (NIC). In order to use a NIC, the *iSCSI software* must be installed ahead of time on the host. The cable port on the storage system is called a *port* (P) on a *channel adapter* (CHA) used for iSCSI connections.

A *logical unit* (LU) contained in a storage system is the target of input to, or output from, the host. You can divide an LU into multiple areas. Each area after the division is called a *Dev*. The Dev is equivalent to a partition. A route that connects a host and an LU is called a *physical path*, and a route that connects a host and a Dev is called a *path*. When an LU has been divided into multiple Devs, the number of paths set to the LU is equal to the number that is found by multiplying the number of physical paths by the number of Devs in the LU.

HDLM assigns an ID to a physical path and manages the paths on a physical-path basis. When you use HDLM, there is no need to consider the difference between a physical path and a path. Thus, hereafter both physical paths and paths might be called *paths*, without a distinction being made between the two. The ID that HDLM assigns for each physical path is called an *AutoPATH_ID*. Also, a path might be called a *management target*.

The following figure shows the configuration of an HDLM system using an IP-SAN.

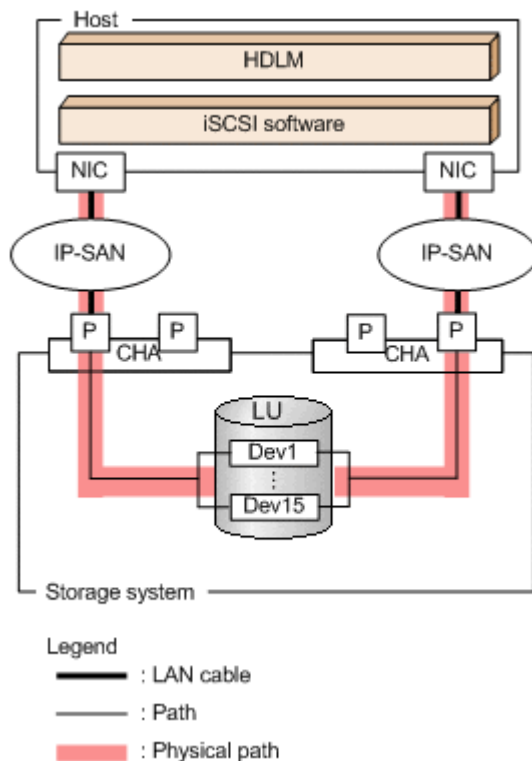


Figure 2-2 Configuration of an HDLM system when using an IP-SAN

The following table lists the HDLM system components when using an IP-SAN.

Table 2-2 HDLM system components when using an IP-SAN

Components	Description
iSCSI software	The driver software that contains the iSCSI initiator function.
NIC	A network interface card that serves as a cable port on a host. The <i>NIC</i> is referred to as the <i>HBA</i> in HDLM commands. Sometimes, it is also just simply called an <i>HBA</i> in this manual.
IP-SAN	A data transfer network that connects hosts and storage systems by using the iSCSI standard.
CHA	A channel adapter.
P	A port on a CHA. This serves as a cable port on a storage system.
LU	A logical unit (a logical volume defined on the storage system). This serves as the target of input or output operations from the host.
Dev	An area (partition) of a divided LU.
Physical path	A route that connects a host and an LU.
Path	A route that connects a host and a Dev.

IP-SAN environments supported by HDLM

HDLM supports system configurations that use an IP-SAN in the following environments:

- OS
 - Red Hat Enterprise Linux 6
 - Red Hat Enterprise Linux 7
 - Red Hat Enterprise Linux 8
 - SUSE LINUX Enterprise Server 11
 - SUSE LINUX Enterprise Server 12
 - SUSE LINUX Enterprise Server 15
 - Oracle Unbreakable Enterprise Kernel 6
 - Oracle Unbreakable Enterprise Kernel 7
- iSCSI software

HDLM supports the following iSCSI initiators supplied with the OS.

 - For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6, or Oracle Unbreakable Enterprise Kernel 7:
`iscsi-initiator-utils`
 - For SUSE LINUX Enterprise Server 11, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:
`open-iscsi`
- Storage system

IP-SAN can be used for the following storage systems: HUS100 series, VSP E series, VSP Gx00 models, and VSP Fx00 models.

Restrictions on using HDLM in an IP-SAN environment

The following restrictions apply when using HDLM in an IP-SAN environment:

- HDLM can only be used in a cluster configuration when it is installed in a Red Hat Enterprise Linux 6 environment with RHCM.
- The `kdump` function cannot be used.

LU configuration

After you have properly installed HDLM, the LU configuration will change as follows:

Before the installation of HDLM:

The host recognizes that a SCSI device is connected to each path.

Thus, a single LU in the storage system is recognized as though there are as many LUs as there are paths.

After the installation of HDLM:

An HDLM device corresponding one-to-one with an LU in the storage system is created at a level higher than the SCSI device.[#]

Thus, from the host, LUs in the storage system are also recognized as a single LU regardless of the number of paths.

#

In addition to the one that indicates the entire LU, a logical device file for the HDLM device is created for each partition.

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 (partition) in a storage system LU are called *host devices* (HDev).

On a system using HDLM, the logical device file for the HDLM device is used to access the target LU instead of the logical device file for the SCSI device.

The following figure shows the LU configuration recognized by the host, after the installation of HDLM.

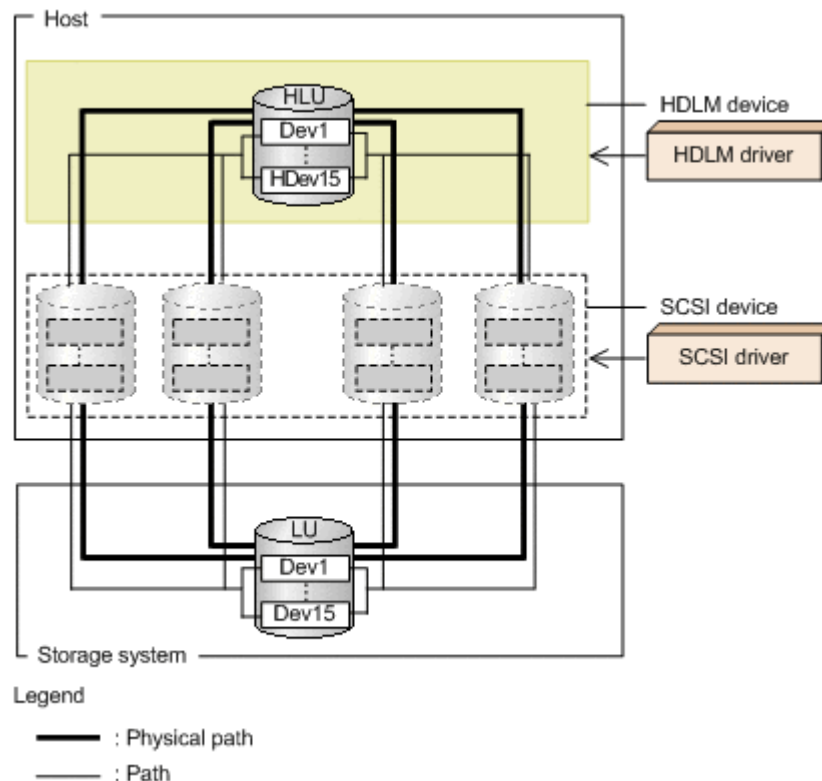


Figure 2-3 LU configuration recognized by the host after HDLM installation

The following table lists and describes the components recognized by the host.

Table 2-3 LU components

Components	Description
HDev	A Dev (partition) in an LU that the host recognizes via the HDLM driver. It is called a <i>host device</i> . One host device is recognized for one Dev in the storage system.
HLU	An LU that the host recognizes via the HDLM driver. It is called a <i>host LU</i> . Regardless of how many paths exist, only one host LU is recognized for each LU in the storage system.

Program configuration

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

The following figure shows the configuration of the HDLM programs.

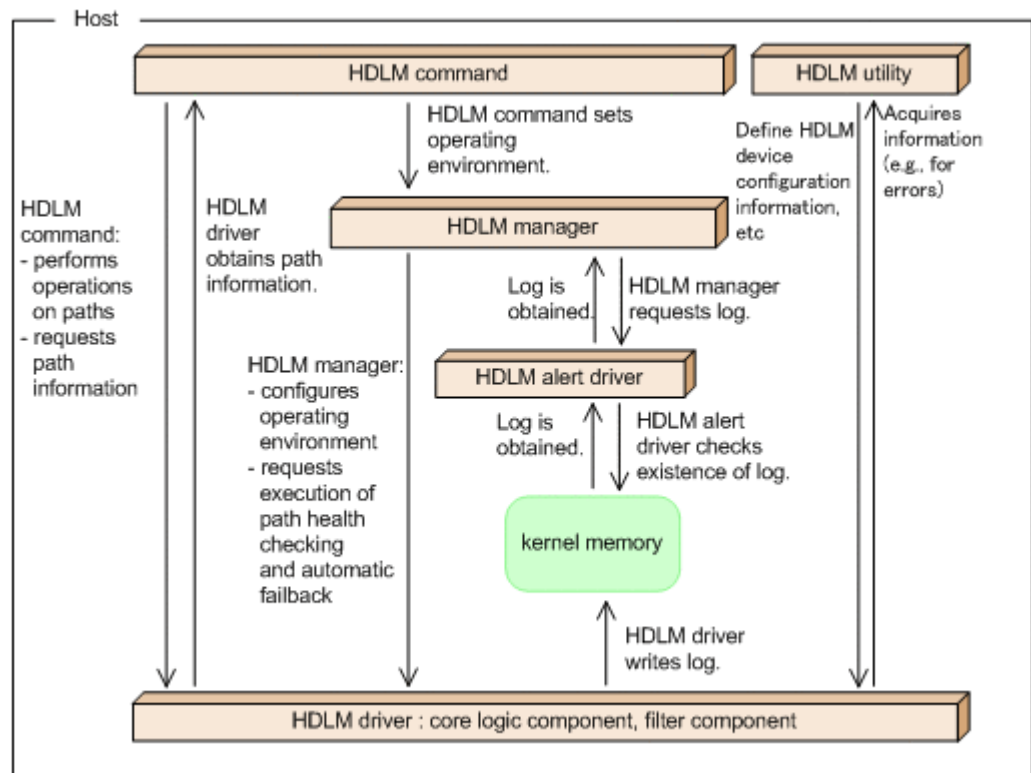


Figure 2-4 Configuration of the HDLM programs

The following table lists and describes the functions of these programs.

Table 2-4 Functionality of HDLM programs

Program name	Functions
HDLM command	Provides the <code>dlmkmgr</code> command, which enables you to: <ul style="list-style-type: none"> • Manage paths • Display error information • Set up the HDLM operating environment
HDLM utility	Provides the HDLM utility, which enables you to: <ul style="list-style-type: none"> • Collect error information • Define HDLM device configuration information • Make an HDLM device available as a boot disk • Clear HDLM persistent reservation • Specify settings for the HDLM filter driver • Perform tasks that are required after the installation of HDLM • Re-register HDLM information • Collect information about errors that occurred during the installation of HDLM • Install HDLM
HDLM manager	Provides the HDLM manager, which enables you to:

Program name	Functions
	<ul style="list-style-type: none"> • Configure the HDLM operating environment • Request path health checks and automatic failbacks to be performed • Collect error log data
HDLM alert driver	Reports the log information collected by the HDLM driver to the HDLM manager. The driver name is <code>sddlmadv</code> .
HDLM driver	<p>Controls all the HDLM functions, manages paths, and detects errors. The HDLM driver consists of the following:</p> <ul style="list-style-type: none"> • Core logic component Controls the basic functionality of HDLM. • Filter component Sends and receives I/O data. The driver name is <code>sddlmfdrv</code>.

Position of the HDLM driver and HDLM device

The HDLM driver is positioned above the SCSI driver. Each application on the host uses the HDLM device (logical device file) created by HDLM, to access LUs in the storage system.

The following figure shows the position of the HDLM driver and HDLM device.

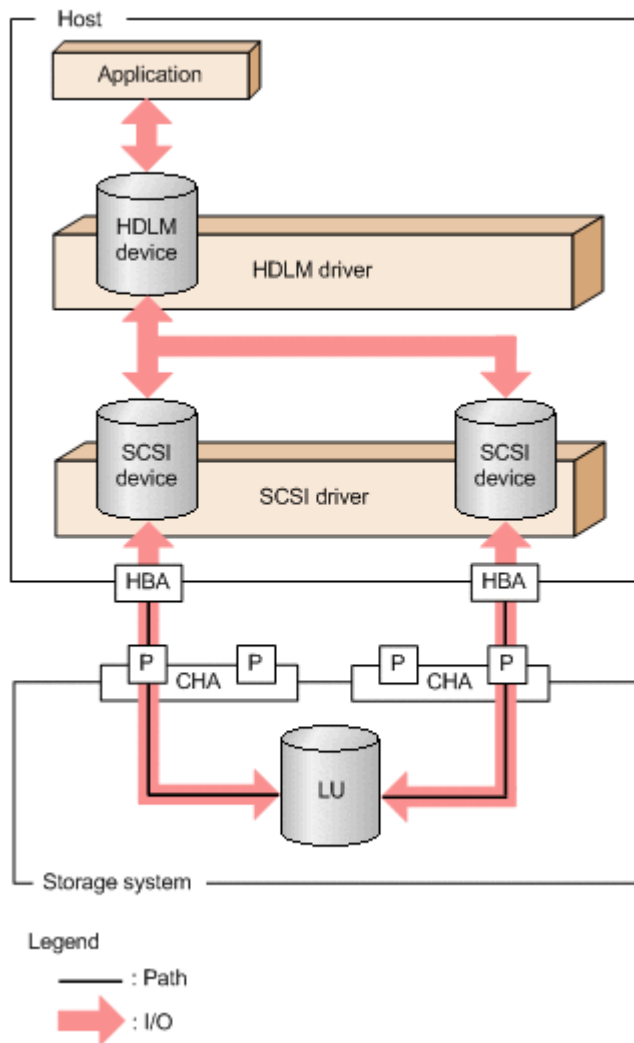


Figure 2-5 Position of the HDLM driver and HDLM devices

Logical device files for HDLM devices

The logical device file name of an HDLM device is different from the logical device file name of a SCSI device. When you configure the logical device file of an HDLM device for applications such as volume management software, these applications can access the LUs that HDLM manages.

The following shows an example of the logical device file name that the application uses to access the LU (for accesses before and after HDLM installation).

[Table 2-5 Example of using the logical device file name of the device used when the application accesses the LU on page 2-12](#) illustrates the logical device file name of the device that the application uses, for before and after HDLM installation.

Table 2-5 Example of using the logical device file name of the device used when the application accesses the LU

Host status	Device file name that the application uses
Before installing HDLM	The application uses the logical device file name for the SCSI device. Example: sda sdb
After installing HDLM	The application uses the logical device file name for the HDLM device. Example: sddlmaa

The logical device file name of an HDLM device has the following format:

`/dev/sddl[m[aa-pop] [1-15]`

About alphabetic letters used in the logical device file name:

- For the first 256 LUs, two alphabetic letters are assigned. The specifiable values for the first two characters are in the range from a to p.
- For the 257th and subsequent LUs, three alphabetic letters are assigned. The specifiable values for the first and third characters are in the range from a to p. The specifiable range of values for the second character is from a to o.
- A major number is required for each of the first characters.

The following figure shows information about alphabetic letters used in the logical device file name.

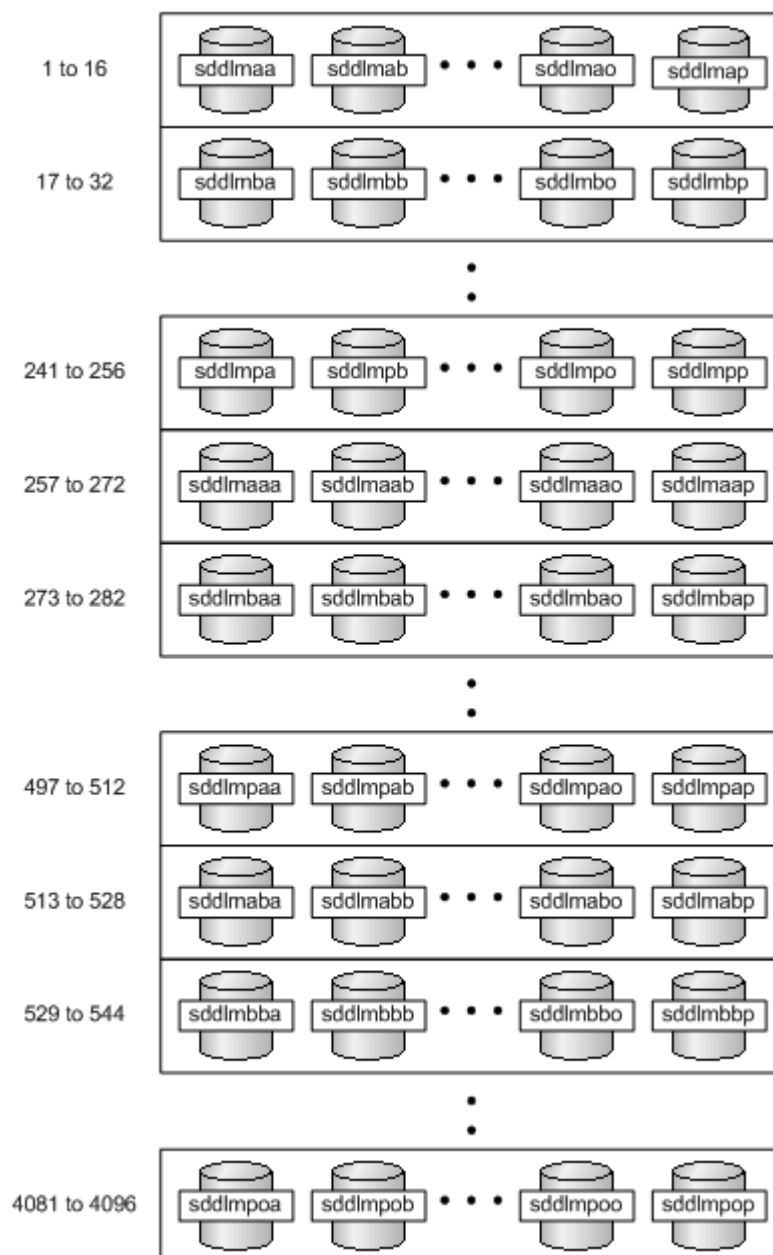


Figure 2-6 About alphabetic letters used in the logical device file name

About numeric values used in a logical device file name:

[1-15] indicates a partition number in the applicable LU. When the HDLM configuration definition utility (`dlmcfmgr`) is executed, all logical device files for partitions 1 to 15 are created.

For example, if the logical device file name of an HDLM device is `sddlmaa1`, it indicates partition 1 on `sddlmaa`. To specify the entire LU, simply use `sddlmaa`. Note that HDLM creates block device files. The system dynamically selects the major number of the block device that this file uses.

Distributing a load using load balancing

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

Note that some I/O operations managed by HDLM can be distributed to each path, while others cannot. Therefore, even though load balancing function is used, I/O operations might not be equally allocated to each path.

[Figure 2-7 Flow of I/O data when the load balancing function is not used on page 2-14](#) shows the flow of I/O data when the load balancing function is not used. [Figure 2-8 Flow of I/O data when the load balancing function is used on page 2-15](#) shows the flow of I/O data when the load balancing function is used. Both figures show examples of I/O operations being issued for the same LU by multiple applications.

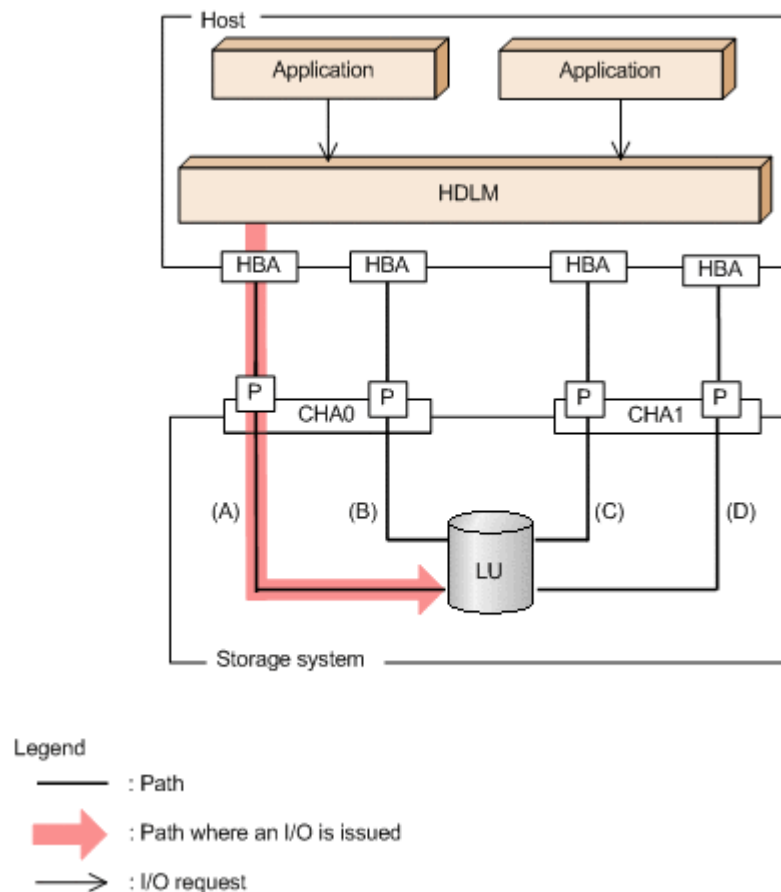


Figure 2-7 Flow of I/O data when the load balancing function is not used

When the load balancing function is not used, I/O operations converge onto a single path (A). The load on that one path (A) will cause a bottleneck, which might cause problems with system performance.

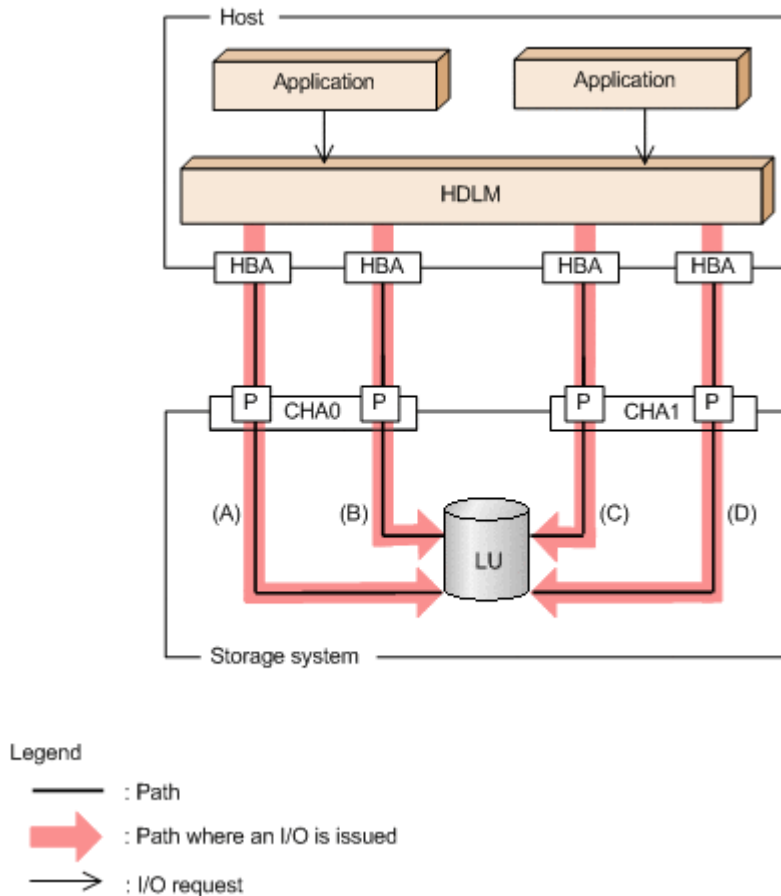


Figure 2-8 Flow of I/O data when the load balancing function is used

When the load balancing function is used, I/O operations are distributed via multiple paths (A, B, C, and D). This helps to prevent problems with system performance and helps prevent bottlenecks from occurring.

Paths to which load balancing is applied

This subsection describes the paths to which the load balancing function is applied.

When all paths are owner paths

If the storage system is supported by HDLM, usually all paths are owner paths. In this case, the load is balanced among all paths that access the same LU. If some of the paths become unusable due to, for example, a failure, the load will be balanced among the remaining usable paths.

For the example in [Figure 2-8 Flow of I/O data when the load balancing function is used on page 2-15](#), the load is balanced among the four paths A, B, C, and D. If one of the paths were to become unusable, the load would be balanced among the three, remaining paths.

Note

When the HUS100 series is used, if the dynamic I/O path control function is disabled (the default setting), the load is balanced among all paths that access the same LU.

When non-owner paths exist

If both owner paths and non-owner paths exist, HDLM will select the path to be used next from the owner paths, and then from the 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. Therefore, if some of the owner paths become unusable due to, for example, a failure, load balancing will be performed among the remaining usable owner paths. When all owner paths cannot be used, load balancing is performed among the non-owner paths.

For the example in [Figure 2-9 Load balancing when both owner paths and non-owner paths exist on page 2-16](#), suppose that the paths (A) and (B) are owner paths, and the paths (C) and (D) are non-owner paths. When the LU is accessed, the load is balanced between the two paths A and B, which are both owner paths. When one of the paths (A) cannot be used, then the LU is accessed from the only other owner path (B). When both of the owner paths (A and B) cannot be used, the load is then balanced between two other, non-owner paths (C and D).

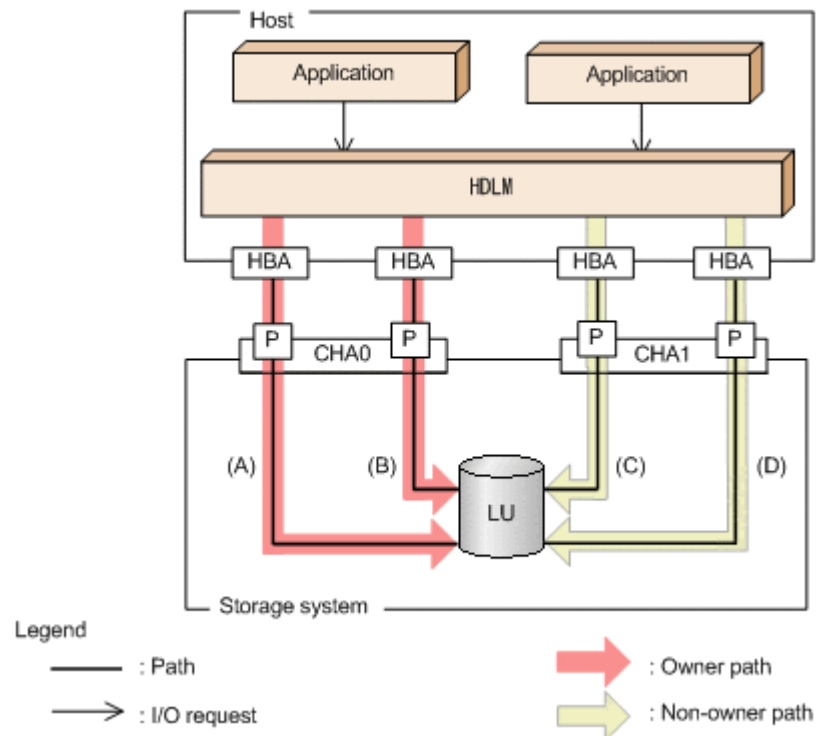


Figure 2-9 Load balancing when both owner paths and non-owner paths exist

The following describes a case in which non-owner paths exist.

- When the dynamic I/O path control function is enabled in the HUS100 series:
When the dynamic I/O path control function is enabled, the controller selected by the dynamic load balance controller function is recognized as the owner controller. Other controllers are recognized as non-owner controllers. Paths that pass through the owner controller are owner paths, and paths that do not pass through the owner controller are non-owner paths.
For details about the dynamic I/O path control function, see [Distributing a load by using the dynamic I/O path control function on page 2-32](#).
- When a global-active device is used and the non-preferred path option is set:
When a global-active device is used, the default settings of the storage system specify that all paths are owner paths. Load balancing is performed on all paths that access the primary and secondary volumes of global-active device pairs.
However, if the primary site and the secondary site are far apart, I/O performance might be low for I/O issued to a site other than the location of the host. In such a case, specify the non-preferred path option on the storage system at the site where the host is not located. A path for which the non-preferred path option is specified is a non-owner path and cannot be used until all the owner paths become unavailable.
If you specify the non-preferred path option on the storage system when the HDLM device is already configured, execute the `refresh` operation of the HDLM command, or restart the host.

Load balancing algorithms

HDLM has the following six load balancing algorithms:

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

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

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

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

- Round Robin
The paths are simply selected in order from among all the connected paths.
- Least I/Os

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

- Least Blocks

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

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

These algorithms determine which path to allocate based on whether the I/O to be issued is sequential with the immediately preceding I/O.

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

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

- Extended Round Robin

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

- Extended Least I/Os

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

- Extended Least Blocks

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

The following table lists and describes the features of the load balancing algorithms.

Table 2-6 Features of the load balancing algorithms

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

[#]

Some I/O operations managed by HDLM can be distributed across all, available paths, and some cannot. Thus, you should be aware that even if you specify the Round Robin algorithm, some of the I/O operations will never be issued uniformly across all the given paths.

The default algorithm is the Extended Least I/Os algorithm, which is set when HDLM is first installed. When an upgrade installation of HDLM is performed, the algorithm that is currently being used is inherited.

Select the load balancing algorithm most suitable for the data access patterns of your system environment. However, if there are no recognizable data access patterns, we recommend using the default algorithm, the Extended Least I/Os algorithm.

You can specify the load balancing function by the `dlmkmgr` command's `set` operation. For details on the `set` operation, see [set \(sets up the operating environment\) on page 6-15](#).

Performing failovers and failbacks using path switching

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

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

Two types of failovers and failbacks are available:

- Automatic failovers and failbacks
- Manual failovers and failbacks

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

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

For details on the `offline` operation, see [offline \(places paths offline\) on page 6-6](#).

For details on path statuses and the transitions of those statuses, see [Path status transition on page 2-23](#).

Automatic path switching

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

Automatic failovers

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

Critical

A fatal error that might stop the system.

Error

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

For details on error levels, see [Filtering of error information on page 2-36](#).

HDLM will select the path to be used next from among the various paths that access the same LU, starting with owner paths, and then non-owner paths.

If the storage system is supported by HDLM, usually all paths are owner paths. As a result, all of the paths accessing the same LU can be possible switching destinations. For example, in [Figure 2-10 Path switching on page 2-21](#), the LU is accessed using only the one path (A). However, after that path is placed offline, the switching destination can come from any of the other three paths (B, C, or D).

When non-owner paths exist, HDLM will select the path to be used next from among the various paths that access the same LU, starting with the owner paths, and then the non-owner paths. For example, in [Figure 2-10 Path switching on page 2-21](#), the owner controller of an LU is CHA0, and access to the LU is made via only one path (A). After that access path (A) is placed offline, the first choice for the switching destination is the other path connected to CHA0 (B). If an error also occurs on that path (B), then the next possibility for a path comes from one of the two paths (C or D) connected to CHA1.

Note

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

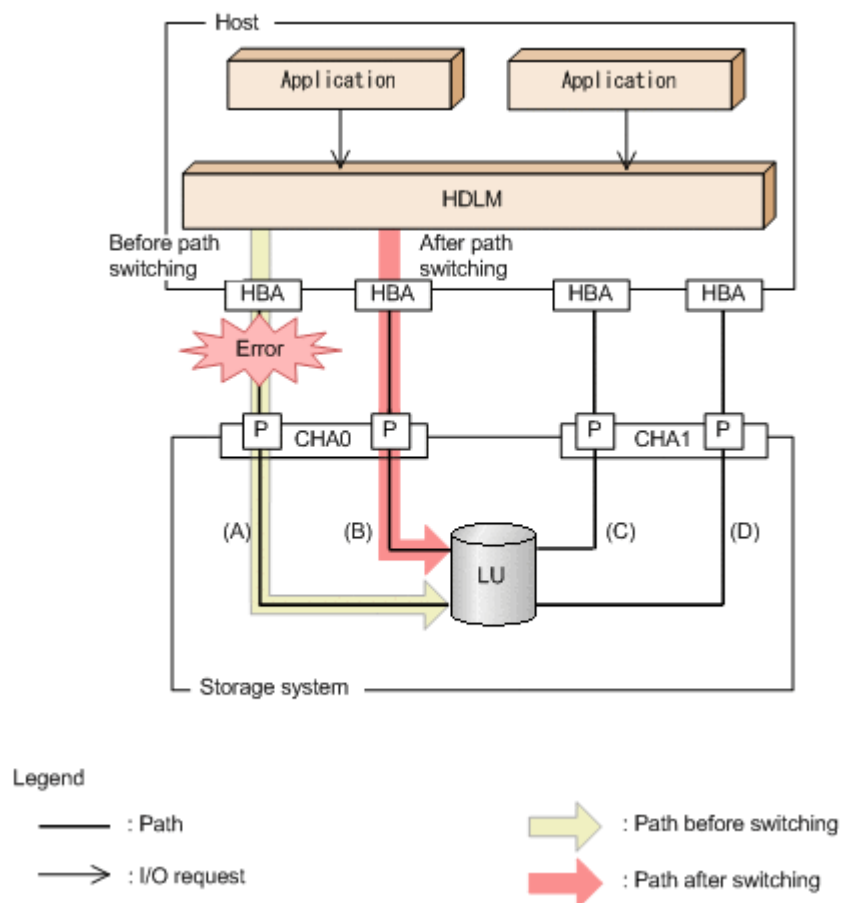


Figure 2-10 Path switching

Automatic failbacks

When a path recovers from an error, HDLM can automatically place the recovered path back online. This function is called the *automatic failback* function. In order to use the automatic failback function, HDLM must already be monitoring error recovery on a regular basis.

When non-owner paths exist, HDLM will select the path to be used next from the online owner paths, and then from the online non-owner paths. When a non-owner path is used because all of the owner-paths are placed offline, if an owner path recovers from an error and HDLM automatically places the recovered path online, the path will be automatically switched over from the non-owner path to the owner path that recovered from the error.

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

You can specify the automatic failback function or intermittent error by the `dlmkmgr` command's `set` operation. For details on the `set` operation, see [set \(sets up the operating environment\) on page 6-15](#).

Note

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

#

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

Manual path switching

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

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

- Execute the `dlmkmgr` command's `online` or `offline` operation.
For details on the `online` operation, see [online \(places paths online\) on page 6-10](#). For details on the `offline` operation, see [offline \(places paths offline\) on page 6-6](#).

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

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

In a normal state, all paths that access the same LU are candidates for the switching destination path. However, if non-owner paths exist, HDLM selects the switching destination path from the owner paths and then from the non-owner paths.

Executing the `online` operation places the offline path online. For details on the `online` operation, see [online \(places paths online\) on page 6-10](#). If non-owner paths are also used, HDLM selects the path to use from the online owner paths, and then from the online non-owner paths.

Note

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

Path status transition

Each of the online and offline statuses described in [Performing failovers and failbacks using path switching on page 2-19](#) is further subdivided into several statuses. The path statuses (the online path statuses and offline path statuses) are explained below.

The online path status

The online path statuses are as follows:

- `Online`
I/Os can be issued normally.
- `Online(E)`
An error has occurred on the path, but none of the other paths that access the same LU are in the Online status.
If none of the paths accessing a particular LU are in the Online status, one of the paths is changed to the Online(E) status. This ensures that the LU can be accessed through at least one path.
The (E) means *error*, which indicates that an error has occurred on the path from some previous operation.
- `Online(S)#`
The paths to the primary volume (P-VOL) in the HAM environment have recovered from an error, but I/O to the P-VOL is suppressed.
- `Online(D)#`
The paths to the primary volume (P-VOL) in an HAM environment have recovered from an error, but I/O to the P-VOL is suppressed. If an error occurs in all the paths to a secondary volume (S-VOL), the status of the P-VOL paths will be automatically changed to the Online status. To change the status to the Online(D) status, specify the `-dfha` parameter for the HDLM command's `online` operation.

#

The status changes to this status when using HAM (High Availability Manager).

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 [offline \(places paths offline\) on page 6-6](#).
The (C) indicates the command attribute, which indicates that the path was placed offline by using the command.
- `Offline(E)`
The status indicating that an I/O could not be issued on a given path, because an error occurred on the path.

The (E) means *error*.

Status transitions of a path

The following figure shows the status transitions of a path.

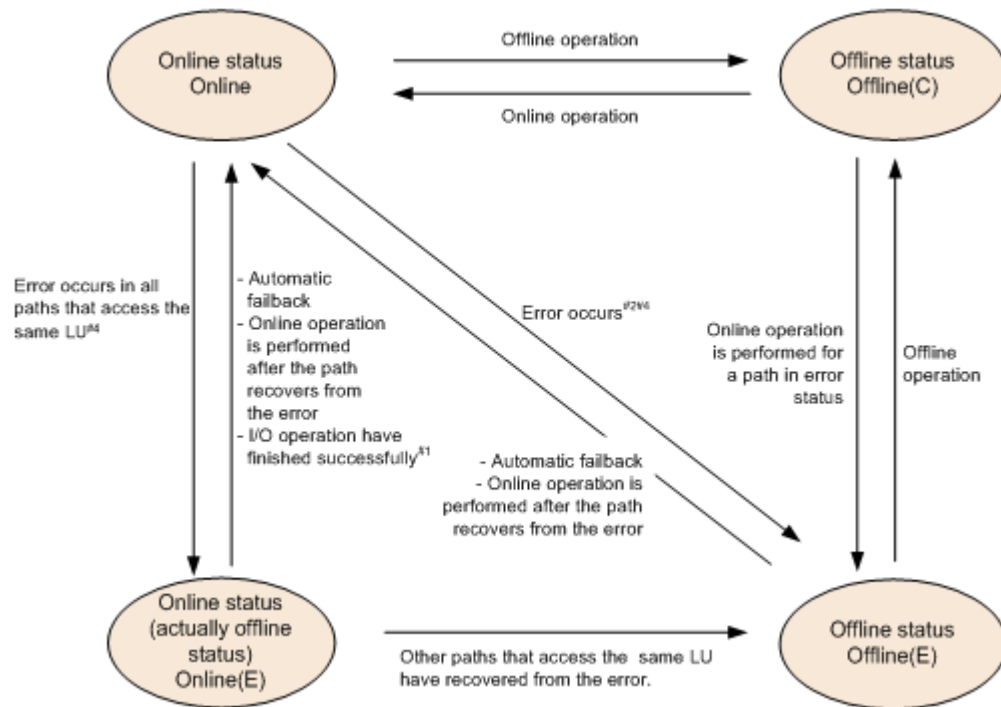


Figure 2-11 Path status transitions

Legend:

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

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

#1

In the following cases, if the processing of continuous I/O operations issued to the LU is successful, the status of the path changes from Online(E) to Online:

- The automatic failback function is disabled.
- The automatic failback function is enabled, and the path has been determined to have an intermittent error.

#2

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

#3

The path status changes when I/O is issued to a path where a failure has occurred.

#4

The path status changes when I/O is issued to a path where a failure has occurred or when HDLM detects a path failure during path health checking. For details on path health checking, see [Detecting errors by using path health checking on page 2-31](#).

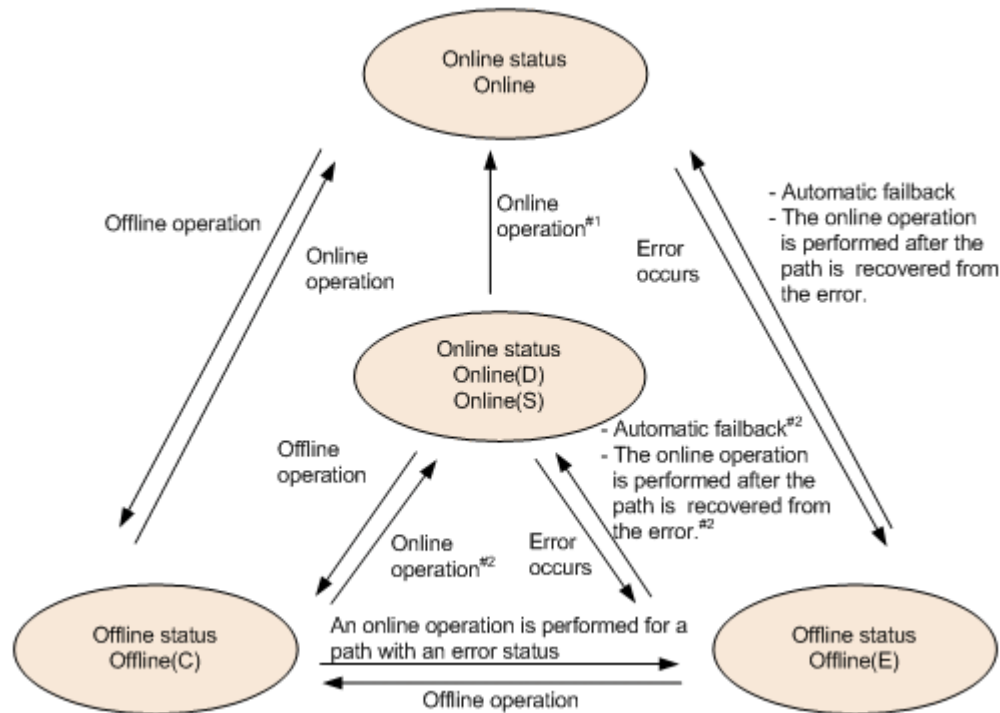


Figure 2-12 Path status transitions (P-VOL in HAM environment)

Legend:

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

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

#1

Also when an error occurs in all the paths to an S-VOL in the Online(D) status.

#2

When I/O operations are processed on an S-VOL.

If there is only one available online path for an LU, it cannot be placed offline by executing the `offline` operation. This ensures that the LU can always be accessed by at least one path. For details on the `offline` operation, see [offline \(places paths offline\) on page 6-6](#).

If none of the paths accessing a particular LU are in the Online status, one of the paths is changed to the Online(E) status. If you are using the automatic failback function, after the path has recovered from the error, the path in the Online(E) status is automatically changed to the Online status. Note that

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

Note

If there is a path failure immediately after a path is taken offline by using either the `an HDLM command`, the status might change from Offline(C) to Offline(E). If an offline operation was just performed, wait about 1 minutes, check the path status by using an HDLM command, and then make sure that the status has changed to Offline(C). If it is still Offline(E), retry the offline operation.

Monitoring intermittent errors (functionality when automatic fallback is used)

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

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

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

Checking intermittent errors

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

For details on the `view` operation, see [view \(displays information\) on page 6-31](#).

Setting up intermittent error monitoring

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

number of times that the error needs to occur, the path is determined to have an intermittent error if an error occurs 3 or more times in 30 minutes.

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

Intermittent error monitoring can be used only when automatic failback has already been enabled. The values that can be specified for intermittent error monitoring depend on the values specified for automatic failbacks. For details on how to specify the settings, see [set \(sets up the operating environment\) on page 6-15](#).

Intermittent error monitoring actions

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

This subsection describes the following intermittent error monitoring actions:

- When an intermittent error occurs
- When an intermittent error does not occur
- When the conditions for an intermittent error to occur are changed during error monitoring
- When failures occur on all paths while monitoring for intermittent errors

When an intermittent error occurs

When an error occurs on a path a specified number of times within a specified interval, the error monitoring will finish and the path is determined to have an intermittent error, upon which the path is removed from those subject to automatic failbacks. The path that is removed will remain in the error status until the `online` operation is performed. However, if the path satisfies certain conditions (see [Figure 2-11 Path status transitions on page 2-24](#)), it is automatically changed to the `Online` status.

The figure below shows the action taken when an intermittent error is assumed to have occurred on the path. For this example, the path is determined to have an intermittent error when the error occurs 3 or more times within 30 minutes. The events that occur are described by using the time arrows.

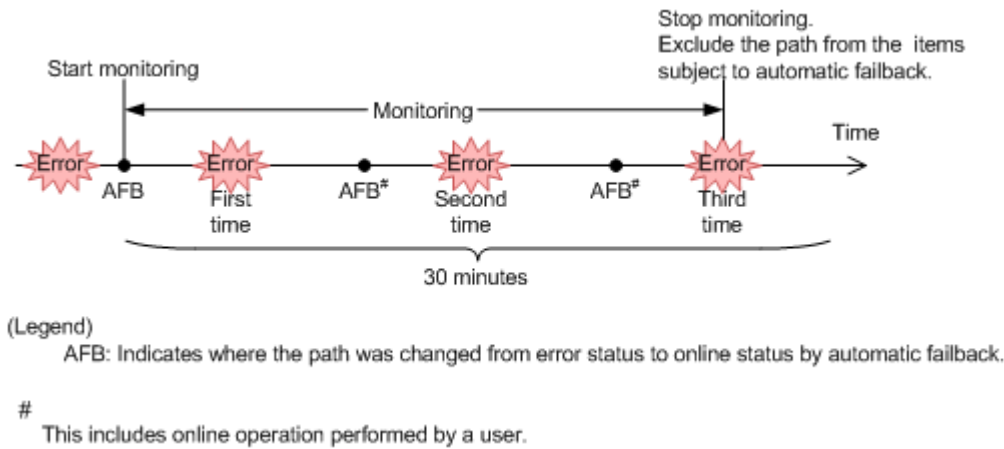


Figure 2-13 Action what will happen when an intermittent error occurs on a path

When an intermittent error does not occur

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

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

The figure below shows the action taken when an intermittent error is assumed not to have occurred on the path. For this example, the path is determined to have an intermittent error if the error occurs three or more times in 30 minutes. The events that occur are described by using the time arrows.

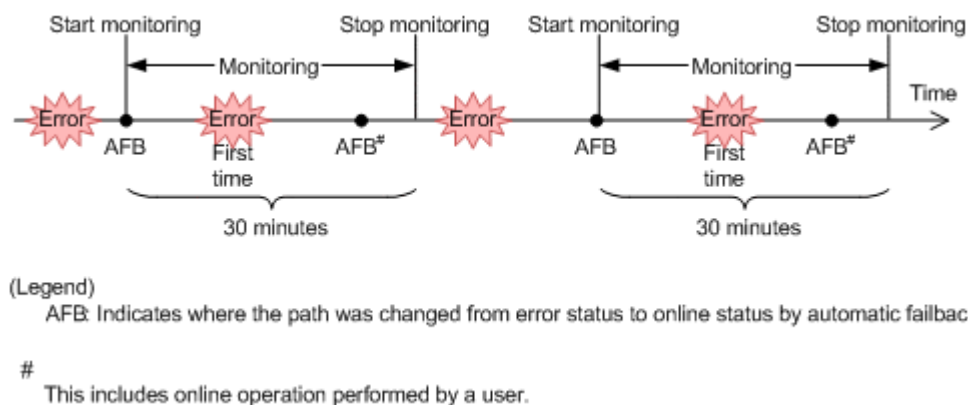


Figure 2-14 What will happen when an intermittent error does not occur on a path

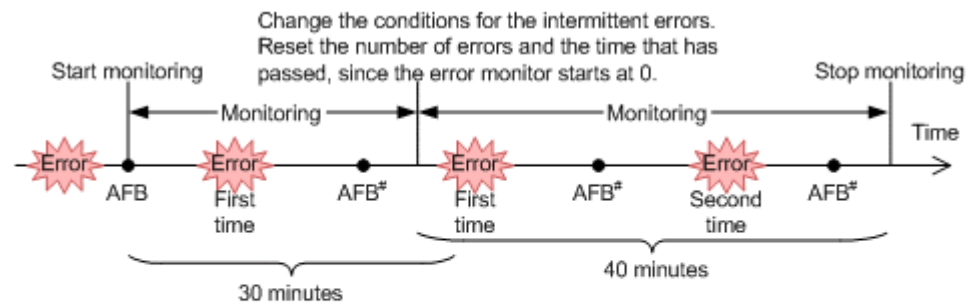
As shown in [Figure 2-14 What will happen when an intermittent error does not occur on a path on page 2-28](#), normally, the count for the number of times that an error occurs is started after the path is first recovered from an error by using the automatic failback function.

When the conditions for an intermittent error are changed during error monitoring

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

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

The figure below shows the action taken when the conditions for an intermittent error are changed during intermittent error monitoring. For this example, the conditions have been changed from 3 or more errors in 30 minutes, to 3 or more errors in 40 minutes. The events that occur are described by using the time arrows.



(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 2-15 What will happen when conditions are changed during error monitoring

When failures occur on all paths while monitoring for intermittent errors

When I/Os are performed continuously for an LU whose paths are all Offline(E), Online(E), Online(S), Online(D), or Offline(C) because of a failure such as a broken wire, the number of times that an error occurs (the IEP value when "dlkmgr view -path -iem" is executed) during intermittent error monitoring might increase even though the automatic failback function did not recover some paths. In such a case, even though an intermittent error did not occur, HDLM often assumes an intermittent error, and excludes paths from the automatic failback function. In such a case, after recovery from the failure, to change the status of a path excluded from automatic failback to online, manually change the status to online.

When a user changes the intermittent error information

The following might be reset when a user changes any of the values set for the intermittent error or the path status: the number of errors that have already been counted during error monitoring, the amount of time that has passed since error monitoring has started, and the information about whether an intermittent error has occurred. [Table 2-7 When effects of a user changing the intermittent error information on page 2-30](#) lists whether the above items are reset.

If you want to check whether intermittent error monitoring is being used for a path, check the IEP item displayed when the `dlnmgr` command's `view -path` operation is executed with the `-iem` parameter specified. If 0 or greater is displayed in the **Intermittent Error Path** item, then intermittent error monitoring is being performed.

Table 2-7 When effects of a user changing the intermittent error information

User operation		Number of errors and time passed since error monitoring started	Information about paths not subject to automatic failback
Changing the intermittent error monitoring settings	Turning <code>off</code>	Reset	Reset ^{#1}
	Changing the conditions for an intermittent error while intermittent error monitoring is being performed	Reset ^{#2}	Inherited
	Turning intermittent error monitoring <code>on</code> by executing the <code>set</code> operation, (but not changing the conditions) while intermittent error monitoring is being performed		
	Changing the intermittent error monitoring conditions while intermittent error monitoring is not being performed	(Not applicable) (Not counted.)	
Changing the automatic failback settings	Turning <code>off</code>	Reset	Reset
Changing the path status	Taking the path <code>Offline(C)</code>	Reset	Reset
	Placing the path <code>Online</code> while intermittent error monitoring is not being performed	(Not applicable) (Not counted.)	

User operation		Number of errors and time passed since error monitoring started	Information about paths not subject to automatic failback
	Placing the path <code>Online</code> while intermittent error monitoring is being performed	Inherited	(Not applicable) If a path has been removed from the paths subject to automatic monitoring, that path is no longer monitored.
Restarting the HDLM manager		Reset ^{#3}	Inherited
Restarting the host		Reset	Reset

#1

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

#2

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

#3

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

Detecting errors by using path health checking

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

Without path health checking, an error cannot be detected unless an I/O operation is performed, because the system only checks the status of a path when an I/O operation is performed. With path health checking, however, the system can check the status of all online paths at regular intervals regardless of whether I/Os operations are being performed. If an error is detected in a path, the path health checking function switches the status of that path to `Offline(E)` or `Online(E)`. You can use the `dlmkmgr` command's `view` operation to check the path error.

For example, in a normal state, I/O operations are not performed on the paths coming from the standby host in the cluster configuration or on non-owner paths[#]. Because of this, for the standby host or for a host connected to non-owner paths, we recommend that you use path health checking to detect errors. This enables the system to use the most up-to-date path-status information when selecting the next path to use.

You can configure path health checking by executing the `dlmkmgr` command's `set` operation. For details on the `set` operation, see [set \(sets up the operating environment\) on page 6-15](#).

#

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

Distributing a load by using the dynamic I/O path control function

The result of using HDLM load balancing to distribute a load can be improved, by applying the HDLM dynamic I/O path control function to the storage system in which the dynamic load balance control function is installed.

What is the dynamic load balance control function

In a system configuration in which multiple hosts and a storage system are connected, the I/O processing load tends to concentrate on the controller of the storage system, causing throughput performance of the entire system decrease. The dynamic load balance controller function evaluates such load statuses on the controller and prevents storage system performance from decreasing.

The following is a list of the storage systems that provide the dynamic load balance controller function and are supported by HDLM.

- HUS100 series

Dynamic I/O path control function

In a storage system in which the dynamic load balance controller function is installed, enable the dynamic I/O path control function to make the HDLM load balancing effective.

When the dynamic I/O path control function is enabled, the controller selected by the dynamic load balance controller function is recognized as the owner controller. Other controllers are recognized as non-owner controllers. Paths that pass through the owner controller are owner paths, and paths that do not pass through the owner controller are non-owner paths.

The dynamic I/O path control function can be enabled or disabled based on each host, connected storage system, or LU.

The dynamic I/O path control function can be specified by using the HDLM command's `set` operation. For details about the `set` operation, see [*set \(sets up the operating environment\) on page 6-15*](#).

Error management

HDLM collects information for troubleshooting into log files. HDLM can also filter error information according to the error level when collecting the information. The following figure shows the flow of data when error information is collected on a host which is running HDLM .

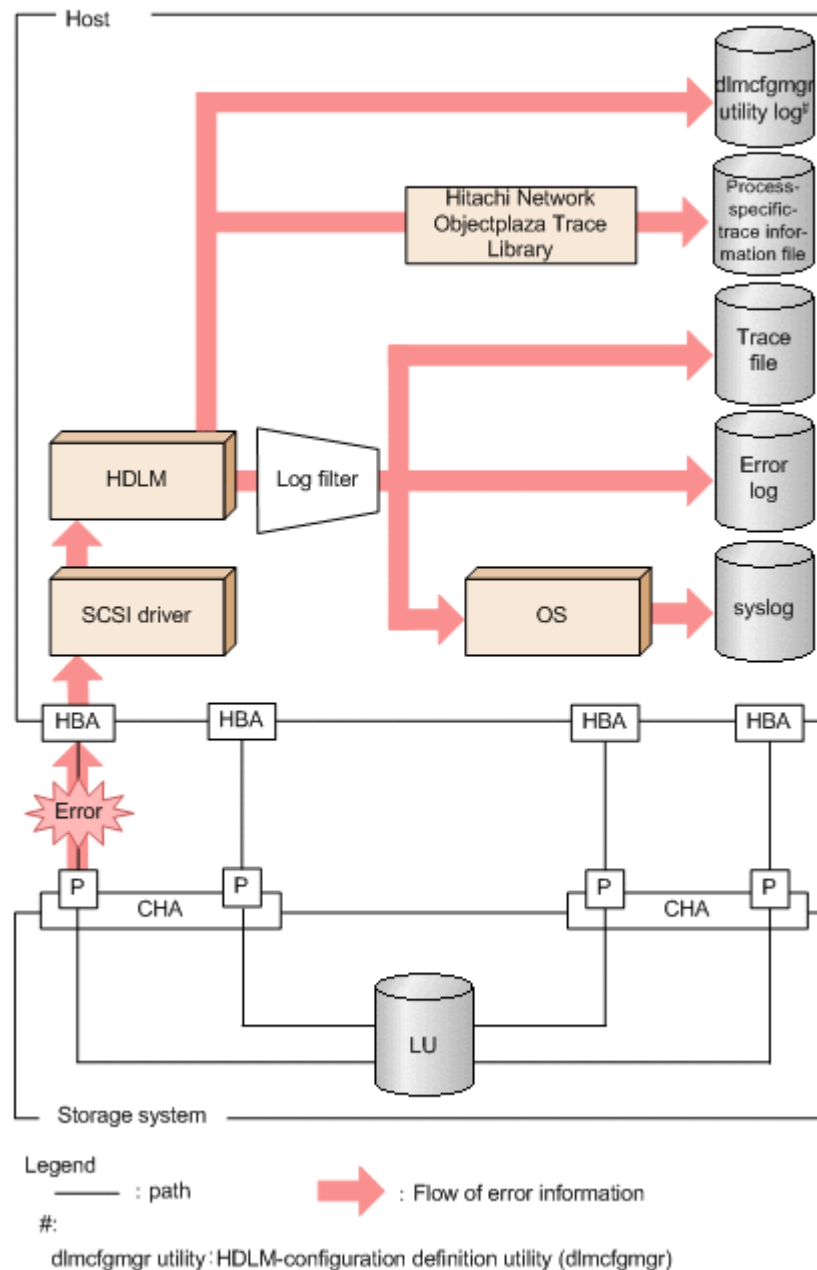


Figure 2-16 Flow of data when collecting error information

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

Types of collected logs

HDLM collects information on the detected error and trace information in the *process-specific-trace information file*, *trace file*, *error logs*, *log for the dlmcfgmgr utility for managing the HDLM configuration* and *syslog*. You can use the error information to examine the status of an error and analyze the cause of the error.

The following table lists and describes the error information that can be collected in logs.

Table 2-8 Types of error information

Log name	Description	Output destination
Process-specific-trace information file	Operation logs for the HDLM command are collected.	The default file path is <code>/var/opt/DynamicLinkManager/log/dlnkmgr[1-2].log</code> .
Trace file	Trace information on the HDLM manager is collected at the level specified by the user. If an error occurs, you might need to change the settings to collect trace information.	The following is the trace file name: <code>/var/opt/DynamicLinkManager/log/hdlmtr[1-64].log</code>
Error log	Error information is collected for the user-defined level. By default, HDLM collects all error information.	<p>HDLM Manager logs:</p> <p><code>/var/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code></p> <p>Hitachi Command Suite Common Agent Component logs:</p> <p><code>/var/opt/DynamicLinkManager/log/dlmwebagent[1-N].log</code></p> <p>The value <i>N</i> depends on the setting in the file <code>dlmwebagent.properties</code>.</p> <p>The default value is 2. To change the number of files, set a value from 2 to 16 for <code>logFileNum</code>.</p>
<i>HDLM-configuration definition utility (dlmcfgmgr) log</i>	Logs are collected when the <code>dlmcfgmgr</code> utility is executed.	<p>The following is the log file name.</p> <ul style="list-style-type: none"> <code>/var/opt/DynamicLinkManager/log/dlmcfgmgr[1-2].log</code> <code>/var/opt/DynamicLinkManager/log/dlminquiry.log</code>
Syslog	<p>The HDLM messages on or above the level set by the user with syslog settings file are collected.[#]</p> <p>We recommend that you configure the system so that information at the Information level and higher is output.</p> <p>Syslogs can be checked using a text editor.</p>	<p>The default file path is <code>/var/log/messages</code>.</p> <p>The syslog file path is specified in the syslog settings file. For details, see the Linux documentation.</p>

Log name	Description	Output destination
	If you want to output HDLM log information to the syslog, enable the syslog daemon.	
HDLM boot log	Logs are collected when HDLM starts in a boot disk environment.	The file name of the HDLM boot log is as follows: /etc/opt/ DynamicLinkManager/ hdlmboot[1-3].log

#

When you want to configure the system so that HDLM messages are output to syslog, specify `user` for the system function name (Facility) in the `syslog` settings file.

The following shows an example when `syslogd` is used, the system function name (Facility) is `user`, and the priority level (Priority) is an information message (`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 [Filtering of error information on page 2-36](#).

Filtering of error information

Errors detected by HDLM are classified into various error levels. The following table lists and describes the error levels, in the order of most to least severe to the system.

Table 2-9 Error levels

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

Error information is filtered by error level, and then collected.

The error level is equivalent to the level of the messages output by HDLM. For details on the level of the message, see [Format and meaning of message IDs on page 8-3](#).

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

Note that all system function names (`Facility`), except for audit logs, are "user" when HDLM outputs messages in syslog.

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

Collection levels for error logs

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

Collection levels for log information in trace files:

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

For details on how to set the collection level, see [Setting up the HDLM functions on page 3-182](#).

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

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

By executing this utility, you can simultaneously collect all the information required for analyzing errors: information such as error logs, process-specific-trace information files, trace files, definition files, core 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 [DLMgetras utility for collecting HDLM error information on page 7-3](#).

Utility for collecting HDLM installation error information (installgetras)

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

By executing this utility, you can collect the logs required for analyzing errors that occurred during installation. You can use the collected information when you contact your HDLM vendor or maintenance company.

For details on the `installgetras` utility, see [installgetras utility for collecting HDLM installation error information on page 7-58](#).

Collecting audit log data

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

Table 2-10 Categories of audit log data that can be collected

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

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

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

Categories and audit events that HDLM can output to the audit log

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

Table 2-11 Categories and audit events that can be output to the audit log

Category	Explanation	Audit event	Severity #1	Message ID
StartStop	Startup and termination of the software	Startup of the HDLM manager was successful.	6	KAPL15401-I
		Startup of the HDLM manager failed.	3	KAPL15402-E
		The HDLM manager stopped.	6	KAPL15403-I
		Startup of the <code>DLMgetras</code> utility	6	KAPL15060-I
		Termination of the <code>DLMgetras</code> utility ^{#2}	6	KAPL15061-I
		Processing of the <code>dlnstart</code> utility was successful.	6	KAPL15062-I
		Processing of the <code>dlnstart</code> utility failed.	3	KAPL15063-E
		Startup of the <code>dlnperfinfo</code> utility was successful.	6	KAPL15320-I
		Startup of the <code>dlnperfinfo</code> utility failed.	3	KAPL15321-E
		The <code>dlnperfinfo</code> utility stopped.	6	KAPL15322-I
		The <code>dlnperfinfo</code> utility terminated. ^{#2}	4	KAPL15323-W
Authentication	Administrator or end-user authentication	Permission has not been granted to execute the HDLM command.	4	KAPL15111-W
		Permission has not been granted to execute HDLM utilities.	4	KAPL15010-W
		Permission has not been granted to start or stop the HDLM manager.	4	KAPL15404-W

Category	Explanation	Audit event	Severity #1	Message ID
ConfigurationAccess	Viewing or updating configuration information	Initialization of path statistics was successful.	6	KAPL15101-I
		Initialization of path statistics failed.	3	KAPL15102-E
		An attempt to place a path online or offline was successful.	6	KAPL15103-I
		An attempt to place a path online or offline failed.	4	KAPL15104-W
		Setup of the operating environment was successful.	6	KAPL15105-I
		Setup of the operating environment failed.	3	KAPL15106-E
		An attempt to display program information was successful.	6	KAPL15107-I
		An attempt to display program information failed.	3	KAPL15108-E
		An attempt to display HDLM management-target information was successful.	6	KAPL15109-I
		An attempt to display HDLM management-target information failed.	3	KAPL15110-E
		Processing of the <code>dlnmpr -k</code> command was successful.	6	KAPL15001-I
		Processing of the <code>dlnmpr -k</code> command failed.	3	KAPL15002-E

Category	Explanation	Audit event	Severity #1	Message ID
		Processing of the <code>dlnpr -c</code> command was successful.	6	KAPL15064-I
		Processing of the <code>dlnpr -c</code> command failed.	3	KAPL15065-E
		Processing of the <code>dlnmcfmgmr -r</code> command was successful.	6	KAPL15040-I
		Processing of the <code>dlnmcfmgmr -r</code> command failed.	3	KAPL15041-E
		Processing of the <code>dlnmcfmgmr -o</code> command was successful.	6	KAPL15042-I
		Processing of the <code>dlnmcfmgmr -o</code> command failed.	3	KAPL15043-E
		Processing of the <code>dlnmcfmgmr -i</code> command was successful.	6	KAPL15044-I
		Processing of the <code>dlnmcfmgmr -i</code> command failed.	3	KAPL15045-E
		Processing of the <code>dlnmcfmgmr -v</code> command was successful.	6	KAPL15046-I
		Processing of the <code>dlnmcfmgmr -v</code> command failed.	3	KAPL15047-E
		Processing of the <code>dlnmcfmgmr -u</code> command was successful.	6	KAPL15048-I
		Processing of the <code>dlnmcfmgmr -u</code> command failed.	3	KAPL15049-E
		Processing of the <code>dlnmcfmgmr -extenddev</code> command was successful.	6	KAPL15330-I

Category	Explanation	Audit event	Severity #1	Message ID
		Processing of the <code>dlnmcfgmgr - extenddev</code> command failed.	3	KAPL15331-E
		Processing of the <code>dlnmkinitrd</code> command was successful.	6	KAPL15050-I
		Processing of the <code>dlnmkinitrd</code> command failed.	3	KAPL15051-E
		Processing of the <code>dlnmsetopt -r</code> command was successful.	6	KAPL15052-I
		Processing of the <code>dlnmsetopt -r</code> command failed.	3	KAPL15053-E
		Processing of the <code>dlnmsetopt -inqt</code> command was successful.	6	KAPL15054-I
		Processing of the <code>dlnmsetopt -inqt</code> command failed.	3	KAPL15055-E
		Processing of the <code>dlnmsetopt -inqr</code> command was successful.	6	KAPL15056-I
		Processing of the <code>dlnmsetopt -inqr</code> command failed.	3	KAPL15057-E
		Processing of the <code>dlnmupdatesysinit</code> command was successful.	6	KAPL15058-I
		Processing of the <code>dlnmupdatesysinit</code> command failed.	3	KAPL15059-E
		Processing of the <code>dlnmchname -o</code> command was successful.	6	KAPL15301-I
		Processing of the <code>dlnmchname -o</code> command failed.	3	KAPL15302-E

Category	Explanation	Audit event	Severity #1	Message ID
		Processing of the <code>d1mchname</code> command was successful.	6	KAPL15303-I
		Processing of the <code>d1mchname</code> command failed.	3	KAPL15304-E
		Processing of the <code>d1mchname -f</code> command was successful.	6	KAPL15305-I
		Processing of the <code>d1mchname -f</code> command failed.	3	KAPL15306-E
		The status of a path was successfully changed to Online.	6	KAPL15116-I
		A path was successfully added.	6	KAPL15117-I
		Path addition failed.	4	KAPL15118-W
		A path was successfully deleted.	6	KAPL15119-I
		Path deletion failed.	4	KAPL15120-W
		The refresh operation was successful.	6	KAPL15121-I
		The refresh operation failed.	4	KAPL15122-W

#1

The severity levels are as follows:

3: Error, 4: Warning, 6: Informational

#2

If you use **Ctrl+C** to terminate the utility while it is running, audit log data indicating that the utility has finished will not be output.

Requirements for outputting audit log data

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

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

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

#:

The following audit log data is output:

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

Notes

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

Destination and filtering of audit log data

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

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

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

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

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

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

Filtering by severity:

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

Table 2-12 Severity levels that can be specified

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

Filtering by category:

The following categories can be specified:

- StartStop
- Authentication
- ConfigurationAccess
- All of the above

For details on how to specify audit log settings, see [Setting up the HDLM functions on page 3-182](#).

Audit log data formats

The output audit log is composed of the `syslog` header and the message.

The output format of the `syslog` header depends on the operating system environment settings.

For example, when `rsyslogd` is used, specifying

`$ActionFileDefaultTemplate RSYSLOG_SyslogProtocol23Format` in the `/etc/rsyslog.conf` file outputs the audit log in a format that supports RFC5424.

The following content is output in the `syslog` header:

- priority
- date-and-time
- host-name
- program-name
- process-ID

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

The format of message-section:

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

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

Table 2-13 Items output in the message section

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

Item#	Explanation
Port number receiving request	Number of the port receiving a request
Common operation ID	Operation serial number in the program
Log type information	Fixed to <code>BasicLog</code>
Application identification information	Program identification information
Reserved area	This field is reserved. No data is output here.
Message text	Data related to the audit event is output.

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

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

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

Integrated HDLM management using Global Link Manager

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

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

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

Note

You cannot manage a single HDLM host from multiple Global Link Manager servers.

The following figure is an example of a system configuration using HDLM and Global Link Manager.

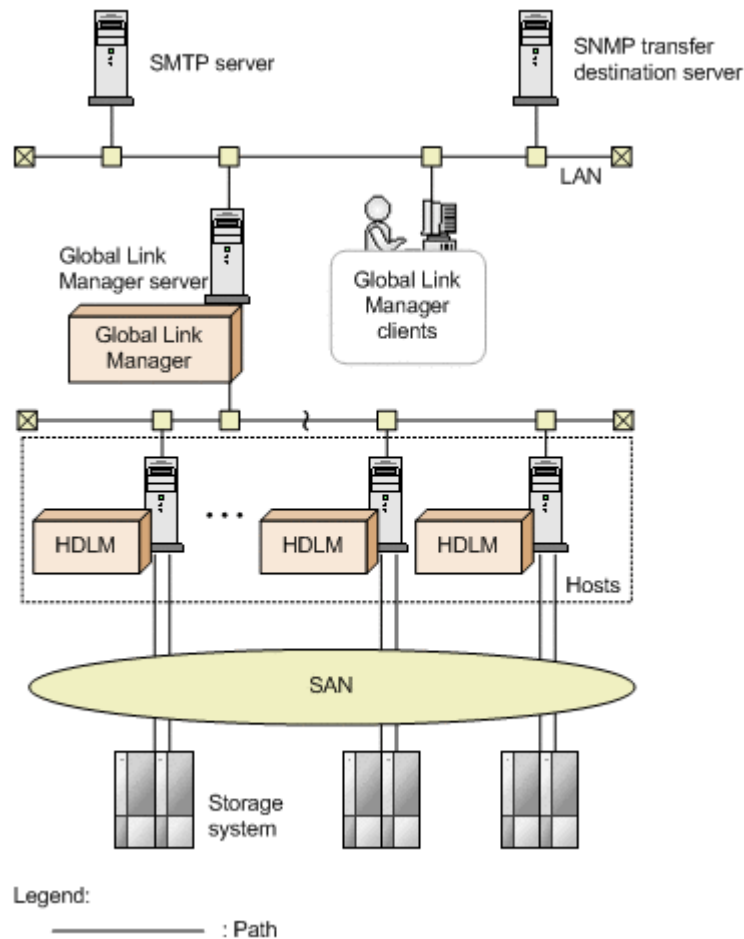


Figure 2-17 Example system configuration using HDLM and Global Link Manager

Cluster support

HDLM can also be used in cluster configurations.

For details about cluster software supported by HDLM, see any of the following sections depending on your OS and its version:

- [Cluster software supported by HDLM on page 3-20 in Related products when using Red Hat Enterprise Linux 6 on page 3-20](#)
- [Cluster software supported by HDLM on page 3-39 in Related products when using Red Hat Enterprise Linux 7 on page 3-39](#)
- [Cluster software supported by HDLM on page 3-47 in Related products when using Red Hat Enterprise Linux 8 on page 3-47](#)
- [Cluster software supported by HDLM on page 3-49 in Related products when using SUSE LINUX Enterprise Server 11 on page 3-49](#)
- [Cluster software supported by HDLM on page 3-52 in Related products when using SUSE LINUX Enterprise Server 12 on page 3-52](#)

- [Cluster software supported by HDLM on page 3-56 in Related products when using Oracle Linux 6 on page 3-56](#)
- [Cluster software supported by HDLM on page 3-58 in Related products when using Oracle Unbreakable Enterprise Kernel 6 on page 3-58](#)
- [Cluster software supported by HDLM on page 3-63 in Related products when using Oracle Linux 7 on page 3-63](#)
- [Cluster software supported by HDLM on page 3-66 in Related products when using Oracle Unbreakable Enterprise Kernel 7 on page 3-66](#)

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

The details of host switching depend on the application.

Creating an HDLM environment

This chapter explains the procedure for setting up an HDLM environment and the procedure for canceling the environment settings.

Make sure that HDLM installation and function setup has been performed. Set up volume groups and cluster software according to the environment you are using.

- ☐ [HDLM system requirements](#)
- ☐ [Flow for creating an HDLM environment](#)
- ☐ [HDLM installation types](#)
- ☐ [Knowledge required before you install HDLM](#)
- ☐ [Notes on creating an HDLM environment](#)
- ☐ [Installing HDLM](#)
- ☐ [Installing HDLM for managing boot disks](#)
- ☐ [Settings for LUKS](#)
- ☐ [Settings for md devices](#)
- ☐ [Settings for LVM2](#)
- ☐ [Settings for Xen](#)
- ☐ [Settings for KVM](#)
- ☐ [Settings for Heartbeat](#)

- ☐ [Settings for Oracle RAC](#)
- ☐ [Settings for the RHCM](#)
- ☐ [Settings for VCS](#)
- ☐ [Checking the path configuration](#)
- ☐ [Setting up HDLM](#)
- ☐ [The process-specific-trace information file](#)
- ☐ [Creating a character-type device file for an HDLM device](#)
- ☐ [Creating file systems for HDLM \(when volume management software is not used\)](#)
- ☐ [Settings for automatic mounting](#)
- ☐ [Canceling the settings for HDLM](#)

HDLM system requirements

Check the following before installing HDLM:

For the requirements for using HDLM in an HAM environment, see the release notes of HDLM.

Hosts and OSs supported by HDLM

HDLM supports hosts running on OSs listed in the following tables that satisfy the requirements listed in [Table 3-1 Requirements for applicable hosts on page 3-3](#):

- [Table 3-2 Red Hat Enterprise Linux 6 kernels supported by HDLM on page 3-5](#)
- [Table 3-3 Red Hat Enterprise Linux 7 kernels supported by HDLM on page 3-7](#)
- [Table 3-4 Red Hat Enterprise Linux 8 kernels supported by HDLM on page 3-7](#)
- [Table 3-5 SUSE LINUX Enterprise Server 11 kernels supported by HDLM on page 3-8](#)
- [Table 3-6 SUSE LINUX Enterprise Server 12 kernels supported by HDLM on page 3-9](#)
- [Table 3-7 SUSE LINUX Enterprise Server 15 kernels supported by HDLM on page 3-9](#)
- [Table 3-8 Oracle Linux 6 kernels supported by HDLM on page 3-10](#)
- [Table 3-9 Oracle Unbreakable Enterprise Kernel 6 kernels supported by HDLM on page 3-11](#)
- [Table 3-10 Oracle Linux 7 kernels supported by HDLM on page 3-12](#)
- [Table 3-11 Oracle Unbreakable Enterprise Kernel 7 kernels supported by HDLM on page 3-13](#)
- [Table 3-12 Oracle Linux 8 kernels supported by HDLM on page 3-13](#)
- [Table 3-13 Oracle Unbreakable Enterprise Kernel 8 kernels supported by HDLM on page 3-14](#)

Table 3-1 Requirements for applicable hosts

Items	Requirements
CPU	Intel Pentium III or more ^{#1}
	AMD Opteron
Memory	512 MB or more
Disk size	170 MB ^{#2} or more

#1

HDLM is compatible with Hyper-Threading technology.

#2

The disk capacity required for installation.

You can install HDLM on a host on which an OS listed in the following tables is running:

- [Table 3-2 Red Hat Enterprise Linux 6 kernels supported by HDLM on page 3-5](#)
- [Table 3-3 Red Hat Enterprise Linux 7 kernels supported by HDLM on page 3-7](#)
- [Table 3-4 Red Hat Enterprise Linux 8 kernels supported by HDLM on page 3-7](#)
- [Table 3-5 SUSE LINUX Enterprise Server 11 kernels supported by HDLM on page 3-8](#)
- [Table 3-6 SUSE LINUX Enterprise Server 12 kernels supported by HDLM on page 3-9](#)
- [Table 3-7 SUSE LINUX Enterprise Server 15 kernels supported by HDLM on page 3-9](#)
- [Table 3-8 Oracle Linux 6 kernels supported by HDLM on page 3-10](#)
- [Table 3-9 Oracle Unbreakable Enterprise Kernel 6 kernels supported by HDLM on page 3-11](#)
- [Table 3-10 Oracle Linux 7 kernels supported by HDLM on page 3-12](#)
- [Table 3-11 Oracle Unbreakable Enterprise Kernel 7 kernels supported by HDLM on page 3-13](#)
- [Table 3-12 Oracle Linux 8 kernels supported by HDLM on page 3-13](#)
- [Table 3-13 Oracle Unbreakable Enterprise Kernel 8 kernels supported by HDLM on page 3-14](#)

To check the kernel architecture and the CPU vendor:

1. Execute the following command to check which kernel architecture is used:

```
# uname -m
x86_64
#
```

The following shows the meaning of the execution result of the `uname` command:

```
i686: IA32 architecture
x86_64: AMD64/EM64T architecture
```

2. Execute the following command to check the vendor of the CPU you are using:

```
# cat /proc/cpuinfo
processor      : 0
vendor_id     : AuthenticAMD
cpu family    : 15
model         : 37
```

```

model name      : AMD Opteron(tm) Processor 252
stepping        : 1
:
:
#

```

Check the `vendor_id` line. `AuthenticAMD` is displayed for AMD CPUs, and `GenuineIntel` is displayed for Intel CPUs.

Note

- Environments where the secure boot function is enabled are not supported. Do not enable the secure boot function after installing HDLM.
- If an IP-SAN is used to connect HDLM with a storage system, HDLM is supported on the following OSs:
 - Red Hat Enterprise Linux 6
 - Red Hat Enterprise Linux 7
 - Red Hat Enterprise Linux 8
 - SUSE LINUX Enterprise Server 11
 - SUSE LINUX Enterprise Server 12
 - SUSE LINUX Enterprise Server 15
 - Oracle Unbreakable Enterprise Kernel 6
 - Oracle Unbreakable Enterprise Kernel 7

HDLM supports the following iSCSI initiators that are included in the OS.

- For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6, or Oracle Unbreakable Enterprise Kernel 7:

`iscsi-initiator-utils`

- For SUSE LINUX Enterprise Server 11, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

`open-iscsi`

Table 3-2 Red Hat Enterprise Linux 6 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
IA32 ^{#2}	2.6.32-71.el6.i686
	2.6.32-131.0.15.el6.i686
	2.6.32-220.el6.i686
	2.6.32-279.el6.i686
	2.6.32-358.el6.i686
	2.6.32-431.el6.i686
	2.6.32-504.el6.i686
	2.6.32-573.el6.i686

Kernel architecture#1	Kernel
	2.6.32-573.53.1.el6.i686
	2.6.32-642.el6.i686
	2.6.32-696.el6.i686
	2.6.32-696.23.1.el6.i686
	2.6.32-754.el6.i686
EM64T/AMD64#3	2.6.32-71.el6.x86_64
	2.6.32-131.0.15.el6.x86_64
	2.6.32-220.el6.x86_64
	2.6.32-279.el6.x86_64
	2.6.32-358.el6.x86_64
	2.6.32-358.87.1.el6.x86_64
	2.6.32-431.el6.x86_64
	2.6.32-431.87.1.el6.x86_64
	2.6.32-504.el6.x86_64
	2.6.32-504.66.1.el6.x86_64
	2.6.32-573.el6.x86_64
	2.6.32-573.53.1.el6.x86_64
	2.6.32-642.el6.x86_64
	2.6.32-696.el6.x86_64
	2.6.32-696.23.1.el6.x86_64
	2.6.32-754.el6.x86_64

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an IA32 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

Note the following in an EM64T/AMD64 environment:

- HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.
- In an EM64T/AMD64 environment, the RPM (Red Hat Package Manager) packages listed below are required. Install these RPM packages before installing HDLM:
 - `libstdc++-RPM package version .i686.rpm`
 - `libgcc-RPM package version .i686.rpm`

- glibc- *RPM package version* .i686.rpm

RPM package version depends on the OS version you are using.

Table 3-3 Red Hat Enterprise Linux 7 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	3.10.0-123.el7.x86_64
	3.10.0-229.el7.x86_64
	3.10.0-327.el7.x86_64
	3.10.0-327.64.1.el7.x86_64
	3.10.0-514.el7.x86_64
	3.10.0-514.44.1.el7.x86_64
	3.10.0-693.el7.x86_64
	3.10.0-693.21.1.el7.x86_64
	3.10.0-862.el7.x86_64
	3.10.0-957.el7.x86_64
	3.10.0-1062.el7.x86_64
	3.10.0-1127.el7.x86_64
	3.10.0-1160.el7.x86_64

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-4 Red Hat Enterprise Linux 8 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	4.18.0-147.el8.x86_64 ^{#3}
	4.18.0-193.el8.x86_64 ^{#3}
	4.18.0-240.el8.x86_64 ^{#3}

Note

This subsection describes the operating environment common to Red Hat Enterprise Linux 8.

- Linkage with Global Link Manager is not supported.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

For Red Hat Enterprise Linux 8, the following RPM package is required for installing HDLM.

- *tar-RPM package version.rpm*
RPM package version depends on the OS version you are using.

Table 3-5 SUSE LINUX Enterprise Server 11 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
IA32 ^{#2}	3.0.101-63.1-default
	3.0.101-63.1-pae
	3.0.101-108.21-default
	3.0.101-108.21-pae
EM64T/AMD64 ^{#3}	3.0.101-108.68-default
	3.0.101-108.68-pae
	3.0.101-63.1-default
	3.0.101-63.1-xen
	3.0.101-108.21-default
	3.0.101-108.21-xen
	3.0.101-108.68-default
	3.0.101-108.68-xen

Note

This subsection describes the operating environment common to SUSE LINUX Enterprise Server 11.

- An HDLM device that applies EVMS functions is not supported.
- You cannot use DRBD functions in an environment where HDLM is installed.
- You cannot use HDLM in a User-Mode Linux environment.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an IA32 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-6 SUSE LINUX Enterprise Server 12 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	3.12.28-4-default
	3.12.28-4-xen
	3.12.59-60.45-default
	3.12.59-60.45-xen
	3.12.74-60.64.40-default
	3.12.74-60.64.40-xen
	4.4.21-69-default
	4.4.103-6.33-default
	4.4.114-94.14-default
	4.12.14-94.41-default
	4.12.14-120-default

Note

This subsection describes the operating environment common to SUSE LINUX Enterprise Server 12.

- An HDLM device that applies EVMS functions is not supported.
- You cannot use DRBD functions in an environment where HDLM is installed.
- You cannot use HDLM in a User-Mode Linux environment.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-7 SUSE LINUX Enterprise Server 15 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	4.12.14-23-default
	4.12.14-195-default
	5.3.18-22-default

Note

This subsection describes the operating environment common to SUSE LINUX Enterprise Server 15.

- o An HDLM device that applies EVMS functions is not supported.
- o You cannot use DRBD functions in an environment where HDLM is installed.
- o You cannot use HDLM in a User-Mode Linux environment.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-8 Oracle Linux 6 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
IA32 ^{#2}	2.6.32-431.el6.i686
	2.6.32-504.el6.i686
	2.6.32-573.el6.i686
	2.6.32-642.el6.i686
	2.6.32-696.el6.i686
	2.6.32-754.el6.i686
EM64T/AMD64 ^{#3}	2.6.32-431.el6.x86_64
	2.6.32-504.el6.x86_64
	2.6.32-573.el6.x86_64
	2.6.32-642.el6.x86_64
	2.6.32-696.el6.x86_64
	2.6.32-754.el6.x86_64

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an IA32 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

Note the following in an EM64T/AMD64 environment:

- o HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.
- o In an EM64T/AMD64 environment, the RPM (Red Hat Package Manager) packages listed below are required. Install these RPM packages before installing HDLM:

- libstdc++- *RPM package version .i686.rpm*
- libgcc- *RPM package version .i686.rpm*
- glibc- *RPM package version .i686.rpm*

RPM package version depends on the OS version you are using.

Table 3-9 Oracle Unbreakable Enterprise Kernel 6 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
IA32 ^{#2}	2.6.39-200.24.1.el6uek.i686
	2.6.39-200.29.1.el6uek.i686
	2.6.39-200.29.2.el6uek.i686
	2.6.39-400.211.1.el6uek.i686
	2.6.39-400.215.10.el6uek.i686
	2.6.39-400.250.7.el6uek.i686
	2.6.39-400.278.2.el6uek.i686
EM64T/AMD64 ^{#3}	2.6.39-200.24.1.el6uek.x86_64
	2.6.39-200.29.1.el6uek.x86_64
	2.6.39-200.29.2.el6uek.x86_64
	2.6.39-400.211.1.el6uek.x86_64
	2.6.39-400.264.1.el6uek.x86_64
	3.8.13-16.2.1.el6uek.x86_64
	3.8.13-44.el6uek.x86_64
	3.8.13-44.1.1.el6uek.x86_64
	3.8.13-68.el6uek.x86_64
	3.8.13-68.1.3.el6uek.x86_64
	3.8.13-68.3.4.el6uek.x86_64
	4.1.12-37.4.1.el6uek.x86_64
	4.1.12-61.1.28.el6uek.x86_64
	4.1.12-94.2.1.el6uek.x86_64
	4.1.12-124.16.4.el6uek.x86_64

Note

Unless there is a note relating to Oracle Unbreakable Enterprise Kernel 6 stating otherwise, for descriptions where Red Hat Enterprise Linux, Red Hat Enterprise Linux 6 or Oracle Linux 6 are indicated, read these as Oracle Unbreakable Enterprise Kernel 6.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an IA32 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

Note the following in an EM64T/AMD64 environment:

- HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.
 - In an EM64T/AMD64 environment, the RPM (Red Hat Package Manager) packages listed below are required. Install these RPM packages before installing HDLM:
 - libstdc++- *RPM package version* .i686.rpm
 - libgcc- *RPM package version* .i686.rpm
 - glibc- *RPM package version* .i686.rpm
- RPM package version depends on the OS version you are using.

Table 3-10 Oracle Linux 7 kernels supported by HDLM

Kernel architecture#1	Kernel
EM64T/AMD64#2	3.10.0-123.el7.x86_64
	3.10.0-229.el7.x86_64
	3.10.0-327.el7.x86_64
	3.10.0-514.el7.x86_64
	3.10.0-693.el7.x86_64
	3.10.0-693.11.6.el7.x86_64
	3.10.0-862.el7.x86_64
	3.10.0-957.el7.x86_64
	3.10.0-1062.el7.x86_64
	3.10.0-1127.el7.x86_64
	3.10.0-1160.el7.x86_64

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-11 Oracle Unbreakable Enterprise Kernel 7 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	3.8.13-44.el7uek.x86_64
	3.8.13-55.1.6.el7uek.x86_64
	3.8.13-68.el7uek.x86_64
	3.8.13-68.2.2.el7uek.x86_64
	3.8.13-98.7.1.el7uek.x86_64
	3.8.13-118.10.2.el7uek.x86_64
	4.1.12-61.1.18.el7uek.x86_64
	4.1.12-61.1.28.el7uek.x86_64
	4.1.12-94.3.9.el7uek.x86_64
	4.1.12-112.16.4.el7uek.x86_64
	4.1.12-124.16.4.el7uek.x86_64
	4.1.12-124.30.1.el7uek.x86_64
	4.14.35-1818.3.3.el7uek.x86_64
	4.14.35-1902.3.2.el7uek.x86_64
	4.14.35-1902.300.11.el7uek.x86_64
	4.14.35-1902.301.1.el7uek.x86_64
	5.4.17-2011.6.2.el7uek.x86_64

Note

Unless there is a note relating to Oracle Unbreakable Enterprise Kernel 7 stating otherwise, for descriptions where Red Hat Enterprise Linux, Red Hat Enterprise Linux 7 or Oracle Linux 7 are indicated, read these as Oracle Unbreakable Enterprise Kernel 7.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

Table 3-12 Oracle Linux 8 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	4.18.0-147.el8.x86_64 ^{#3}

Kernel architecture ^{#1}	Kernel
	4.18.0-193.el8.x86_64 ^{#3}
	4.18.0-240.el8.x86_64 ^{#3}

Note

This subsection describes the operating environment common to Oracle Linux 8.

- Linkage with Global Link Manager is not supported.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

For Oracle Linux 8, the following RPM package is required for installing HDLM.

- *tar-RPM package version.rpm*
RPM package version depends on the OS version you are using.

Table 3-13 Oracle Unbreakable Enterprise Kernel 8 kernels supported by HDLM

Kernel architecture ^{#1}	Kernel
EM64T/AMD64 ^{#2}	5.4.17-2011.5.3.el8uek.x86_64

Note

- Unless there is a note relating to Oracle Unbreakable Enterprise Kernel 8 stating otherwise, for descriptions where Red Hat Enterprise Linux, Red Hat Enterprise Linux 8 or Oracle Linux 8 are indicated, read these as Oracle Unbreakable Enterprise Kernel 8.
- Linkage with Global Link Manager is not supported.

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

JRE used when linking with Global Link Manager

When HDLM is linked with Global Link Manager, use the JRE that comes with HDLM[#]. If either of the JRE versions listed in the table below is installed on the host, you can also use that JRE version. To use the JRE version installed on the host, see the *Hitachi Global Link Manager Installation and Configuration Guide*.

#

The following shows the version of the JRE included in HDLM:

- For Red Hat Enterprise Linux 7, Oracle Linux 7, SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15:
JRE 1.8.0_271
- For OSs other than the above:
JRE 1.5.0_85

Table 3-14 JRE used when linking with Global Link Manager

OS	JRE
Red Hat Enterprise Linux 6 (IA32) SUSE LINUX Enterprise Server 11 (IA32) SUSE LINUX Enterprise Server 11 (EM64T/AMD64) Oracle Linux 6 (IA32) Oracle Unbreakable Enterprise Kernel 6 (IA32)	JRE 1.8.0 (32 bit version)
Red Hat Enterprise Linux 6 (EM64T/AMD64) Red Hat Enterprise Linux 7 (EM64T/AMD64) SUSE LINUX Enterprise Server 12 (EM64T/AMD64) SUSE LINUX Enterprise Server 15 (EM64T/AMD64) Oracle Linux 6 (EM64T/AMD64) Oracle Linux 7 (EM64T/AMD64) Oracle Unbreakable Enterprise Kernel 6 (EM64T/AMD64) Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	JRE 1.8.0 (64 bit version)

Storage systems supported by HDLM

The following shows the storage systems that HDLM supports.

Storage systems

The following storage systems are supported by HDLM:

If an FC-SAN is used:

- Hitachi Virtual Storage Platform
- HPE StorageWorks P9500 Disk Array
- Hitachi Virtual Storage Platform 5100[#]

- Hitachi Virtual Storage Platform 5500#
- Hitachi Virtual Storage Platform 5100H#
- Hitachi Virtual Storage Platform 5500H#
- Hitachi Virtual Storage Platform G1000#
- HPE XP8 Storage#
- HPE XP7 Storage#
- Hitachi Virtual Storage Platform G1500#
- Hitachi Virtual Storage Platform F1500#
- Hitachi Virtual Storage Platform E590#
- Hitachi Virtual Storage Platform E790#
- Hitachi Virtual Storage Platform E990#
- Hitachi Virtual Storage Platform G200#
- Hitachi Virtual Storage Platform G350#
- Hitachi Virtual Storage Platform G370#
- Hitachi Virtual Storage Platform G400#
- Hitachi Virtual Storage Platform G600#
- Hitachi Virtual Storage Platform G700#
- Hitachi Virtual Storage Platform G800#
- Hitachi Virtual Storage Platform G900#
- Hitachi Virtual Storage Platform F350#
- Hitachi Virtual Storage Platform F370#
- Hitachi Virtual Storage Platform F400#
- Hitachi Virtual Storage Platform F600#
- Hitachi Virtual Storage Platform F700#
- Hitachi Virtual Storage Platform F800#
- Hitachi Virtual Storage Platform F900#
- Hitachi Virtual Storage Platform N400#
- Hitachi Virtual Storage Platform N600#
- Hitachi Virtual Storage Platform N800#
- HUS100 series
- HUS VM#

#

You can expand virtual volumes. Note that you need to exclude HDLM devices from the management targets before expanding a virtual volume. After that, add the HDLM devices to the management targets.

If an IP-SAN is used:

- Hitachi Virtual Storage Platform E590
- Hitachi Virtual Storage Platform E790
- Hitachi Virtual Storage Platform E990
- Hitachi Virtual Storage Platform G200
- Hitachi Virtual Storage Platform G350
- Hitachi Virtual Storage Platform G370
- Hitachi Virtual Storage Platform G400
- Hitachi Virtual Storage Platform G600
- Hitachi Virtual Storage Platform G700
- Hitachi Virtual Storage Platform G800
- Hitachi Virtual Storage Platform G900
- Hitachi Virtual Storage Platform F350
- Hitachi Virtual Storage Platform F370
- Hitachi Virtual Storage Platform F400
- Hitachi Virtual Storage Platform F600
- Hitachi Virtual Storage Platform F700
- Hitachi Virtual Storage Platform F800
- Hitachi Virtual Storage Platform F900
- Hitachi Virtual Storage Platform N400
- Hitachi Virtual Storage Platform N600
- Hitachi Virtual Storage Platform N800
- HUS100 series

Storage systems that are used must have a dual controller configuration. If you use them in a HUB-connected environment, specify a unique loop ID for all the connected hosts and storage systems. For details on the microprogram version required for using HDLM, see *HDLM Release Notes*. For details on the settings information for storage system, see the maintenance documentation for the storage system.

Note

For details on storage systems applicable to a Hitachi Compute Blade environment or boot disk environment, see the following according to your OS and version:

- [*Boot disk environments supported by HDLM on page 3-36 in Related products when using Red Hat Enterprise Linux 6 on page 3-20*](#)
- [*Boot disk environments supported by HDLM on page 3-46 in Related products when using Red Hat Enterprise Linux 7 on page 3-39*](#)
- [*Boot disk environments supported by HDLM on page 3-48 in Related products when using Red Hat Enterprise Linux 8 on page 3-47*](#)

- [*Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-51 in Related products when using SUSE LINUX Enterprise Server 11 on page 3-49*](#)
- [*Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-54 in Related products when using SUSE LINUX Enterprise Server 12 on page 3-52*](#)
- [*Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-55 in Related products when using SUSE LINUX Enterprise Server 15 on page 3-54*](#)
- [*Boot disk environments supported by HDLM on page 3-57 in Related products when using Oracle Linux 6 on page 3-56*](#)
- [*Boot disk environments supported by HDLM on page 3-62 in Related products when using Oracle Unbreakable Enterprise Kernel 6 on page 3-58*](#)
- [*Boot disk environments supported by HDLM on page 3-65 in Related products when using Oracle Linux 7 on page 3-63*](#)
- [*Boot disk environments supported by HDLM on page 3-68 in Related products when using Oracle Unbreakable Enterprise Kernel 7 on page 3-66*](#)
- [*Boot disk environments supported by HDLM on page 3-70 in Related products when using Oracle Linux 8 on page 3-69*](#)
- [*Boot disk environments supported by HDLM on page 3-71 in Related products when using Oracle Unbreakable Enterprise Kernel 8 on page 3-71*](#)

List of information for storage settings

To use HDLM, you need to set the information for storage settings that are indicated in the table below. The character string enclosed in square brackets [] indicates the items to be set. Selecting the item after the item enclosed in square brackets [] displays the next item. Specify the values indicated in the Setting value column.

For other settings, see the maintenance manual of the storage system.

Table 3-15 Storage settings (Other than the HUS100 series)

Items	Items to be set	Set value
Host ID Mode	(Not applicable)	00

Table 3-16 Storage settings (HUS100 series)

Items	Items to be set	Set value
Dual configuration	[System Startup Attribute]	Dual Active Mode

HBA (if an FC-SAN is used)

For details about the supported HBAs, see *HDLM Release Notes*.

NIC (if an IP-SAN is used)

For details about the supported NICs, see *HDLM Release Notes*.

FCoE

The following operating systems now support FCoE via the QLogic 8400 Series and later versions: Red Hat Enterprise Linux 6, and Red Hat Enterprise Linux 7.

When handling intermediate volumes managed by Hitachi RapidXchange

The following table lists the related programs that are required when you convert data with intermediate volumes managed by Hitachi RapidXchange.

Table 3-17 HDLM-related programs required when handling intermediate volumes managed by Hitachi RapidXchange

Kernel architecture ^{#1}	Kernel	Related programs
IA32 ^{#2}	2.6.32-131.0.15.el6.i686	File Access Library and File Conversion Utility (FAL/FCU) 01-07-68/00 or later ^{#4}
	2.6.32-431.el6.i686	File Access Library and File Conversion Utility (FAL/FCU) 01-06-67/21 or later ^{#5}
EM64T/AMD64 ^{#3}	2.6.32-131.0.15.el6.x86_64	File Access Library and File Conversion Utility (FAL/FCU) 01-07-68/00 or later ^{#4}
	2.6.32-431.el6.x86_64	File Access Library and File Conversion Utility (FAL/FCU) 01-06-67/21 or later ^{#5}
	3.10.0-693.el7.x86_64	File Access Library and File Conversion Utility (FAL/FCU) 01-07-68/00 or later ^{#5}

#1

Only kernels that are provided by OS distributors in binary format are supported.

#2

HDLM supports an environment where an IA32 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

#3

Note the following in an EM64T/AMD64 environment:

- HDLM supports an environment where an EM64T/AMD64 kernel is installed on a system that uses an Intel CPU or AMD Opteron CPU.

- o In an EM64T/AMD64 environment, the RPM (Red Hat Package Manager) packages listed below are required. Install these RPM packages before installing HDLM:
 - libstdc++- *RPM package version* .i686.rpm
 - libgcc- *RPM package version* .i686.rpm
 - glibc- *RPM package version* .i686.rpm
 RPM package version depends on the OS version you are using.

#4

The connected storage system is Hitachi Virtual Storage Platform G1000.

#5

The connected storage system is Hitachi Virtual Storage Platform.

For details about Hitachi RapidXchange, see the manual *Reference Manual File Access Library & File Conversion Utility*.

Related products when using Red Hat Enterprise Linux 6

The following describes related products when Red Hat Enterprise Linux 6 is used.

Cluster software supported by HDLM

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:

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

The following tables list the related programs used when creating a cluster:

- [Table 3-18 Cluster software used with Red Hat Enterprise Linux 6 \(if an FC-SAN is used\) on page 3-20](#)
- [Table 3-19 Cluster software used with Red Hat Enterprise Linux 6 \(if an IP-SAN is used\) on page 3-33](#)

Table 3-18 Cluster software used with Red Hat Enterprise Linux 6 (if an FC-SAN is used)

Kernel architecture	Usable kernels	Cluster software
IA32	2.6.32-71.el6.i686	LifeKeeper v8 LifeKeeper v8 Update1 (8.1.1) ^{#1} LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
	2.6.32-131.0.15.el6.i686	LifeKeeper v8
	2.6.32-220.el6.i686	LifeKeeper v8 Update1 (8.1.1) ^{#1} LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3} LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
	2.6.32-279.el6.i686	LifeKeeper v8 LifeKeeper v8 Update1 (8.1.1) ^{#1} LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3} LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
	2.6.32-358.el6.i686	LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
	2.6.32-431.el6.i686	LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update3 (9.3.1)#20 LifeKeeper v9 Update3 (9.3.2)#21 LifeKeeper v9 Update4 (9.4.0)#22 LifeKeeper v9 Update4 (9.4.1)#23 LifeKeeper v9 Update5(9.5.0)#24 RHCM
	2.6.32-504.el6.i686	LifeKeeper v8 Update3 (8.3.2)#7
	2.6.32-573.el6.i686	LifeKeeper v8 Update4 (8.4.0)#8
	2.6.32-573.53.1.el6.i686	LifeKeeper v8 Update4 (8.4.1)#9 LifeKeeper v9#10 LifeKeeper v9 Update0 (9.0.1)#11 LifeKeeper v9 Update0 (9.0.2)#12 LifeKeeper v9 Update1 (9.1.0)#13 LifeKeeper v9 Update1 (9.1.1)#14 LifeKeeper v9 Update1 (9.1.2)#15 LifeKeeper v9 Update2 (9.2.0)#16 LifeKeeper v9 Update2 (9.2.1)#17 LifeKeeper v9 Update2 (9.2.2)#18 LifeKeeper v9 Update3 (9.3.0)#19 LifeKeeper v9 Update3 (9.3.1)#20 LifeKeeper v9 Update3 (9.3.2)#21 LifeKeeper v9 Update4 (9.4.0)#22 LifeKeeper v9 Update4 (9.4.1)#23 LifeKeeper v9 Update5(9.5.0)#24 RHCM
	2.6.32-642.el6.i686	LifeKeeper v8 Update3 (8.3.2)#7 LifeKeeper v8 Update4 (8.4.0)#8 LifeKeeper v8 Update4 (8.4.1)#9 LifeKeeper v9#10 LifeKeeper v9 Update0 (9.0.1)#11 LifeKeeper v9 Update0 (9.0.2)#12 LifeKeeper v9 Update1 (9.1.0)#13 LifeKeeper v9 Update1 (9.1.1)#14 LifeKeeper v9 Update1 (9.1.2)#15 LifeKeeper v9 Update2 (9.2.0)#16 LifeKeeper v9 Update2 (9.2.1)#17 LifeKeeper v9 Update2 (9.2.2)#18 LifeKeeper v9 Update3 (9.3.0)#19

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM ^{#28}
	2.6.32-696.el6.i686	LifeKeeper v9 Update1 (9.1.2) ^{#15}
	2.6.32-696.23.1.el6.i686	LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
	2.6.32-754.el6.i686	LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} RHCM
EM64T/AMD64	2.6.32-71.el6.x86_64	LifeKeeper v8 LifeKeeper v8 Update1 (8.1.1) ^{#1} LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3} LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} RHCM
	2.6.32-131.0.15.el6.x86_64	LifeKeeper v8 LifeKeeper v8 Update1 (8.1.1) ^{#1}
	2.6.32-220.el6.x86_64	LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3} LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} RHCM
	2.6.32-279.el6.x86_64	LifeKeeper v8 LifeKeeper v8 Update1 (8.1.1) ^{#1} LifeKeeper v8 Update1 (8.1.2) ^{#2} LifeKeeper v8 Update2 (8.2.0) ^{#3} LifeKeeper v8 Update2 (8.2.1) ^{#4} LifeKeeper v8 Update3 (8.3.0) ^{#5} LifeKeeper v8 Update3 (8.3.1) ^{#6} LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} RHCM

Kernel architecture	Usable kernels	Cluster software
	2.6.32-358.el6.x86_64	LifeKeeper v8 Update1 (8.1.2)#2
	2.6.32-358.87.1.el6.x86_64	LifeKeeper v8 Update2 (8.2.0)#3 LifeKeeper v8 Update2 (8.2.1)#4 LifeKeeper v8 Update3 (8.3.0)#5 LifeKeeper v8 Update3 (8.3.1)#6 LifeKeeper v8 Update3 (8.3.2)#7 LifeKeeper v8 Update4 (8.4.0)#8 LifeKeeper v8 Update4 (8.4.1)#9 LifeKeeper v9#10 LifeKeeper v9 Update0 (9.0.1)#11 LifeKeeper v9 Update0 (9.0.2)#12 LifeKeeper v9 Update1 (9.1.0)#13 LifeKeeper v9 Update1 (9.1.1)#14 LifeKeeper v9 Update1 (9.1.2)#15 LifeKeeper v9 Update2 (9.2.0)#16 LifeKeeper v9 Update2 (9.2.1)#17 LifeKeeper v9 Update2 (9.2.2)#18 LifeKeeper v9 Update3 (9.3.0)#19 LifeKeeper v9 Update3 (9.3.1)#20 LifeKeeper v9 Update3 (9.3.2)#21 LifeKeeper v9 Update4 (9.4.0)#22 LifeKeeper v9 Update4 (9.4.1)#23 LifeKeeper v9 Update5(9.5.0)#24 Oracle RAC 11g Release 2 (11.2.0.3.0)#25#26 Oracle RAC 11g Release 2 (11.2.0.4.0)#25#26 Oracle RAC 12c Release 1 (12.1.0.2.0)#25#26 Oracle RAC 12c Release 2 (12.2.0.1.0)#26#27 RHCM
	2.6.32-431.el6.x86_64	LifeKeeper v8 Update2 (8.2.1)#4
	2.6.32-431.87.1.el6.x86_64	LifeKeeper v8 Update3 (8.3.0)#5 LifeKeeper v8 Update3 (8.3.1)#6 LifeKeeper v8 Update3 (8.3.2)#7 LifeKeeper v8 Update4 (8.4.0)#8 LifeKeeper v8 Update4 (8.4.1)#9 LifeKeeper v9#10

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update0 (9.0.1) ^{#11}
		LifeKeeper v9 Update0 (9.0.2) ^{#12}
		LifeKeeper v9 Update1 (9.1.0) ^{#13}
		LifeKeeper v9 Update1 (9.1.1) ^{#14}
		LifeKeeper v9 Update1 (9.1.2) ^{#15}
		LifeKeeper v9 Update2 (9.2.0) ^{#16}
		LifeKeeper v9 Update2 (9.2.1) ^{#17}
		LifeKeeper v9 Update2 (9.2.2) ^{#18}
		LifeKeeper v9 Update3 (9.3.0) ^{#19}
		LifeKeeper v9 Update3 (9.3.1) ^{#20}
		LifeKeeper v9 Update3 (9.3.2) ^{#21}
		LifeKeeper v9 Update4 (9.4.0) ^{#22}
		LifeKeeper v9 Update4 (9.4.1) ^{#23}
		LifeKeeper v9 Update5(9.5.0) ^{#24}
		Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26}
		Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26}
		Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26}
		Oracle RAC 12c Release 2 (12.2.0.1.0) ^{#26#27}
		RHCM
	2.6.32-504.el6.x86_64	LifeKeeper v8 Update3 (8.3.2) ^{#7}
	2.6.32-504.66.1.el6.x86_64	LifeKeeper v8 Update4 (8.4.0) ^{#8}
		LifeKeeper v8 Update4 (8.4.1) ^{#9}
	2.6.32-573.el6.x86_64	LifeKeeper v9 ^{#10}
	2.6.32-573.53.1.el6.x86_64	LifeKeeper v9 Update0 (9.0.1) ^{#11}
		LifeKeeper v9 Update0 (9.0.2) ^{#12}
		LifeKeeper v9 Update1 (9.1.0) ^{#13}
		LifeKeeper v9 Update1 (9.1.1) ^{#14}
		LifeKeeper v9 Update1 (9.1.2) ^{#15}
		LifeKeeper v9 Update2 (9.2.0) ^{#16}
		LifeKeeper v9 Update2 (9.2.1) ^{#17}
		LifeKeeper v9 Update2 (9.2.2) ^{#18}
		LifeKeeper v9 Update3 (9.3.0) ^{#19}
		LifeKeeper v9 Update3 (9.3.1) ^{#20}
		LifeKeeper v9 Update3 (9.3.2) ^{#21}
		LifeKeeper v9 Update4 (9.4.0) ^{#22}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} Oracle RAC 12c Release 2 (12.2.0.1.0) ^{#26#27} RHCM
	2.6.32-642.el6.x86_64	LifeKeeper v8 Update3 (8.3.2) ^{#7} LifeKeeper v8 Update4 (8.4.0) ^{#8} LifeKeeper v8 Update4 (8.4.1) ^{#9} LifeKeeper v9 ^{#10} LifeKeeper v9 Update0 (9.0.1) ^{#11} LifeKeeper v9 Update0 (9.0.2) ^{#12} LifeKeeper v9 Update1 (9.1.0) ^{#13} LifeKeeper v9 Update1 (9.1.1) ^{#14} LifeKeeper v9 Update1 (9.1.2) ^{#15} LifeKeeper v9 Update2 (9.2.0) ^{#16} LifeKeeper v9 Update2 (9.2.1) ^{#17} LifeKeeper v9 Update2 (9.2.2) ^{#18} LifeKeeper v9 Update3 (9.3.0) ^{#19} LifeKeeper v9 Update3 (9.3.1) ^{#20} LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} Oracle RAC 12c Release 2 (12.2.0.1.0) ^{#26#27} RHCM ^{#28}
	2.6.32-696.el6.x86_64	LifeKeeper v9 Update3 (9.3.0) ^{#19}
	2.6.32-696.23.1.el6.x86_64	LifeKeeper v9 Update3 (9.3.1) ^{#20}

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update3 (9.3.2) ^{#21} LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} Oracle RAC 12c Release 2 (12.2.0.1.0) ^{#26#27} RHCM
	2.6.32-754.el6.x86_64	LifeKeeper v9 Update4 (9.4.0) ^{#22} LifeKeeper v9 Update4 (9.4.1) ^{#23} LifeKeeper v9 Update5(9.5.0) ^{#24} Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#25#26} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#25#26} Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#25#26} Oracle RAC 12c Release 2 (12.2.0.1.0) ^{#26#27} RHCM

Note 1

For details about LifeKeeper environments, contact our sales representatives.

#1

Only environments where HDLM ARK 8.1.1-5620 is used are supported.

#2

Only environments where HDLM ARK 8.1.2-5795 is used are supported.

#3

Only environments where HDLM ARK 8.2.0-6213 is used are supported.

#4

Only environments where HDLM ARK 8.2.1-6353 is used are supported.

#5

Only environments where HDLM ARK 8.3.0-6389 is used are supported.

#6

Only environments where HDLM ARK 8.3.1-6397 is used are supported.

- #7
Only environments where HDLM ARK 8.3.2-6405 is used are supported.
- #8
Only environments where HDLM ARK 8.4.0-6427 is used are supported.
- #9
Only environments where HDLM ARK 8.4.1-6449 is used are supported.
- #10
Only environments where HDLM ARK 9.0.0-6488 is used are supported.
- #11
Only environments where HDLM ARK 9.0.1-6492 is used are supported.
- #12
Only environments where HDLM ARK 9.0.2-6513 is used are supported.
- #13
Only environments where HDLM ARK 9.1.0-6538 is used are supported.
- #14
Only environments where HDLM ARK 9.1.1-6594 is used are supported.
- #15
Only environments where HDLM ARK 9.1.2-6609 is used are supported.
- #16
Only environments where HDLM ARK 9.2.0-6629 is used are supported.
- #17
Only environments where HDLM ARK 9.2.1-6653 is used are supported.
- #18
Only environments where HDLM ARK 9.2.2-6679 is used are supported.
- #19
Only environments where HDLM ARK 9.3.0-6728 is used are supported.
- #20
Only environments where HDLM ARK 9.3.1-6750 is used are supported.
- #21
Only environments where HDLM ARK 9.3.2-6863 is used are supported.
- #22
Only environments where HDLM ARK 9.4.0-6959 is used are supported.
- #23
Only environments where HDLM ARK 9.4.1-6983 is used are supported.
- #24
Only environments where HDLM ARK 9.5.0-7075 is used are supported.

#25

Only configurations that include the Automatic Storage Management (ASM) function (raw devices are used) and Oracle Grid Infrastructure are supported.

The HDLM device name can be specified directly for ASM.

For details, see [Settings for Oracle RAC on page 3-176](#).

#26

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

#27

Only the following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure
For details, see [Settings for Oracle RAC on page 3-176](#).
- Configurations that include the Automatic Storage Management (ASM) function (using ASMLib Kernel driver (ASMLib)) and Oracle Grid Infrastructure

#28

You can also use Pacemaker provided by the OS.

Table 3-19 Cluster software used with Red Hat Enterprise Linux 6 (if an IP-SAN is used)

Kernel architecture	Usable kernels	Cluster software
IA32	2.6.32-71.el6.i686	RHCM
	2.6.32-131.0.15.el6.i686	
	2.6.32-220.el6.i686	
	2.6.32-279.el6.i686	
	2.6.32-358.el6.i686	
EM64T/AMD64	2.6.32-71.el6.x86_64	
	2.6.32-131.0.15.el6.x86_64	
	2.6.32-220.el6.x86_64	
	2.6.32-279.el6.x86_64	
	2.6.32-358.el6.x86_64	

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-20 Volume managers when using Red Hat Enterprise Linux 6

Kernel architecture	Kernel	Volume manager
IA32	2.6.32-71.el6.i686	LVM2.02.72-8.el6
	2.6.32-131.0.15.el6.i686	LVM2.02.83-3.el6
	2.6.32-220.el6.i686	LVM2.02.87-6.el6
	2.6.32-279.el6.i686	LVM2.02.95-10.el6
	2.6.32-358.el6.i686	LVM2.02.98-9.el6
	2.6.32-431.el6.i686	LVM2.02.100-8.el6
	2.6.32-504.el6.i686	LVM2.02.111-2.el6
	2.6.32-573.el6.i686	LVM2.02.118-2.el6
	2.6.32-573.53.1.el6.i686	
	2.6.32-642.el6.i686	LVM2.02.143-7.el6
	2.6.32-696.el6.i686	LVM2.02.143-12.el6
	2.6.32-696.23.1.el6.i686	
	2.6.32-754.el6.i686	LVM2.02.143-12.el6_9.1
EM64T/AMD64	2.6.32-71.el6.x86_64	LVM2.02.72-8.el6
	2.6.32-131.0.15.el6.x86_64	LVM2.02.83-3.el6
	2.6.32-220.el6.x86_64	LVM2.02.87-6.el6
	2.6.32-279.el6.x86_64	LVM2.02.95-10.el6
	2.6.32-358.el6.x86_64	LVM2.02.98-9.el6
	2.6.32-358.87.1.el6.x86_64	
	2.6.32-431.el6.x86_64	LVM2.02.100-8.el6
	2.6.32-431.87.1.el6.x86_64	
	2.6.32-504.el6.x86_64	LVM2.02.111-2.el6
	2.6.32-504.66.1.el6.x86_64	
	2.6.32-573.el6.x86_64	LVM2.02.118-2.el6
	2.6.32-573.53.1.el6.x86_64	
	2.6.32-642.el6.x86_64	LVM2.02.143-7.el6
	2.6.32-696.el6.x86_64	LVM2.02.143-12.el6
	2.6.32-696.23.1.el6.x86_64	
	2.6.32-754.el6.x86_64	LVM2.02.143-12.el6_9.1

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-21 Supported file systems when using Red Hat Enterprise Linux 6

Kernel architecture	Kernel	File system
IA32	2.6.32-71.el6.i686	ext2 (supplied with the OS)
	2.6.32-131.0.15.el6.i686	ext3 (supplied with the OS)
	2.6.32-220.el6.i686	ext4 (supplied with the OS)
	2.6.32-279.el6.i686	GFS2 (supplied with the OS) ^{#1}
	2.6.32-358.el6.i686	
	2.6.32-431.el6.i686	
	2.6.32-504.el6.i686	
	2.6.32-573.el6.i686	
	2.6.32-573.53.1.el6.i686	
	2.6.32-642.el6.i686	
	2.6.32-696.el6.i686	
	2.6.32-696.23.1.el6.i686	
	2.6.32-754.el6.i686	
EM64T/AMD64	2.6.32-71.el6.x86_64	ext2 (supplied with the OS)
	2.6.32-131.0.15.el6.x86_64	ext3 (supplied with the OS)
		ext4 (supplied with the OS)
		GFS2 (supplied with the OS) ^{#1}
	2.6.32-220.el6.x86_64	ext2 (supplied with the OS)
		ext3 (supplied with the OS)
		ext4 (supplied with the OS)
		GFS2 (supplied with the OS) ^{#1}
		xfs (supplied with the OS) ^{#1}
	2.6.32-279.el6.x86_64	ext2 (supplied with the OS)
		ext3 (supplied with the OS)
		ext4 (supplied with the OS)
		GFS2 (supplied with the OS) ^{#1}
	2.6.32-358.el6.x86_64	ext2 (supplied with the OS)
	2.6.32-358.87.1.el6.x86_64	ext3 (supplied with the OS)
	2.6.32-431.el6.x86_64	ext4 (supplied with the OS)
	2.6.32-431.87.1.el6.x86_64	GFS2 (supplied with the OS) ^{#1}
		xfs (supplied with the OS) ^{#1}
	2.6.32-504.el6.x86_64	ext2 (supplied with the OS)
	2.6.32-504.66.1.el6.x86_64	ext3 (supplied with the OS)
		ext4 (supplied with the OS)
		GFS2 (supplied with the OS) ^{#1}
		StorNext ^{#1#2#3}

Kernel architecture	Kernel	File system
		xfs (supplied with the OS)
	2.6.32-573.el6.x86_64	ext2 (supplied with the OS)
	2.6.32-573.53.1.el6.x86_64	ext3 (supplied with the OS)
	2.6.32-642.el6.x86_64	ext4 (supplied with the OS)
	2.6.32-696.el6.x86_64	GFS2 (supplied with the OS) ^{#1}
	2.6.32-696.23.1.el6.x86_64	xfs (supplied with the OS)
	2.6.32-754.el6.x86_64	

#1

An HDLM device cannot be used as a boot disk.

#2

LVM2 environments are not supported.

#3

Create a file by performing the following steps in order for StorNext to recognize the HDLM device:

a. Stop the StorNext service.

```
# service cvfs stop
```

b. In `/usr/cvfs/config/cvpaths`, create the file with the following two lines specified:

```
wildcard=/dev/sddlm[a-z][a-z]
wildcard=/dev/sddlm[a-z][a-z][a-z]
```

c. Restart the StorNext service.

```
# service cvfs start
```

Boot disk environments supported by HDLM

HDLM supports boot disks in the environments listed in the following tables:

- [Table 3-22 Operating environments for boot disks when using Red Hat Enterprise Linux 6 \(if an FC-SAN is used\) on page 3-36](#)
- [Table 3-23 Operating environments for boot disks when using Red Hat Enterprise Linux 6 \(if an IP-SAN is used\) on page 3-38](#)

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-22 Operating environments for boot disks when using Red Hat Enterprise Linux 6 (if an FC-SAN is used)

Kernel architecture	Kernel	HBA	Supported storage systems
IA32	2.6.32-71.el6.i686 ^{#1}	Brocade Emulex	HUS100 series HUS VM

Kernel architecture	Kernel	HBA	Supported storage systems	
	2.6.32-131.0.15.el6.i686 ^{#1}	QLogic ^{#2}	Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series	
	2.6.32-220.el6.i686 ^{#1}	Emulex		
	2.6.32-279.el6.i686 ^{#1}	QLogic ^{#2}		
	2.6.32-358.el6.i686 ^{#1}			
	2.6.32-431.el6.i686 ^{#1}			
	2.6.32-504.el6.i686 ^{#1}			
	2.6.32-573.el6.i686 ^{#1}			
	2.6.32-573.53.1.el6.i686 ^{#1}			
	2.6.32-642.el6.i686 ^{#1}			
	2.6.32-696.el6.i686 ^{#1}	Emulex		QLogic
	2.6.32-696.23.1.el6.i686 ^{#1}			
	2.6.32-754.el6.i686 ^{#1}			
EM64T/AMD64	2.6.32-71.el6.x86_64 ^{#1}	Brocade Emulex		
	2.6.32-131.0.15.el6.x86_64 ^{#1}	QLogic ^{#2}		
	2.6.32-220.el6.x86_64 ^{#1}	Emulex QLogic ^{#2} Cisco		
	2.6.32-279.el6.x86_64 ^{#1}	Emulex QLogic ^{#2}		
	2.6.32-358.el6.x86_64 ^{#1}			
	2.6.32-358.87.1.el6.x86_64 ^{#1}			
	2.6.32-431.el6.x86_64 ^{#1}			
	2.6.32-431.87.1.el6.x86_64 ^{#1}			
	2.6.32-504.el6.x86_64 ^{#1}	Emulex QLogic ^{#2}		Cisco
	2.6.32-504.66.1.el6.x86_64 ^{#1}			

Kernel architecture	Kernel	HBA	Supported storage systems
	2.6.32-573.el6.x86_64 ^{#1}	Emulex QLogic ^{#2}	
	2.6.32-573.53.1.el6.x86_64 ^{#1}		
	2.6.32-642.el6.x86_64 ^{#1}	Emulex QLogic ^{#2} Cisco	
	2.6.32-696.el6.x86_64 ^{#1}	Emulex QLogic	
	2.6.32-696.23.1.el6.x86_64 ^{#1}		
	2.6.32-754.el6.x86_64 ^{#1}		

#1

LUKS is not available in an environment where an HDLM device is used as a boot disk.

#2

HDLM supports the QLogic 8400 series.

Table 3-23 Operating environments for boot disks when using Red Hat Enterprise Linux 6 (if an IP-SAN is used)

Kernel architecture	Kernel	HBA	Supported storage systems
IA32	2.6.32-220.el6.i686	Red Hat	HUS100 series VSP Gx00 models VSP Fx00 models VSP N series
	2.6.32-220.31.1.el6.i686		
	2.6.32-279.el6.i686		
	2.6.32-358.el6.i686		
EM64T/AMD64	2.6.32-220.el6.x86_64		
	2.6.32-220.31.1.el6.x86_64		
	2.6.32-279.el6.x86_64		
	2.6.32-358.el6.x86_64		
	2.6.32-358.87.1.el6.x86_64		

Related products when using Red Hat Enterprise Linux 7

The following describes related products when Red Hat Enterprise Linux 7 is used.

Cluster software supported by HDLM

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:

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

The following table shows the related programs used when creating a cluster:

Table 3-24 Cluster software used with Red Hat Enterprise Linux 7 (if an FC-SAN is used)

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	3.10.0-123.el7.x86_64	LifeKeeper v9#1#2 LifeKeeper v9 Update0(9.0.1)#2#3 LifeKeeper v9 Update0(9.0.2)#2#4 LifeKeeper v9 Update1(9.1.0)#5 LifeKeeper v9 Update1(9.1.1)#6 LifeKeeper v9 Update1(9.1.2)#7 LifeKeeper v9 Update2(9.2.0)#8 LifeKeeper v9 Update2(9.2.1)#9 LifeKeeper v9 Update2(9.2.2)#10 LifeKeeper v9 Update3(9.3.0)#11 LifeKeeper v9 Update3(9.3.1)#12 LifeKeeper v9 Update3(9.3.2)#13 LifeKeeper v9 Update4(9.4.0)#14 LifeKeeper v9 Update4(9.4.1)#15 LifeKeeper v9 Update5(9.5.0)#16 Oracle RAC 11g Release 2 (11.2.0.4.0)#17#18#19 Oracle RAC 12c Release 1(12.1.0.2.0)#17#18#20 Oracle RAC 12c Release 2(12.2.0.1.0)#17#18 RHCM
	3.10.0-229.el7.x86_64	LifeKeeper v9#1#2

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update0(9.0.1) ^{#2#3} LifeKeeper v9 Update0(9.0.2) ^{#2#4} LifeKeeper v9 Update1(9.1.0) ^{#5} LifeKeeper v9 Update1(9.1.1) ^{#6} LifeKeeper v9 Update1(9.1.2) ^{#7} LifeKeeper v9 Update2(9.2.0) ^{#8} LifeKeeper v9 Update2(9.2.1) ^{#9} LifeKeeper v9 Update2(9.2.2) ^{#10} LifeKeeper v9 Update3(9.3.0) ^{#11} LifeKeeper v9 Update3(9.3.1) ^{#12} LifeKeeper v9 Update3(9.3.2) ^{#13} LifeKeeper v9 Update4(9.4.0) ^{#14} LifeKeeper v9 Update4(9.4.1) ^{#15} LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22}
	3.10.0-327.el7.x86_64	LifeKeeper v9 ^{#1#2}
	3.10.0-327.64.1.el7.x86_64	LifeKeeper v9 Update0(9.0.1) ^{#2#3} LifeKeeper v9 Update0(9.0.2) ^{#2#4} LifeKeeper v9 Update1(9.1.0) ^{#5} LifeKeeper v9 Update1(9.1.1) ^{#6} LifeKeeper v9 Update1(9.1.2) ^{#7} LifeKeeper v9 Update2(9.2.0) ^{#8} LifeKeeper v9 Update2(9.2.1) ^{#9} LifeKeeper v9 Update2(9.2.2) ^{#10} LifeKeeper v9 Update3(9.3.0) ^{#11} LifeKeeper v9 Update3(9.3.1) ^{#12} LifeKeeper v9 Update3(9.3.2) ^{#13} LifeKeeper v9 Update4(9.4.0) ^{#14} LifeKeeper v9 Update4(9.4.1) ^{#15} LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21}

Kernel architecture	Usable kernels	Cluster software
		Oracle RAC 12c Release 2(12.2.0.1.0)#17#22 RHCM
	3.10.0-514.el7.x86_64	LifeKeeper v9 Update1(9.1.1)#6
	3.10.0-514.44.1.el7.x86_64	LifeKeeper v9 Update1(9.1.2)#7 LifeKeeper v9 Update2(9.2.0)#8 LifeKeeper v9 Update2(9.2.1)#9 LifeKeeper v9 Update2(9.2.2)#10 LifeKeeper v9 Update3(9.3.0)#11 LifeKeeper v9 Update3(9.3.1)#12 LifeKeeper v9 Update3(9.3.2)#13 LifeKeeper v9 Update4(9.4.0)#14 LifeKeeper v9 Update4(9.4.1)#15 LifeKeeper v9 Update5(9.5.0)#16 Oracle RAC 11g Release 2 (11.2.0.4.0)#17#18#19 Oracle RAC 12c Release 1(12.1.0.2.0)#17#20#21 Oracle RAC 12c Release 2(12.2.0.1.0)#17#22 RHCM
	3.10.0-693.el7.x86_64	LifeKeeper v9 Update2(9.2.0)#8
	3.10.0-693.21.1.el7.x86_64	LifeKeeper v9 Update2(9.2.1)#9 LifeKeeper v9 Update2(9.2.2)#10 LifeKeeper v9 Update3(9.3.0)#11 LifeKeeper v9 Update3(9.3.1)#12 LifeKeeper v9 Update3(9.3.2)#13 LifeKeeper v9 Update4(9.4.0)#14 LifeKeeper v9 Update4(9.4.1)#15 LifeKeeper v9 Update5(9.5.0)#16 Oracle RAC 11g Release 2 (11.2.0.4.0)#17#18#19 Oracle RAC 12c Release 1(12.1.0.2.0)#17#20#21 Oracle RAC 12c Release 2(12.2.0.1.0)#17#22 RHCM
	3.10.0-862.el7.x86_64	LifeKeeper v9 Update3(9.3.0)#11 LifeKeeper v9 Update3(9.3.1)#12 LifeKeeper v9 Update3(9.3.2)#13

Kernel architecture	Usable kernels	Cluster software
		LifeKeeper v9 Update4(9.4.0) ^{#14} LifeKeeper v9 Update4(9.4.1) ^{#15} LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22} RHCM
	3.10.0-957.el7.x86_64	LifeKeeper v9 Update3(9.3.2) ^{#13} LifeKeeper v9 Update4(9.4.0) ^{#14} LifeKeeper v9 Update4(9.4.1) ^{#15} LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22} Oracle RAC 19c (19.3.0.0.0) ^{#17#18} Oracle RAC 19c (19.5.0.0.0) ^{#17#18} Oracle RAC 19c (19.6.0.0.0) ^{#17#18} Oracle RAC 19c (19.8.0.0.0) ^{#17#23} Oracle RAC 19c (19.9.0.0.0) ^{#17#18} RHCM
	3.10.0-1062.el7.x86_64	LifeKeeper v9 Update4(9.4.0) ^{#14} LifeKeeper v9 Update4(9.4.1) ^{#15} LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22} Oracle RAC 19c (19.3.0.0.0) ^{#17#18} Oracle RAC 19c (19.5.0.0.0) ^{#17#18} Oracle RAC 19c (19.6.0.0.0) ^{#17#18} Oracle RAC 19c (19.8.0.0.0) ^{#17#23} Oracle RAC 19c (19.9.0.0.0) ^{#17#18} RHCM

Kernel architecture	Usable kernels	Cluster software
	3.10.0-1127.el7.x86_64	LifeKeeper v9 Update5(9.5.0) ^{#16} Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22} Oracle RAC 19c (19.3.0.0.0) ^{#17#18} Oracle RAC 19c (19.5.0.0.0) ^{#17#18} Oracle RAC 19c (19.6.0.0.0) ^{#17#18} Oracle RAC 19c (19.8.0.0.0) ^{#17#23} Oracle RAC 19c (19.9.0.0.0) ^{#17#18} RHCM
	3.10.0-1160.el7.x86_64	Oracle RAC 11g Release 2 (11.2.0.4.0) ^{#17#18#19} Oracle RAC 12c Release 1(12.1.0.2.0) ^{#17#20#21} Oracle RAC 12c Release 2(12.2.0.1.0) ^{#17#22} Oracle RAC 19c (19.3.0.0.0) ^{#17#18} Oracle RAC 19c (19.5.0.0.0) ^{#17#18} Oracle RAC 19c (19.6.0.0.0) ^{#17#18} Oracle RAC 19c (19.8.0.0.0) ^{#17#23} Oracle RAC 19c (19.9.0.0.0) ^{#17#18} RHCM

Note 1

For details about LifeKeeper environments, contact our sales representatives.

#1

Only environments where HDLM ARK 9.0.0-6488 is used are supported.

#2

You need to apply the patch [Bug7205](#). For details on how to obtain the patch, see the LifeKeeper website.

#3

Only environments where HDLM ARK 9.0.1-6492 is used are supported.

#4

Only environments where HDLM ARK 9.0.2-6513 is used are supported.

#5

Only environments where HDLM ARK 9.1.0-6538 is used are supported.

- #6
Only environments where HDLM ARK 9.1.1-6594 is used are supported.
- #7
Only environments where HDLM ARK 9.1.2-6609 is used are supported.
- #8
Only environments where HDLM ARK 9.2.0-6629 is used are supported.
- #9
Only environments where HDLM ARK 9.2.1-6653 is used are supported.
- #10
Only environments where HDLM ARK 9.2.2-6679 is used are supported.
- #11
Only environments where HDLM ARK 9.3.0-6728 is used are supported.
- #12
Only environments where HDLM ARK 9.3.1-6750 is used are supported.
- #13
Only environments where HDLM ARK 9.3.2-6863 is used are supported.
- #14
Only environments where HDLM ARK 9.4.0-6959 is used are supported.
- #15
Only environments where HDLM ARK 9.4.1-6983 is used are supported.
- #16
Only environments where HDLM ARK 9.5.0-7075 is used are supported.
- #17
It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.
- #18
Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.
For details, see [Settings for Oracle RAC on page 3-176](#).
- #19
The p18370031 and p19692824 patches must be applied.
- #20
You can also use Oracle Cloud File System. In such a case, you need to apply patch P18321597.
- #21
The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices are used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

#22

The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices are used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (ASM Filter Driver (ASMFD) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

#23

The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices are used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (ASM Filter Driver (ASMFD) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-25 Volume managers when using Red Hat Enterprise Linux 7

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	3.10.0-123.el7.x86_64	LVM2.02.105-14.el7
	3.10.0-229.el7.x86_64	LVM2.02.115-3.el7
	3.10.0-327.el7.x86_64	LVM2.02.130-5.el7
	3.10.0-327.64.1.el7.x86_64	
	3.10.0-514.el7.x86_64	LVM2.02.166-1.el7
	3.10.0-514.44.1.el7.x86_64	LVM2.02.171-8.el7
	3.10.0-693.el7.x86_64	LVM2.02.171-8.el7

Kernel architecture	Kernel	Volume manager
	3.10.0-693.21.1.el7.x86_64	
	3.10.0-862.el7.x86_64	LVM2.02.177-4.el7 LVM2.02.180-8.el7
	3.10.0-957.el7.x86_64	LVM2.02.180-8.el7
	3.10.0-1062.el7.x86_64	LVM2.02.185-2.el7
	3.10.0-1127.el7.x86_64	LVM2.02.186-7.el7
	3.10.0-1160.el7.x86_64	LVM2.02.187-6.el7

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-26 Supported file systems when using Red Hat Enterprise Linux 7

Kernel architecture	Kernel	File system
EM64T/AMD64	3.10.0-123.el7.x86_64	ext2 (supplied with the OS)
	3.10.0-229.el7.x86_64	ext3 (supplied with the OS)
	3.10.0-327.el7.x86_64	ext4 (supplied with the OS)
	3.10.0-327.64.1.el7.x86_64	xfx (supplied with the OS)
	3.10.0-514.el7.x86_64	
	3.10.0-514.44.1.el7.x86_64	
	3.10.0-693.el7.x86_64	
	3.10.0-693.21.1.el7.x86_64	
	3.10.0-862.el7.x86_64	
	3.10.0-957.el7.x86_64	
	3.10.0-1062.el7.x86_64	
	3.10.0-1127.el7.x86_64	
	3.10.0-1160.el7.x86_64	

Boot disk environments supported by HDLM

HDLM supports boot disks in the environments listed in [Table 3-27 Operating environments for boot disks when using Red Hat Enterprise Linux 7 \(if an FC-SAN is used\) on page 3-47](#).

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-27 Operating environments for boot disks when using Red Hat Enterprise Linux 7 (if an FC-SAN is used)

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	3.10.0-123.el7.x86_64	Emulex QLogic ^{#1}	HUS100 series
	3.10.0-229.el7.x86_64		HUS VM
	3.10.0-327.el7.x86_64	Emulex QLogic ^{#1}	Virtual Storage Platform series
	3.10.0-327.64.1.el7.x86_64	Cisco	VSP 5000 series
	3.10.0-514.el7.x86_64	Emulex QLogic ^{#1}	VSP G1000 series
	3.10.0-514.44.1.el7.x86_64		VSP G1500
	3.10.0-693.el7.x86_64	Emulex QLogic	VSP F1500
	3.10.0-693.21.1.el7.x86_64		VSP E series
	3.10.0-862.el7.x86_64		VSP Gx00 models
	3.10.0-957.el7.x86_64		VSP Fx00 models
	3.10.0-1062.el7.x86_64		VSP N series
	3.10.0-1127.el7.x86_64		
	3.10.0-1160.el7.x86_64		

#

HDLM supports the QLogic 8400 series.

Related products when using Red Hat Enterprise Linux 8

The following describes related products when Red Hat Enterprise Linux 8 is used.

Cluster software supported by HDLM

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:

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

The following table shows the related programs used when creating a cluster:

Table 3-28 Cluster software used with Red Hat Enterprise Linux 8 (if an FC-SAN is used)

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	4.18.0-147.el8.x86_64	RHCM
	4.18.0-193.el8.x86_64	
	4.18.0-240.el8.x86_64	

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-29 Volume managers when using Red Hat Enterprise Linux 8

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	4.18.0-147.el8.x86_64	LVM2.03.05-5.el8
	4.18.0-193.el8.x86_64	LVM2.03.08-3.el8
	4.18.0-240.el8.x86_64	LVM2.03.09-5.el8

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-30 Supported file systems when using Red Hat Enterprise Linux 8

Kernel architecture	Kernel	File system
EM64T/AMD64	4.18.0-147.el8.x86_64	ext2 (supplied with the OS)
	4.18.0-193.el8.x86_64	ext3 (supplied with the OS)
	4.18.0-240.el8.x86_64	ext4 (supplied with the OS) xfs (supplied with the OS)

Boot disk environments supported by HDLM

HDLM supports boot disks in the environments listed in [Table 3-31 Operating environments for boot disks when using Red Hat Enterprise Linux 8 \(if an FC-SAN is used\) on page 3-49](#).

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-31 Operating environments for boot disks when using Red Hat Enterprise Linux 8 (if an FC-SAN is used)

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	4.18.0-147.el8.x86_64	Emulex	HUS100 series HUS VM
	4.18.0-193.el8.x86_64	Emulex QLogic	Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series
	4.18.0-240.el8.x86_64		

Related products when using SUSE LINUX Enterprise Server 11

The following describes related products when SUSE LINUX Enterprise Server 11 is used.

Cluster software supported by HDLM

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:

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

The following table lists the related programs used when creating a cluster.

Table 3-32 Cluster software when using SUSE LINUX Enterprise Server 11

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	3.0.101-63.1-default	Oracle RAC 11g Release 2(11.2.0.3.0) ^{#1#2}
	3.0.101-108.21-default	
	3.0.101-108.68-default	Oracle RAC 11g Release 2(11.2.0.4.0) ^{#1#2}

^{#1}

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a

multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

#2

The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-33 Volume managers when using SUSE LINUX Enterprise Server 11

Kernel architecture	Kernel	Volume manager
IA32	3.0.101-63.1-default	LVM2.02.98-0.33.1
	3.0.101-63.1-pae	
	3.0.101-108.21-default	
	3.0.101-108.21-pae	
	3.0.101-108.68-default	
	3.0.101-108.68-pae	
	3.0.101-63.1-default	
	3.0.101-63.1-xen	
EM64T/AMD64	3.0.101-63.1-default	LVM2.02.98-0.33.1
	3.0.101-63.1-xen	
	3.0.101-108.21-default	
	3.0.101-108.21-xen	
	3.0.101-108.68-default	
	3.0.101-108.68-xen	
	3.0.101-63.1-default	
	3.0.101-63.1-xen	

Notes on using a volume manager

Note the following when using a volume manager:

- Although disk partitioning and system backup functions are supported for disks in a YaST2 system, the combination of YaST2 and LVM is not supported.

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-34 Supported file systems when using SUSE LINUX Enterprise Server 11

Kernel architecture	Kernel	File system
IA32	3.0.101-63.1-default	ext2 (supplied with the OS)
	3.0.101-63.1-pae	ext3 (supplied with the OS)
	3.0.101-108.21-default	ext4 (supplied with the OS)
	3.0.101-108.21-pae	ReiserFS (supplied with the OS)
EM64T/AMD64	3.0.101-108.68-default	xfs (supplied with the OS)
	3.0.101-108.68-pae	Btrfs (supplied with the OS) ^{#1}
	3.0.101-63.1-default	ext2 (supplied with the OS)
	3.0.101-63.1-xen	ext3 (supplied with the OS)
	3.0.101-108.21-default	ext4 (supplied with the OS)
	3.0.101-108.21-xen	ReiserFS (supplied with the OS)
	3.0.101-108.68-default	xfs (supplied with the OS)
	3.0.101-108.68-xen	Btrfs (supplied with the OS) ^{#1}

#1

An HDLM device cannot be used as a boot disk.

#2

You cannot use the GPFS reservation function.

Boot disk environments supported by HDLM (if an FC-SAN is used)

HDLM supports boot disks in any of the environments listed in [Table 3-35 Operating environments for boot disks when using SUSE LINUX Enterprise Server 11 on page 3-51](#).

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-35 Operating environments for boot disks when using SUSE LINUX Enterprise Server 11

Kernel architecture	Kernel	HBA	Supported storage systems
IA32	3.0.101-63.1-default	Emulex QLogic	HUS100 series
	3.0.101-63.1-pae		HUS VM
	3.0.101-108.21-default		Virtual Storage Platform series
	3.0.101-108.21-pae		VSP 5000 series
EM64T/AMD64	3.0.101-108.68-default	Emulex QLogic	VSP G1000 series
	3.0.101-108.68-pae		VSP G1500
	3.0.101-63.1-default		VSP F1500
			VSP E series

Kernel architecture	Kernel	HBA	Supported storage systems
	3.0.101-63.1-xen		VSP Gx00 models VSP Fx00 models VSP N series
	3.0.101-108.21-default		
	3.0.101-108.21-xen		
	3.0.101-108.68-default		
	3.0.101-108.68-xen		

Related products when using SUSE LINUX Enterprise Server 12

The following describes related products when SUSE LINUX Enterprise Server 12 is used.

Cluster software supported by HDLM

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:

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

The following table lists the related programs used when creating a cluster.

Table 3-36 Cluster software when using SUSE LINUX Enterprise Server 12

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	3.12.59-60.45-default 3.12.74-60.64.40-default	Oracle RAC 12c Release 2(12.2.0.1.0) ^{#1#2}

#1

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

#2

The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-37 Volume managers when using SUSE LINUX Enterprise Server 12

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	3.12.28-4-default 3.12.28-4-xen	LVM2.02.98-48.8
	3.12.59-60.45-default 3.12.59-60.45-xen	LVM2.02.120-60.1
	3.12.74-60.64.40-default 3.12.74-60.64.40-xen	
	4.4.21-69-default	LVM2.02.120-72.8
	4.4.103-6.33-default	LVM2.02.120-77.2
	4.4.114-94.14-default	
	4.12.14-94.41-default	LVM2.02.180-8.16
	4.12.14-120-default	LVM2.02.180-9.18.1

Notes on using a volume manager

Note the following when using a volume manager:

- Although disk partitioning and system backup functions are supported for disks in a YaST2 system, the combination of YaST2 and LVM is not supported.

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-38 Supported file systems when using SUSE LINUX Enterprise Server 12

Kernel architecture	Kernel	File system
EM64T/AMD64	3.12.28-4-default 3.12.28-4-xen	ext3 (supplied with the OS) ext4 (supplied with the OS) xfs (supplied with the OS) Btrfs (supplied with the OS)
	3.12.59-60.45-default 3.12.59-60.45-xen	
	3.12.74-60.64.40-default 3.12.74-60.64.40-xen	
	4.4.21-69-default	
	4.4.103-6.33-default	

Kernel architecture	Kernel	File system
	4.4.114-94.14-default	
	4.12.14-94.41-default	
	4.12.14-120-default	

Boot disk environments supported by HDLM (if an FC-SAN is used)

HDLM supports boot disks in any of the environments listed in [Table 3-39 Operating environments for boot disks when using SUSE LINUX Enterprise Server 12 on page 3-54](#).

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-39 Operating environments for boot disks when using SUSE LINUX Enterprise Server 12

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	3.12.28-4-default	QLogic	HUS100 series
	3.12.28-4-xen		HUS VM
	3.12.59-60.45-default	Emulex	Virtual Storage Platform series
	3.12.59-60.45-xen	QLogic	VSP 5000 series
	3.12.74-60.64.40-default		VSP G1000 series
	3.12.74-60.64.40-xen		VSP G1500
	4.4.21-69-default		VSP F1500
	4.4.103-6.33-default		VSP E series
	4.4.114-94.14-default		VSP Gx00 models
	4.12.14-94.41-default		VSP Fx00 models
	4.12.14-120-default		VSP N series

Related products when using SUSE LINUX Enterprise Server 15

The following describes related products when SUSE LINUX Enterprise Server 15 is used.

Volume managers supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-40 Volume managers when using SUSE LINUX Enterprise Server 15

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	4.12.14-23-default	LVM2.02.177-5.11
	4.12.14-195-default	LVM2.02.180-10.16
	5.3.18-22-default	LVM2.03.05-6.5

Notes on using a volume manager

Note the following when using a volume manager:

- Although disk partitioning and system backup functions are supported for disks in a YaST2 system, the combination of YaST2 and LVM is not supported.

File systems supported by HDLM

The following table lists the file systems supported by HDLM.

Table 3-41 Supported file systems when using SUSE LINUX Enterprise Server 15

Kernel architecture	Kernel	File system
EM64T/AMD64	4.12.14-23-default	ext3 (supplied with the OS)
	4.12.14-195-default	ext4 (supplied with the OS)
	5.3.18-22-default	xfs (supplied with the OS) Btrfs (supplied with the OS)

Boot disk environments supported by HDLM (if an FC-SAN is used)

HDLM supports boot disks in any of the environments listed in [Table 3-42 Operating environments for boot disks when using SUSE LINUX Enterprise Server 15 on page 3-55](#).

For details on OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-42 Operating environments for boot disks when using SUSE LINUX Enterprise Server 15

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	4.12.14-23-default	Emulex	HUS100 series

Kernel architecture	Kernel	HBA	Supported storage systems
	4.12.14-195-default	QLogic	HUS VM Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series
	5.3.18-22-default		

Related products when using Oracle Linux 6

The following describes related products when Oracle Linux 6 is used.

Cluster software supported by HDLM

When you use HDLM in a cluster configuration, you must install the same version of HDLM on all of the nodes that make up the cluster. If different versions of HDLM are installed, the cluster system might not operate correctly. If `HDLM Version` and `Service Pack Version`, which you can display by executing the following command, are the same, then the HDLM versions are also the same:

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

The following table lists the related programs used when creating a cluster.

Table 3-43 Cluster software when using Oracle Linux 6

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	2.6.32-431.el6.x86_64	Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#1#2}

#1

Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.

For details, see [Settings for Oracle RAC on page 3-176](#).

#2

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a

multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-44 Volume managers when using Oracle Linux 6

Kernel architecture	Kernel	Volume manager
IA32	2.6.32-431.el6.i686	LVM2.02.100-8.el6
	2.6.32-504.el6.i686	LVM2.02.111-2.el6
	2.6.32-573.el6.i686	LVM2.02.118-2.el6
	2.6.32-642.el6.i686	LVM2.02.143-7.el6
	2.6.32-696.el6.i686	LVM2.02.143-12.el6
	2.6.32-754.el6.i686	LVM2.02.143-12.el6_9.1
EM64T/AMD64	2.6.32-431.el6.x86_64	LVM2.02.100-8.el6
	2.6.32-504.el6.x86_64	LVM2.02.111-2.el6
	2.6.32-573.el6.x86_64	LVM2.02.118-2.el6
	2.6.32-642.el6.x86_64	LVM2.02.143-7.el6
	2.6.32-696.el6.x86_64	LVM2.02.143-12.el6
	2.6.32-754.el6.x86_64	LVM2.02.143-12.el6_9.1

File systems supported by HDLM

HDLM supports the following file systems:

- ext2 (supplied with the OS)
- ext3 (supplied with the OS)
- ext4 (supplied with the OS)
- GFS2 (supplied with the OS)[#]

[#]

An HDLM device cannot be used as a boot disk.

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-45 Operating environments for boot disks when using Oracle Linux 6 on page 3-58](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-45 Operating environments for boot disks when using Oracle Linux 6

Kernel architecture	Kernel	HBA	Supported storage systems
IA32	2.6.32-431.el6.i686	Emulex QLogic	HUS100 series HUS VM Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series
	2.6.32-504.el6.i686		
	2.6.32-573.el6.i686		
	2.6.32-642.el6.i686		
	2.6.32-696.el6.i686		
	2.6.32-754.el6.i686		
EM64T/AMD64	2.6.32-431.el6.x86_64		
	2.6.32-504.el6.x86_64		
	2.6.32-573.el6.x86_64		
	2.6.32-642.el6.x86_64		
	2.6.32-696.el6.x86_64		
	2.6.32-754.el6.x86_64		

Related products when using Oracle Unbreakable Enterprise Kernel 6

The following describes related products when Oracle Unbreakable Enterprise Kernel 6 is used.

Cluster software supported by HDLM

When you use HDLM in a cluster configuration, you must install the same version of HDLM on all of the nodes that make up the cluster. If different versions of HDLM are installed, the cluster system might not operate correctly. If `HDLM Version` and `Service Pack Version`, which you can display by executing the following command, are the same, then the HDLM versions are also the same:

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

The following table lists the related programs used when creating a cluster.

Table 3-46 Cluster software when using Oracle Unbreakable Enterprise Kernel 6

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	2.6.39-200.24.1.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.3.0) ^{#1#2}

Kernel architecture	Usable kernels	Cluster software
		Oracle RAC 12c Release 1(12.1.0.2.0)#2#3#4
	2.6.39-200.29.1.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.3.0)#1#2 Oracle RAC 12c Release 1(12.1.0.2.0)#2#3#4
	2.6.39-200.29.2.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.3.0)#1#2 Oracle RAC 12c Release 1(12.1.0.2.0)#2#3#4
	2.6.39-400.211.1.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.4.0)#1#2 Oracle RAC 12c Release 1 (12.1.0.2.0)#1#2
	3.8.13-16.2.1.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.4.0)#1#2 Oracle RAC 12c Release 1 (12.1.0.2.0)#1#2
	3.8.13-44.el6uek.x86_64	Oracle RAC 11g Release 2 (11.2.0.3.0)#1#2
	4.1.12-94.2.1.el6uek.x86_64	Oracle RAC 12c Release 1(12.1.0.2.0)#2#3

#1

Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.

For details, see [Settings for Oracle RAC on page 3-176](#).

#2

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

#3

The following configurations are supported:

- Configurations that include the Automatic Storage Management (ASM) function (raw devices are used) and Oracle Grid Infrastructure
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

#4

You can also use Oracle Cloud File System. In such a case, you need to apply patch P18321597.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-47 Volume managers when using Oracle Unbreakable Enterprise Kernel 6

Kernel architecture	Kernel	Volume manager
IA32	2.6.39-200.24.1.el6uek.i686	LVM2.02.95-10.el6
	2.6.39-200.29.1.el6uek.i686	LVM2.02.87-6.el6
	2.6.39-200.29.2.el6uek.i686	
	2.6.39-400.211.1.el6uek.i686	LVM2.02.98-9.el6 LVM2.02.100-8.el6 [#]
	2.6.39-400.215.10.el6uek.i686	LVM2.02.111-2.el6
	2.6.39-400.250.7.el6uek.i686	LVM2.02.118-2.el6
	2.6.39-400.278.2.el6uek.i686	LVM2.02.143-7.el6
EM64T/AMD64	2.6.39-200.24.1.el6uek.x86_64	LVM2.02.95-10.el6
	2.6.39-200.29.1.el6uek.x86_64	LVM2.02.87-6.el6
	2.6.39-200.29.2.el6uek.x86_64	
	2.6.39-400.211.1.el6uek.x86_64	LVM2.02.98-9.el6
	2.6.39-400.264.1.el6uek.x86_64	
	3.8.13-16.2.1.el6uek.x86_64	LVM2.02.100-8.el6
	3.8.13-44.el6uek.x86_64	
	3.8.13-44.1.1.el6uek.x86_64	
	3.8.13-68.el6uek.x86_64	LVM2.02.100-8.el6
	3.8.13-68.1.3.el6uek.x86_64	
	3.8.13-68.3.4.el6uek.x86_64	LVM2.02.118-2.el6
	4.1.12-37.4.1.el6uek.x86_64	LVM2.02.143-7.el6
	4.1.12-61.1.28.el6uek.x86_64	LVM2.02.143-12.el6
	4.1.12-94.2.1.el6uek.x86_64	
	4.1.12-124.16.4.el6uek.x86_64	LVM2.02.143-12.el6_9.1

#

This is supported only for Oracle Unbreakable Enterprise Kernel 6.5.

File systems supported by HDLM

HDLM supports the following file systems:

Table 3-48 Supported file systems when using Oracle Unbreakable Enterprise Kernel 6

Kernel architecture	Kernel	File system
IA32	2.6.39-200.24.1.el6uek.i686	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS) GFS2 (supplied with the OS) [#]
	2.6.39-200.29.1.el6uek.i686	
	2.6.39-200.29.2.el6uek.i686	
	2.6.39-400.211.1.el6uek.i686	
	2.6.39-400.215.10.el6uek.i686	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS)
	2.6.39-400.250.7.el6uek.i686	
	2.6.39-400.278.2.el6uek.i686	
EM64T/AMD64	2.6.39-200.24.1.el6uek.x86_64	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS) GFS2 (supplied with the OS) [#]
	2.6.39-200.29.1.el6uek.x86_64	
	2.6.39-200.29.2.el6uek.x86_64	
	2.6.39-400.211.1.el6uek.x86_64	
	2.6.39-400.264.1.el6uek.x86_64	
	3.8.13-16.2.1.el6uek.x86_64	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS) Btrfs (supplied with the OS)
	3.8.13-44.el6uek.x86_64	
	3.8.13-44.1.1.el6uek.x86_64	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS) xfs (supplied with the OS) Btrfs (supplied with the OS)
	3.8.13-68.el6uek.x86_64	
	3.8.13-68.1.3.el6uek.x86_64	
	3.8.13-68.3.4.el6uek.x86_64	
	4.1.12-37.4.1.el6uek.x86_64	ext3 (supplied with the OS) ext4 (supplied with the OS)

Kernel architecture	Kernel	File system
	4.1.12-61.1.28.el6uek.x86_64	xfs (supplied with the OS) Btrfs (supplied with the OS)
	4.1.12-94.2.1.el6uek.x86_64	
	4.1.12-124.16.4.el6uek.x86_64	

#

An HDLM device cannot be used as a boot disk.

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-49 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 6 on page 3-62](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-49 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 6

Kernel architecture	Kernel	HBA	Supported storage systems
IA32	2.6.39-200.24.1.el6uek.i686	Emulex QLogic	HUS100 series HUS VM Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series
	2.6.39-200.29.1.el6uek.i686		
	2.6.39-200.29.2.el6uek.i686		
	2.6.39-400.211.1.el6uek.i686		
	2.6.39-400.215.10.el6uek.i686		
	2.6.39-400.250.7.el6uek.i686		
	2.6.39-400.278.2.el6uek.i686		
EM64T/AMD64	2.6.39-200.24.1.el6uek.x86_64		
	2.6.39-200.29.1.el6uek.x86_64		
	2.6.39-200.29.2.el6uek.x86_64		
	2.6.39-400.211.1.el6uek.x86_64		
	2.6.39-400.264.1.el6uek.x86_64		
	3.8.13-16.2.1.el6uek.x86_64		

Kernel architecture	Kernel	HBA	Supported storage systems
	3.8.13-44.el6uek.x86_64		
	3.8.13-44.1.1.el6uek.x86_64		
	3.8.13-68.el6uek.x86_64		
	3.8.13-68.1.3.el6uek.x86_64		
	3.8.13-68.3.4.el6uek.x86_64		
	4.1.12-37.4.1.el6uek.x86_64		
	4.1.12-61.1.28.el6uek.x86_64		
	4.1.12-94.2.1.el6uek.x86_64		
	4.1.12-124.16.4.el6uek.x86_64		

Related products when using Oracle Linux 7

The following describes related products when Oracle Linux 7 is used.

Cluster software supported by HDLM

When you use HDLM in a cluster configuration, you must install the same version of HDLM on all of the nodes that make up the cluster. If different versions of HDLM are installed, the cluster system might not operate correctly. If `HDLM Version` and `Service Pack Version`, which you can display by executing the following command, are the same, then the HDLM versions are also the same:

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

The following table lists the related programs used when creating a cluster.

Table 3-50 Cluster software when using Oracle Linux 7

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	3.10.0-123.el7.x86_64	Oracle RAC 12c Release 1 (12.1.0.2.0)#1#2#3
	3.10.0-693.el7.x86_64	Oracle RAC 11g Release 2(11.2.0.4.0)#2#4#5 Oracle RAC 12c Release 2(12.2.0.1.0)#2#4

#1

Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.

For details, see [Settings for Oracle RAC on page 3-176](#).

#2

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

#3

You can also use Oracle Cloud File System. In such a case, you need to apply patch P18321597.

#4

The following configurations are supported:

- Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.
- Configurations that include the Automatic Storage Management (ASM) function (the ASMLib kernel driver (ASMLib) is used) and Oracle Grid Infrastructure

For details, see [Settings for Oracle RAC on page 3-176](#).

#5

The p18370031 and p19692824 patches must be applied.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-51 Volume managers when using Oracle Linux 7

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	3.10.0-123.el7.x86_64	LVM2.02.105-14.el7
	3.10.0-229.el7.x86_64	LVM2.02.115-3.el7
	3.10.0-327.el7.x86_64	LVM2.02.130-5.el7
	3.10.0-514.el7.x86_64	LVM2.02.166-1.el7
	3.10.0-693.el7.x86_64	LVM2.02.171-8.el7
	3.10.0-693.11.6.el7.x86_64	
	3.10.0-862.el7.x86_64	
	3.10.0-957.el7.x86_64	LVM2.02.180-8.el7
	3.10.0-1062.el7.x86_64	LVM2.02.185-2.0.1.el7

Kernel architecture	Kernel	Volume manager
	3.10.0-1127.el7.x86_64	LVM2.02.186-7.0.1.el7
	3.10.0-1160.el7.x86_64	LVM2.02.187-6.0.3.el7

File systems supported by HDLM

HDLM supports the following file systems:

- ext2 (supplied with the OS)
- ext3 (supplied with the OS)
- ext4 (supplied with the OS)
- xfs (supplied with the OS)

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-52 Operating environments for boot disks when using Oracle Linux 7 on page 3-65](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-52 Operating environments for boot disks when using Oracle Linux 7

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	3.10.0-123.el7.x86_64	Emulex QLogic	HUS100 series HUS VM Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series
	3.10.0-229.el7.x86_64		
	3.10.0-327.el7.x86_64		
	3.10.0-514.el7.x86_64		
	3.10.0-693.el7.x86_64		
	3.10.0-693.11.6.el7.x86_64		
	3.10.0-862.el7.x86_64		
	3.10.0-957.el7.x86_64		
	3.10.0-1062.el7.x86_64		
	3.10.0-1127.el7.x86_64		
	3.10.0-1160.el7.x86_64		

Related products when using Oracle Unbreakable Enterprise Kernel 7

The following describes related products when Oracle Unbreakable Enterprise Kernel 7 is used.

Cluster software supported by HDLM

When you use HDLM in a cluster configuration, you must install the same version of HDLM on all of the nodes that make up the cluster. If different versions of HDLM are installed, the cluster system might not operate correctly. If `HDLM Version` and `Service Pack Version`, which you can display by executing the following command, are the same, then the HDLM versions are also the same:

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

The following table lists the related programs used when creating a cluster.

Table 3-53 Cluster software when using Oracle Unbreakable Enterprise Kernel 7

Kernel architecture	Usable kernels	Cluster software
EM64T/AMD64	3.8.13-44.el7uek.x86_64	Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#1#2}
	4.1.12-61.1.28.el7uek.x86_64	Oracle RAC 12c Release 1 (12.1.0.2.0) ^{#1#2}
	4.1.12-124.16.4.el7uek.x86_64	

#1

Only configurations that include the Automatic Storage Management (ASM) function (using raw devices) and Oracle Grid Infrastructure are supported.

For details, see [Settings for Oracle RAC on page 3-176](#).

#2

It is recommended that you use external redundancy for ASM disk groups. To use normal or high redundancy in an environment in which a multipath configuration is used between servers and storage systems, contact the Oracle Corporation about the necessary Oracle settings.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-54 Volume managers when using Oracle Unbreakable Enterprise Kernel 7

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	3.8.13-44.el7uek.x86_64	LVM2.02.105-14.el7
	3.8.13-55.1.6.el7uek.x86_64	
	3.8.13-68.el7uek.x86_64	
	3.8.13-68.2.2.el7uek.x86_64	
	3.8.13-98.7.1.el7uek.x86_64	LVM2.02.130-5.el7
	3.8.13-118.10.2.el7uek.x86_64	
	4.1.12-61.1.18.el7uek.x86_64	LVM2.02.166-1.el7
	4.1.12-61.1.28.el7uek.x86_64	LVM2.02.166-1.el7 LVM2.02.171-8.0.1.el7
	4.1.12-94.3.9.el7uek.x86_64	LVM2.02.171-8.0.1.el7
	4.1.12-112.16.4.el7uek.x86_64	LVM2.02.177-4.0.1.el7
	4.1.12-124.16.4.el7uek.x86_64	LVM2.02.171-8.0.1.el7 LVM2.02.177-4.0.1.el7
	4.1.12-124.30.1.el7uek.x86_64	
	4.1.12-124.30.1.el7uek.x86_64	LVM2.02.180-8.el7
	4.14.35-1818.3.3.el7uek.x86_64	LVM2.02.180-8.el7
	4.14.35-1902.3.2.el7uek.x86_64	LVM2.02.185-2.0.1.el7
	4.14.35-1902.300.11.el7uek.x86_64	LVM2.02.186-7.0.1.el7
	4.14.35-1902.301.1.el7uek.x86_64	
	5.4.17-2011.6.2.el7uek.x86_64	LVM2.02.187-6.0.3.el7

File systems supported by HDLM

HDLM supports the following file systems:

Table 3-55 Supported file systems when using Oracle Unbreakable Enterprise Kernel 7

Kernel architecture	Kernel	File system
EM64T/AMD64	3.8.13-44.el7uek.x86_64	ext2 (supplied with the OS)
	3.8.13-55.1.6.el7uek.x86_64	ext3 (supplied with the OS)
	3.8.13-68.el7uek.x86_64	ext4 (supplied with the OS)
	3.8.13-68.2.2.el7uek.x86_64	xfs (supplied with the OS)
	3.8.13-98.7.1.el7uek.x86_64	Btrfs (supplied with the OS)
	3.8.13-118.10.2.el7uek.x86_64	
	4.1.12-61.1.18.el7uek.x86_64	
	4.1.12-61.1.28.el7uek.x86_64	
	4.1.12-94.3.9.el7uek.x86_64	
	4.1.12-112.16.4.el7uek.x86_64	
	4.1.12-124.16.4.el7uek.x86_64	
	4.1.12-124.30.1.el7uek.x86_64	
	4.14.35-1818.3.3.el7uek.x86_64	
	4.14.35-1902.3.2.el7uek.x86_64	
	4.14.35-1902.300.11.el7uek.x86_64	
	4.14.35-1902.301.1.el7uek.x86_64	
	5.4.17-2011.6.2.el7uek.x86_64	

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-56 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 7 on page 3-69](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-56 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 7

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	3.8.13-44.el7uek.x86_64	Emulex QLogic	HUS100 series HUS VM
	3.8.13-55.1.6.el7uek.x86_64	Cisco	Virtual Storage Platform series
	3.8.13-68.el7uek.x86_64		VSP 5000 series VSP G1000 series
	3.8.13-68.2.2.el7uek.x86_64		VSP G1500 VSP F1500
	3.8.13-98.7.1.el7uek.x86_64		VSP E series VSP Gx00 models
	3.8.13-118.10.2.el7uek.x86_64		VSP Fx00 models VSP N series
	4.1.12-61.1.18.el7uek.x86_64	Emulex QLogic	
	4.1.12-61.1.28.el7uek.x86_64		
	4.1.12-94.3.9.el7uek.x86_64		
	4.1.12-112.16.4.el7uek.x86_64		
	4.1.12-124.16.4.el7uek.x86_64		
	4.1.12-124.30.1.el7uek.x86_64		
	4.14.35-1818.3.3.el7uek.x86_64		
	4.14.35-1902.3.2.el7uek.x86_64		
	4.14.35-1902.300.11.el7uek.x86_64		
	4.14.35-1902.301.1.el7uek.x86_64		
	5.4.17-2011.6.2.el7uek.x86_64		

Related products when using Oracle Linux 8

The following describes related products when Oracle Linux 8 is used.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-57 Volume managers when using Oracle Linux 8

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	4.18.0-147.el8.x86_64	LVM2.03.05-5.el8
	4.18.0-193.el8.x86_64	LVM2.03.08-3.el8
	4.18.0-240.el8.x86_64	LVM2.03.09-5.el8

File systems supported by HDLM

HDLM supports the following file systems:

- ext2 (supplied with the OS)
- ext3 (supplied with the OS)
- ext4 (supplied with the OS)
- xfs (supplied with the OS)

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-58 Operating environments for boot disks when using Oracle Linux 8 on page 3-70](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-58 Operating environments for boot disks when using Oracle Linux 8

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	4.18.0-147.el8.x86_64	Emulex	HUS100 series
	4.18.0-193.el8.x86_64	Emulex	HUS VM
	4.18.0-240.el8.x86_64	QLogic	Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series

Related products when using Oracle Unbreakable Enterprise Kernel 8

The following describes related products when Oracle Unbreakable Enterprise Kernel 8 is used.

Volume manager supported by HDLM

The following table shows the related programs when using a volume manager.

Table 3-59 Volume managers when using Oracle Unbreakable Enterprise Kernel 8

Kernel architecture	Kernel	Volume manager
EM64T/AMD64	5.4.17-2011.5.3.el8uek.x86_64	LVM2.03.08-3.el8

File systems supported by HDLM

HDLM supports the following file systems:

Table 3-60 Supported file systems when using Oracle Unbreakable Enterprise Kernel 8

Kernel architecture	Kernel	File system
EM64T/AMD64	5.4.17-2011.5.3.el8uek.x86_64	ext2 (supplied with the OS) ext3 (supplied with the OS) ext4 (supplied with the OS) xfs (supplied with the OS) Btrfs (supplied with the OS)

Boot disk environments supported by HDLM

HDLM supports boot disks in any of the environments listed in [Table 3-61 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 8 on page 3-72](#).

For details on the OSs (kernels) that each storage system model supports, see the storage system documentation.

Table 3-61 Operating environments for boot disks when using Oracle Unbreakable Enterprise Kernel 8

Kernel architecture	Kernel	HBA	Supported storage systems
EM64T/AMD64	5.4.17-2011.5.3.el8uek.x86_64	Emulex QLogic	HUS100 series HUS VM Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series

Memory and disk capacity requirements

This section describes memory and disk capacity requirements.

Memory requirements

The following table lists the memory requirements for a host.

Table 3-62 Memory requirements for a host

OS	Required memory
Red Hat Enterprise Linux SUSE LINUX Enterprise Server Oracle Linux 6 Oracle Linux 7 Oracle Linux 8 Oracle Unbreakable Enterprise Kernel	26 MB

Disk requirements

The following table lists the disk capacity requirements for a host.

Table 3-63 Disk capacity requirements for a host

Directory	Disk capacity requirements
/tmp	570 KB

Directory	Disk capacity requirements
/var	$p \text{ MB}^{\#1} + q \text{ MB}^{\#2} + 4 \text{ MB}^{\#3} + u \text{ MB}^{\#4} + 20 \text{ MB}^{\#5} + v \text{ MB}^{\#6} + x \text{ MB}^{\#10} + 65 \text{ MB}$ (220 MB ^{#7})
/opt	168 MB
/etc	$y \text{ MB}^{\#8} + z \text{ MB}^{\#9} + 5.5 \text{ MB}$ (10 MB ^{#7})
/root	580 KB
/sbin	500 KB
/boot	20 MB

#1

This size differs depending on the settings for log files (maximum size: 30 GB).

p is obtained by the following formula:

$$p = (s \times m) / 1024 \text{ [MB]}$$

Where s is the error log file size (unit: KB, default value: 9900) and m is the number of error log files (default value: 2). The result is rounded up to MB.

#2

This size differs depending on the settings for trace files (maximum size: 1000 MB).

q is obtained by using the following formula:

$$q = (t \times n) / 1024 \text{ [MB]}$$

Where t is the trace file size (unit: KB, default value: 9900) and n is the number of trace files (default value: 4). The result is rounded up to MB.

#3

The size of the process-specific-trace information file.

#4

The size of the log file for inquiry information.

u is obtained by using the following formula:

$$u = (2500 \text{ bytes} \times \text{number-of-paths}) / 1024 / 1024 \text{ [MB]}$$

The result is rounded up to MB.

#5

The default value for the size of the log files for Hitachi Command Suite Common Agent Component.

The size of each log file (`d1mwwebagent[1-N].log`) is 9900 KB (approximately 10 MB). The size of the log files is calculated as approximately 20 MB because two log files are created by default.

You can create a maximum of 16 log files depending on the setting in the `dlnwebagent.properties` file. If you create 16 log files, the size of the log files will be approximately 160 MB.

#6

The size of the log files for the `dlnmcfgmgr` utility.

This size differs depending on the settings for the size of the log files for the `dlnmcfgmgr` utility (maximum size: 1954 MB (approximately 2 GB)).

v is obtained by using the following formula:

$$v = (w \times 2) / 1024 \text{ [MB]}$$

Where w is the size of the log files for the `dlnmcfgmgr` utility (unit: KB, default value: 1024).

The result is rounded up to MB.

#7

This is an approximate value when the default values are used for the HDLM functions and when the number of paths is 256.

For details on the values of the HDLM functions, see [*Table 3-80 The recommended and default values of each function on page 3-182.*](#)

#8

The size of the configuration definition file.

y is obtained by using the following formula:

$$y = (2500 \text{ bytes} \times \text{number-of-paths} \times 4) / 1024 / 1024 \text{ [MB]}$$

The result is rounded up to MB.

#9

The size of the file that defines non-HDLM-managed disks.

z is obtained by using the following formula:

$$z = (20 \text{ bytes} \times \text{number-of-non-HDLM-managed-disks} \times 4) / 1024 / 1024 \text{ [MB]}$$

The result is rounded up to MB.

#10

The total size of the files to be backed up by using the utility for creating an HDLM boot disk environment (`dlnbootstart`)

x is calculated as the total of the sizes of the following files.

The file sizes depend on the user environment, so check the file sizes in your environment.

- o `/etc/fstab`
- o `/etc/lvm/lvm.conf`
- o Boot loader configuration file
- o Initial RAM disk image file

Number of LUs and paths that are supported in HDLM

The following table lists the number of LUs and paths that are supported by HDLM.

Table 3-64 Number of LUs and paths that are supported by HDLM

	Target	Supported number
Number of paths per LU	Red Hat Enterprise Linux SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8 Oracle Unbreakable Enterprise Kernel	1 to 64
	SUSE LINUX Enterprise Server 11	1 to 32
Number of LUs for one port in a storage system	SUSE LINUX Enterprise Server 11 Oracle Unbreakable Enterprise Kernel	1 to 512
	Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	1 to 4096 [#]
Total number of paths (Number of LU x Number of paths per LU)	SUSE LINUX Enterprise Server 11 Oracle Unbreakable Enterprise Kernel	1 to 1024
	Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	1 to 8192 [#]
Total number of LUs	SUSE LINUX Enterprise Server 11 Oracle Unbreakable Enterprise Kernel	1 to 512
	Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	1 to 4096 [#]

Target		Supported number
	Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	

#

For a large-scale system configuration in which at least 1,024 paths are managed, a longer time is required to start the host or execute an HDLM configuration definition utility.

Examples of HDLM configuration definition utility execution times and host startup times that are measured in the following environment are listed in [Table 3-65 Examples of HDLM configuration definition utility execution times in a large-scale HDLM operating environment on page 3-76](#) and [Table 3-66 Examples of host startup times in a large-scale HDLM operating environment on page 3-76](#).

CPU: Xeon 3.07GHz×24

Memory: 99 GB

Configuration between the host and storage system: 4,096 LUs x 2 paths (8,192 paths in total)

Table 3-65 Examples of HDLM configuration definition utility execution times in a large-scale HDLM operating environment

HDLM configuration utility	Execution time	Description
<code>dlmcfgmgr -r</code>	4 minutes 31 seconds	Registers the path to an HDLM device.
<code>dlmcfgmgr -o all</code>	9 minutes 34 seconds	Excludes all managed HDLM devices (4,096 devices) from the management targets.
<code>dlmcfgmgr -i all</code>	63 minutes 43 seconds	Includes all unmanaged HDLM devices (4,096 devices) as management targets.
<code>dlmcfgmgr -u all</code>	8 minutes 20 seconds	Deletes all paths (8,192 paths) whose Device column is displayed as a hyphen (-) in the HDLM device configuration information which is displayed by executing <code>dlmcfgmgr -v</code> .

Table 3-66 Examples of host startup times in a large-scale HDLM operating environment

Operating environment	Time required for startup
An environment in which an HDLM device is not used as a boot disk	30 minutes 14 seconds

Operating environment	Time required for startup
An environment in which an HDLM device is used as a boot disk	65 minutes 21 seconds

Virtual environments supported by HDLM

HDLM supports the following virtual environments:

- Logical partitioning feature available on Hitachi Compute Blade blade servers
- Xen

If you choose to use Xen, make sure that HDLM is installed in domain0. The following table shows the Xen hypervisor operating environments supported by HDLM.

Table 3-67 Xen hypervisor operating environments supported by HDLM

OS	Kernel architecture	Kernel	Xen hypervisor version
SUSE LINUX Enterprise Server 11	EM64T/AMD64	3.0.101-63.1-xen	xen-4.4.2_08-1.7
		3.0.101-108.21-xen	
		3.0.101-108.68-xen	
SUSE LINUX Enterprise Server 12	EM64T/AMD64	3.12.28-4-xen	xen-4.4.1_06-2.2
		3.12.59-60.45-xen	xen-4.5.1_12-2.3
		3.12.74-60.64.40-xen	
		4.4.21-69-default	xen-4.7.0_12-23.4
		4.4.103-6.33-default	xen-4.9.0_08-2.2
		4.4.114-94.14-default	
		4.12.14-94.41-default	xen-4.11.0_08-1.11
SUSE LINUX Enterprise Server 15	EM64T/AMD64	4.12.14-120-default	xen-4.12.1_06-1.1
		4.12.14-23-default	xen-4.10.1_04-1.4
		4.12.14-195-default	xen-4.12.0_12-1.1
		5.3.18-22-default	xen-4.13.1_02-1.2

- KVM

If you choose to use KVM, make sure that you use an HDLM management-target device as a virtual device if a guest OS is running. The following table shows the KVM operating environments supported by HDLM.

Table 3-68 KVM operating environments supported by HDLM

OS	Kernel architecture	Kernel	KVM version
Red Hat Enterprise Linux 6 [#]	EM64T/AMD64	2.6.32-71.el6.x86_64	KVM supplied with the OS is supported.
		2.6.32-131.0.15.el6.x86_64	
		2.6.32-220.el6.x86_64	
		2.6.32-279.el6.x86_64	
		2.6.32-358.el6.x86_64	
		2.6.32-358.87.1.el6.x86_64	
		2.6.32-431.el6.x86_64	
		2.6.32-431.87.1.el6.x86_64	
		2.6.32-504.el6.x86_64	
		2.6.32-504.66.1.el6.x86_64	
		2.6.32-573.el6.x86_64	
		2.6.32-573.53.1.el6.x86_64	
		2.6.32-642.el6.x86_64	
		2.6.32-696.el6.x86_64	
		2.6.32-696.23.1.el6.x86_64	
		2.6.32-754.el6.x86_64	
Red Hat Enterprise Linux 7 [#]	EM64T/AMD64	3.10.0-123.el7.x86_64	
		3.10.0-229.el7.x86_64	

OS	Kernel architecture	Kernel	KVM version
		3.10.0-327.el7.x86_64	
		3.10.0-327.64.1.el7.x86_64	
		3.10.0-514.el7.x86_64	
		3.10.0-514.44.1.el7.x86_64	
		3.10.0-693.el7.x86_64	
		3.10.0-693.21.1.el7.x86_64	
		3.10.0-862.el7.x86_64	
		3.10.0-957.el7.x86_64	
		3.10.0-1062.el7.x86_64	
		3.10.0-1127.el7.x86_64	
		3.10.0-1160.el7.x86_64	
Red Hat Enterprise Linux 8 [#]	EM64T/AMD64	4.18.0-147.el8.x86_64	
		4.18.0-193.el8.x86_64	
		4.18.0-240.el8.x86_64	
Oracle Linux 6 [#]	EM64T/AMD64	2.6.32-431.el6.x86_64	
		2.6.32-504.el6.x86_64	
		2.6.32-573.el6.x86_64	
		2.6.32-642.el6.x86_64	
		2.6.32-696.el6.x86_64	
		2.6.32-754.el6.x86_64	

OS	Kernel architecture	Kernel	KVM version
Oracle Unbreakable Enterprise Kernel 6#	EM64T/AMD64	2.6.39-200.24.1.el6uek.x86_64	
		2.6.39-200.29.1.el6uek.x86_64	
		2.6.39-200.29.2.el6uek.x86_64	
		2.6.39-400.211.1.el6uek.x86_64	
		2.6.39-400.264.1.el6uek.x86_64	
		3.8.13-16.2.1.el6uek.x86_64	
		3.8.13-44.el6uek.x86_64	
		3.8.13-44.1.1.el6uek.x86_64	
		3.8.13-68.el6uek.x86_64	
		3.8.13-68.1.3.el6uek.x86_64	
		3.8.13-68.3.4.el6uek.x86_64	
		4.1.12-37.4.1.el6uek.x86_64	
		4.1.12-61.1.28.el6uek.x86_64	
		4.1.12-94.2.1.el6uek.x86_64	
		4.1.12-124.16.4.el6uek.x86_64	
Oracle Linux 7#	EM64T/AMD64	3.10.0-123.el7.x86_64	
		3.10.0-229.el7.x86_64	
		3.10.0-327.el7.x86_64	
		3.10.0-514.el7.x86_64	
		3.10.0-693.el7.x86_64	
		3.10.0-693.11.6.el7.x86_64	

OS	Kernel architecture	Kernel	KVM version
		3.10.0-862.el7.x86_64	
		3.10.0-957.el7.x86_64	
		3.10.0-1062.el7.x86_64	
		3.10.0-1127.el7.x86_64	
		3.10.0-1160.el7.x86_64	
Oracle Unbreakable Enterprise Kernel 7#	EM64T/AMD64	3.8.13-44.el7uek.x86_64	
		3.8.13-55.1.6.el7uek.x86_64	
		3.8.13-68.el7uek.x86_64	
		3.8.13-68.2.2.el7uek.x86_64	
		3.8.13-98.7.1.el7uek.x86_64	
		3.8.13-118.10.2.el7uek.x86_64	
		4.1.12-61.1.18.el7uek.x86_64	
		4.1.12-61.1.28.el7uek.x86_64	
		4.1.12-94.3.9.el7uek.x86_64	
		4.1.12-112.16.4.el7uek.x86_64	
		4.1.12-124.16.4.el7uek.x86_64	
		4.1.12-124.30.1.el7uek.x86_64	
		4.14.35-1818.3.3.el7uek.x86_64	
		4.14.35-1902.3.2.el7uek.x86_64	
		4.14.35-1902.300.11.el7uek.x86_64	
		4.14.35-1902.301.1.el7uek.x86_64	

OS	Kernel architecture	Kernel	KVM version
		5.4.17-2011.6.2.el7uek.x86_64	
Oracle Linux 8 [#]	EM64T/AMD64	4.18.0-147.el8.x86_64	
		4.18.0-193.el8.x86_64	
		4.18.0-240.el8.x86_64	
Oracle Unbreakable Enterprise Kernel 8 [#]	EM64T/AMD64	5.4.17-2011.5.3.el8uek.x86_64	

#

Only the configuration using qcow2 for the file format of a virtual device is supported.

Flow for creating an HDLM environment

Set up the environment to use HDLM as shown in the following diagram.

If you are going to use volume management software, the procedure for building a file system shown in the figure is not required.

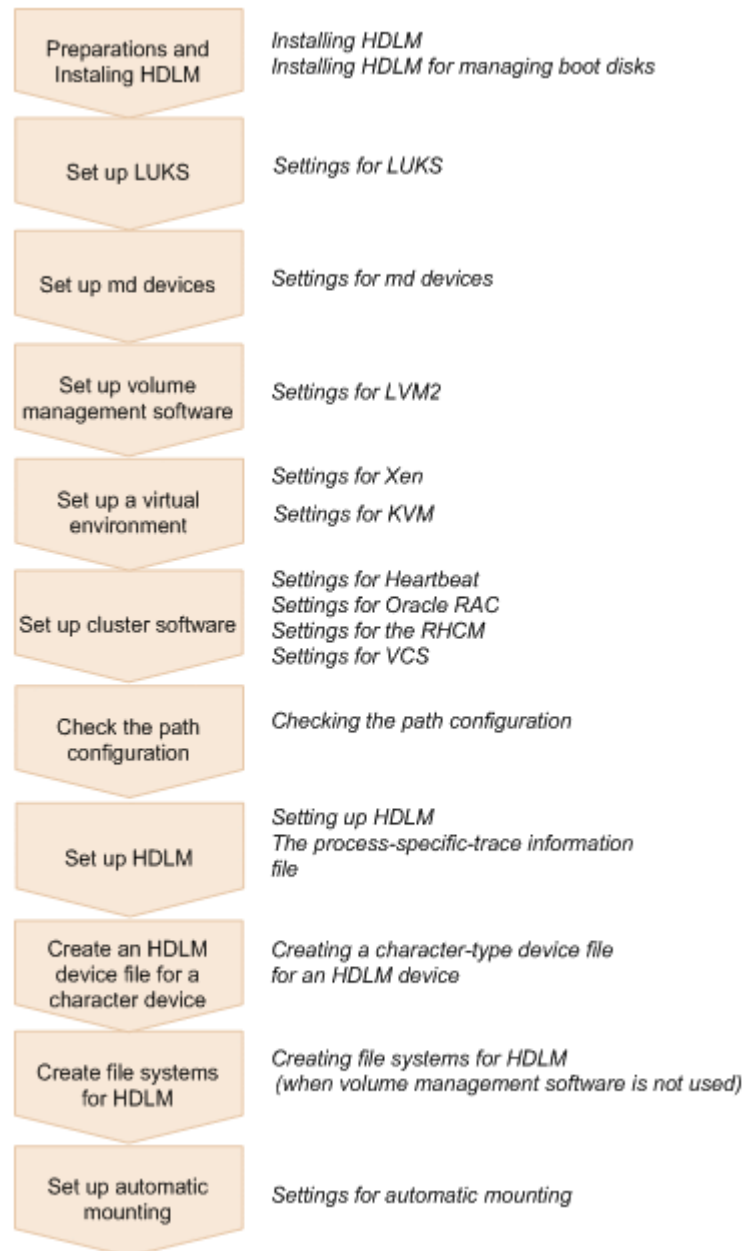


Figure 3-1 Flow of HDLM environment setup

HDLM installation types

This subsection describes the following types of HDLM installation: new installation, upgrade installation, and re-installation.

New installation of HDLM:

Installing HDLM on a server on which HDLM has not been installed is called a *new installation of HDLM*.

Upgrade installation of HDLM:

Installing a new version of HDLM without removing the existing old version is called an *upgrade installation of HDLM*.

Re-installation of HDLM:

Installing the same version of HDLM, to restore the existing version, without first removing that version is called a *re-installation of HDLM*.

Knowledge required before you install HDLM

- You can install HDLM on the following disks or devices:
 - An internal disk on a host machine
 - LUs of storage systems that are used as a boot diskFor details about the storage systems on which HDLM can be installed, see the following sections related to your OS and its version:
 - [Boot disk environments supported by HDLM on page 3-36 in Related products when using Red Hat Enterprise Linux 6 on page 3-20](#)
 - [Boot disk environments supported by HDLM on page 3-46 in Related products when using Red Hat Enterprise Linux 7 on page 3-39](#)
 - [Boot disk environments supported by HDLM on page 3-48 in Related products when using Red Hat Enterprise Linux 8 on page 3-47](#)
 - [Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-51 in Related products when using SUSE LINUX Enterprise Server 11 on page 3-49](#)
 - [Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-54 in Related products when using SUSE LINUX Enterprise Server 12 on page 3-52](#)
 - [Boot disk environments supported by HDLM \(if an FC-SAN is used\) on page 3-55 in Related products when using SUSE LINUX Enterprise Server 15 on page 3-54](#)
 - [Boot disk environments supported by HDLM on page 3-57 in Related products when using Oracle Linux 6 on page 3-56](#)
 - [Boot disk environments supported by HDLM on page 3-62 in Related products when using Oracle Unbreakable Enterprise Kernel 6 on page 3-58](#)
 - [Boot disk environments supported by HDLM on page 3-65 in Related products when using Oracle Linux 7 on page 3-63](#)
 - [Boot disk environments supported by HDLM on page 3-68 in Related products when using Oracle Unbreakable Enterprise Kernel 7 on page 3-66](#)
 - [Boot disk environments supported by HDLM on page 3-70 in Related products when using Oracle Linux 8 on page 3-69](#)

- [Boot disk environments supported by HDLM on page 3-71 in Related products when using Oracle Unbreakable Enterprise Kernel 8 on page 3-71](#)
- HDLM outputs the log information for analyzing errors at the time of installation to a file. The file name, which is the output destination, is `/var/tmp/hdlminstlog/installhdlm[01-10].log`, and the maximum number of files that can be created is 10. If 10 files already exist and you perform another installation, the oldest file is deleted and a new log file is output.
- The following information is inherited from the previous environment even when HDLM is installed during an upgrade installation or re-installation:
 - Information for defining the configuration of an HDLM device
 - Information for setting up HDLM functions
 - Log information
 - Driver configuration

Notes on creating an HDLM environment

This section provides notes on creating an HDLM environment.

For notes on operating HDLM, see [Notes on using HDLM on page 4-2](#).

Notes on hardware settings

- The types of HBA that are installed on one host can be mixed. However, the HBAs connected to an HDLM-managed device must all be of the same type. Also make sure that the HBA driver versions are the same. If the types or versions of HBAs connected to the devices for the HDLM-managed SCSI disks vary, you cannot switch the path when an error occurs.
- You must not change the vendor ID and product ID of the storage system.
If you change these IDs, HDLM cannot recognize the storage system.
- Make sure that you start the storage system before starting the host.
- When a device is added to a PCI bus, and the IRQ is shared with the HBA and other devices, a problem might occur. When adding a device, make sure that the IRQ is not shared with other devices.
- Note the following in an environment where a host is connected to a storage system by using a Fibre Channel switch.
 - If the host starts while the path between the Fibre Channel switch and the storage system is disconnected, the target ID of the path might be changed after the host restarts. At that time, the disconnected path might not be recoverable while the host is running. Also, when you execute the HDLM command to display the path status, the target ID of the path before the change might be displayed or the disconnected path might not be displayed.

In either case, change the disconnected path so that the configuration is the same as that used when that path operated normally. Physically restore the disconnected path in the same configuration where it used to operate normally. If the HDLM device name has been changed, reconfigure the higher-level program.

- If the zone setting for the Fibre Channel switch has changed, the target ID of the path might have also changed. When you execute the HDLM command to display the path status, the target ID of the path before the change might be displayed. In addition, the HDLM device name might be changed after the host is restarted. Check the HDLM device name after the host is restarted. If the HDLM device name has been changed, reconfigure the higher-level program.

However, you can avoid the above situations by setting a permanent target ID for each LU with the HBA driver persistent binding functionality. For details on whether the persistent binding functionality is supported for your HBA driver and the setting method, see the manual provided with the HBA driver.

Notes on Linux

- When installing HDLM, do not configure the setting[#] that prevents the execution of programs under the `/var/tmp` directory.

#

The `noexec` option

If the `noexec` option is specified for the `/var/tmp` directory, you can use the `mount` command to check the settings.

Examples of executing the commands are as follows:

```
# mount
/dev/mapper/vg_uma-lv_rhel73_tmp on /var/tmp type xfs
(rw,nosuid,noexec,relatime,attr2,inode64,noquota)
#
```

Note that if you configure the setting that prevents the execution of programs under the `/var/tmp` directory after installation of HDLM is complete, operation of HDLM is not affected.

- Of the items in the `/etc/lvm/lvm.conf` file, the description formats described in this manual are supported only for the items listed below. For details about the description format for each item, see the relevant descriptions, such as sections [Settings for a multipath boot disk environment on page 3-131](#), [Upgrade installation of HDLM in a boot disk environment on page 3-133](#), and [Notes on using LVM2 on page 3-154](#). Items other than those listed below support only the default values of the OS.

- `filter`
- `global_filter`
- `types`
- `write_cache_state`
- `md_component_detection`

- `use_lvmetad`
- `allow_changes_with_duplicate_pvs`
- HDLM can be installed in or removed from a single-user-mode environment or a multi-user-mode environment.
- Note that, if the `/var` directory is set up on a different partition than the root directory (`/`), no logs will be output to the `/var/log/messages` file until the `/var` directory has been mounted during the OS start process.
- If multiple OSs exist on a disk that differs physically or logically within the same host, HDLM can be installed on each OS. Also, if multiple kernels exist on one OS, HDLM can be used only when the kernel installed with HDLM is started.

Note, however, that if the OS is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8, you can use HDLM even if HDLM is not installed in the running kernel. In this case, no settings are required.

- For Red Hat Enterprise Linux (excluding Red Hat Enterprise Linux 7 and Red Hat Enterprise Linux 8), if HDLM is installed, the `initscripts` package is updated, the OS is restarted, and no HDLM information exists in the `/etc/rc.d/rc.sysinit` file, execute the system script update utility (`dmlupdatesysinit`).

Confirm that the HDLM information is missing by executing the following commands:

```
# grep DLM /etc/rc.d/rc.sysinit
```

If nothing is output after command execution, HDLM information is missing.

For details about the `dmlupdatesysinit` utility, see [dmlupdatesysinit utility for updating system scripts on page 7-57](#).

- In an environment that uses SUSE LINUX Enterprise Server 11, after upgrading the `aaa_base`, `raidtools`, `mdadm`, or `lvm2` package after HDLM installation and then restarting the OS, you must execute the `dmlupdatesysinit` utility to update the system scripts if the following conditions are satisfied:

- An HDLM device for which automatic mounting is specified has not been mounted.
- An md device created on an HDLM device has not been activated.
- An LVM created on an HDLM device has not been activated.
- HDLM information is missing in the `/etc/init.d/boot.localfs` file, the `/etc/init.d/boot.md` file, or the `/etc/init.d/lvm2` file.

Confirm that the HDLM information is missing by executing the following commands:

```
# grep Required-Start /etc/init.d/boot.localfs
# grep Required-Start /etc/init.d/boot.md
# grep Required-Start /etc/init.d/boot.lvm
```

If the information in `boot.hdlm` is not output after command execution, HDLM information is missing.

For details about the `dmlupdatesysinit` utility, see [dmlupdatesysinit utility for updating system scripts on page 7-57](#).

- The **Start Multipath** button on the web console for Red Hat Enterprise Linux 8 is used to start the Device-Mapper multipath service. This button cannot be used to start HDLM.

If you want to use HDLM, do not click the **Start Multipath** button.

- For Red Hat Enterprise Linux 7, you can use the Device-Mapper multipath function to manage some of the LUs that are managed by HDLM. This does not, however, apply if Device-Mapper multipath is used as a boot disk.

The following procedure describes how to separate the LUs that are managed by HDLM from the LUs that are managed by Device-Mapper multipath.

For environments where the boot disk is an HDLM device

- a. For `blacklist` in the `/etc/multipath.conf` file, specify the HDLM devices and LUs that are not managed by the Device-Mapper multipath (LUs managed by HDLM).

The following is an example how to specify `blacklist` in the `/etc/multipath.conf` file.

This example shows the lines (in a configuration file) that specify, for `blacklist`, the LU whose WWID is

360060e8010027810049714c100000025 (an LU that is not managed by the Device-Mapper multipath) and a regular expression for HDLM devices.

```
blacklist {  
    wwid 360060e8010027810049714c100000025  
    devnode "^sddlm[a-z]*"
}
```

- b. Incorporate the `/etc/multipath.conf` file that you changed in step a into the initial RAM disk image file.

The following is an example of how to incorporate the `/etc/multipath.conf` file into the initial RAM disk image file.

In this example, the running kernel is 3.10.0-514.el7.x86_64.

- a. If necessary, back up the initial RAM disk image file.

```
# /bin/cp -a /boot/  
initramfs-3.10.0-514.el7.x86_64.img /boot/  
initramfs-3.10.0-514.el7.x86_64.img_backup
```

- b. Change `hdlm_dracut=n` defined in the `/etc/opt/DynamicLinkManager/hdlm.conf` file to `hdlm_dracut=y`.
- c. Execute the `dracut` command.

```
# /usr/sbin/dracut --force --add multipath --
include /etc/multipath /etc/multipath /boot/
initramfs-3.10.0-514.el7.x86_64.img `uname -r`
```

- c. Restart the host.

```
# shutdown -r now
```

- d. Make sure that the LUs that are not managed by the Device-Mapper multipath are set correctly.

Use the `multipath -l` command to make sure that the LU registered for `blacklist` in step a is not managed by the Device-Mapper multipath.

If the LU registered for `blacklist` is not displayed in the message output by the `multipath -l` command, the LU that is not managed by the Device-Mapper multipath is set correctly.

```
# /usr/sbin/multipath -l
```

- e. Exclude the LUs that are not managed by HDLM (LUs managed by the Device-Mapper multipath) from the management target.

The following is an example of how to exclude an LU that is not managed by HDLM from the management target.

In this example, `/dev/sddlmb` is excluded from the HDLM management target.

```
# /sbin/dlmcfgmgr -o /dev/sddlmb
```

- f. Make sure that the LUs that are not managed by HDLM are set correctly.

Use the `dlmcfgmgr -v` command to make sure that the LU excluded from the management target in step e is no longer managed by HDLM.

If the `Management` status of the LU excluded from the management targets is `unconfigured` in the message output by the `dlmcfgmgr -v` command, the LU that is not managed by HDLM is set correctly.

```
# /sbin/dlmcfgmgr -v
HDevName      Management      Device      Host      Channel
Target  Lun
/dev/sddlmb    unconfigured    /dev/sdc          1
0            0            1
```

For environments where the boot disk is not an HDLM device

- a. For `blacklist` in the `/etc/multipath.conf` file, specify the HDLM devices and LUs that are not managed by the Device-Mapper multipath (LUs managed by HDLM).

The following is an example how to specify `blacklist` in the `/etc/multipath.conf` file.

This example shows the lines (in a configuration file) that specify, for `blacklist`, the LU whose WWID is 360060e8010027810049714c100000025 (an LU that is not managed by the `Device-Mapper multipath`) and a regular expression for HDLM devices.

```
blacklist {
    wwid 360060e8010027810049714c100000025
    devnode "^sddlm[a-z]*)"
}
```

- b. If `Device-Mapper multipath` is incorporated into the initial RAM disk image file, incorporate the file `/etc/multipath.conf`, that you changed in step a, into the initial RAM disk image file. If `Device-Mapper multipath` is not incorporated into the initial RAM disk image file, proceed to step c.

In this example, the running kernel is 3.10.0-514.el7.x86_64.

- a. If necessary, back up the initial RAM disk image file.

```
# /bin/cp -a /boot/
initramfs-3.10.0-514.el7.x86_64.img /boot/
initramfs-3.10.0-514.el7.x86_64.img_backup
```

- b. Execute the `dracut` command.

```
# /usr/sbin/dracut --force --add multipath --
include /etc/multipath /etc/multipath /boot/
initramfs-3.10.0-514.el7.x86_64.img `uname -r`
```

- c. Restart the host.

```
# shutdown -r now
```

- d. Make sure that the LUs that are not managed by the `Device-Mapper multipath` are set correctly.

Use the `multipath -l` command to make sure that the LU registered for `blacklist` in step a is not managed by the `Device-Mapper multipath`.

If the LU registered for `blacklist` is not displayed in the message output by the `multipath -l` command, the LU that is not managed by the `Device-Mapper multipath` is set correctly.

```
# /usr/sbin/multipath -l
```

- e. Exclude the LUs that are not managed by HDLM (LUs managed by the `Device-Mapper multipath`) from the management target.

The following is an example of how to exclude an LU that is not managed by HDLM from the management target.

In this example, `/dev/sddlmab` is excluded from the HDLM management target.

```
# /sbin/dlmcfgmgr -o /dev/sddlmap
```

- f. Make sure that the LUs that are not managed by HDLM are set correctly.

Use the `dlmcfgmgr -v` command to make sure that the LU excluded from the management target in step e is no longer managed by HDLM.

If the `Management` status of the LU excluded from the management targets is `unconfigured` in the message output by the `dlmcfgmgr -v` command, the LU that is not managed by HDLM is set correctly.

```
# /sbin/dlmcfgmgr -v
HDevName      Management      Device      Host      Channel
Target  Lun
/dev/sddlmap  unconfigured  /dev/sdc           1
0          0          1
```

- For OSs other than Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8, you cannot use HDLM along with the `Device-Mapper` multipath function.

You can check whether the `Device-Mapper` multipath function is enabled by checking whether `device-mapper-multipath` is installed and multipath devices are enabled.

Disable multipath devices if `device-mapper-multipath` is installed and if multipath devices are enabled. For details on how to disable multipath devices, see the `device-mapper-multipath` documentation. The examples below show how to check whether `device-mapper-multipath` is installed and whether multipath devices are enabled.

- If multipath devices are enabled:

```
# rpm -q device-mapper-multipath
device-mapper-multipath-0.4.9-46.el6.i686
#
# /sbin/multipath -l
mpathc (360060e801082eea004d4252a000000c6) dm-3 HITACHI,DF600F
size=1.0G features='0' hwhandler='0' wp=rw
|-+- policy='round-robin 0' prio=0 status=active
|  |- 2:0:1:2 sdm 8:192 active undef running
|  `-- 3:0:1:2 sdo 8:224 active undef running
`-+- policy='round-robin 0' prio=0 status=enabled
    |- 3:0:0:2 sdh 8:112 active undef running
    `-- 2:0:0:2 sdi 8:128 active undef running
        :
        :
```

- If multipath devices are disabled:

If you execute the `/sbin/multipath -l` command, no information appears.

```
# /sbin/multipath -l
#
```

- If you use a Hitachi HBA driver (Hitachi FIVE-EX based Fibre Channel to PCIe HBA) in a Red Hat Enterprise Linux 7 environment, create an initial

RAM disk image file while the driver is loaded. In addition, if you perform a re-installation or upgrade installation of the Hitachi HBA driver, re-create an initial RAM disk image file.

- In a QLogic 8400 Series (FCoE) environment, an HDLM device might not be correctly configured when the OS starts.

If the path status is Online(E) or Offline(E), increase the value of `fcoe_boot_delay` in the `/etc/opt/DynamicLinkManager/hdlm.conf` file. For `fcoe_boot_delay`, specify a value (in seconds) from 0 to 86400.

Notes on installing HDLM

- A license key is required to perform a new installation of HDLM. To update the HDLM license, execute the `dlmkmgr` command's `set -lic` operation. The expiration time of the license key is determined by the type of license key specified in the license key file or entered by the user. For information on license key types and the `set` operation, see [set \(sets up the operating environment\) on page 6-15](#).

- For Red Hat Enterprise Linux 8, Oracle Linux 8 and Oracle Unbreakable Enterprise Kernel 8, the following RPM package is required for installing HDLM.

- `tar-RPM package version.rpm`

If the RPM package does not exist, the KAPL09320-E message is output and the installation is terminated. Make sure that the OS you are using meets the prerequisite conditions, and install all required packages. Then, re-install HDLM.

- During the installation of HDLM, a check is performed of whether the use of LVM cache files is enabled.

If the use of LVM cache files is enabled, the KAPL12451-E message is output and the installation is terminated. Disable the use of LVM cache files by performing the action corresponding to the message, and then perform installation again.

- When the `dlmcfmgr` utility is executed to change the HDLM device configuration, memory might become insufficient due to the HAL daemon[#]. In this case, the host will not respond.

To avoid this, stop the HAL daemon when executing the `dlmcfmgr` utility. The following procedure shows how to stop the HAL daemon.

This does not apply to Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 7, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15.

#

The HAL daemon detects hardware configurations changes, for example, when a USB device or CD-ROM is inserted.

To stop the HAL daemon:

- a. Check the status of the HAL daemon.

Execute the `/sbin/service` command to check the HAL daemon status. If the daemon is running, `running` will appear.

```
# /sbin/service haldaemon status
```

If the daemon is not running, `stopped` will appear.

- b. Check the result of step a. If the HAL daemon is running, stop the daemon.

Execute the `/sbin/service` command to stop the HAL daemon. Note that it might take a while to stop the daemon completely.

```
# /sbin/service haldaemon stop
```

- c. Make sure that the HAL daemon is stopped.

Execute the `/sbin/service` command to make sure that the HAL daemon is not running.

```
# /sbin/service haldaemon status
```

- d. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -r` or `dlmcfgmgr -i`) to configure the HDLM device.

```
# /sbin/dlmcfgmgr -r
```

or

```
# /sbin/dlmcfgmgr -i
```

- e. Start the HAL daemon.

Execute the `/sbin/service` command to start the HAL daemon.

```
# /sbin/service haldaemon start
```

- f. Make sure that the HAL daemon is running.

Execute the `/sbin/service` command to make sure that the HAL daemon is running.

```
# /sbin/service haldaemon status
```

Notes on an upgrade installation or re-installation of HDLM

- A license key is required to perform a re-installation or upgrade installation of HDLM after the valid license period has expired. To update the HDLM license, execute the `dlmkmgr` command's `set -lic` operation. The expiration time of the license key is determined by the type of license key specified in the license key file or entered by the user. For information on license key types and the `set` operation, see [set \(sets up the operating environment\) on page 6-15](#).

- The HDLM manager is stopped during an upgrade installation. Therefore, when you perform an upgrade installation, stop any applications that require HDLM manager operations, such as a log output operation.
 - Because the HDLM manager is stopped during an upgrade installation, an error log will not be output. Also, you will not be able to set up HDLM functions. After the upgrade installation finishes successfully, immediately restart the host.
 - Do not cancel an upgrade installation.
- The information set by the HDLM command's `set` operation is inherited even after a reinstallation or upgrade installation of HDLM.
- Before re-installing HDLM, if the `dlnperfinfo` utility (utility for displaying HDLM performance information) is running, press **Ctrl+C** to stop the `dlnperfinfo` utility.

Notes on a Device Manager agent

When installing HDLM on a host where 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`

Notes on linking with Global Link Manager

When you manage HDLM by using Global Link Manager, do not register one HDLM host into two or more Global Link Manager servers.

Installing HDLM

The following section describes how to install HDLM for a new installation, for a re-installation, and for an upgrade installation. Depending on the procedure, the host might have to be restarted after HDLM is installed. HDLM can also be installed by performing an unattended installation, which enables a user to install HDLM without entering information. Select the procedure suitable for your environment.

To create an HDLM device, the HDLM configuration definition utility `dlnmcfmgmgr` is used. For details on the `dlnmcfmgmgr` utility, see [dlnmcfmgmgr utility for managing the HDLM configuration on page 7-26](#).

If you want to install HDLM in a boot disk environment that uses SCSI devices, see [Installing HDLM for managing boot disks on page 3-127](#).

HDLM supports `md` devices in Red Hat Enterprise Linux 6 environments. If you want to perform a new installation of HDLM in an environment where an `md` device has been activated, see [Using HDLM in an `md` device environment on page 3-146](#).

Preparations for a new installation of HDLM

This section describes the preparations required before newly installing HDLM. This includes backing up devices to be managed by HDLM and setting up the hardware and volume management software.

Operations required for devices to be managed by HDLM

If any devices to be managed by HDLM are operating, you need to perform the following procedure.

To prepare a device that is already operating:

1. Terminate all processes of applications that are accessing devices to be managed by HDLM.
2. If necessary, back up all devices that are to be managed by HDLM.
3. Unregister the devices.

If a device to be managed by HDLM is registered in a program, including cluster software (excluding the volume management software), release the registration.

When accessing a device that is to be managed after HDLM installation, the setting name used until now cannot be used for access because the logical device file name for the HDLM device that HDLM creates is used.

4. Unmount the disks.

If the disks to be managed by HDLM were mounted by specifying SCSI devices, unmount them.

First, check the current settings. Execute the following command:

```
# mount
```

The current settings will be output as shown in [Figure 3-2 Execution results of the mount command on page 3-95](#).

```
# mount
/dev/hda5 on / type ext3 (rw)
/dev/sda on /mntpt type ext3 (rw)
none on /proc type proc (rw)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/hda1 on /boot type ext3 (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
none on /dev/shm type tmpfs (rw)
none on /proc/sys/fs/binfmt_misc type binfmt_misc (rw)
#
```

Figure 3-2 Execution results of the mount command

The shaded portion shows the SCSI device to be managed by HDLM. Execute the following command on this SCSI device to unmount it:

```
# umount /mntpt
```

5. If the disks are set to be mounted automatically when the host starts, delete this setting from the `/etc/fstab` file.

An example of how to edit the `/etc/fstab` file is shown in [Figure 3-3 Example of how to edit the `/etc/fstab` file on page 3-96](#).

LABEL=	/	ext3	defaults	1 1
/dev/hda1	/boot	ext3	defaults	1 2
/dev/sda	/mntpt	ext3	defaults,noauto	0 0
none	/dev/pts	devpts	gid=5,mode=620	0 0
none	/proc	proc	defaults	0 0
none	/dev/shm	tmpfs	defaults	0 0
/dev/hda3	swap	swap	defaults	0 0
/dev/cdrom	/mnt/cdrom	iso9660	noauto,owner,kudzu,ro	0 0
/dev/fd0	/mnt/floppy	auto	noauto,owner,kudzu	0 0

Figure 3-3 Example of how to edit the `/etc/fstab` file

Comment out the shaded portions by placing a hash mark (#) at the beginning of each line.

Checking the volume group

If you have already created a physical volume, volume group, or logical volume by using LVM, you can use the procedure described in [Settings for LVM2 on page 3-154](#) only when all of the conditions below are satisfied. Migration is not affected even when a logical volume or file system has been created.

- A physical volume is created for only one of the logical device files on any one path for each SCSI device to be managed by HDLM. In addition, *a volume group is created* for only the physical volume.

This subsection describes how to check whether this condition exists.

- The logical volume is unmounted.

The following explains how to check whether the above condition exists when the volume group `vg02` consists of either one physical volume or two physical volumes. Note that `/dev/sde` and `/dev/sdu` are assumed to be the logical device files of SCSI devices defined for the same device to be managed by HDLM.

To check the physical volumes that belong to the volume group `vg02`, execute the following command:

```
# vgdisplay -v
```

The following figures show examples of command execution when the volume group consists of only one physical volume (condition satisfied) and when the volume group consists of two physical volumes (condition not satisfied).

```

# vgdisplay -v
--- Volume group ---
VG Name          vg02
VG Access         read/write
VG Status         available/resizable
VG #             2
MAX LV           256
Cur LV          0
Open LV          0
MAX LV Size      255.99 GB
Max PV           256
Cur PV          1
Act PV           1
VG Size          2.29 GB
PE Size          4 MB
Total PE         585
Alloc PE / Size  0 / 0
Free PE / Size   585 / 2.29 GB
VG UUID          SCaKcF-17i2-0jxy-m2Xw-YIxfj-XE1h-WuyCkO

--- No logical volumes defined in "vg02" ---

--- Physical volumes ---
PV Name (#)      /dev/sde (1)
PV Status         available / allocatable
Total PE / Free PE 585 / 585

```

Figure 3-4 Result of executing `vgdisplay -v` (when there is one physical volume)

Check the shaded portion and confirm that `vg02` consists of `/dev/sde`.

```

# vdisplay -v
--- Volume group ---
VG Name          vg02
VG Access         read/write
VG Status         available/resizable
VG #             2
MAX LV           256
Cur LV          0
Open LV          0
MAX LV Size      255.99 GB
Max PV           256
Cur PV          2
Act PV           2
VG Size          4.57 GB
PE Size          4 MB
Total PE         1170
Alloc PE / Size  0 / 0
Free PE / Size   1170 / 4.57 GB
VG UUID

--- No logical volumes defined in "vg02" ---

--- Physical volumes ---
PV Name (#)      /dev/sdu (2)
PV Status         available / allocatable
Total PE / Free PE 585 / 585

PV Name (#)      /dev/sde (1)
PV Status         available / allocatable
Total PE / Free PE 585 / 585

```

Figure 3-5 Result of executing `vdisplay -v` (when there are two physical volumes)

Check the shaded portion and confirm that `vg02` consists of `/dev/sde` and `/dev/sdu`, both of which have been defined for the same device to be managed by HDLM.

Setting in the syslog settings file

The log for when the installation is performed is output to syslog. Check the syslog settings file and make sure that the settings are specified so that messages with Error level or higher are to be output. The following figure shows an example of the contents of the settings file when syslog is used in Red Hat Enterprise Linux.

```

# cat /etc/syslog.conf | grep /var/log/messages
*.info;mail.none;authpriv.none;cron.none      /var/log/messages
#

```

Figure 3-6 Example of the contents of the syslogd settings file (in Red Hat Enterprise Linux)

When you collect audit log data, we recommend that you use any of the extended facilities (local0 to local7) as the exclusive output destination for the data. We also recommend that you specify `info` as the severity level for the extended facility. This example shows how to specify the recommended settings in the `/etc/syslog.conf` file:

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

Setting the mount point (in Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8)

In Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8, a DVD-ROM is not automatically mounted.

Create the `/media/cdrom` directory beforehand.

Checking the partition

Confirm that the `/etc/opt` directory is located on the same partition as the root directory (`/`).

Create the `/etc/opt` directory in advance when configuring the OS.

Xen settings

If Xen is being used, make sure that domainU has been stopped. If domainU has been set to automatically start whenever domain0 starts, temporarily change the setting so that domainU will not start automatically.

Performing a new installation of HDLM

This subsection describes how to perform a new installation of HDLM. The preparations before newly installing HDLM are required. For details about the preparations before installing HDLM, see [Preparations for a new installation of HDLM on page 3-95](#).

To perform a new installation of HDLM:

1. Log on to Linux as the root user.
2. Prepare the license key.

Use either of the following methods to store the license key file in the specified directories:

- Store the license key file (*.plk) in the `/var/tmp` directory, under the name `hdlm_license`.

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

- Execute the following commands to create the license key file (`dml.lic_key`) in the `/etc/opt/DynamicLinkManager` directory.

```
# mkdir /etc/opt/DynamicLinkManager
# echo "license-key" >
```

```
/etc/opt/DynamicLinkManager/dlm.lic_key
```

3. Insert the DVD-ROM and mount it.

If the DVD-ROM was not automatically mounted, execute the `mount` command to mount the DVD-ROM to the fixed mount point.

The following shows an example of command execution when the mount point is `/media/cdrom`:

```
# mount /dev/cdrom /media/cdrom
```

The following table lists the fixed mount points for each distribution.

Table 3-69 Mount point for each distribution

Distribution	Mount point
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/media/cdrom
SUSE LINUX Enterprise Server	/media/cdrom If the DVD-ROM is automatically mounted: /media/ <i>media-volume-id</i> #

Note 1

HDLM cannot be installed if the DVD-ROM is mounted to a mount point other than the above.

Note 2

To copy the DVD-ROM to a directory, and then install HDLM from that directory, copy the DVD-ROM to a directory with the same name as the mount point noted above. If the file permissions or the directory structure differs, HDLM cannot be installed.

#

This refers to the volume name for the CD-ROM or other media, formatted for ISO-9660 file systems. Use the `volname` command to check *media-volume-id*.

The following shows an execution example for when *media-volume-id* is VOL01234.

```
# volname /dev/cdrom
VOL01234
#
```

4. Check the version of HDLM.

Execute `installux.sh` or the HDLM installation utility (`installhdlm`) stored on the HDLM DVD-ROM to check the version of HDLM that will be installed.

The following example shows how to execute the command when the mount point for the DVD-ROM is `/media/cdrom`:

- When executing `installux.sh`

```
# /media/cdrom/installux.sh -v
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm -v
```

A command execution example is described below. `x.x.x-xx` is the version of HDLM.

```
KAPL09177-I HDLM version: x.x.x-xx
```

5. Perform the installation.

Execute `installux.sh` or the `installhdlm` utility stored on the HDLM DVD-ROM to start installation.

The following shows an installation execution example for when the DVD-ROM mount point is `/media/cdrom`.

- When executing `installux.sh`

```
# /media/cdrom/installux.sh
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm
```

6. The KAPL09093-I message is displayed to confirm that you want to perform a new installation. Check the HDLM version, and if it is correct, enter `y`.

The license key file will be deleted when installation finishes.

7. Make sure that HDLM is installed.

Execute the following command to display detailed information about the installed package.

```
# rpm -qi HDLM
Name       : HDLM
Version    : x.x.x.x.xxx
Release    : xx
:
```

If HDLM Version is `x.x.x.x.xxx`, the installed version of HDLM is correct. `x.x.x.x.xxx` indicates the HDLM version that was installed.

8. If IP-SAN is used for the connection between the host and the storage system, change `iscsi_boot=n`, written in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, to `iscsi_boot=y`.

In addition, if the QLogic 8400 Series (FCoE) is used to connect the host and the storage system, in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, change `fcoe_boot=n` to `fcoe_boot=y`.

9. If you want to set the HDLM driver options, run the `dldmsetopt` utility.
For details on this utility, see [dldmsetopt utility for setting HDLM driver options on page 7-52](#).
If you performed this step, go to step 12.
10. When you want to install HDLM without restarting the host, go to step 11.
When you want to install HDLM with restarting the host, then go to step 12.
11. Execute the `dldmstart` utility for starting HDLM.
For details, see [dldmstart utility for starting HDLM on page 7-57](#).
12. Add `/opt/DynamicLinkManager/bin` in the environment variable `PATH` in the environment setup file for the shell used by the root user.
Add the following code to the `PATH` environment variable in the environment settings file for the root user. This makes executing the HDLM commands and HDLM utilities easier.

When the BourneAgain shell or Korn shell is used:

```
PATH=$PATH:/opt/DynamicLinkManager/bin ; export PATH
```

When the C shell is used:

```
set path= ( $path /opt/DynamicLinkManager/bin )
```

If the `PATH` environment variable is not set, specify an absolute path to execute commands and utilities.

If you have performed steps 11, go to step 14.

13. Restart the host.
Execute the following command to restart the host:

```
# shutdown -r now
```

A path will be established in the HDLM device and the HDLM manager will start.

14. If you have edited the `/etc/fstab` file as described in [Operations required for devices to be managed by HDLM on page 3-95](#), add the line show below to change the setting from a SCSI device specification to an HDLM device specification.
The Linux functionality that adds `LABEL=` or `UUID=` to a SCSI device is not supported in HDLM. Do not use this functionality.
An example of how to edit the `/etc/fstab` file is shown in the following figure:

<code>LABEL=/</code>	<code>/</code>	<code>ext3</code>	<code>defaults</code>	<code>1 1</code>
<code>/dev/hda1</code>	<code>/boot</code>	<code>ext3</code>	<code>defaults</code>	<code>1 2</code>
<code>#/dev/sda</code>	<code>/mntpt</code>	<code>ext3</code>	<code>defaults,noauto</code>	<code>0 0</code>
<code>/dev/sddlmaa</code>	<code>/mntpt</code>	<code>ext3</code>	<code>defaults,noauto</code>	<code>0 0</code>
<code>none</code>	<code>/dev/pts</code>	<code>devpts</code>	<code>gid=5,mode=620</code>	<code>0 0</code>
<code>none</code>	<code>/proc</code>	<code>proc</code>	<code>defaults</code>	<code>0 0</code>
<code>none</code>	<code>/dev/shm</code>	<code>tmpfs</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/hda3</code>	<code>swap</code>	<code>swap</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/cdrom</code>	<code>/mnt/cdrom</code>	<code>iso9660</code>	<code>noauto,owner,kudzu,ro</code>	<code>0 0</code>
<code>/dev/fd0</code>	<code>/mnt/floppy</code>	<code>auto</code>	<code>noauto,owner,kudzu</code>	<code>0 0</code>

Add the shaded line shown in the above figure.

15. Specify the settings required for using LUKS.

Perform this step if your host OS uses LUKS. If HDLM manages a SCSI device that has been configured to use LUKS, the LUKS settings must be migrated from the SCSI device to an HDLM device.

For details on setting up LUKS, see [Settings for LUKS on page 3-140](#).

16. Specify the settings required for using md devices.

If you want to use md devices, create them in a multi-path environment.

For details about the md device settings, see [Settings for md devices on page 3-142](#).

17. Specify the settings required for using the volume management software.

If the logical volume created with the volume management software is already being used, replace it with a logical volume whose physical volume is an HDLM device.

For details on setting the volume management software, see [Settings for LVM2 on page 3-154](#).

18. Specify the settings required for using virtual environments.

When using Xen, set it up to use HDLM devices in domainU. When using KVM, register HDLM devices into the hardware configuration file.

For details on operating environments for the virtual environments supported by HDLM, see [Virtual environments supported by HDLM on page 3-77](#). For details on how to set up a virtual environment, see [Settings for Xen on page 3-173](#) or [Settings for KVM on page 3-174](#).

19. Specify the settings required for operations in a cluster configuration.

For a cluster configuration, change the logical device file names of SCSI devices specified in the cluster to logical device file names of HDLM devices.

For details on setting the cluster software, see [Settings for Heartbeat on page 3-175](#), [Settings for Oracle RAC on page 3-176](#), [Settings for the RHCM on page 3-179](#), or [Settings for VCS on page 3-180](#).

20. Execute the `dlmkmgr` command's `view` operation to check the HDLM settings and status of each program.

The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlmkmgr view -sys
HDLM Version           : x.x.x-xx
Service Pack Version   :
Load Balance           : on(extended lio)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : on(1)
Reservation Status     :
Intermittent Error Monitor : off
Dynamic I/O Path Control : off(10)
HDLM Manager Ver      : WakeupTime
Alive                 x.x.x-xx   yyyy/mm/dd hh:mm:ss
```

```

HDLM Alert Driver Ver WakeupTime ElogMem Size
Alive x.x.x-xx yyyy/mm/dd hh:mm:ss 1000
HDLM Driver Ver WakeupTime
Alive x.x.x-xx yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#

```

Even when cluster software is being used, Support Cluster is blank. However, the cluster function is operating normally.

21. Check that the correct version of HDLM is installed.
If HDLM version `x.x.x-xx` is displayed, the installed HDLM version is correct. `x.x.x-xx` is the version of the installed HDLM.
22. 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 the programs are not running properly, see [What to do for a program error on page 5-6](#), and then take actions.

After the installation, check the path configuration according to the procedure indicated in [Checking the path configuration on page 3-180](#).

Preparations for an upgrade installation or re-installation of HDLM

This section describes the preparations required before performing an upgrade installation or re-installation of HDLM.

For details on how to re-install HDLM, see [Performing a re-installation of HDLM on page 3-105](#). For details on how to upgrade-install HDLM, see [Performing an upgrade installation of HDLM on page 3-111](#).

Operations required for devices to be managed by HDLM

Before performing an upgrade installation or re-installation of HDLM, you must unmount the HDLM devices that correspond to HDLM-managed devices, and then back up the HDLM-managed devices.

1. Terminate the processes of all applications that access the disks managed by HDLM.
2. Unmount the HDLM devices.
If HDLM-managed devices have been mounted by specifying HDLM devices, unmount them.
3. If necessary, back up HDLM-managed LUs (for example, to a tape or disk). Follow the instructions of the backup software to back up the LUs. Perform this operation if necessary.

Deactivating the md devices

You must deactivate any md devices that are being used before re-installing or upgrading HDLM.

1. Execute the following command to deactivate the md devices:

```
# mdadm -S --scan
```

2. Execute the following command to make sure that the md devices have been deactivated. In the following example, RAID1 (mirroring) is used:

```
# cat /proc/mdstat
Personalities : [raid1]
unused devices: <none>
```

Make sure that `mdx : active` is not displayed.

Deactivating the volume group

If you are using a logical volume on an HDLM device, you must deactivate the volume group before re-installing or upgrading HDLM.

1. Unmount the logical volume on the HDLM device.

In the following example, the logical volume subject to the move has been mounted on `/mnt/lvol1`:

```
# umount /mnt/lvol1
```

2. Deactivate the volume group.

In the following example, the logical volume subject to the move belongs to the `vg01` volume group:

```
# vgchange -an vg01
0 logical volume(s) in volume group "vg01" now active
```

Setting up Xen

If Xen is being used, make sure that `domainU` has been stopped. If `domainU` has been set up to automatically start whenever `domain0` starts, temporarily change the setting so that `domainU` will not start automatically.

Performing a re-installation of HDLM

The following is the procedure for a re-installation. Some preparations before installing HDLM are required. For details about such preparations, see [*Preparations for an upgrade installation or re-installation of HDLM on page 3-104.*](#)

The license key is required when you re-install HDLM after the valid license period has expired.

To perform a re-installation of HDLM:

1. Log on to Linux as the root user.
2. Make sure that no HDLM devices are being used.
Run the following command and make sure either that 0 is displayed for Used for `sddlmfdrv` or that `sddlmfdrv` is not displayed.

```
# /sbin/lsmmod
Module              Size  Used by
:
:
sddlmfdrv            254092  0
```

If `sddlmfdrv` is displayed and a value other than 0 is displayed for `Used`, perform both of the following procedures so that the HDLM devices can no longer be used.

- [Preparations for an upgrade installation or re-installation of HDLM on page 3-104](#)
- [Operations on HDLM-managed devices on page 3-198](#)

3. Prepare the license key.
Store the license key file (*.plk) in the `/var/tmp` directory, under the name `hdlm_license`.

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

Notes on the license key for a re-installation:

When a permanent license key has been entered, you do not need to create the license key file.

When a temporary or emergency license key has been entered, the expiration date for the key is displayed.

If the temporary license key or the emergency license key is expired, you need to update the license key file (`dml.lic_key`) in the `/etc/opt/DynamicLinkManager` directory.

When the license key file is not found during installation, the following message appears, and the process continues: `KAPL09090-W This operation will now be continued without updating the license.`

For details about how to create the license key, see [Performing a new installation of HDLM on page 3-99](#).

For details about the license key, see [Parameters on page 6-16](#).

4. Insert the DVD-ROM and mount it.
If the DVD-ROM was not automatically mounted, execute the `mount` command to mount the DVD-ROM to the fixed mount point.
The following shows an example of command execution when the mount point is `/media/cdrom`:

```
# mount /dev/cdrom /media/cdrom
```

The following table lists the fixed mount points for each distribution.

Table 3-70 Mount point for each distribution

Distribution	Mount point
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/media/cdrom
SUSE LINUX Enterprise Server	/media/cdrom If the DVD-ROM is automatically mounted: /media/ <i>media-volume-id</i> #

Note 1

HDLM cannot be installed if the DVD-ROM is mounted to a mount point other than the above.

Note 2

To copy the DVD-ROM to a directory, and then install HDLM from that directory, copy the DVD-ROM to a directory with the same name as the mount point noted above. If the file permissions or the directory structure differs, HDLM cannot be installed.

#

This refers to the volume name for the CD-ROM or other media, formatted for ISO-9660 file systems. Use the `volname` command to check *media-volume-id*.

The following shows an execution example for when *media-volume-id* is VOL01234.

```
# volname /dev/cdrom
VOL01234
#
```

5. Check the version of HDLM.

Execute `installux.sh` or the HDLM installation utility (`installhdlm`) stored on the HDLM DVD-ROM to check the version of HDLM that will be installed.

The following example shows how to execute the command when the mount point for the DVD-ROM is `/media/cdrom`:

- When executing `installux.sh`

```
# /media/cdrom/installux.sh -v
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm -v
```

A command execution example is described below. x.x.x-xx is the version of HDLM.

```
KAPL09177-I HDLM version: x.x.x-xx
```

6. Perform the installation.

Execute `installux.sh` or the `installhdlm` utility stored on the HDLM DVD-ROM to start installation.

The following shows an installation execution example for when the DVD-ROM mount point is `/media/cdrom`.

- When executing `installux.sh`

```
# /media/cdrom/installux.sh
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm
```

7. The KAPL09093-I message is displayed to confirm that you want to perform an upgrade installation. Check the HDLM version, and if it is correct, enter `y`.

8. Make sure that HDLM is installed.

Execute the following command to display detailed information about the installed package.

```
# rpm -qi HDLM
Name       : HDLM
Version    : x.x.x.x.xxx
Release    : xx
          :
```

If HDLM Version is `x.x.x.x.xxx`, the installed version of HDLM is correct. `x.x.x.x.xxx` indicates the HDLM version that was installed.

9. When you want to set the HDLM driver options, run the `dlnmsetopt` utility for setting HDLM driver option.

For details on this utility, see [dlnmsetopt utility for setting HDLM driver options on page 7-52](#).

If you performed this step, go to step 12.

10. When you want to install HDLM without restarting the host, go to step 11. When you want to install HDLM with restarting the host, then go to step 12.

11. Execute the `dlnmstart` utility for starting HDLM.

For details, see [dlnmstart utility for starting HDLM on page 7-57](#).

12. Add `/opt/DynamicLinkManager/bin` in the environment variable `PATH` in the environment setup file for the shell used by the root user.

Add the following code to the `PATH` environment variable in the environment settings file for the root user. This makes executing the HDLM commands and HDLM utilities easier.

When the BourneAgain shell or Korn shell is used:

```
PATH=$PATH:/opt/DynamicLinkManager/bin ; export PATH
```

When the C shell is used:

```
set path= ( $path /opt/DynamicLinkManager/bin )
```

If the `PATH` environment variable is not set, specify an absolute path to execute commands and utilities.

If you have performed steps 11, go to step 14.

13. Restart the host.

Execute the following command to restart the host:

```
# shutdown -r now
```

A path will be established in the HDLM device and the HDLM manager will start.

14. If you have edited the `/etc/fstab` file as described in [Operations required for devices to be managed by HDLM on page 3-95](#), add the line show below to change the setting from a SCSI device specification to an HDLM device specification.

The Linux functionality that adds `LABEL=` or `UUID=` to a SCSI device is not supported in HDLM. Do not use this functionality.

An example of how to edit the `/etc/fstab` file is shown in the following figure:

<code>LABEL=/</code>	<code>/</code>	<code>ext3</code>	<code>defaults</code>	<code>1 1</code>
<code>/dev/hda1</code>	<code>/boot</code>	<code>ext3</code>	<code>defaults</code>	<code>1 2</code>
<code>*/dev/sda</code>	<code>/mnt/pt</code>	<code>ext3</code>	<code>defaults,noauto</code>	<code>0 0</code>
<code>/dev/sddlmaa</code>	<code>/mnt/pt</code>	<code>ext3</code>	<code>defaults,noauto</code>	<code>0 0</code>
<code>none</code>	<code>/dev/pts</code>	<code>devpts</code>	<code>gid=5,mode=620</code>	<code>0 0</code>
<code>none</code>	<code>/proc</code>	<code>proc</code>	<code>defaults</code>	<code>0 0</code>
<code>none</code>	<code>/dev/shm</code>	<code>tmpfs</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/hda3</code>	<code>swap</code>	<code>swap</code>	<code>defaults</code>	<code>0 0</code>
<code>/dev/cdrom</code>	<code>/mnt/cdrom</code>	<code>iso9660</code>	<code>noauto,owner,kudzu,ro</code>	<code>0 0</code>
<code>/dev/fd0</code>	<code>/mnt/floppy</code>	<code>auto</code>	<code>noauto,owner,kudzu</code>	<code>0 0</code>

Add the shaded line shown in the above figure.

15. Specify the settings required for using LUKS.

Perform this step if your host OS uses LUKS. If HDLM manages a SCSI device that has been configured to use LUKS, the LUKS settings must be migrated from the SCSI device to an HDLM device.

For details on setting up LUKS, see [Settings for LUKS on page 3-140](#).

16. If md devices are used, execute the following command to activate them:

```
# mdadm -A -scan
mdadm: /dev/md0 has been started with 2 drives.
```

17. If md devices are used, execute the following command to make sure that they have been activated.

In the following example, RAID1 (mirroring) is used:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaal[0] sddlmabl[1]
      5238528 blocks [2/2] [UU]

unused devices: <none>
```

Make sure that `md0 : active` is displayed and that the HDLM devices are displayed.

18. Specify the settings required for using the volume management software. If you performed the operations described in [Deactivating the volume group on page 3-105](#), perform the following steps to activate the volume group:

If you did not perform step 13:

Go to step 19.

If you performed step 13:

Go to step 20.

If you do not use the volume management software, go to step 22.

For details on other settings for the volume management software, see [Settings for LVM2 on page 3-154](#).

19. Activate the volume group.

In the following example, the logical volume on the HDLM device belongs to the `vg01` volume group:

```
# vgchange -ay vg01
vgchange -- volume group "vg01" successfully activated
```

20. Mount the logical volume on the HDLM device.

In the following example, the logical volume is `/dev/vg01/lvol1` and the command mounts the volume on `/mnt/lvol1`:

```
# mount /dev/vg01/lvol1 /mnt/lvol1
```

21. Specify the settings required for using virtual environments.

If you are using Xen, set up Xen to use HDLM devices in domainU. If you are using KVM, register HDLM devices into the hardware configuration file.

For details on operating environments for the virtual environments supported by HDLM, see [Virtual environments supported by HDLM on page 3-77](#). For details on how to set up a virtual environment, see [Settings for Xen on page 3-173](#) or [Settings for KVM on page 3-174](#).

22. Specify the settings required for operations in a cluster configuration.

For a cluster configuration, change the logical device file names of SCSI devices specified in the cluster to logical device file names of HDLM devices.

For details on setting the cluster software, see [Settings for Heartbeat on page 3-175](#), [Settings for Oracle RAC on page 3-176](#), [Settings for the RHCM on page 3-179](#), or [Settings for VCS on page 3-180](#).

Performing an upgrade installation of HDLM

The following is the procedure for an upgrade installation. The preparations before installing HDLM are required. For details about the preparations before installing HDLM, see [Preparations for an upgrade installation or re-installation of HDLM on page 3-104](#).

A license key is required if you perform an upgrade installation of HDLM from a version earlier than 5.4 or if you install HDLM 5.4 or a later version after the valid license period has expired.

To perform an upgrade installation of HDLM:

1. Log on to Linux as the root user.
2. If the environment is using LVM, disable the LVM cache. For details, see [Notes on using LVM2 on page 3-154](#).
3. Make sure that no HDLM devices are being used.

Run the following command and make sure either that 0 is displayed for Used for `sddlmfdrv` or that `sddlmfdrv` is not displayed.

```
# /sbin/lsmmod
Module                               Size  Used by
:
:
sddlmfdrv                           254092  0
```

If `sddlmfdrv` is displayed and a value other than 0 is displayed for Used, perform both of the following procedures so that the HDLM devices can no longer be used.

- [Preparations for an upgrade installation or re-installation of HDLM on page 3-104](#)
 - [Operations on HDLM-managed devices on page 3-198](#)
4. Prepare the license key.

Use either of the following methods to store the license key file in the specified directories:

- Store the license key file (*.plk) in the `/var/tmp` directory, under the name `hdlm_license`.

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

- Execute the following commands to create the license key file (`dml.lic_key`) in the `/etc/opt/DynamicLinkManager` directory. If the `/etc/opt/DynamicLinkManager` directory does not exist, use the `mkdir` command to create the directory.

```
# mkdir /etc/opt/DynamicLinkManager
# echo "license-key" > /etc/opt/DynamicLinkManager/dlm.lic_key
```

5. Insert the DVD-ROM and mount it.

If the DVD-ROM was not automatically mounted, execute the `mount` command to mount the DVD-ROM to the fixed mount point.

The following shows an example of command execution when the mount point is `/media/cdrom`:

```
# mount /dev/cdrom /media/cdrom
```

The following table lists the fixed mount points for each distribution.

Table 3-71 Mount point for each distribution

Distribution	Mount point
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/media/cdrom
SUSE LINUX Enterprise Server	/media/cdrom If the DVD-ROM is automatically mounted: /media/ <i>media-volume-id</i> #

Note 1

HDLM cannot be installed if the DVD-ROM is mounted to a mount point other than the above.

Note 2

To copy the DVD-ROM to a directory, and then install HDLM from that directory, copy the DVD-ROM to a directory with the same name as the mount point noted above. If the file permissions or the directory structure differs, HDLM cannot be installed.

#

This refers to the volume name for the CD-ROM or other media, formatted for ISO-9660 file systems. Use the `volname` command to check *media-volume-id*.

The following shows an execution example for when *media-volume-id* is VOL01234.

```
# volname /dev/cdrom
VOL01234
#
```

6. Check the version of HDLM.

Execute `installux.sh` or the HDLM installation utility (`installhdlm`) stored on the HDLM DVD-ROM to check the version of HDLM that will be installed.

The following example shows how to execute the command when the mount point for the DVD-ROM is `/media/cdrom`:

- When executing `installux.sh`

```
# /media/cdrom/installux.sh -v
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm -v
```

A command execution example is described below. `x.x.x-xx` is the version of HDLM.

```
KAPL09177-I HDLM version: x.x.x-xx
```

7. Perform the installation.

Execute `installux.sh` or the `installhdlm` utility stored on the HDLM DVD-ROM to start installation.

The following shows an installation execution example for when the DVD-ROM mount point is `/media/cdrom`.

- When executing `installux.sh`

```
# /media/cdrom/installux.sh
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm
```

8. The KAPL09093-I message is displayed to confirm that you want to perform an upgrade installation. Check the HDLM version, and if it is correct, enter `y`.

9. Make sure that HDLM is installed.

Execute the following command to display detailed information about the installed package.

```
# rpm -qi HDLM
Name       : HDLM
Version    : x.x.x.x.xxx
Release    : xx
:
```

If HDLM Version is `x.x.x.x.xxx`, the installed version of HDLM is correct. `x.x.x.x.xxx` indicates the HDLM version that was installed.

10. If IP-SAN is used for the connection between the host and the storage system, change `iscsi_boot=n`, written in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, to `iscsi_boot=y`.

In addition, if the QLogic 8400 Series (FCoE) is used to connect the host and the storage system, in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, change `fcoe_boot=n` to `fcoe_boot=y`.

11. When you want to set the HDLM driver options, run the `dlnmsetopt` utility for setting HDLM driver option.
For details on this utility, see [dlnmsetopt utility for setting HDLM driver options on page 7-52](#).
If you performed this step, go to step 14.
12. When you want to install HDLM without restarting the host, go to step 13. When you want to install HDLM with restarting the host, then go to step 14.
13. Execute the `dlnmstart` utility for starting HDLM.
For details, see [dlnmstart utility for starting HDLM on page 7-57](#).
14. Add `/opt/DynamicLinkManager/bin` in the environment variable `PATH` in the environment setup file for the shell used by the root user.
Add the following code to the `PATH` environment variable in the environment settings file for the root user. This makes executing the HDLM commands and HDLM utilities easier.

When the BourneAgain shell or Korn shell is used:

```
PATH=$PATH:/opt/DynamicLinkManager/bin ; export PATH
```

When the C shell is used:

```
set path= ( $path /opt/DynamicLinkManager/bin )
```

If the `PATH` environment variable is not set, specify an absolute path to execute commands and utilities.

If you have performed steps 13, go to step 16.

15. Restart the host.
Execute the following command to restart the host:

```
# shutdown -r now
```

A path will be established in the HDLM device and the HDLM manager will start.

16. If you have edited the `/etc/fstab` file as described in [Operations required for devices to be managed by HDLM on page 3-95](#), add the line show below to change the setting from a SCSI device specification to an HDLM device specification.
The Linux functionality that adds `LABEL=` or `UUID=` to a SCSI device is not supported in HDLM. Do not use this functionality.
An example of how to edit the `/etc/fstab` file is shown in the following figure:

LABEL=/	/	ext3	defaults	1 1
/dev/hda1	/boot	ext3	defaults	1 2
*/dev/sda	/mnt/pt	ext3	defaults,noauto	0 0
/dev/sddlmaa	/mnt/pt	ext3	defaults,noauto	0 0
none	/dev/pts	devpts	gid=5,mode=620	0 0
none	/proc	proc	defaults	0 0
none	/dev/shm	tmpfs	defaults	0 0
/dev/hda3	swap	swap	defaults	0 0
/dev/cdrom	/mnt/cdrom	iso9660	noauto,owner,kudzu,ro	0 0
/dev/fd0	/mnt/floppy	auto	noauto,owner,kudzu	0 0

Add the shaded line shown in the above figure.

17. Specify the settings required for using LUKS.

Perform this step if your host OS uses LUKS. If HDLM manages a SCSI device that has been configured to use LUKS, the LUKS settings must be migrated from the SCSI device to an HDLM device.

For details on setting up LUKS, see [Settings for LUKS on page 3-140](#).

18. If md devices are used, execute the following command to activate them:

```
# mdadm -A -scan
mdadm: /dev/md0 has been started with 2 drives.
```

19. If md devices are used, execute the following command to make sure that they have been deactivated.

In the following example, RAID1 (mirroring) is used:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaa1[0] sddlmaa1[1]
      5238528 blocks [2/2] [UU]

unused devices: <none>
```

Make sure that md0 : active is displayed and that the HDLM devices are displayed.

20. Specify the settings required for using the volume management software.

If you performed the operations described in [Deactivating the volume group on page 3-105](#), perform the following steps to activate the volume group:

If you did not perform step 15:

Go to step 21.

If you performed step 15:

Go to step 22.

If you do not use the volume management software, go to step 24.

For details on other settings for the volume management software, see [Settings for LVM2 on page 3-154](#).

21. Activate the volume group.

In the following example, the logical volume subject to the move belongs to the vg01 volume group:

```
# vgchange -ay vg01
```

```
vgchange -- volume group "vg01" successfully activated
```

22. Mount the logical volume that was moved.

In the following example, the logical volume is `/dev/vg01/lvol1` and the command mounts the volume on `/mnt/lvol1`:

```
# mount /dev/vg01/lvol1 /mnt/lvol1
```

23. Specify the settings required for using virtual environments.

If you are using Xen, set up Xen to use HDLM devices in domainU. If you are using KVM, register HDLM devices into the hardware configuration file. For details on operating environments for the virtual environments supported by HDLM, see [Virtual environments supported by HDLM on page 3-77](#). For details on how to set up a virtual environment, see [Settings for Xen on page 3-173](#) or [Settings for KVM on page 3-174](#).

24. Specify the settings required for operations in a cluster configuration.

For a cluster configuration, change the logical device file names of SCSI devices specified in the cluster to logical device file names of HDLM devices.

For details on setting the cluster software, see [Settings for Heartbeat on page 3-175](#), [Settings for Oracle RAC on page 3-176](#), [Settings for the RHCM on page 3-179](#), or [Settings for VCS on page 3-180](#).

Unattended installation of HDLM

When you perform a new installation, re-installation, or upgrade installation of HDLM, you can choose an unattended installation. An unattended installation enables a user to install HDLM without entering information.

The procedure for performing an unattended installation of HDLM is described below. Note that preparations before installing HDLM are required. For details about the preparations before performing a new installation of HDLM, see [Preparations for a new installation of HDLM on page 3-95](#). For details about the preparations before performing a re-installation or an upgrade installation of HDLM, see [Preparations for an upgrade installation or re-installation of HDLM on page 3-104](#).

1. Log on to Linux as the root user.
2. If the environment is using LVM, disable the LVM cache. For details, see [Notes on using LVM2 on page 3-154](#).
3. Make sure that no HDLM devices are being used.

In the case of a re-installation or an upgrade installation, run the following command and make sure either that 0 is displayed for `Used` for `sddlmfdrv` or that `sddlmfdrv` is not displayed.

```
# /sbin/lsmmod
Module                               Size  Used by
:
:
```

If `sddlmfdrv` is displayed and a value other than 0 is displayed for `Used`, perform both of the following procedures so that the HDLM devices can no longer be used.

- [Preparations for an upgrade installation or re-installation of HDLM on page 3-104](#)
 - [Operations on HDLM-managed devices on page 3-198](#)
4. In the following cases, prepare the license key or the license key file:
- If you are installing HDLM for the first time
 - If you are upgrading or re-installing HDLM after the licensing term has expired

If the directory that contains the license key or the license key file is specified in the installation information settings file, you can use any storage directory name and file name. The license key file or license key is not deleted after the installation.

For an unattended installation, you can specify any directory to store the license key file. For details, see [Editing an installation-information settings file on page 7-60](#).

5. Insert the DVD-ROM and mount it.

If the DVD-ROM was not automatically mounted, execute the `mount` command to mount the DVD-ROM to the fixed mount point.

The following shows an example of command execution when the mount point is `/media/cdrom`:

```
# mount /dev/cdrom /media/cdrom
```

The following table lists the fixed mount points for each distribution.

Table 3-72 Mount point for each distribution

Distribution	Mount point
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	<code>/media/cdrom</code>
SUSE LINUX Enterprise Server	<code>/media/cdrom</code> If the DVD-ROM is automatically mounted: <code>/media/media-volume-id #</code>

Note 1

HDLM cannot be installed if the DVD-ROM is mounted to a mount point other than the above.

Note 2

To copy the DVD-ROM to a directory, and then install HDLM from that directory, copy the DVD-ROM to a directory with the same name as

the mount point noted above. If the file permissions or the directory structure differs, HDLM cannot be installed.

#

This refers to the volume name for the CD-ROM or other media, formatted for ISO-9660 file systems. Use the `volname` command to check *media-volume-id*.

The following shows an execution example for when *media-volume-id* is VOL01234.

```
# volname /dev/cdrom
VOL01234
#
```

6. Check the version of HDLM.

Execute `installux.sh` or the HDLM installation utility (`installhdlm`) stored on the HDLM DVD-ROM to check the version of HDLM that will be installed.

The following example shows how to execute the command when the mount point for the DVD-ROM is `/media/cdrom`:

- When executing `installux.sh`

```
# /media/cdrom/installux.sh -v
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm -v
```

A command execution example is described below. `x.x.x-xx` is the version of HDLM.

```
KAPL09177-I HDLM version: x.x.x-xx
```

7. Create an installation information settings file.

Edit the installation information settings file based on your desired settings. Specify any settings that are not specified in this file after installing HDLM, as necessary.

To use the sample file, copy it from the DVD-ROM to a directory on the hard disk. Note that the sample file name can be changed to any name.

The following shows an installation execution example for when the DVD-ROM mount point is `/media/cdrom`.

```
# cp -p /media/cdrom/HDLM_Linux/config/sample_installhdlm.conf /
any-directory/any-file-name
```

For details about how to edit the installation information settings file, which is used by the `installhdlm` utility, see [Editing an installation-information settings file on page 7-60](#).

Note

If the QLogic 8400 Series (FCoE) is used to connect the host and the storage system, do not specify to restart the host.

8. Perform the installation.

Execute `installux.sh` or the `installhdlm` utility stored on the HDLM DVD-ROM to start installation.

The following shows an installation execution example for when the DVD-ROM mount point is `/media/cdrom`.

- When executing `installux.sh`

```
# /media/cdrom/installux.sh -f /any-directory/installation-  
information-settings-file
```

- When executing the `installhdlm` utility

```
# /media/cdrom/HDLM_Linux/installhdlm -f /any-directory/  
installation-information-settings-file
```

Note that, if you edited the installation information settings file in step 7 so that the host is restarted, the host is automatically restarted.

9. Make sure that HDLM is installed.

Execute the following command to display detailed information about the installed package.

```
# rpm -qi HDLM  
Name       : HDLM  
Version    : x.x.x.x.xxx  
Release    : xx  
          :
```

If HDLM Version is `x.x.x.x.xxx`, the installed version of HDLM is correct. `x.x.x.x.xxx` indicates the HDLM version that was installed.

10. If IP-SAN is used for the connection between the host and the storage system, change `iscsi_boot=n`, written in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, to `iscsi_boot=y`.

In addition, if the QLogic 8400 Series (FCoE) is used to connect the host and the storage system, in the `/etc/opt/DynamicLinkManager/hdlm.conf` file, change `fcoe_boot=n` to `fcoe_boot=y`.

11. If you want to set the HDLM driver options, run the `dlnmsetopt` utility.

For details on this utility, see [dlnmsetopt utility for setting HDLM driver options on page 7-52](#).

12. Add `/opt/DynamicLinkManager/bin` in the environment variable `PATH` in the environment setup file for the shell used by the root user.

Add the following code to the `PATH` environment variable in the environment settings file for the root user. This makes executing the HDLM commands and HDLM utilities easier.

When the BourneAgain shell or Korn shell is used:

```
PATH=$PATH:/opt/DynamicLinkManager/bin ; export PATH
```

When the C shell is used:

```
set path= ( $path /opt/DynamicLinkManager/bin )
```

If the PATH environment variable is not set, specify an absolute path to execute commands and utilities.

13. If you have edited the `/etc/fstab` file as described in [Operations required for devices to be managed by HDLM on page 3-95](#), add the line show below to change the setting from a SCSI device specification to an HDLM device specification.

The Linux functionality that adds LABEL= or UUID= to a SCSI device is not supported in HDLM. Do not use this functionality.

An example of how to edit the `/etc/fstab` file is shown in the following figure:

LABEL=/	/	ext3	defaults	1 1
/dev/hda1	/boot	ext3	defaults	1 2
*/dev/sda	/mnt/pt	ext3	defaults,noauto	0 0
/dev/sddlmaa	/mnt/pt	ext3	defaults,noauto	0 0
none	/dev/pts	devpts	gid=5,mode=620	0 0
none	/proc	proc	defaults	0 0
none	/dev/shm	tmpfs	defaults	0 0
/dev/hda3	swap	swap	defaults	0 0
/dev/cdrom	/mnt/cdrom	iso9660	noauto,owner,kudzu,ro	0 0
/dev/fd0	/mnt/floppy	auto	noauto,owner,kudzu	0 0

Add the shaded line shown in the above figure.

14. Specify the settings required for using LUKS.
Perform this step if your host OS uses LUKS. If HDLM manages a SCSI device that has been configured to use LUKS, the LUKS settings must be migrated from the SCSI device to an HDLM device.
For details on setting up LUKS, see [Settings for LUKS on page 3-140](#).
15. Specify the settings required for using md devices.
If you want to use md devices, create them in a multi-path environment.
For details about the md device settings, see [Settings for md devices on page 3-142](#).
16. Specify the settings required for using the volume management software.
If you performed the operations described in [Deactivating the volume group on page 3-105](#), perform the following steps to activate the volume group:

If you did not edit the installation information settings file in step 7 so that the host is restarted:

Go to step 17.

If you edited the installation information settings file in step 7 so that the host is restarted:

Go to step 18.

If you do not use the volume management software, go to step 20.

For details on other settings for the volume management software, see [Settings for LVM2 on page 3-154](#).

17. Activate the volume group.

In the following example, the logical volume subject to the move belongs to the `vg01` volume group:

```
# vgchange -ay vg01
vgchange -- volume group "vg01" successfully activated
```

18. Mount the logical volume that was moved.

In the following example, the logical volume is `/dev/vg01/lvol1` and the command mounts the volume on `/mnt/lvol1`:

```
# mount /dev/vg01/lvol1 /mnt/lvol1
```

19. Specify the settings required for using virtual environments.

If you are using Xen, set up Xen to use HDLM devices in domainU. If you are using KVM, register HDLM devices into the hardware configuration file.

For details on operating environments for the virtual environments supported by HDLM, see [Virtual environments supported by HDLM on page 3-77](#). For details on how to set up a virtual environment, see [Settings for Xen on page 3-173](#) or [Settings for KVM on page 3-174](#).

20. Specify the settings required for operations in a cluster configuration.

For a cluster configuration, change the logical device file names of SCSI devices specified in the cluster to logical device file names of HDLM devices.

For details on setting the cluster software, see [Settings for Heartbeat on page 3-175](#), [Settings for Oracle RAC on page 3-176](#), [Settings for the RHCM on page 3-179](#), or [Settings for VCS on page 3-180](#).

Disk replication OS installation

This subsection explains how to use the Master Image Deployment functionality of Hitachi Compute Systems Manager (Compute Systems Manager) or the disk replication functionality of Deployment Manager to replicate an environment to which HDLM has been installed. Also, see the Compute Systems Manager manual as necessary.

This method can be used in the following environment:

- Red Hat Enterprise Linux 6

Important

When creating a disk image file on the replication-source host, be sure to reduce the number of LUs recognized by the replication-source host to 256 or less. You can increase the number of LUs to the maximum number of LUs that can be supported by HDLM on the replication-destination host after distributing the disk image file to the replication-destination host.

For Red Hat Enterprise Linux 6 (using UUID for the kernel parameter)

The following procedure shows how to use UUID for the kernel parameter for Red Hat Enterprise Linux 6:

1. Back up the replication-source host.
Use the System-level Backup functionality of Compute Systems Manager or Deployment Manager to back up the replication-source host so that you can restore the replication-source host after the replication or in the event that an installation error occurs for the disk replication OS.
2. Check the HDLM devices specified in the `/etc/fstab` file on the replication-source host.
To create a disk image of the replication-source host, change the description of the HDLM devices so that the disk image uses UUID.
The following is an example of the `/etc/fstab` file in which HDLM devices are specified:

```
        :  
/dev/sddlmaa1      /boot                ext4      defaults  1 2  
        :  
/dev/sddlmaa3      swap                  swap      defaults  0 0  
        :
```

3. Verify that `UUID` shows the HDLM devices on the replication-source host.

An example of executing the command is as follows:

```
# /sbin/blkid -c /dev/null /dev/sddlmaa1  
/dev/sddlmaa1: UUID="a136da75-c151-472d-ac5c-20f165f93776"  
TYPE="ext4"
```

Verify that `UUID` shows `a136da75-c151-472d-ac5c-20f165f93776`.

The following is an output example when the `UUID` setting is not configured.

When the partition type is not swap and the file system type is ext4:

```
# /sbin/blkid -c /dev/null /dev/sddlmaa1  
/dev/sddlmaa1: TYPE="ext4"
```

When the partition type is swap:

```
# /sbin/blkid -c /dev/null /dev/sddlmaa3  
/dev/sddlmaa3: TYPE="swap"
```

When the `UUID` setting is not configured, use the method below to configure the `UUID` setting.

When the partition type is not swap and the file system type is ext4:

- a. Execute the `tune2fs` command to configure the `UUID` setting.

An example of executing the command is as follows:

```
# /sbin/tune2fs -U `/usr/bin/uuidgen` /dev/sddlmaa1  
tune2fs 1.39 (29-May-2006)
```

- b. Execute the `blkid` command to verify that the `UUID` setting is configured.

An example of executing the command is as follows:

```
# /sbin/blkid -c /dev/null /dev/sddlmaa1  
/dev/sddlmaa1: UUID="9cc2f846-cb45-4506-927b-a3c1e3f7b8a2"  
TYPE="ext4"
```

When the partition type is swap:

- a. Execute the `swapoff` command to disable a swap device.

An example of executing the command is as follows:

```
# /sbin/swapoff /dev/sddlmaa3
```

- b. Execute the `mkswap` command to re-create the swap device and apply the `UUID` setting to the device.

An example of executing the command is as follows:

```
# /sbin/mkswap -U `/usr/bin/uuidgen` /dev/sddlmaa3
mkswap: /dev/sddlmaa3: warning: don't erase bootbits sectors
on whole disk. Use -f to force.
Setting up swapspace version 1, size = 2097148 KiB
no label, UUID=ae3d45f6-202e-48c5-9050-c04f172a95fe
```

- c. Execute the `swapon` command to enable the swap device.

An example of executing the command is as follows:

```
# /sbin/swapon /dev/sddlmaa3
```

- d. Execute the `blkid` command to verify that the `UUID` setting is applied.

An example of executing the command is as follows:

```
# /sbin/blkid -c /dev/null /dev/sddlmaa3
/dev/sddlmaa3: UUID="ae3d45f6-202e-48c5-9050-c04f172a95fe"
TYPE="swap"
```

4. Edit the `/etc/fstab` file on the replication-source host.

An example of editing the `/etc/fstab` file is shown below.

(Before change)

```
:
/dev/sddlmaa1      /boot             ext4      defaults  1 2
:
/dev/sddlmaa3      swap              swap      defaults  0 0
:
```

(After change)

```
:
#/dev/sddlmaa1     /boot             ext4      defaults  1 2
UUID=a136da75-c151-472d-ac5c-20f165f93776 /boot ext4
defaults 1 2
:
#/dev/sddlmaa3     swap              swap      defaults  0 0
UUID=898c0125-39b1-4e0d-9dad-4118de688349 swap swap defaults
0 0
:
```

- a. Copy the lines for HDLM devices.
- b. Comment out the copy-source lines by placing a hash mark (#) at the beginning of each of the lines.
- c. Change the HDLM devices in the copied data to the format used for `LABEL`.

5. Prepare for replication on the replication-source host.

For Compute Systems Manager:

From the replication-source host, access the Compute Systems Manager web client. From the **Tools** menu, choose the **Download** command to download the Sysprep tool for Linux. Decompress the tool on the replication-source host and execute the following command:

decompression-destination-directory-of-Sysprep-tool/linuxrep/LinuxRepSetUp

For Deployment Manager:

Execute the following command on the replication-source host. *mount-point-of-the-Deployment-Manager-installation-media/Linux/host-architecture/bin/linuxrep/LinuxRepSetUp*

6. For Compute Systems Manager, create a Master Image for replication.
For Deployment Manager, create a disk image of the replication-source host.
For Compute Systems Manager:
Use Compute Systems Manager to obtain a snapshot of the replication-source host.
For Deployment Manager:
Use Deployment Manager to back up the replication-source host disk.
7. Restore the status of the replication-source host.
For Compute Systems Manager:
If you want to continue to use the replication-source host for operation, use the System-level Restore functionality of Compute Systems Manager to restore the image backed up in step 1 to the replication-source host.
For Deployment Manager:
If you want to continue to use the replication-source host for operation, use Deployment Manager to restore the image backed up in step 1 to the replication-source host.
8. For Compute Systems Manager, input the deployment template information about the replication-destination host.
For Deployment Manager, create a disk replication information file for the replication-destination host.
For Compute Systems Manager:
Use Compute Systems Manager to input the Deployment Template information about the replication-destination host.
For Deployment Manager:
Use Deployment Manager to create a disk replication information file for the replication-destination host.
9. For Compute Systems Manager, distribute the Master Image to the replication-destination host.
For Deployment Manager, distribute the disk image to the replication-destination host.
For Compute Systems Manager:
On the replication-destination host, execute the Master Image Deployment functionality of Compute Systems Manager by using the information created in step 6 and the information input in step 8.
For Deployment Manager:

Use Deployment Manager to distribute the disk image to the replication-destination host.

10. On the destination host, check the correspondence between the mount points of file systems and devices, and the devices that are used as swap devices.

A new HDLM device configuration is created on the destination host. Because of this, different HDLM device names are used between the replication-source host and the replication-destination host.

Execute the `mount` command to check the correspondence between the mount points of the file systems and devices in the `/etc/fstab` file. In addition, execute the `swapon -s` command to check the devices used as swap devices.

The following examples show how to use commands when the `/boot` line and the `swap` line are edited in step 4. In the execution results, HDLM devices might be output or SCSI devices might be output.

When an HDLM device is output

Examples of executing the commands are as follows:

```
# /bin/mount
:
/dev/sddlma1 on /boot type ext4 (rw)
:
/boot corresponds to /dev/sddlma1.
# /sbin/swapon -s
Filename                Type                Size      Used      Priority
/dev/sddlma3            partition          4095992    0         -1
swap corresponds to /dev/sddlma3.
```

When HDLM devices are output, go to step 12.

When a SCSI device is output

Examples of executing the commands are as follows:

```
# /bin/mount
:
/dev/sda1 on /boot type ext4 (rw)
:
/boot corresponds to /dev/sda1.
# /sbin/swapon -s
Filename                Type                Size      Used      Priority
/dev/sda3              partition          4095992    0         -1
swap corresponds to /dev/sda3.
```

11. On the replication-destination host, execute the HDLM configuration definition utility (`dlmcfmgr`) with the `-v` parameter to check the correspondence between the HDLM devices and SCSI devices.

An example of executing the command is as follows:

```
# /sbin/dlmcfmgr -v
HDevName      Management      Device      Host      Channel
Target  Lun
/dev/sddlmaa   configured      -           2         0
0           0
1           0
```

```

/dev/sddlmaab    configured    /dev/sda    3        0
0              0
                                /dev/sdb    3        0
1              0

```

KAPL10302-I /sbin/dlmcfgmgr completed normally.

The SCSI device /dev/sda and /dev/sdb correspond to the HDLM device /dev/sddlmaab.

It does not matter if - is displayed in the Device column.

12. Edit the /etc/fstab file on the replication-destination host.

Edit the /etc/fstab file based on the checked results in steps 10 and 11 (this step is performed only when SCSI devices are output in step 10).

Examples of editing the /etc/fstab file which was edited in step 4 are as follows:

(Before change)

```

:
#/dev/sddlmaa1      /boot                ext4 defaults 1 2
UUID=a136da75-c151-472d-ac5c-20f165f93776 /boot ext4
defaults 1 2
:
#/dev/sddlmaa3      swap                swap defaults 0 0
UUID=898c0125-39b1-4e0d-9dad-4118de688349 swap swap defaults
0 0
:

```

(After change)

```

:
#/dev/sddlmaa1      /boot                ext4 defaults 1 2
#UUID=a136da75-c151-472d-ac5c-20f165f93776 /boot ext4
defaults 1 2
/dev/sddlmaab1      /boot                ext4 defaults 1 2
:
#/dev/sddlmaa3      swap                swap defaults 0 0
#UUID=898c0125-39b1-4e0d-9dad-4118de688349 swap swap
defaults 0 0
/dev/sddlmaab3      swap                swap defaults 0 0
:

```

- Copy the lines in which devices are specified with UUID.
- Comment out the copy-source lines by placing a hash mark (#) at the beginning of each of the lines.
- Change the devices described using UUID in the copied data to descriptions using HDLM devices.

13. Restart the replication-destination host.

To apply the edited results obtained in step 12, restart the replication-destination host by executing the following command:

```
# /sbin/shutdown -r now
```

14. Delete any unnecessary information regarding HDLM devices that were created on the replication-destination host.

Execute the HDLM configuration definition utility (dlmcfgmgr -u all -s) to delete any unnecessary information about the HDLM devices.

An example of executing the command is as follows:


```
# dlmcfmgr -u all -s
KAPL10340-E Several processes failed. See the /var/opt/
DynamicLinkManager/log/dlmcfmgr1.log file. Check the message
output before this message.
```

The KAPL10340-E message is output. This does not affect HDLM operation.

15. Execute the `view` operation of the HDLM command (`dlnmgr view -lu`) to check that HDLM correctly recognizes the number of storage devices, the number of LUs, and the number of paths.

An example of executing the command is as follows:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -lu
Product       : VSP_Ex00
SerialNumber  : 416032
LUs           : 1
```

```
iLU    HDevName Device    PathID Status
000115 sddlmb   /dev/sda  000000 Online
                /dev/sdb  000001 Online
```

```
KAPL01001-I The HDLM command completed normally. Operation name
= view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
#
```

The above execution results indicate that one storage system and one LU in a two-path configuration are recognized.

Note that you can remove the backup file created in step 1 if you are no longer going to use the file.

Installing HDLM for managing boot disks

This section explains the procedure for installing HDLM in an environment in which the boot disk is on a SCSI device in the storage system, and for creating an HDLM device. This section also explains the procedure for setting up an environment in which the HDLM device is the boot disk.

Notes on installing HDLM in a boot disk environment

Note the following when using HDLM on a boot disk:

- The storage system for which the boot disk will be created must satisfy the following conditions:
 - The storage system supports the boot disk functionality even if HDLM is not used.
 - HBAs support startup from the storage system.
- When you install the OS, create the root directory (/) and the /boot directory in separate partitions.
- When you use HDLM as a boot disk, do not specify an HDLM device for the kernel parameters `resume`, `journal`, and `dump`.
- When Red Hat Enterprise Linux, or SUSE LINUX Enterprise Server is used, HDLM supports environments that use LVM2 as a boot disk.

- When Red Hat Enterprise Linux, or SUSE LINUX Enterprise Server is used, HDLM does not support an environment that uses an md device as a boot disk.
- If you changed the configuration during startup or if the `/etc/fstab` file settings are incorrect, the system might not start.
- If the root directory (`/`) has not been mounted at startup, you cannot collect a boot error log (`/etc/opt/DynamicLinkManager/hdlmboot.log`). In this case, if a problem occurs, use the log displayed on the console to analyze the problem.
- The `dlnmcfmgr` log created at startup is output to `/etc/opt/DynamicLinkManager/hdlmboot.log`.
- In an environment where an HDLM device is to be used as the boot disk, make sure that `y` is specified for `hdlm_dracut` in the `/etc/opt/DynamicLinkManager/hdlm.conf` file. If you want to set `hdlm_dracut=n`, do so when you create an initial RAM disk image file for the SCSI device.
- Once you have built an environment for starting the OS from an HDLM device, you cannot change the boot disk.
- If you do not use the storage systems disk set for the boot disk, before you install HDLM, edit the `/etc/fstab` file in the following manner to disable the `LABEL` specification and enable the `sd` device specification.

- a. Check the installation directory of the OS specified in the `LABEL` setting.

```
# cat /etc/fstab
LABEL=/      /      ext3      defaults    1 1
LABEL=/boot  /boot  ext3      defaults    1 2
```

Confirm that `LABEL` indicates the root directory and the `/boot` directory.

- b. Check the correspondence between the `LABEL` setting and the `sd` device.

```
# mount
/dev/sda2 on / type ext3 (rw)
none on /proc type proc (rw)
none on /dev/pts type devpts (rw,gid=5,mode=620)
usbdevfs on /proc/bus/usb type usbdevfs (rw)
/dev/sda1 on /boot type ext3 (rw)
none on /dev/shm type tmpfs (rw)
```

Confirm that the root directory is `/dev/sda2`, and the `/boot` directory is `/dev/sda1`.

- c. Using an editor such as `vi`, change the `LABEL` specification to an `sd` device specification.
(before)

```
LABEL=/      /      ext3      defaults    1 1
```

```

LABEL=/boot    /boot    ext3    defaults    1 2

```

(after)

```

/dev/sda2    /    ext3    defaults    1 1
/dev/sda1    /boot    ext3    defaults    1 2

```

- d. Install HDLM.
- e. After configuring the HDLM device, execute the `dlmcfmgr -o` command to exclude the HDLM device that corresponds to the boot disk as a management target.
- If the SCSI device name has been changed by using the `udev` function, see [Settings for a multipath boot disk environment on page 3-131](#) and [Upgrade installation of HDLM in a boot disk environment on page 3-133](#) and perform operations while reading the SCSI device names in those subsections as the new SCSI device names (`udev` name) that were changed by using the `udev` function.

In an environment where HDLM has been installed, you can use the `dlmcfmgr` utility to check the correspondence between a SCSI device and a `udev` name.

The following shows an example of executing the `dlmcfmgr` utility with the `-v` and `-udev` parameters specified.

```

# dlmcfmgr -v -udev
HDevName      Management  Device      Host  Channel Target Lun  Udev
/dev/sddlmaa   configured  /dev/sda    0     0        0    0    /dev/aaaaaaaa
KAPL10302-I /sbin/dlmcfmgr completed normally.

```

Figure 3-7 Example of executing the `dlmcfmgr` utility with the `-v` and `-udev` parameters specified

The `HDevName`, `Device`, and `Udev` columns display HDLM devices, SCSI devices, and `udev` names, respectively.

- To update the kernel package, you need to perform either of the following depending on which OS you are using:
 - When using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, or Red Hat Enterprise Linux 8:
Refer to the information about updating the kernel package in [Updating kernel packages and applying OS update packages on page 4-6](#).
 - When using SUSE LINUX Enterprise Server:
You must first remove HDLM before updating the kernel package, and then re-install it after the update. Note that removing and re-installing HDLM might change the correspondence between HDLM devices and SCSI devices.
- To update the kernel package in an environment that satisfies the following conditions, you need to change the Persistent Binding setting:
 - The host is in a Hitachi Compute Blade environment.
 - The boot disk is managed by HDLM.

- The Persistent Binding functionality is enabled.

For details about the Persistent Binding setting, see the manual *Hitachi Gigabit Fibre Channel Board User's Guide*.

- If you use HDLM on a boot disk, LUKS cannot be used for the swap partitions.
- The created LVM configuration does not change even if you perform an upgrade installation of HDLM.
- If you execute the `dracut` command or `vgscan` command when using a logical volume (LVM2) on the HDLM device in a boot disk environment, a message such as the following might be output temporarily. This does not affect HDLM operation.

```
WARNING: Device mismatch detected for VG-name which is accessing
SCSI-device-name instead of HDLM-device-name.
```

or

```
WARNING: Device mismatch detected for VG-name which is accessing
SCSI-device-name instead of (null).
```

- When the logical volume (LVM2) on the HDLM device is used as a boot disk, the message below might be output when the server is activated. This does not affect HDLM operation.

```
MM DD hh:mm:ss host-name kernel: dracut: Found duplicate PV
pvid: using SCSI-device-name not SCSI-device-name
```
- For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, SUSE Linux Enterprise Server 12, SUSE LINUX Enterprise Server 15, Oracle Unbreakable Enterprise Kernel 6, Oracle Unbreakable Enterprise Kernel 7, or Oracle Unbreakable Enterprise Kernel 8, install the LVM2 package even if LVM2 is not used.

Overview of the procedure for installing HDLM in a boot disk environment

This subsection provides an overview of the procedure for installing HDLM in a boot disk environment.

Settings for using an HDLM device or a logical volume (LVM2) on an HDLM device as a boot disk

This subsection provides an overview of how to perform a new installation of HDLM in a boot disk environment that uses either a SCSI device or a logical volume (LVM2) on a SCSI device. For details, see [Settings for a multipath boot disk environment on page 3-131](#).

1. Install HDLM.
See step 1 to 2 in [Settings for a multipath boot disk environment on page 3-131](#).
2. Edit the configuration file to change the definition such that the HDLM device can be used as a boot disk.

After editing the configuration file, restart the host to activate the setting. See steps 4 to 8 in [Settings for a multipath boot disk environment on page 3-131](#).

After completing the above procedure, you can perform a new installation of HDLM in a boot disk environment that uses a SCSI device or a logical volume (LVM2) on a SCSI device.

Upgrade installation in an environment where an HDLM device or a logical volume (LVM2) on an HDLM device is used as a boot disk

To perform an upgrade installation of HDLM in a boot disk environment that uses an HDLM device or a logical volume (LVM2) on an HDLM device (for details, see [Upgrade installation of HDLM in a boot disk environment on page 3-133](#)):

1. Check the current HDLM settings.
See steps 2 to 6 in [Upgrade installation of HDLM in a boot disk environment on page 3-133](#).
2. Perform an upgrade installation of HDLM.
See step 8 to 11 in [Upgrade installation of HDLM in a boot disk environment on page 3-133](#).

After completing the above procedure, you can perform an upgrade installation of HDLM in a boot disk environment that uses an HDLM device or a logical volume (LVM2) on an HDLM device.

Settings for a multipath boot disk environment

This subsection describes how to perform a new installation of HDLM in a single-path boot disk environment that uses a SCSI device and how to configure a multipath boot disk environment.

To manually configure an environment without using the utility for creating an HDLM boot disk environment (`dmlbootstart`), see [Appendix C, Manually setting a boot disk environment on page C-1](#).

Note that if the settings are incorrect, the OS might not start. For details about what action to take if the OS cannot be started from an HDLM device, see [Countermeasures for unsuccessful startup of the OS from an HDLM device on page 3-139](#).

To install HDLM in a boot disk environment that uses a SCSI device, and set up the environment:

1. Log in to Linux as a user with root permissions.
2. Install HDLM.
See [Performing a new installation of HDLM on page 3-99](#), and then create an HDLM device by performing step 2 to 12.
3. Execute the `swapoff` command to disable a swap device.
An example of executing the command to disable all swap devices is as follows:

```
# /sbin/swapoff -a
```

In an environment where all of the following conditions are met, if you perform the step while a swap device is enabled, the host might take a while to stop.

Make sure to disable the swap, and then perform the step.

- Either of the following OSs is used:
 - Red Hat Enterprise Linux 7
 - Red Hat Enterprise Linux 8
 - Oracle Linux 7
 - Oracle Linux 8
 - SUSE LINUX Enterprise Server 12
 - SUSE LINUX Enterprise Server 15
- The HDLM management-target device is enabled as a swap device.

4. Execute the utility for creating an HDLM boot disk environment (`dlnbootstart`) to configure a boot disk environment that uses HDLM.

```
# /opt/DynamicLinkManager/bin/dlnbootstart -set hdlm
```

Note

Do not turn off the power of the host machine during execution of the `dlnbootstart` utility. Also, do not turn off the power of the host machine after the `dlnbootstart` utility is forced to stop.

Note that if you turn off the power to the host machine, the OS might be unable to start. If you cannot start the OS, contact your HDLM vendor or maintenance company, and report the information that was collected by the `DLMgetras` utility.

5. Shut down the host.

Execute the following command to shut down the host:

```
# shutdown -h now
```

6. Add a path to the LU (system disk) and then change the configuration from a single-path configuration to a multi-path configuration.

7. Start the host.

8. Check that the HDLM boot disk environment is configured.

See `/proc/mounts` to check the devices mounted on the root (/). Then execute the following command to output the root information and check the devices that are output.

```
# /bin/cat /proc/mounts | /bin/grep -w / | /bin/grep -v rootfs
```

Check as follows, depending on the devices that are output.

- If `/dev/{HDLM-device}` is output:

The HDLM boot disk environment is used.
- If another device is output:

- a. Execute the `/usr/bin/readlink -f {output-device}` command.
The full path of the file is output.
- b. Execute the `/bin/ls -l {output-device}` command.
In a general file, the `major` and `minor` values are displayed where the file size is displayed.
- c. Execute the following command with the `major` value specified for the argument:

```
# /bin/cat /proc/devices | /bin/grep -w {major}
```

- If `sddlmfdrv` is output, the HDLM boot disk environment is used.
- If `device-mapper` is output:
Execute `/sbin/dmsetup ls --tree` to check the `major` and `minor` values of the device associated with the `major` and `minor` values displayed in b..

Display example:

```
# /sbin/dmsetup ls --tree
system-usr (252:3)
|- (251:2)
system-var (252:4)
|- (251:2)
system-swap (252:1)
|- (251:2)
system-root (252:0)
|- (251:2)
system-tmp (252:2)
|- (251:2)
#
```

If the `major` and `minor` values in b. are 252 and 0 respectively, then, in the example above, the corresponding device is (251:2), which has `major` and `minor` values of 251 and 2 respectively.

Execute the following command with the `major` value specified for the argument:

```
/bin/cat /proc/devices | /bin/grep -w {major}
```

If `sddlmfdrv` is output, the HDLM boot disk environment is used.

If `sddlmfdrv` is not output, the HDLM boot disk environment is not used.

- If another device is output:
The HDLM boot disk environment is not used.

Upgrade installation of HDLM in a boot disk environment

This subsection explains how to perform an upgrade installation of HDLM and specify environment settings in a multi-path configuration boot disk environment using the HDLM device.

Note that if settings are incorrect, the OS might not start. For details about what action to take if the OS cannot be started from an HDLM device, see [Countermeasures for unsuccessful startup of the OS from an HDLM device on page 3-139](#).

The name of the boot loader configuration file used in these procedures differs depending on the boot loader and OS. The following table lists the names of the boot loader configuration files.

Table 3-73 Names of boot loader configuration files

Boot loader			Configuration file name
GRUB	BIOS	Red Hat Enterprise Linux Oracle Unbreakable Enterprise Kernel 6	/boot/grub/grub.conf
		SUSE LINUX Enterprise Server 11	/boot/grub/menu.lst
	UEFI	Red Hat Enterprise Linux 6	/boot/efi/EFI/redhat/ grub.conf
GRUB2	BIOS	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	/boot/grub2/grub.cfg
	UEFI	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/boot/efi/EFI/redhat/ grub.cfg

To perform an upgrade installation of HDLM in a multi-path boot disk environment that uses an HDLM device, and to set up the environment:

1. Log in to Linux as a user with root permissions.
2. Check that the HDLM boot disk environment is used.
Execute the following command to check the root (/) information.

```
# /bin/mount | /bin/grep -w /
```

If an HDLM device is output, the HDLM boot disk environment is used.

If an HDLM device is not output, execute the following command:

```
# /sbin/dmsetup deps {output-device}
```

If the command terminates abnormally, the HDLM boot disk environment is not used.

If the command terminates normally, a list containing the items `major` and `minor` is output.

Execute the `/bin/cat /proc/devices | /bin/grep -w {major}` command with the value `major` specified for the argument.

If `sddlmfdrv` is output, the HDLM boot disk environment is used.

If `sddlmfdrv` is not output, the HDLM boot disk environment is not used.

3. If the HDLM LVM boot disk environment is used, check the `/etc/lvm/lvm.conf` file.

Check the values of the items below. If an incorrect value is set, change it to the correct value.

Record the original values, because they are necessary when removing HDLM.

- For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later:

- `global_filter = ["a|sddlm[a-p][a-p].*|", "r|/dev/sd|"]`
- `types = ["sddlmfdrv", 16]`
- `md_component_detection = 0`
- `allow_changes_with_duplicate_pvs = 1`

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Linux 7 :

Specify 1 for `allow_changes_with_duplicate_pvs`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

- `filter = ["a|sddlm[a-p][a-p].*|", "r|/dev/sd|"]`
- `write_cache_state = 0`
- `types = ["sddlmfdrv", 16]`
- `md_component_detection = 0`

- For OSs other than the above:

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

- `global_filter = ["a|sddlm[a-p][a-p].*|", "r|/dev/sd|"]`
- `write_cache_state = 0`
- `types = ["sddlmfdrv", 16]`
- `md_component_detection = 0`

4. If the environment is using LVM, disable the LVM cache. For details, see [Notes on using LVM2 on page 3-154](#).
5. Check that the HDLM device or the logical volume that was created on the HDLM device is specified in the definition of the `/etc/fstab` file.

Make sure that the mount points for the HDLM management-target devices are defined so that the HDLM device will be mounted:

The following shows an example of the `/etc/fstab` file:

```

:
:
/dev/sddlmaa2 / ext2 defaults 1 1
:
:
/dev/sddlmaa4 /tmp ext2 defaults 1 2
:
```

:

Note that, in the HDLM boot disk environment, the following format restrictions, depending on the OS, apply to the device names that can be specified in the mount point for the root (/) partition. If a different format is used, change the item to the correct format.

Table 3-74 Device name format that can be specified for the root partition (/) in the /etc/fstab file

OS	HDLM boot disk environment	
	Without LVM	With LVM
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	/dev/{ <i>HDLM device</i> }	/dev/mapper/{ <i>VG</i> }-{ <i>LV</i> }
SUSE LINUX Enterprise Server 11		/dev/{ <i>VG</i> }/{ <i>LV</i> }
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15		UUID={ <i>UUID-value</i> } or /dev/{ <i>VG</i> }/{ <i>LV</i> }

6. Check the boot loader configuration file (`grub.conf`).

If the OS is SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8 , Oracle Linux 7 or Oracle Linux 8, skip this step and go to step 7.

For cases other than the above, make sure that the default value corresponds to the HDLM boot disk environment.

If `default=1` is set, check the underlined part of the second title as follows.

```
default=1
timeout=5
splashimage=(hd0,0)/grub/splash.xpm.gz
hiddenmenu

title Red Hat Enterprise Linux 6 (2.6.32-754.el6.x86_64) #
Backed up by HDLM
    root (hd0,0)
    kernel /vmlinuz-2.6.32-754.el6.x86_64 ro root=UUID=0d5f28ce-
f4ac-44f4-bf10-2dlac785fbac ...
    initrd /initramfs-2.6.32-754.el6.x86_64.img

title HDLM Red Hat Enterprise Linux 6 (2.6.32-754.el6.x86_64) #
Setting from HDLM
    root (hd0,0)
    kernel /vmlinuz-2.6.32-754.el6.x86_64 ro root=UUID=0d5f28ce-
f4ac-44f4-bf10-2dlac785fbac ...
    initrd /initramfs-hdlm-2.6.32-754.el6.x86_64.img

:
```

For an HDLM boot disk environment, check the format of the items below.
If a specification is incorrect, change it to the correct format.

- Check the specification of the kernel parameter `root`.

Table 3-75 Format of values that can be specified for the kernel parameter "root="

OS	HDLM boot disk environment	
	Without LVM	With LVM
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	<code>root=UUID={UUID-value}</code>	<code>root=UUID={UUID-value}</code> or <code>root=/dev/mapper/{VG}-{LV}</code>
SUSE LINUX Enterprise Server 11	<code>root=/dev/{HDLM device}</code>	<code>root=/dev/{VG}/{LV}</code>
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	<code>root=UUID={UUID-value}</code>	<code>root=UUID={UUID-value}</code> or <code>root=/dev/{VG}/{LV}</code>

- Check the file name specified for `initrd`.

Table 3-76 File name specified for initrd (the name of the initial RAM disk image file for HDLM)

OS	File name
Red Hat Enterprise Linux 6 Oracle Linux 6	<code>initramfs-hdlm-{kernel-version#}.img</code>
SUSE LINUX Enterprise Server 11	<code>initrd-hdlm-{kernel-version#}.img</code>
Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 7 Oracle Linux 8	<code>initramfs-{kernel-version#}.img</code>
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	<code>initrd-{kernel-version#}</code>

#

This is the output result of the `uname -r` command.

- Execute the `swapoff` command to disable a swap device.

An example of executing the command to disable all swap devices is as follows:

```
# /sbin/swapoff -a
```

In an environment where all of the following conditions are met, if you perform the step while a swap device is enabled, the host might take a while to stop.

Make sure to disable the swap, and then perform the step.

- Either of the following OSs is used:
 - Red Hat Enterprise Linux 7
 - Red Hat Enterprise Linux 8
 - Oracle Linux 7
 - Oracle Linux 8
 - SUSE LINUX Enterprise Server 12
 - SUSE LINUX Enterprise Server 15
- An upgrade installation is performed for a version of HDLM earlier than 8.6.2-01.
- An HDLM device is enabled as a swap device.

8. Perform an upgrade installation of HDLM.

To perform an upgrade installation, specify `installux.sh` or the `installhdlm` utility that are stored on the HDLM DVD-ROM. The following shows an example of performing an upgrade installation when the mount point for the DVD-ROM is `/media/cdrom`.

a. To run `installux.sh`:

```
# /media/cdrom/installux.sh -update
```

b. To run the `installhdlm` utility:

```
# /media/cdrom/HDLM_Linux/installhdlm -update
```

9. Check the initial RAM disk image file that is used when the server starts.

If the OS is SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8, skip this step and go to step 10.

If the operation of step 8 terminates normally, the following message is output.

```
KAPL09300-I An initial RAM disk image was created. (file name = /boot/initramfs-hdlm-2.6.32-754.el6.x86_64.img)
```

Check that the displayed file name is the same as the file name of the initial RAM disk image file that was output for `initrd` in step 6. If they are not the same, change the name of the initial RAM disk image file that was output, or change the file name in the boot loader configuration file (`grub.conf` or `menu.lst`) so that it matches the name of the initial RAM disk image file that was output.

10. Restart the host.

Execute the following command to restart the host.

```
# /sbin/shutdown -r now
```

11. Check that the HDLM boot disk environment is used.

For details on how to check the environment, see step 8 in [Settings for a multipath boot disk environment on page 3-131](#).

Countermeasures for unsuccessful startup of the OS from an HDLM device

This subsection explains what actions you should take if the OS cannot be started from an HDLM device. If startup of the OS fails, either of the following happens:

- An error message appears and the OS stops.
- A prompt for a password for starting maintenance appears, and the OS stops.

The following explains the action to be taken for each case.

When an error message appears and the OS stops

The probable causes of this error are as follows:

Cause 1

The initial RAM disk image file was specified incorrectly in the boot loader configuration.

Cause 2

The initial RAM disk image file is corrupted.

Cause 3

The startup disk was no longer recognized first because the system environment configuration was modified.

If the startup disk is not found due to the changes in the system environment configuration, the following message appears:

```
KAPL10302-I Multiple instances of the utility for supporting the boot disk cannot
be executed concurrently.
KAPL10325-I The command started. Command name = /sbin/dlmcfgmgr -v
/usr/bin/expr: syntax error
/bin/echo: write error: Invalid argument
KAPL10328-I Execution of linuxrc completed.
/bin/mv: cannot move '/etc/dlmtmplog' to
'/opt/DynamicLinkManager/Root/etc/opt/DynamicLinkManager/hdlmboot.log': No such file or
directory
VFS: Cannot open root device "" or 08:03
Please append a correct "root=" boot option
Kernel panic: VFS: Unable to mount root fs on 08:03
```

To correct the above error:

1. Restart the host.
2. In the window for setting information about boot loader startup, select the option for startup from a SCSI device.
If startup from the SCSI device fails, enable only the path to the LU on which the OS is installed, and then start the OS.

3. Check the definitions in the `grub.conf` file, or `/boot/grub/menu.lst` file to make sure that the initial RAM disk image file and `ramdisk_size` are specified correctly.

Modify any incorrect specification.

If startup from the HDLM device still fails after you correctly specify the initial RAM disk image file and `ramdisk_size`, the initial RAM disk image file might be corrupted. Execute the boot disk support utility to re-create the initial RAM disk image file.

4. Restart the host to start the OS from the HDLM device.

When a prompt for a password for starting maintenance appears, and the OS stops

The probable causes of this error are as follows:

- Startup from a SCSI device was selected in the boot loader configuration, but `/etc/fstab` file was defined to mount an HDLM device.

To correct the above error:

1. Enter the root user password.
2. Execute `mount -o remount rw /` to mount the root directory again.
3. In the `/etc/fstab` file, change the mount destination of `root` to the SCSI device.
4. Restart the host to start the OS from the SCSI device.
5. To restart the OS from an HDLM device, set up the environment according to the following procedure:

Follow the procedure in [Settings for a multipath boot disk environment on page 3-131](#) or [Upgrade installation of HDLM in a boot disk environment on page 3-133](#).

Settings for LUKS

This section explains the procedures that the user must perform when using LUKS.

Notes on using LUKS

The followings are notes on using LUKS:

- HDLM supports LUKS on the following OSs:
 - Red Hat Enterprise Linux 6
- LUKS is not available in an environment where an HDLM device is used as a boot disk.
- To set up LUKS on an HDLM device, execute the `/sbin/cryptsetup` command, which is the same way as setting up LUKS on SCSI devices.

- When using LUKS on an HDLM device, enter the HDLM device's device file name in the `/etc/crypttab` file's second field.

Using HDLM in an LUKS environment

This subsection describes how to migrate LUKS from a SCSI device environment using LUKS to HDLM devices.

To migrate from `/dev/sdh` to `/dev/sddlmaa`:

1. Check the HDLM device to be migrated from the SCSI device.
Execute the HDLM-configuration definition utility (`dlmcfgmgr`) with the `-v` parameter specified to check the correspondence between the SCSI device and the HDLM device.

The following shows an example of executing the `dlmcfgmgr` utility with the specified `-v` parameter:

```
# dlmcfgmgr -v
HDevName      Management Device      Host  Channel  Target  Lun
/dev/sddlmaa   configured /dev/sdh    1      0        0     0
/dev/sddlmaab  configured /dev/sdj    1      0        0     1
:
:
KAPL10302-I /sbin/dlmcfgmgr completed normally.
#
```

HDLM devices are listed in the `HDevName` column, and SCSI devices are listed in the `Device` column.

2. Check the `/etc/crypttab` file's second field.
 - If a SCSI device is directly specified, change the SCSI device in the `/etc/crypttab` file's second field to the corresponding HDLM device that was checked in step 1, and then go to step 4.
The following shows an example of editing the `/etc/crypttab` file's second field:
Before editing:
`luks-volumel /dev/sdh /etc/cryptpassword1`
After editing:
`luks-volumel /dev/sddlmaa /etc/cryptpassword1`
 - If the device name is specified in UUID format, go to step 3.
3. Execute the following command to check the correspondence between the UUID and the device name.

```
# blkid -t UUID="050f9901-3ab8-4556-a091-9c6e4a404f09" -l -o
device
/dev/sdh
#
```

- If you have an HDLM device name as the output, change the UUID to the HDLM device name in the `/etc/crypttab` file's second field.

- If you have got a SCSI device name as the output, check the output of step 1 to confirm the HDLM device name corresponding to the SCSI device name, and change the UUID to the HDLM device name in the `/etc/crypttab` file's second field.

The following shows an example of changing the setting in the `/etc/crypttab` file's second field.

Before:

```
luks-volume1 UUID="050f9901-3ab8-4556-a091-9c6e4a404f09" /etc/cryptpassword1
```

After:

```
luks-volume1 /dev/sddlmaa /etc/cryptpassword1
```

4. Unmap the SCSI device from the device used by the device mapper.

The following shows an example of unmapping the SCSI device from the `/dev/mapper/luks-volume1` device.

```
# cryptsetup luksClose luks-volume1
#
```

5. Map the device used by device mapper to the HDLM device.

The following shows an example of mapping `/dev/mapper/luks-volume1` (that was unmapped at step 4) to the HDLM device when using a key file (`/etc/cryptpassword1`).

```
# cryptsetup -d /etc/cryptpassword1 luksOpen /dev/sddlmaa luks-volume1
key slot 0 unlocked.
Command successful.
#
```

6. Change the single-path configuration to a multi-path configuration.

Settings for md devices

This section explains the procedures that the user must perform when using md devices.

Note, however, that md devices are not supported for Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8.

Notes on setting up md devices

The following are notes on using md devices:

- Because HDLM is multi-path software, it cannot be used with the `MULTIPATH` function for md devices.

- If you are using the `MULTIPATH` function for md devices before you install HDLM, change it to the `LINEAR` function after installing HDLM.
- An md device created in HDLM cannot be used in a boot disk environment.
- If an md device has been applied to a directory that cannot be unmounted while the system is operating (such as `/opt`, `/tmp`, or `/var`), HDLM cannot be applied to that md device.
- You cannot use the disk partition type `RAID (fd)`.
- In mdadm package versions 1.6.0-2 or earlier, you cannot manage devices whose major or minor number is 256 or greater. Use mdadm package versions 1.6.0-3 or later.
- You cannot simultaneously specify SCSI devices and HDLM devices to configure an md device. The following figure shows an example of when SCSI devices and HDLM devices are simultaneously specified by mistake.

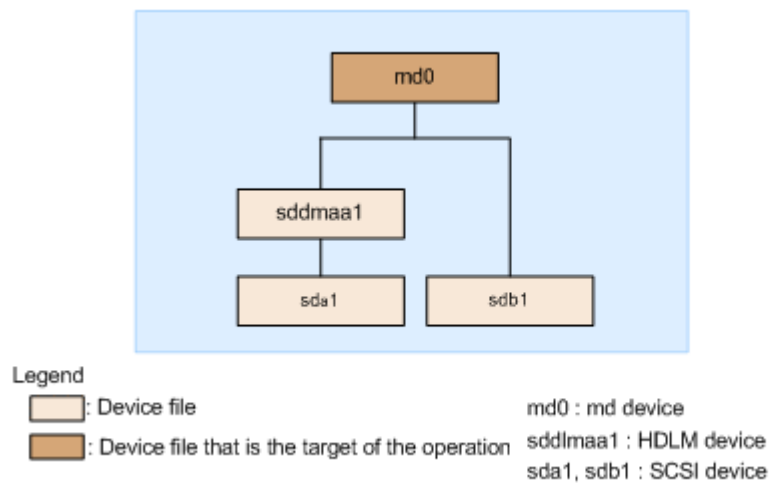


Figure 3-8 Example of incorrectly configured md devices

If you want to manage md devices by using HDLM, migrate the md devices that are made up of SCSI devices to the md devices that are made up of HDLM devices. The following figure shows an example of when this migration is performed.

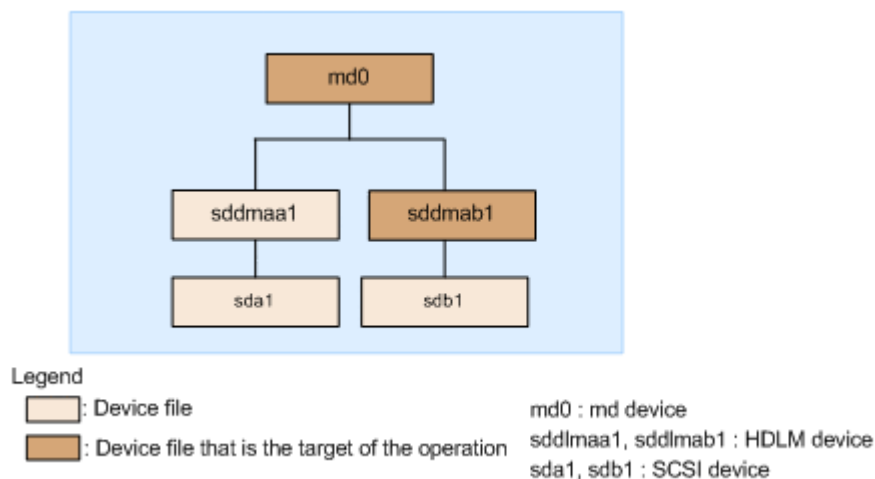


Figure 3-9 Example of correctly configured md devices

Creating an md device

This subsection explains the procedure for creating a new md device in a multi-path environment in which HDLM has been installed.

During this procedure, `/dev/md0` is created on `/dev/sddlmaa1` and `/dev/sddlmaab1`. Use the following procedure to configure the environment shown in [Figure 3-10 Device configuration when creating an md device on an HDLM device on page 3-144](#).

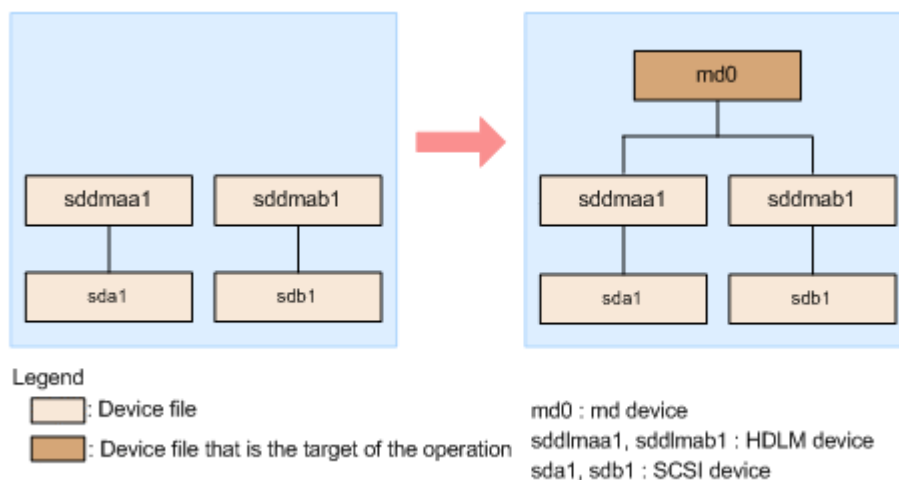


Figure 3-10 Device configuration when creating an md device on an HDLM device

To create an md device:

1. Create a disk partition.
Specify the disk partition type 83 when you create a disk partition.

The following example shows how to execute the `fdisk` command to create a disk partition:

```
# fdisk /dev/sddlmaa

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-1018, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-1018, default
1018):
Using default value 1018

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): 83

Command (m for help): p

Disk /dev/sddlmaa: 5368 MB, 5368709120 bytes
166 heads, 62 sectors/track, 1018 cylinders
Units = cylinders of 10292 * 512 = 5269504 bytes

Device Boot    Start    End    Blocks    Id  System
/dev/sddlmaa1      1    1018    5238597    83  Linux

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
```

Also perform the above operation for `/dev/sddlmaab`.

2. Create an md device.

In the following example, RAID1 (mirroring) is used for the md device:

```
# mdadm -C /dev/md0 -l1 -n2 /dev/sddlmaa1 /dev/sddlmaab1
mdadm: /dev/sddlmaa1 appears to contain an ext2fs file system
       size=5238592K mtime=Fri Jan 25 19:26:25 2008
mdadm: /dev/sddlmaab1 appears to contain an ext2fs file system
       size=5238592K mtime=Fri Jan 25 19:27:07 2008
Continue creating array? y
mdadm: array /dev/md0 started.
```

3. Make sure that the md device has been installed in HDLM.

In the following example, RAID1 (mirroring) is used for the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaa1[0] sddlmaab1[1]
       5238528 blocks [2/2] [UU]
unused devices: <none>
```

Make sure that `md0 : active` and the HDLM devices are displayed.

4. If necessary, back up the configuration file.
If the configuration file `/etc/mdadm.conf` has already been created, execute the following command to create a backup:

```
# cp -pr /etc/mdadm.conf /etc/mdadm.conf.backup
```

5. Execute the following command to create a configuration file:

```
# echo "DEVICE /dev/sddlmaa1 /dev/sddlmab1" >> /etc/mdadm.conf
# mdadm --detail --scan | grep -w "/dev/md0" >> /etc/mdadm.conf
```

For `sddlmaa1` and `sddlmab1`, specify the HDLM devices corresponding to `md0`, which was displayed in step 3.

The following example shows the contents of the created configuration file:

```
# cat /etc/mdadm.conf
DEVICE /dev/sddlmaa1 /dev/sddlmab1
ARRAY /dev/md0 level=raid1 num-devices=2
UUID=e39a6b15:32e48a5d:ca05f4db:25bc8af9
```

For details about the contents of the configuration file, see the Linux documentation or use the `man` command.

6. Edit the configuration file created in step 5.
Edit the `/etc/mdadm.conf` file to add `auto=yes` to the `ARRAY` line:

```
DEVICE /dev/sddlmaa1 /dev/sddlmab1
ARRAY /dev/md0 level=raid1 num-devices=2
UUID=e39a6b15:32e48a5d:ca05f4db:25bc8af9 auto=yes
```

7. Restart the host.
8. Make sure that the `md` device has been activated.
In the following example, RAID1 (mirroring) is used for the `md` device:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaa1[0] sddlmab1[1]
      5238528 blocks [2/2] [UU]
unused devices: <none>
```

Make sure that `md0 : active` and the HDLM devices are displayed.

Using HDLM in an md device environment

This subsection describes how to migrate an environment where the `md` devices were constructed by using SCSI devices to an environment where the `md` devices were constructed by using HDLM-managed devices.

If the MULTIPATH function is not used for md devices, perform the procedure described in [When the MULTIPATH function is not being used for md devices on page 3-147](#). If the function is used, perform the procedure described in [When the MULTIPATH function is being used for md devices on page 3-151](#).

When the MULTIPATH function is not being used for md devices

The following explains the procedure to use HDLM in an md device environment where the MULTIPATH function is not being used. The example below assumes that the RAID functionality is being used for md devices.

In this procedure, the device `/dev/md0` on `/dev/sdh1` and `/dev/sdi1` is migrated to the device `/dev/md0` on `/dev/sddlmaa1` and `/dev/sddlma1`. Use the following procedure to configure the environment shown in [Figure 3-11 Device configuration where an md device on a SCSI device is migrated to an HDLM device \(an environment that uses the md device's RAID functionality\) on page 3-147](#).

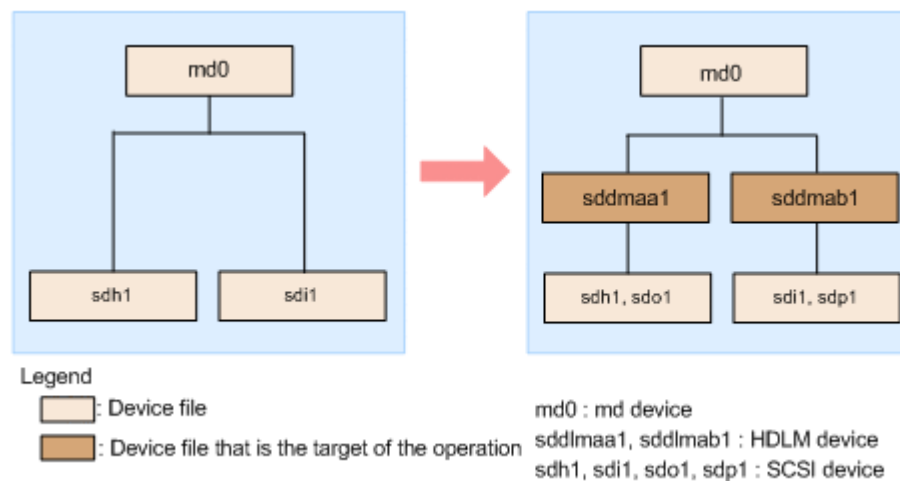


Figure 3-11 Device configuration where an md device on a SCSI device is migrated to an HDLM device (an environment that uses the md device's RAID functionality)

To migrate `/dev/md0`:

1. Stop all applications that are using the existing md device.
2. If necessary, back up the application data residing on the md device.
3. If file systems have been mounted on the md device, unmount them.
4. Check the status of the md device.

Execute the following command to check the configuration of the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdh1[0] sdi1[1]
      5238528 blocks [2/2] [UU]
```

unused devices: <none>

Make sure that `md0 : active` and that SCSI devices are displayed.

If `md0 : active` is not displayed, activate the md device.

5. If you have already used a configuration file (`/etc/mdadm.conf`), back up that file.

Execute the following command to back up that configuration file:

```
# cp -pr /etc/mdadm.conf /etc/mdadm.conf.backup
```

6. Execute the following command to create a configuration file:
Even if a configuration file had already been used in step 5, you still need to create a configuration file so that the md device will be managed by HDLM.

```
# echo "DEVICE /dev/sdh1 /dev/sdi1" >> /etc/mdadm.conf
# mdadm --detail --scan | grep -w "/dev/md0" >> /etc/mdadm.conf
```

For `sdh1` and `sdi1`, specify the SCSI devices displayed in step 4.

The following example shows the contents of the created configuration file:

The underlined part indicates the lines added in this step.

```
# cat /etc/mdadm.conf
DEVICE /dev/sdh1 /dev/sdi1
DEVICE /dev/sdf1 /dev/sdg1 /dev/sdh1 /dev/sdi1
ARRAY /dev/md0 level=raid1 num-devices=2
UUID=e39a6b15:32e48a5d:ca05f4db:25bc8af9
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102
```

For details about the contents of the configuration file, see the Linux documentation or use the `man` command.

If you created a new configuration file, go to step 9.

7. If you have already used a configuration file (`/etc/mdadm.conf`), delete the unnecessary `ARRAY` line in that configuration file.

Delete the `ARRAY` line that includes the same name as the md device name (`md0`) created in step 6. In the following example, the underlined lines are to be deleted.

```
# cat /etc/mdadm.conf
DEVICE /dev/sdh1 /dev/sdi1
DEVICE /dev/sdf1 /dev/sdg1 /dev/sdh1 /dev/sdi1
ARRAY /dev/md0 level=raid1 num-devices=2
UUID=e39a6b15:32e48a5d:ca05f4db:25bc8af9
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102
```

8. If you have already used a configuration file (`/etc/mdadm.conf`), edit the `DEVICE` lines.

If the existing `DEVICE` lines include SCSI devices that are specified in the `DEVICE` lines created in step 6, edit the `DEVICE` lines to exclude the SCSI devices.

The following are examples of editing the lines:

Before the correction:

```
DEVICE /dev/sdh1 /dev/sdi1
DEVICE /dev/sdf1 /dev/sdg1 /dev/sdh1 /dev/sdi1
```

After the correction:

```
DEVICE /dev/sdh1 /dev/sdi1
DEVICE /dev/sdf1 /dev/sdg1
```

9. Edit the `/etc/mdadm.conf` file to add `auto=yes` to the `ARRAY` line in the configuration file:

```
DEVICE /dev/sdh1 /dev/sdi1
DEVICE /dev/sdf1 /dev/sdg1
ARRAY /dev/md0 level=raid1 num-devices=2
UUID=e39a6b15:32e48a5d:ca05f4db:25bc8af9 auto=yes
```

10. Install HDLM.

Perform steps 2 to 11 in [Performing a new installation of HDLM on page 3-99](#).

11. Check the correspondence between the HDLM devices and SCSI devices. Execute the HDLM-configuration definition utility `dlmcfmgmgr` with the `-v` parameter specified:

```
# dlmcfmgmgr -v
HDevName      Management  Device      Host Channel Target Lun
/dev/sddlmaa configured /dev/sdh    1          0         0    0
/dev/sddlmaab configured /dev/sdi    1          0         0    1
KAPL10302-I /sbin/dlmcfmgmgr completed normally.
```

The `HDevName` and `Device` columns display HDLM devices and SCSI devices, respectively.

12. Execute the following command to deactivate the md device.

```
# mdadm -Ss /dev/md0
```

13. Make sure that the md device has been deactivated.

In the following example, RAID1 (mirroring) is used for the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
unused devices: <none>
```

Make sure that `md0 : active` is not displayed.

14. Edit the configuration file.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 11, change the SCSI device names on the `DEVICE` line to the HDLM device names.

Before the correction:

```
DEVICE /dev/sdh1 /dev/sdi1
```

After the correction:

```
DEVICE /dev/sddlmaa1 /dev/sddlma1
```

When you edit the `DEVICE` line, change only the device names. Do not change the partition numbers.

15. If the disk partition type of the HDLM device is `fd`, change the type to `83`. The following example shows how to execute the `fdisk` command to change the disk partition type to `83`:

```
# fdisk /dev/sddlmaa

Command (m for help): p

Disk /dev/sddlmaa: 5368 MB, 5368709120 bytes
166 heads, 62 sectors/track, 1018 cylinders
Units = cylinders of 10292 * 512 = 5269504 bytes
Device Boot      Start         End      Blocks   Id  System
/dev/sddlmaa1      1         1018       5238597    fd  Linux raid
autodetect

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): 83
Changed system type of partition 1 to 83 (Linux)

Command (m for help): p
Disk /dev/sddlmaa: 5368 MB, 5368709120 bytes
166 heads, 62 sectors/track, 1018 cylinders
Units = cylinders of 10292 * 512 = 5269504 bytes

Device Boot      Start         End      Blocks   Id  System
/dev/sddlmaa1      1         1018       5238597    83  Linux

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
```

Also perform the above operation for `/dev/sddlma1`.

16. Execute the following command to activate the md device:

```
# mdadm -As /dev/md0
mdadm: /dev/md0 has been started with 2 drives.
```

17. Make sure that the md device has been activated. In the following example, RAID1 (mirroring) is used for the md device:


```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaa1[0] sddlmaa1[1]
      5238528 blocks [2/2] [UU]
unused devices: <none>
```

Make sure that `md0 : active` and the HDLM devices are displayed.

18. If you need to mount the file systems on the md device, mount them.

19. Add a path to the LU.

Connect a path to the corresponding LU and then restart the host, or add a path to an existing LU by performing the procedure described in [Adding a path to an existing LU on page 4-41](#).

When the MULTIPATH function is being used for md devices

The following explains the procedure to use HDLM in an md device environment where the MULTIPATH function is being used. To use HDLM, you need to disable md device's MULTIPATH function. The example below explains how to migrate an md device for which the MULTIPATH function is used to an md device for which the LINEAR function is used.

Note

Red Hat Enterprise Linux 6 cannot migrate an md device for which the `MULTIPATH` function is used to an md device for which the `LINEAR` function is used.

In this procedure, the device `/dev/md0` on `/dev/sdo1` and `/dev/sdh1` is migrated to the device `/dev/md0` on `/dev/sddlmaa1`. Use the following procedure to configure the environment shown in [Figure 3-12 Device configuration where an md device \(an environment that uses the md device's MULTIPATH function\) on a SCSI device is migrated to an md device on an HDLM device on page 3-151](#).

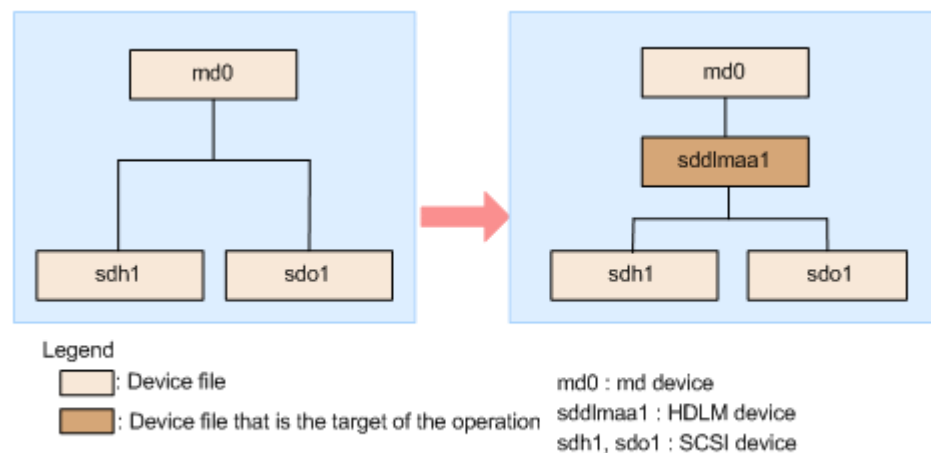


Figure 3-12 Device configuration where an md device (an environment that uses the md device's MULTIPATH function) on a SCSI device is migrated to an md device on an HDLM device

To migrate /dev/md0

1. Stop all applications that are using the existing md device.
2. If necessary, back up the application data residing on the md device.
3. If file systems have been mounted on the md device, unmount them.
4. Check the status of the md device.

Execute the following command to check the configuration of the md device:

```
# cat /proc/mdstat
Personalities : [multipath]
md0 : active multipath sdo1[0] sdh1[1]
      5238528 blocks [2/2] [UU]

unused devices: <none>
```

Make sure that md0 : active and that SCSI devices are displayed.

If md0 : active is not displayed, activate the md device.

5. Specify the settings required for the md device, and then install HDLM.
Perform steps 5 to 10 in [When the MULTIPATH function is not being used for md devices on page 3-147](#).
6. Check the correspondence with HDLM device.
Execute the HDLM-configuration definition utility `dlmcfgmgr` with the `-v` parameter specified:

```
# dlmcfgmgr -v
HDevName      Management Device      Host Channel Target Lun
/dev/sddlmaa configured /dev/sdh      1         0         0  0
               /dev/sdo      2         0         0  1
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

The `HDevName` and `Device` columns display HDLM devices and SCSI devices, respectively.

7. Create an md device.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 6, create an md device.

When you specify a device name, you must also specify the partition number that is displayed in step 4.

```
# mdadm -C /dev/md0 -l linear -f -n1 /dev/sddlmaa1
mdadm: /dev/sddlmaa1 appears to contain an ext2fs file system
      size=5238528K mtime=Wed Feb  6 19:17:08 2008
mdadm: /dev/sddlmaa1 appears to be part of a raid array:
      level=-4 devices=2 ctime=Wed Feb  6 19:16:07 2008
Continue creating array? y
mdadm: array /dev/md0 started.
```

8. Create a configuration file.

Execute the following command to add an md device definition to the existing configuration file `/etc/mdadm.conf`:

```
# mdadm --detail --scan | grep -w "/dev/md0" >> /etc/mdadm.conf
```

The following example shows the contents of the created configuration file:

The underlined part indicates the lines added in this step.

```
# cat /etc/mdadm.conf
DEVICE /dev/sd01 /dev/sdh1
ARRAY /dev/md0 level=multipath num-devices=2 UUID=6b2ec21b:
06d0f50b:bbf04d32:1e00b09a auto=yes
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102
```

For details about the contents of the configuration file, see the Linux documentation or use the `man` command.

9. If the configuration file `/etc/mdadm.conf` has been recreated, delete the unnecessary `ARRAY` line in that configuration file.

Delete the `ARRAY` line that includes the same name as the `md` device name (`md0`) created in step 8. In the following example, the underlined lines are to be deleted.

```
# cat /etc/mdadm.conf
DEVICE /dev/sd01 /dev/sdh1
ARRAY /dev/md0 level=multipath num-devices=2 UUID=6b2ec21b:
06d0f50b:bbf04d32:1e00b09a auto=yes
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102
```

10. Edit the `/etc/mdadm.conf` file to add `auto=yes` to the `ARRAY` line in the configuration file:

```
DEVICE /dev/sd01 /dev/sdh1
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102 auto=yes
```

11. On the `DEVICE` line of the configuration file, change a SCSI device name to an HDLM device name.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 6, change the SCSI device names on the `DEVICE` line to the HDLM device names.

Before the correction:

```
DEVICE /dev/sd01 /dev/sdh1
```

After the correction:

```
DEVICE /dev/sddlmaa1
```

When you edit the `DEVICE` line, change only the device names. Do not change the partition numbers.

12. Execute the following command to deactivate the `md` device:

```
# mdadm -Ss /dev/md0
```

13. Make sure that the md device has been deactivated.

In the following example, the `LINEAR` function is used for the md device:

```
# cat /proc/mdstat
Personalities : [linear] [multipath]#
unused devices: <none>
```

Make sure that `md0 : active` is not displayed.

```
#
```

Although `[multipath]` will be displayed until the host is restarted, there are no operational problems.

14. Activate the md device and add a path to the LU.

Perform steps 15 to 19 in [When the MULTIPATH function is not being used for md devices on page 3-147](#).

Note that, in step 17 in [When the MULTIPATH function is not being used for md devices on page 3-147](#), `[multipath]` will be displayed until the host is restarted. However, there are no operational problems.

Settings for LVM2

This section describes the procedure for setting the following items in an LVM2 environment:

- When using an HDLM device to create a new logical volume
- When moving a logical volume created on a SCSI device in a single-path environment, to an HDLM device

When using HDLM in an LVM2 environment, use the HDLM device as an LVM2 physical volume.

Notes on using LVM2

The following are notes on using LVM2:

- If a logical volume on an HDLM device (LVM2) is used as the boot disk, a SCSI device cannot be used as an LVM2 physical volume.
- To use a SCSI device and an HDLM device concurrently as LVM2 physical volumes, edit the `/etc/lvm/lvm.conf` file so that SCSI devices, which are managed by HDLM, are not recognized by LVM2.

If you are using Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later, specify `global_filter`.

If you want to use `use_lvmetad=0` for operation in SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Linux 7, specify `filter`, not `global_filter`.

Also, for OSs other than SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Linux 8, and Oracle Unbreakable Enterprise Kernel 8, if you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

- SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8:

Specify a permanent name, so that the order of the disks that can be viewed from LVM does not change even if the order of the disks recognized by the OS changes.

```
global_filter = [ "a|sddlm[a-p][a-p].*|", "a|
scsi-3600605b005d7a320196f1f53484dfb20|", "r|/dev/sd|" ]
```

Use the `udevadm` command to check the value to be specified.

```
# udevadm info -q symlink -n /dev/sda2
block/8:0 disk/by-id/scsi-3600605b005d7a320196f1f53484dfb20
disk/by-path/information-generated-based-on-the-disk-location
disk/by-uuid/information-specific-to-the-disk disk/by-id/wwn-
information-specific-to-the-disk
```

Output 3600605b005d7a320196f1f53484dfb20 is sda2 and a supporting by-id name.

- Red Hat Enterprise Linux 6, Oracle Linux 6 or Oracle Unbreakable Enterprise Kernel 6:

Specify a permanent name, so that the order of the disks that can be viewed from LVM does not change even if the order of the disks recognized by the OS changes.

```
filter = [ "a|sddlm[a-p][a-p].*|", "a|
scsi-3600605b005d7a320196f1f53484dfb20|", "r|/dev/sd|" ]
```

Use the `udevadm` command to check the value to be specified.

```
# udevadm info -q symlink -n /dev/sda2
block/8:0 disk/by-id/scsi-3600605b005d7a320196f1f53484dfb20
disk/by-path/information-generated-based-on-the-disk-location
disk/by-uuid/information-specific-to-the-disk disk/by-id/wwn-
information-specific-to-the-disk
```

Output 3600605b005d7a320196f1f53484dfb20 is sda2 and a supporting by-id name.

- For OSs other than the above:

The following shows an example of settings when the SCSI device (`/dev/sda`) and the HDLM device are used together as the physical volume for LVM2.

```
filter = [ "a|sddlm[a-p][a-p].*|", "a|/dev/sda[1-9].*|",
"r|/dev/sd|" ]
```

The following shows an editing example when both a SCSI device (`/dev/sda`) and an HDLM device are used as LVM2 physical volumes.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle

Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8:

```
global_filter = [ "a|sddlm[a-p][a-p].*|", "a|/dev/sda[1-9].*|", "r|/dev/sd|" ]
```

- For OSs other than the above:

```
filter = [ "a|sddlm[a-p][a-p].*|", "a|/dev/sda[1-9].*|", "r|/dev/sd|" ]
```

In the above `filter` line, the underlined portion enables LVM2 to recognize SCSI devices.

In this example, the following `filter` line is used in the `/etc/lvm/lvm.conf` file so that LVM2 does not recognize SCSI devices:

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8:

```
global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
```

- For OSs other than the above:

```
filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
```

- If one of the following OSs is used, in the device section of the `/etc/lvm/lvm.conf` file, specify 1 for `allow_changes_with_duplicate_pvs`. If `allow_changes_with_duplicate_pvs` is not in the file, add the line `allow_changes_with_duplicate_pvs=1`.

- Red Hat Enterprise Linux 7.3 or later
- Red Hat Enterprise Linux 8 or later
- Oracle Linux 7.3 (Oracle Unbreakable Enterprise Kernel 7.3) or later
- Oracle Linux 8 (Oracle Unbreakable Enterprise Kernel 8) or later
- SUSE LINUX Enterprise Server 12 SP4 (4.12.14-94.41 Kernel) or later
- SUSE LINUX Enterprise Server 15 or later

If the value is changed to 0, duplicate physical volumes will be detected during the boot processing in a SAN boot configuration, and the volume groups will not be activated. As a result, the startup processing in the SAN boot configuration will fail.

- LVM cache files cannot be used. For an OS other than Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later, disable the LVM cache by performing the operation described below. For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later, the following operation is unnecessary because neither `write_cache_state` or the LVM cache files exist.

- a. Specify 0 for `write_cache_state` in the `/etc/lvm/lvm.conf` file.
- b. Execute the VG scan.
After editing the file, execute the following command.

```
# /sbin/vgscan
```

- c. Delete the LVM cache files.
If the following files exist, delete them:
 - `/etc/lvm/.cache`
 - `/etc/lvm/cache/.cache`
- d. Re-create the initial RAM disk image file.

If you are using the HDLM device as a boot disk

Perform step 9 of [Settings for a multipath boot disk environment on page C-2](#).

If you are not using the HDLM device as a boot disk

Create an initial RAM disk image file for HDLM.

The format of the initial RAM disk image file name to be specified in the parameter is shown below. If a file having the same name as the initial RAM disk image file to be created already exists, back up the existing file under a different name.

Table 3-77 Names of initial RAM disk image files

OS	File name
Red Hat Enterprise Linux 6 Oracle Linux 6	<code>initramfs-{kernel-version#}.img</code>
SUSE LINUX Enterprise Server 11	<code>initrd-{kernel-version#}</code>
Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 7 Oracle Linux 8	<code>initramfs-{kernel-version#}.img</code>
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	<code>initrd-{kernel-version#}</code>

#

This is the output result of the `uname -r` command.

From the following, perform the procedure that corresponds to the host OS.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8:
 - a. Execute the `dracut` command.
The following shows an example of executing the command:

```
# /usr/bin/dracut /boot/initrd-3.12.28-4-default
`uname -r`
```

- For Red Hat Enterprise Linux 6 or Oracle Linux 6:

- a. Execute the `dracut` command.

The following shows an example of executing the command:

```
# /sbin/dracut /boot/initramfs-2.6.32-71.el6.i686.img
`uname -r`
```

- For OSs other than the above:

Execute the utility for supporting a boot disk (`dlmmkinitrd`).

For details on the `dlmmkinitrd` utility, see [dlmmkinitrd utility for supporting a boot disk on page 7-38](#).

- e. Restart the host.

```
# shutdown -r now
```

- f. Execute the following command to check whether LVM cache files exist:

```
# ls /etc/lvm/.cache
# ls /etc/lvm/cache/.cache
```

If LVM cache files exist, go to step g. If they do not exist, this is the end of the procedure.

- g. Perform the confirmation procedure described in [Confirming that the logical volume is in a multi-path configuration on page 3-171](#).

If you are using a multi-path configuration

Execute the following command to delete the LVM cache files.

```
# rm /etc/lvm/.cache
# rm /etc/lvm/cache/.cache
```

This is the end of the processing.

If you are not using a multi-path configuration

Execute the following command to delete the LVM cache files, and then go to step h.

Alternatively, you can restart the server instead of performing steps h and i.

```
# rm /etc/lvm/.cache
# rm /etc/lvm/cache/.cache
```

- h. Deactivate volume groups that include logical volumes that are not in a multi-path configuration.

The following is an example of the command executed when the logical volume to be migrated belongs to volume group `vg01`:

```
# vgchange -an vg01
```


- i. Activate the volume group.

The following is an example of the command executed when the logical volume to be migrated belongs to volume group vg01:

```
# vgchange -ay vg01
```

When using an HDLM device to create a new logical volume

This subsection explains the procedure for using an HDLM device to create a new logical volume. Use the following procedure to configure the environment shown in [Figure 3-13 Device configuration when creating a logical volume on an HDLM device on page 3-159](#).

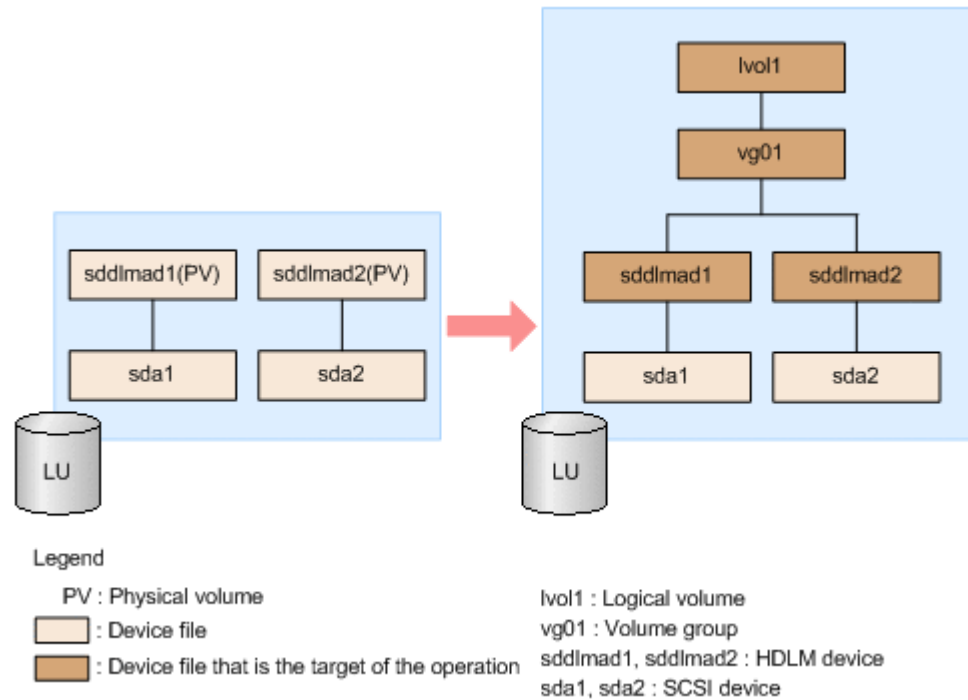


Figure 3-13 Device configuration when creating a logical volume on an HDLM device

To create a new logical volume on an HDLM device:

1. Stop all processes and services that are using the HDLM device.
2. Create a disk partition on the HDLM device and change the system ID from `Linux` (83 in hexadecimal representation) to `Linux LVM` (8e in hexadecimal representation).

The following shows an example of how to create two partitions in `/dev/sddlmad` (HDLM device):

Example of executing the `fdisk` command (IA32):

```
# fdisk /dev/sddlmad

Command (m for help): p

Disk /dev/sddlmad: 255 heads, 63 sectors, 130 cylinders
Units = cylinders of 16065 * 512 bytes

Device Boot    Start    End   Blocks  Id System
/dev/sddlmad1      1      65    522081   83  Linux
/dev/sddlmad2     66     130    522112*  83  Linux

Command (m for help): t
Partition number (1-4): 1
Hex code (type L to list codes): 8e

Command (m for help): t
Partition number (1-4): 2
Hex code (type L to list codes): 8e

Command (m for help): p

Disk /dev/sddlmad: 255 heads, 63 sectors, 130 cylinders
Units = cylinders of 16065 * 512 bytes

Device Boot    Start    End   Blocks  Id System
/dev/sddlmad1      1      65    522081   8e Linux LVM
/dev/sddlmad2     66     130    522112*  8e Linux LVM

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
```

Example of executing the parted command (IA32, or EM64T/AMD64):

```
# parted /dev/sddlmd
GNU Parted 1.6.15
Copyright (C) 1998 - 2004 Free Software Foundation, Inc.
This program is free software, covered by the GNU General Public License.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY;
without even the implied warranty of MERCHANTABILITY
or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

Using /dev/sddlmd
(parted) p
Disk geometry for /dev/sddlmd: 0.000-1025.000 megabytes
Disk label type: msdos
Minor  Start      End      Type      Filesystem  Flags
(parted) mkpart primary 1 500
(parted) mkpart primary 501 1000
(parted) p
Disk geometry for /dev/sddlmd: 0.000-1025.000 megabytes
Disk label type: msdos
Minor  Start      End      Type      Filesystem  Flags
1      1.000      500.000  primary   ext2         type=83
2      501.000    1000.000 primary   ext2         type=83
(parted) mkfs 1 ext2
(parted) mkfs 2 ext2
(parted) p
Disk geometry for /dev/sddlmd: 0.000-1025.000 megabytes
Disk label type: msdos
Minor  Start      End      Type      Filesystem  Flags
1      1.000      500.000  primary   ext2         type=83
2      501.000    1000.000 primary   ext2         type=83
(parted) set 1 lvm on
(parted) set 2 lvm on
(parted) p
Disk geometry for /dev/sddlmd: 0.000-1025.000 megabytes
Disk label type: msdos
Minor  Start      End      Type      Filesystem  Flags
1      1.000      500.000  primary   ext2         lvm, type=8e
2      501.000    1000.000 primary   ext2         lvm, type=8e
(parted)q

# blockdev --rereadpt /dev/sddlmd
```

When you use the `parted` command to change the partition, to let the system recognize the partitions on the HDLM device, execute the `blockdev` command after the `parted` command.

3. Edit the `/etc/lvm/lvm.conf` file.

Edit the device section in the file as shown below to disable the SCSI device configuration and enable the HDLM device configuration:

The following shows an example of editing the `/etc/lvm/lvm.conf` file.

- For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:

Before:

```
devices {
    :
    # global_filter = [ "a./." ]
    global_filter = [ "r|sddlmd[a-p][a-p].*|", "a|/dev/
sd|" ]
    :
    # types = [ "fd", 16 ]
    :
    md_component_detection = 1
    :
    allow_changes_with_duplicate_pvs = 0
}
```

```

                                :
}
After:
devices {
                                :
    # global_filter = [ "a/.*/" ]
    #_global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
                                :
    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
                                :
    # md_component_detection = 1
    md_component_detection=0
                                :
    # allow_changes_with_duplicate_pvs = 0
    allow_changes_with_duplicate_pvs = 1
                                :
}

```

Comment out the existing `global_filter`, `types`, `md_component_detection` and `allow_changes_with_duplicate_pvs` lines, and then add the underlined parts.

Record the original values, because they are necessary when restoring the SCSI device configuration.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:

Specify 1 for `allow_changes_with_duplicate_pvs` and 0 for `write_cache_state`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

Before:

```

# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
                                :

    # filter = [ "a/.*/" ]
    filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
                                :

    write_cache_state = 1
                                :

    # types = [ "fd", 16 ]
                                :

    md_component_detection = 1
                                :
}

```

After:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
    :

    # filter = [ "a/*/" ]
    #_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
    filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
    :

    #_write_cache_state = 1
    write_cache_state = 0
    :

    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
    :

    #_md_component_detection = 1
    md_component_detection=0
    :
}
```

Comment out the existing `filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts. Record the original values, because they are necessary when restoring the SCSI device configuration.

- For OSs other than the above:

Specify 0 for `write_cache_state`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

Before:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
    :

    # filter = [ "a/*/" ]
    :

    # global_filter = [ "a/*/" ]
    global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
    :

    write_cache_state = 1
    :

    # types = [ "fd", 16 ]
    :

    md_component_detection = 1
}
```

```

        :
    }
After:
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
        :

        # filter = [ "a/*/" ]
        :

        # global_filter = [ "a/*/" ]
        #_global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
        global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
        :

        #_write_cache_state = 1
        write_cache_state = 0
        :

        # types = [ "fd", 16 ]
        types = [ "sddlmfdrv", 16 ]
        :

        #_md_component_detection = 1
        md_component_detection=0
        :
    }

```

Comment out the existing `global_filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts.

Record the original values, because they are necessary when restoring the SCSI device configuration.

4. Execute the VG scan.

After editing the file, execute the following command.

```
# /sbin/vgscan
```

5. Delete the LVM cache files.

If the following files exist, delete them:

- o /etc/lvm/.cache
- o /etc/lvm/cache/.cache

6. Create the physical volumes.

The following example shows how to define `/dev/sddlmad1` and `/dev/sddlmad2` as physical volumes:

```
# pvcreate /dev/sddlmad1
Physical volume "/dev/sddlmad1" successfully created
# pvcreate /dev/sddlmad2
```

```
Physical volume "/dev/sddlmd2" successfully created
```

7. Create a volume group.

In the following example, the command creates the `vg01` volume group by using the physical volumes `/dev/sddlmd1` and `/dev/sddlmd2`:

```
# vgcreate vg01 /dev/sddlmd1 /dev/sddlmd2
Volume group "vg01" successfully created
```

8. Create the logical volume.

In the following example, the command creates the logical volume (`lv01`: 100 MB) by using the `vg01` volume group:

```
# lvcreate -L 100M -n lv01 vg01
Logical volume "lv01" created
```

9. Create a file system.

The following example shows how to use the `mke2fs` command to create a file system on the `lv01` logical volume:

```
# mke2fs /dev/vg01/lv01
Filesystem label=
OS type: Linux
Block size=1024 (log=0)
Fragment size=1024 (log=0)
25688 inodes, 102400 blocks
5120 blocks (5.00%) reserved for the super user
First data block=1
13 block groups
8192 blocks per group, 8192 fragments per group
1976 inodes per group
Superblock backups stored on blocks:
    8193, 24577, 40961, 57345, 73729

Writing inode tables: done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 38 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to
override.
```

10. Create the directory to which the logical volume is to be mounted.

The following example shows how to create the `/mnt/lv01` directory:

```
# mkdir /mnt/lv01
```

11. Mount the logical volume.

The following example shows how to mount the logical volume to the `/mnt/lv01` directory:

```
# mount /dev/vg01/lv01 /mnt/lv01
```

12. When using Red Hat Enterprise Linux 6, update the information about the volume group.
- Execute the following command to update the information about the volume group.

```
# vgscan
Reading all physical volumes. This may take a while...
Found volume group "VolGroup00" using metadata type lvm2
```

When moving a logical volume created on a SCSI device in a single-path environment to an HDLM device

This subsection explains the procedure for moving a logical volume created on a SCSI device in a single-path environment to an HDLM device in a multi-path environment. Use the following procedure to configure the environment in [Figure 3-14 Device configuration when a logical volume on a SCSI device is moved to an HDLM device on page 3-166](#).

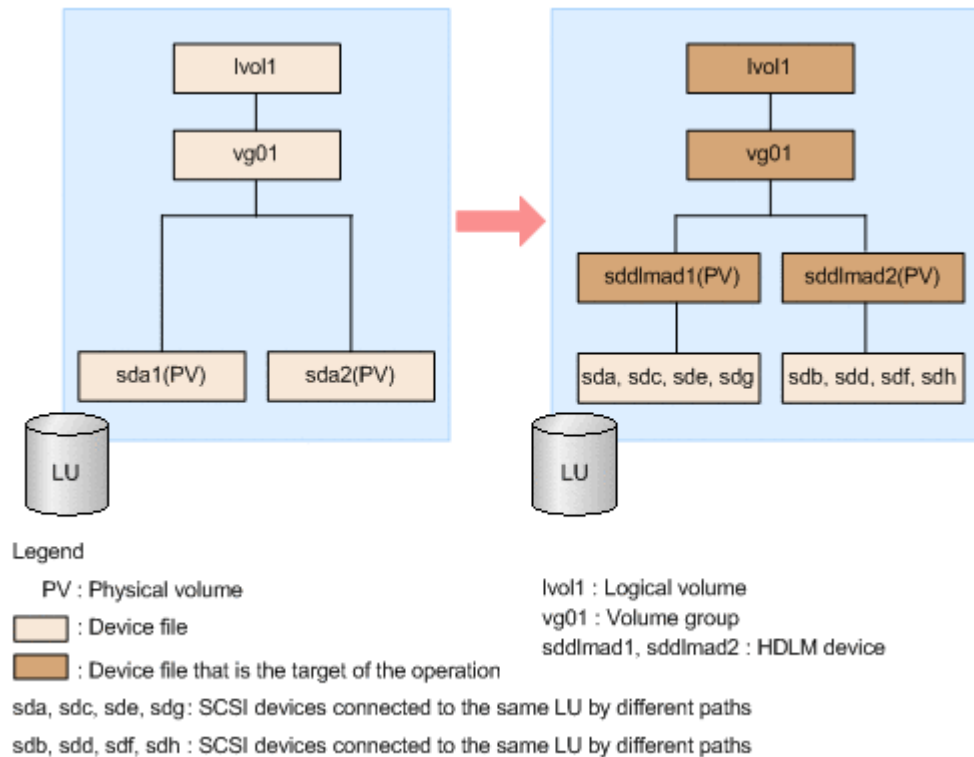


Figure 3-14 Device configuration when a logical volume on a SCSI device is moved to an HDLM device

In [Figure 3-14 Device configuration when a logical volume on a SCSI device is moved to an HDLM device on page 3-166](#), *sd_n* indicates the different LUs. *sddlmd1* and *sddlmd2* indicate the HDLM devices corresponding to each LU.

To move the logical volume to an HDLM device:

1. Make sure that HDLM has been installed.

Execute the `rpm` command to make sure that HDLM has been installed.

```
# rpm -q HDLM
HDLM-x.x.x.x.xxx-x
```

2. Make sure that the path is a single path.

Execute the HDLM-configuration definition utility (`dlnmcfmgmgr`) with the `-v` parameter specified to make sure that the path to the LU is a single path.

```
# dlnmcfmgmgr -v
HDevName      Management  Device    Host Channel  Target  Lun
/dev/sddlmaa   configured  /dev/sda  2           0       0       0
/dev/sddlmab   configured  /dev/sdb  2           0       0       1
KAPL10302-I /sbin/dlnmcfmgmgr completed normally.
```

3. Stop all processes and services that are using the SCSI and HDLM devices.

4. Unmount the logical volume to be moved.

In the following example, the logical volume subject to the move has been mounted on `/mnt/lvol1`:

```
# umount /mnt/lvol1
```

5. Deactivate the volume group.

In the following example, the logical volume to be moved belongs to the `vg01` volume group:

```
# vgchange -an vg01
0 logical volume(s) in volume group "vg01" now active
```

6. Export the volume group.

In the following example, the command exports information about the `vg01` volume group:

```
# vgexport vg01
Volume group "vg01" successfully exported
```

7. Edit the `/etc/lvm/lvm.conf` file.

Edit the device section in the file as shown below to disable the SCSI device configuration and enable the HDLM device configuration:

The following shows an example of editing the `/etc/lvm/lvm.conf` file.

- o For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:

Before:

```
devices {
    :
    # global_filter = [ "a/*/" ]
}
```

```

        global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
        :
        # types = [ "fd", 16 ]
        :
        md_component_detection = 1
        :
        allow_changes_with_duplicate_pvs = 0
        :
    }

After:
devices {
        :
        # global_filter = [ "a/.*/" ]
        #_global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
        global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
        :
        # types = [ "fd", 16 ]
        types = [ "sddlmfdrv", 16 ]
        :
        # md_component_detection = 1
        md_component_detection=0
        :
        # allow_changes_with_duplicate_pvs = 0
        allow_changes_with_duplicate_pvs = 1
        :
    }

```

Comment out the existing `global_filter`, `types`, `md_component_detection` and `allow_changes_with_duplicate_pvs` lines, and then add the underlined parts.

Record the original values, because they are necessary when restoring the SCSI device configuration.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:

Specify 1 for `allow_changes_with_duplicate_pvs` and 0 for `write_cache_state`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

Before:

```

# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
        :
        :
        # filter = [ "a/.*/" ]
        filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
        :
    }

```

```

        write_cache_state = 1
        :

        # types = [ "fd", 16 ]
        :

        md_component_detection = 1
        :
    }

```

After:

This section allows you to configure which block devices should

be used by the LVM system.

devices {

```

        :

        # filter = [ "a./.*/" ]
        #_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
        filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
        :

        #_write_cache_state = 1
        write_cache_state = 0
        :

        # types = [ "fd", 16 ]
        types = [ "sddlmfdrv", 16 ]
        :

        #_md_component_detection = 1
        md_component_detection=0
        :
    }

```

Comment out the existing `filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts.

Record the original values, because they are necessary when restoring the SCSI device configuration.

- For OSs other than the above:

Specify 0 for `write_cache_state`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

Before:

This section allows you to configure which block devices should

be used by the LVM system.

devices {

```

        :

        # filter = [ "a./.*/" ]
        :

        # global_filter = [ "a./.*/" ]
        global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/

```

```

sd| " ]
:

write_cache_state = 1
:

# types = [ "fd", 16 ]
:

md_component_detection = 1
:
}

```

After:

```

# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
:

# filter = [ "a/.*/" ]
:

# global_filter = [ "a/.*/" ]
#_global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd| " ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd| " ]
:

#_write_cache_state = 1
write_cache_state = 0
:

# types = [ "fd", 16 ]
types = [ "sddlmfdrv", 16 ]
:

#_md_component_detection = 1
md_component_detection=0
:
}

```

Comment out the existing `global_filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts.

Record the original values, because they are necessary when restoring the SCSI device configuration.

8. Execute the VG scan.

To re-create the volume group on the HDLM device, execute the `vgscan` command as shown in the following example:

```

# vgscan
Reading all physical volumes. This may take a while...
Found exported volume group "vg01" using metadata type lvm2

```

9. Delete the LVM cache files.

If the following files exist, delete them:

- o /etc/lvm/.cache
- o /etc/lvm/cache/.cache

10. Import the volume group.

In the following example, the command imports the `vg01` volume group:

```
# vgimport vg01
Volume group "vg01" successfully imported
```

11. Execute the `pvscan` command to check that the environment has been changed successfully.

Execute the following command to make sure that the information about the physical volume for the target logical volume has been changed to the information about the HDLM device:

```
# pvscan
PV /dev/sddlmd1   VG vg01   lvm2 [468.00 MB / 368.00 MB free]
PV /dev/sddlmd2   VG vg01   lvm2 [548.00 MB / 548.00 MB free]
Total: 2 [1016.00 MB] / in use: 2 [1016.00 MB] / in no VG: 0
[0   ]
```

12. Activate the volume group.

In the following example, the logical volume subject to the move belongs to the `vg01` volume group:

```
# vgchange -ay vg01
1 logical volume(s) in volume group "vg01" now active
```

13. Add a path to the LU.

Add a path to an existing LU by carrying out the procedure described in [Adding a path to an existing LU on page 4-41](#).

14. Mount the logical volume that was moved.

In the following example, the logical volume that was moved is `/dev/vg01/lvol1` and the command mounts the volume on `/mnt/lvol1`:

```
# mount /dev/vg01/lvol1 /mnt/lvol1
```

Confirming that the logical volume is in a multi-path configuration

Perform the following procedure to confirm that the logical volume is in a multi-path configuration.

1. Use the `dmsetup deps -o blkdevname` command to check the mapping information of the volume group.

Depending on the version of the command, the command will return either the device name or the major and minor numbers of the device file.

If the command returns the device name, go to step 3.

In the following example, the command returns the device name:

```
# dmsetup deps -o blkdevname
volume group name-logical volume name: N dependencies : (device
name)
```

In the following example, the command returns the major and minor numbers of the device file:

```
# dmsetup deps -o blkdevname
volume group name-logical volume name: N dependencies : (major
number, minor number)
```

Check the device name or the major and minor numbers referenced by each logical volume. You can ignore the value of *N*, which indicates the number of disks that make up the logical volume, because the value is not necessary for this confirmation procedure

2. Check whether the `/proc/partitions` information contains the name of the device corresponding to the major and minor numbers you checked in step 1.

The following is an example of executing the command:

```
# cat /proc/partitions
major      minor      #blocks      name
major number  minor number  number of logical disk blocks
device name
```

3. Execute the HDLM-configuration definition utility (`dlmcfgmgr`) with the `-v` parameter specified to check the names of the HDLM device and the managed SCSI devices.

The following is an example of executing the command:

```
# /sbin/dlmcfgmgr -v
HDevName      Management      Device      Host      Channel
Target  Lun
/dev/sddlmaa  configured      /dev/sda      2      0
0          0
              /dev/sdh      3      0
0          0
```

```
...
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

In this example, the HDLM device name is `sddlmaa`, and the names of the managed SCSI devices are `sda` and `sdh`.

4. Check whether the device name you checked in step 1 or 2 appears in the list of managed SCSI devices. Ignore partition numbers when comparing device names.

If the device name appears, the corresponding logical volume (volume group) is not in a multi-path configuration.

If the device name does not appear, the corresponding logical volume (volume group) is in a multi-path configuration.

Settings for Xen

When HDLM is installed in an environment that uses Xen, the SCSI devices corresponding to HDLM devices are accessible from a domainU environment. Therefore, you must specify the certain settings so that the SCSI devices cannot be accessed from the domainU environment directly.

The following procedure shows how to migrate SCSI device `/dev/sda`, which is connected in the domainU environment in a single-path configuration, to HDLM device `/dev/sddlmaa`, which is connected in a multi-path configuration.

1. Check the correspondence between the HDLM and SCSI devices.

Execute the HDLM configuration definition utility (`dlmcfgmgr`) with the `-v` parameter.

```
# /sbin/dlmcfgmgr -v
HDevName      Management  Device  Host  Channel Target  Lun
/dev/sddlmaa  configured  /dev/sda  2      0      0      0
/dev/sddlmaab configured  /dev/sdb  2      0      0      1
:
:
KAPL10302-I /sbin/dlmcfgmgr completed normally.
#
```

HDLM devices are listed in the `HDevName` column, and SCSI devices are listed in the `Device` column.

2. Check whether the SCSI devices can be migrated to the HDLM devices. Execute the command shown below.

In the following example, the `domU` configuration information is retrieved from the management domain:

```
# /usr/sbin/xm list -l domU
:
:
(device
  (vbd
    (uuid 6b393aaa-89e7-44dc-7a57-24d477dee43d)
    (bootable 0)
    (driver paravirtualised)
    (dev sdx)
    (uname phy:/dev/sda)
    (mode w)
  )
)
:
:
```

If the SCSI device displayed on the `uname phy` line is the SCSI device that appeared in step 1, continue to step 3. (Only a SCSI device that appears in step 1 can be migrated to an HDLM device.)

3. If domainU is running, stop it.

If domainU has been set to automatically start when domain0 starts, temporarily change the setting so that domainU will not start automatically.

4. Specify the settings so that SCSI devices are not used in domainU.
Disable the block device settings from domainU. For details, see the Linux documentation.
5. Specify the settings so that HDLM devices are used in domainU.
Set (export) the block devices to domainU. For details, see the Linux documentation.
Make sure that you specify the settings based on the correspondence between the HDLM and SCSI devices displayed in step 1.
6. Change the single-path configuration to a multi-path configuration.
7. Start domainU.
If you temporarily changed the settings in step 3 so that domainU would not automatically start, restore the previous settings.

Settings for KVM

If you install HDLM in an environment in which KVM is used, you need to register HDLM devices into the hardware configuration file (`/etc/libvirt/qemu/domain-name.xml`). For details on the hardware configuration file, see the OS documentation.

To register HDLM devices by using the `virsh` command:

1. Execute the following command to check the domain name and operating status of the guest OS.

```
# virsh list --all
 Id Name                               State
-----
 1  domK                               running
```

The underlined part indicates the domain name.

2. If the guest OS is running, stop it.
For details on how to stop the guest OS, see the OS documentation.
3. To register a new HDLM device, register the HDLM device into the hardware configuration file.

The following example shows how to register the HDLM device (`/dev/sddlmac`) as the IDE device (`/dev/hdb`) into the guest OS:

```
<disk type='block' device='disk'>
  <source dev='/dev/sddlmac'/>
  <target dev='hdb' bus='ide'/>
</disk>
```

For details on the values that can be specified for `disk type`, `target dev`, and `target bus`, see the OS documentation.

4. To migrate an environment that uses a SCSI device to an environment that uses an HDLM device, change the SCSI device registered in the hardware configuration file to an HDLM device.

The following example shows how to edit the hardware configuration file when migrating the SCSI device (`/dev/sda`) to the HDLM device (`/dev/sddlmaad`):

Before:

```
<source dev='/dev/sda' />
```

After:

```
<source dev='/dev/sddlmaad' />
```

For details on which SCSI devices correspond to which HDLM devices, see [Displaying corresponding information about an HDLM device, SCSI device, and LDEV on page 4-18](#).

5. Execute the following command to enable the settings in the hardware configuration file.

```
# virsh define /etc/libvirt/qemu/domK.xml
```

6. Start the guest OS.

For details on how to start the guest OS, see the OS documentation.

Settings for Heartbeat

This section describes the procedure that the user must perform when HDLM is installed in an environment in which Heartbeat is used for SUSE LINUX Enterprise Server 11.

To set up Heartbeat:

1. Stop the Heartbeat service in the cluster.

If the Heartbeat service is running, stop it by executing the following command:

```
# etc/init.d/heartbeat stop
```

2. Migrate the SCSI devices used by Heartbeat to HDLM devices.

If a SCSI device that is subordinate to an HDLM device is being used as a file system resource, edit the settings as shown in the following example:

```
# host1 172.26.4.321 Filesystem::/dev/sda::mnt/point::ext3
host1 172.26.4.321 Filesystem::/dev/sddlmaa::mnt/point::ext3
```

In this example, the line that defines the SCSI device `/dev/sda` is commented out, and the HDLM device `/dev/sddlmaa` is added.

3. Start the Heartbeat service in the cluster.

Execute the following command to start the Heartbeat service:

```
# /etc/init.d/heartbeat start
```

Settings for Oracle RAC

The following are notes on using Oracle RAC:

- When you use Oracle Cluster file System 2 in an Oracle RAC environment, set the `O2CB_HEARTBEAT_THRESHOLD` parameter in the `/etc/sysconfig/o2cbf` file to the following value:
 - If the Virtual Storage Platform series, VSP 5000 series, VSP G1000 series, VSP G1500, VSP F1500, VSP E series, VSP Gx00 models, VSP Fx00 models, VSP N series, or HUS VM is being used:
 $(\text{number-of-paths-connected-to-Oracle-Cluster-file-System-2} \times 60 \text{ seconds} / 2) + 1$
 - If the HUS100 series is being used:
 $(\text{number-of-paths-connected-to-Oracle-Cluster-file-System-2} \times 30 \text{ seconds} / 2) + 1$
- When a host and an Oracle RAC voting disk are connected by multiple paths, HDLM performs failover processing for those paths (in the same way as for normal paths) when an I/O timeout occurs for one of the paths.

Note that, depending on the settings of Oracle RAC, Oracle RAC might determine that a node error has occurred before the failover processing performed by HDLM is completed, and then re-configure the cluster.

Therefore, if an Oracle RAC voting disk is connected to an HDLM device, depending on the type or the operational requirements of the storage system, change the value of `MISSCOUNT` for Oracle RAC 10g 10.1.0.3.0 or later, and change the values of `MISSCOUNT` and `DISKTIMEOUT` for Oracle RAC 10g 10.2.0.2.0 or later, Oracle RAC 11g, Oracle RAC 12g, and Oracle RAC 19c.

When prioritizing the availability of the storage system

For `MISSCOUNT`, specify the maximum allowed time before it is determined that the heartbeat cannot be recognized. For `DISKTIMEOUT`, specify the maximum allowed time before it is determined that an I/O operation for a voting disk cannot be performed. Calculate values to be specified by following the descriptions in [Table 3-78 Formula for calculating MISSCOUNT on page 3-177](#) and [Table 3-79 Formula for calculating DISKTIMEOUT on page 3-177](#), and then change the current value to a value greater than or equal to the value you have obtained. If availability is to be considered, the greater the number of paths, the greater the values to be specified for `MISSCOUNT` and `DISKTIMEOUT` will be, and the time before the reconfiguration of Oracle RAC starts becomes longer.

When prioritizing the time before the reconfiguration of Oracle RAC starts

To reduce the time before the reconfiguration of Oracle RAC starts, determine the values of `MISSCOUNT` and `DISKTIMEOUT` from the maximum time allowed before the reconfiguration of Oracle RAC starts. In this case, the values of `MISSCOUNT` and `DISKTIMEOUT` might become smaller than the values obtained by the calculation formula. This will not affect HDLM operation. However, if an error that requires detection time (such as a timeout error) occurs, the values of `MISSCOUNT` and `DISKTIMEOUT` become smaller than the time taken for a failover to an online path to be completed. This makes reconfiguration of Oracle RAC highly possible, despite the availability of a failover.

The number of paths contained in the formula for calculating `MISSCOUNT` and `DISKTIMEOUT` indicates the number of paths that connect a voting disk to the host for which `MISSCOUNT` and `DISKTIMEOUT` are to be set. If connections are established from a target host through two paths to the voting disk, the number of path will be 2.

Table 3-78 Formula for calculating `MISSCOUNT`

Storage system type	Formula for obtaining the value of <code>MISSCOUNT</code>
<ul style="list-style-type: none"> Virtual Storage Platform series VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 VSP E series VSP Gx00 models VSP Fx00 models VSP N series HUS VM 	<i>number-of-paths-connected-to-the-voting-disk</i> x 60 seconds
<ul style="list-style-type: none"> HUS100 series 	<i>number-of-paths-connected-to-the-voting-disk</i> x 30 seconds

Table 3-79 Formula for calculating `DISKTIMEOUT`

Storage system type	Number of paths connected to the voting disk	Formula for obtaining the value of <code>DISKTIMEOUT</code>
<ul style="list-style-type: none"> Virtual Storage Platform series 	3 or less	You do not need to change the value of <code>DISKTIMEOUT</code> .
<ul style="list-style-type: none"> VSP 5000 series VSP G1000 series VSP G1500 VSP F1500 	4 or more	<i>number-of-paths-connected-to-the-voting-disk</i> x 60 seconds

Storage system type	Number of paths connected to the voting disk	Formula for obtaining the value of DISKTIMEOUT
<ul style="list-style-type: none"> VSP E series VSP Gx00 models VSP Fx00 models VSP N series HUS VM 		
<ul style="list-style-type: none"> HUS100 series 	6 or less	You do not need to change the value of DISKTIMEOUT.
	7 or more	<i>number-of-paths-connected-to-the-voting-disk</i> x 30 seconds

Note

If the value of `MISSCOUNT` is greater than or equal to that of `DISKTIMEOUT`, an error might occur as a result of the specifications of Oracle. In such cases, in addition to changing the value of `MISSCOUNT`, specify settings so that the value of `MISSCOUNT` is less than that of `DISKTIMEOUT`, for example, by adding 1 to the value of `DISKTIMEOUT`.

For details, contact the company with which you have a contract for Oracle Support Services.

Note that when you remove 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.

- If the Oracle command `oracleasm` is executed for HDLM devices, the KAPL05023-E message might be output to syslog.

If the following message indicating the successful completion of the `oracleasm` command is output after this message, there is no problem with HDLM operation.

```
oracleasm: succeeded
```

- If you use HDLM with Oracle RAC 10g, Oracle RAC 11g, or Oracle RAC 12c, and use ASMLib for Oracle RAC 10g, Oracle RAC 11g, or Oracle RAC 12c, you must change the settings in the ASMLib configuration file.

After installing ASMLib, do the following for each node:

- Execute the following command to create the ASMLib configuration file:
 - For Oracle RAC 12c, or ASMLib 2.1.0 or later:


```
# /usr/sbin/oracleasm configure -i
```
 - For ASMLib versions earlier than 2.1.0:


```
# /etc/init.d/oracleasm configure
```

- b. Open the ASMLib configuration file (`/etc/sysconfig/oracleasm`).
- c. Change the `ORACLEASM_SCANORDER` line as follows:
`ORACLEASM_SCANORDER = "sddl"`
 If an ASM disk defined in an HDLM device already exists, perform this procedure, and then restart all the nodes.
 This step must be done to enable the settings.
- Depending on the version of Red Hat Enterprise Linux, the following differences might apply:
 If you use Oracle RAC 11g Release 2 and HDLM together in Red Hat Enterprise Linux 6, you can use the shared file systems created by using ADVM and ACFS as the archived REDO log area. However, if you use Oracle RAC 11g Release 2 (11.2.0.3.0) and HDLM together in Red Hat Enterprise Linux 6.0, 6.1, or 6.2, then PSU 11.2.0.3.3 or a later version is required.

Settings for the RHCM

The user must execute the following procedure when HDLM is installed in an environment that uses *RHCM*.

Notes on using RHCM

- The HDLM device used by the cluster service and the HDLM device used by Quorum must be the same.
- When specifying the HDLM device on Quorum disk in the cluster settings file (`/etc/cluster/cluster.conf`), use `device` to directly specify the HDLM device. Do not use `label`.

The following shows an example of editing the `/etc/cluster/cluster.conf` file when the HDLM device (`/dev/sddlma1`) is set.

```
<quorumd cman_label="NAME" interval="2" master_wins="0" tko="5"
votes="1" device="/dev/sddlma1"/>
```

When using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, or Red Hat Enterprise Linux 8

To specify settings for RHCM:

1. Stop the service of the RHCM cluster.
 Stop the RHCM service with the following command if the service is running:


```
# service rgmanager stop
# service cman stop
```
2. Change the SCSI device being used by RHCM to an HDLM device.
 Edit as shown below if the lower SCSI device (`/dev/sda`) of the HDLM device (`/dev/sddlmaa`) is being used as `/dev/raw/raw1`.

```
# vi /etc/udev/rules.d/60-raw.rules
# ACTION=="add", KERNEL=="sda", RUN+="/bin/raw /dev/raw/raw1 %N"
ACTION=="add", KERNEL=="sddlmaa", RUN+="/bin/raw /dev/raw/raw1
%N"
```

Comment out `KERNEL=="sda"` and add `KERNEL=="sddlmaa"`.

3. If you will restart the host, go to step 4. If you will not restart the host, go to step 5.
4. Restart the host to apply the changes made in step 2.
Execute the following command to restart the host:

```
# shutdown -r now
```

RHCM setup is complete.

5. Execute the following command to apply the changes made in step 2.

```
# /sbin/start_udev
```

6. Start the cluster service of RHCM.
Executing the following command to start the service:

```
# service cman start
# service rgmanager start
```

Settings for VCS

The following is the procedure that must be executed by the user when HDLM is installed in an environment that uses VCS. For details on how to operate the VCS GUI, see the VCS documentation.

1. Stop the cluster service of VCS.
2. Change the SCSI device used by VCS to an HDLM device.
Change the `Block Devices` parameter of the `Mount` resource from the SCSI device to an HDLM device.
3. Start the cluster service of VCS.

Checking the path configuration

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

To check the path information, use the `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 [view \(displays information\) on page 6-31](#).

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

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -path > redirect-destination-file-1
```

Open *redirect-destination-file-1* and check the following:

- Make sure that there is at least one LU being accessed by a path.
A path can be identified by `PathName`. The LU that is accessed by a path can be identified by both `DskName` and `iLU`.
- Make sure that all the paths are online.
Make sure that `PathStatus` is `Online`. If a path is not online, `Reduced` will be displayed.
- Make sure that for each path the combination of the CHA port (`ChaPort`), through which multiple paths are accessing the same LU, and the HBA port (the host port number and bus number displayed in the `PathName` column) is different.
The digits displayed on the left of `PathName` indicate a host port number. The numbers displayed between the period to the right of the host port number and the next period indicate a bus number.
- Make sure that there are different host port numbers and bus numbers for each physical HBA port.

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

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -drv > redirect-destination-file-2
```

Open *redirect-destination-file-2* and check the `HDevName` and `Device` entries to see whether the HDLM device corresponding to the SCSI device has been created.

Setting up HDLM

HDLM includes functions like the load balancing function, the automatic failback function, the error logging function, the audit logging function, etc. You can set up these functions by using the `dlnmgr` command's `set` operation.

Checking the current settings

Check the current settings by executing the following command to set the HDLM functionality by using the `dlnmgr` command's `view` operation.

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys -sfunc
HDLM Version                : x.x.x-xx
Service Pack Version        :
```

```

Load Balance                : on(extended lio)
Support Cluster              :
Elog Level                   : 3
Elog File Size(KB)           : 9900
Number Of Elog Files         : 2
Trace Level                  : 0
Trace File Size(KB)          : 1000
Number Of Trace Files        : 4
Path Health Checking         : on(30)
Auto Failback                : on(1)
Reservation Status           :
Intermittent Error Monitor   : off
Dynamic I/O Path Control     : off(10)
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

To check the current audit log settings, execute the following command:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log                    : off
Audit Log Category           : -
Audit Log Facility           : -
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

Setting up the HDLM functions

The table below summarizes the functions that can be set in HDLM. For details about each function, see [Setting up load balancing on page 3-183](#) and subsequent sections.

Each function has a default value and a recommended value. If no function is set by the HDLM command's `set` operation, the default value is applied for each function. The recommended values are used as the guideline values when functions are configured.

Table 3-80 The recommended and default values of each function

Function	Default value	Recommended value
Load-balancing	on The Extended Least I/Os algorithm is used.	on The recommended algorithm depends on the operating environment.
Path health checking	on 30-minute check interval	on The recommended checking interval depends on the operating environment.
Automatic failback	on 1-minute check interval	The recommended checking interval depends on the operating environment.

Function	Default value	Recommended value
Intermittent Error Monitor	off	off
Dynamic I/O path control [#]	off 10-minute check interval	off The recommended checking interval depends on the operating environment.
Logging level	3: Collects all the error information for the "Information" level or higher	3: Collects all the error information for the "Information" level or higher
Trace level	0: Do not output trace files	0: Do not output trace files
File size for the Error log	9900 (KB)	9900 (KB)
Number of files for the Error logs	2	2
File size for trace information	1000 (KB)	1000 (KB)
Number of files for trace information	4	4
Collection of audit log data	off	The recommended value depends on the operating environment. Set on, if you want to collect audit log data.
Audit log facility	user	local0 to local7

#

This function is applied only when HUS100 series storage is used.

Setting up load balancing

You can select whether to enable load balancing.

The following is an example of using a command to set load balancing.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -lb on -lbtype exlio
```

To enable load balancing, specify on. Specify off otherwise. When you set on, specify one of the following algorithm values after the -lbtype option:

- rr for the Round Robin algorithm
- exrr for the Extended Round Robin algorithm
- lio for the Least I/Os algorithm
- exlio for the Extended Least I/Os algorithm
- lbk for the Least Blocks. algorithm

- `exlbc` for the Extended Least Blocks algorithm

The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even if, you disable the load balancing function by specifying `-lb off`. If you decide to re-enable load balancing at a later time, and you do not specify an algorithm, load balancing will still be executed by using the algorithm that was previously specified.

Setting up path health checking

You can choose whether you want to use path health checking.

The following is an example of using a command to enable path health checking.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -pchk on -intvl 10
```

To enable path health checking, specify `on`. Specify `off` otherwise. When you specify `on`, you can use the `-intvl` parameter to specify the checking interval. The value that was specified previously will be applied if the checking interval is not specified. For example, specify the path health check as `off` after specifying the *checking* interval as 15 minutes and executing. Then, when executing after specifying the path health check as `on` without specifying the *checking* interval, the 15 minutes that were specified previously will be applied again.

Setting up the automatic fallback function

When intermittent error monitoring is enabled and the number of error occurrences is 2 or more, the following condition must be satisfied.

```
error-monitoring-interval >= checking-interval-for-automatic-failbacks x number-of-times-an-error-is-to-occur-during-intermittent-error-monitoring
```

If this condition is not satisfied, an error will occur and the warning message KAPL01080-W will be output.

If this happens, change any of the following settings: the checking interval for automatic failbacks, the intermittent error-monitoring interval, or the number of times that the error needs to occur.

If you set the number of times that the error needs to occur to 1, the above condition does not need to be satisfied.

The following is an example of using a command to enable automatic fallback:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -afb on -intvl 10
```

To enable automatic fallback, specify `on`. Specify `off` otherwise. When you specify `on`, you can use the `-intvl` parameter to specify the *checking* interval

can be specified with the `-intvl` parameter when `on` is specified. The value that was specified previously will be applied if the *checking* interval is not specified. For example, specify auto failback as `off` after specifying the *checking* interval to five minutes and executing. Then, when executing after specifying auto failback as `on` without specifying the *checking* interval, the five minutes that were specified previously will be applied again.

Setting up intermittent error monitoring

Intermittent error monitoring is specifiable only when the automatic failback function is enabled. To prevent an intermittent error from reducing I/O performance, we recommend that you monitor intermittent errors when automatic failback is enabled.

When intermittent error monitoring is enabled, you can specify intermittent error conditions. The default value for the intermittent error-monitoring interval is 30. The default value for the number of error occurrences is 3.

The system assumes that an intermittent error has occurred if the specified number of times that the error needs to occur is reached during the specified monitoring interval (minutes). A path that is assumed to have an intermittent error is excluded from performing an automatic failback. Intermittent error monitoring starts right when the path is recovered from the error by performing an automatic failback. Monitoring is performed on each, individual path.

When a value of 2 or more is specified for the number of times an error needs to occur, make sure that the condition described in [Setting up the automatic failback function on page 3-184](#) is satisfied.

To determine whether a path is invalid for an automatic failback, you can use the results of the `dlmkmgr` command's `view` operation.

The following is an example of using a command to enable intermittent error monitoring:

```
# /opt/DynamicLinkManager/bin/dlmkmgr set -iem on -intvl 20 -iemnum 2
```

To enable intermittent error monitoring, specify `on`. To disable intermittent error monitoring, specify `off`. When you specify `on`, you can use the `-intvl` and `-iemnum` parameters to specify intermittent error conditions (the conditions used by the system to determine whether an intermittent error is occurring). In the `-intvl` parameter, specify the monitoring interval for an intermittent error. In the `-iemnum` parameter, specify the number of times that the error is to occur. When these parameters are omitted and 3 or more errors occur within 30 minutes, the system assumes that an intermittent error is occurring.

Setting up dynamic I/O path control

To prevent degrading of I/O performance, this function dynamically switches the output controllers for HDLM, following the switching of controllers performed by the storage system.

The dynamic I/O path control function can be set for each storage system or LU. The checking interval for reviewing the switching status information can also be set in order to properly follow the switching of controllers performed by the storage system.

The following is an example of setting the dynamic I/O path control function:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -dpc on -pathid 000001 -lu
# /opt/DynamicLinkManager/bin/dlnkmgr set -dpcintvl 10
```

Specify "on" to enable the dynamic I/O path control function, or "off" to disable the function. For the `-pathid` parameter, specify an LU, or the ID of a path connected to the storage system. For the `-dpcintvl` parameter, specify the checking interval (in minutes) for reviewing the information about the switching of controllers performed by the storage system.

Setting the error log collection level

The error log (the HDLM manager log (`dlnmgrn.log` (*n* indicates a file number from 1 to 16)) collection level can be set.

The following table lists and describes the values for the error log collection level setting.

Table 3-81 Values for the error log collection level setting

Value	Description
0	No error logs are collected.
1	All information for errors of the "Error" level or higher is collected.
2	All information for errors of the "Warning" level or higher is collected.
3	All information for errors of the "Information" level or higher is collected.
4	All information for errors of the "Information" level or higher (including maintenance information) is collected.

If an error occurs, you might have to change the collection level to 1 or higher to collect any log information.

The higher this value is set, the more information that will be output. As the amount of log information to be output increases, it will take less time to overwrite the old error log information with the new information.

The following is an example of using a command to set the error log collection level.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -ellv 2
```

Specify the error log collection level as a number.

Setting the trace level

You can set up the trace level for a trace file `hdlmtrn.log` (n indicates a file number from 1 to 64).

The following table lists and describes the values for the trace level setting.

Table 3-82 Values for the trace level setting

Value	Description
0	No trace is output.
1	Only error information is output.
2	Program operation summaries are output.
3	Program operation details are output.
4	All information is output.

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

The higher this value is set, the more information that will be output. As the amount of trace information to be output increases, it will take less time to overwrite the old trace information with the new information.

For normal operation, we recommend that you set the trace level to 0. If you set the trace level to a value higher than necessary, HDLM performance might decrease, or trace information required to analyze the cause of an error might be overwritten.

The following is an example of using a command to set the trace level.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systflv 1
```

Specify the trace level as a number.

Setting the error log file size

The error log file size (the HDLM manager log (`dldmmgrn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value (in KB) from 100 to 2000000 for the error log file size. The specified value is applied for HDLM manager logs.

When an error log file reaches its maximum size, the information in the oldest error log file will be overwritten with new information. By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30GB) of error log information.

The following is an example of using a command to set the error log file size.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -elfs 1000
```

Specify the size of the error log file in KB.

Setting the number of error log files

The number of the error log files (the HDLM manager log (`dldmgn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value from 2 to 16 for the number of HDLM manager log files.

By specifying both the log file size and the number of log files, you can collect up to 32000000KB (approximately 30GB) of error logs.

The following is an example of using a command to set the number of error log files.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -elfn 5
```

Specify the number of error log files by a number.

Setting the trace file size

Trace files for which a trace file size can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64). The length of a trace file is fixed, regardless of how much trace information is actually in the file.

For the trace file size, you can specify a value (in kilobytes) from 100 to 16000. If you specify a value smaller than the setting value, the KAPL01097-W message will be displayed to confirm the execution, and the trace file will be temporarily deleted.

When all the trace files become full, the oldest file is overwritten with any new trace data.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000 KB of trace data.

The following is an example of using a command to set the trace file size:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systfs 2000
```

Specify the size of the trace file in KB.

Setting the number of trace files

Trace files for which the number of files can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64).

For the number of trace files, you can specify a value from 2 to 64. If you specify a value smaller than the value that has already been specified, the KAPL01097-W message will be displayed to confirm the execution, and the trace file will be temporarily deleted.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000 KB of trace data.

The following is an example of using a command to set the number of trace files:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systfn 10
```

Specify the number of trace files by using numbers.

Setting up audit log data collection

If you want to collect audit log data, you must also specify the collection level for audit log data and the audit log categories.

The table below lists and describes the values for the audit log collection level setting. An audit log data collection level is a severity level. The default is 6.

Table 3-83 Values indicating audit log data collection levels

Value (severity)	Explanation
0	No audit log data is collected.
1	
2	Critical-level audit log data is collected.
3	Critical-level and Error-level audit log data is collected.
4	Critical-level, Error-level, and Warning-level audit log data is collected.
5	
6	Critical-level, Error-level, Warning-level, and Informational-level audit log data is collected.
7	

The table below lists and describes the values for the audit log category setting. The default is `all`.

Table 3-84 Values indicating audit log data categories

Value	Explanation
<code>ss</code>	Audit log events of the <code>StartStop</code> category are collected.
<code>a</code>	Audit log events of the <code>Authentication</code> category are collected.
<code>ca</code>	Audit log events of the <code>ConfigurationAccess</code> category are collected.
<code>all</code>	Audit log events of the <code>StartStop</code> , <code>Authentication</code> , and <code>ConfigurationAccess</code> categories are all collected.

This example shows how to enable the collection of audit log data:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -audlog on -audlv 6 -  
category all
```

Specify `on` if you want to collect audit log data, and `off` if you do not want to collect audit log data. If you specify `on`, you can use the `-audlv` parameter to specify the collection level for audit log data and the `-category` parameter to specify the audit log categories.

If you want to set the audit log facility, see [Setting the audit log facility on page 3-190](#).

Setting the audit log facility

The following describes how to specify the output destination for audit log data.

If you want to specify the output destination for audit log data, first specify the audit log facility by using the `dlnmgr set -audfac` command. Next, define the output destination of the facility in the syslog settings file. The table below lists the values for the audit log facility setting. The default is `user`.

Table 3-85 Values indicating audit log facility

Value	Corresponding facility value in the syslog settings file
user or 1	user
local0 or 16	local0
local1 or 17	local1
local2 or 18	local2
local3 or 19	local3
local4 or 20	local4
local5 or 21	local5
local6 or 22	local6
local7 or 23	local7

This example shows how to specify the audit log facility:

```
# /opt/DynamicLinkManager/bin/dlnmgr set -audfac local0
```

Checking the updated settings

This chapter describes steps involved in how to check the new settings by using the `dlnmgr` command's `set` operation after the new settings are applied.

When you some these settings, you can display information about all of HDLM function settings. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys -sfunc
HDLM Version           : x.x.x-xx
```



```

Service Pack Version          :
Load Balance                  : on(extended lio)
Support Cluster               :
Elog Level                    : 2
Elog File Size(KB)            : 1000
Number Of Elog Files          : 5
Trace Level                   : 1
Trace File Size(KB)           : 2000
Number Of Trace Files         : 10
Path Health Checking          : on(10)
Auto Failback                 : on(10)
Reservation Status            :
Intermittent Error Monitor    : on(2/20)
Dynamic I/O Path Control      : off(10)
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

After you have set up the collection of audit log data, use the following command to make sure that the setting has been specified correctly:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log                     : on(6)
Audit Log Category            : all
Audit Log Facility            : local0
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

The process-specific-trace information file

When HDLM is used, the dlnkmgr command logs are output to the following process-specific-trace (traces for multiple processes) information files of Hitachi Network Objectplaza Trace Library (HNTRLib2): `/var/opt/DynamicLinkManager/log/dlnkmgrn.log` (*n* indicates a file number).

The following table shows the setting values for the process-specific-trace information files.

Table 3-86 Setting values for the process-specific-trace information files

Settings	Values [#]
Size of the process-specific-trace information file	2048 (KB)
Number of process-specific-trace information files	2

#

The setting values cannot be modified.

Notes on using the Hitachi Network Objectplaza Trace Library

Note the following when using Hitachi Network Objectplaza trace library:

- If a different Hitachi product is using HNTRLib2 when you attempt to remove HDLM, HNTRLib2 will not be removed

Creating a character-type device file for an HDLM device

This section describes how to create a character-type device file for an HDLM device.

- HDLM creates only a block-type device under `/dev`.
- If the OS is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15, use an `udev` rule file to create the character-type device file. If the OS is SUSE LINUX Enterprise Server 11, use the `raw` command to create the character-type device file.

The following shows the difference between these two methods:

- The character-type device file created by using the `raw` command is deleted when the host is restarted.
- The character-type device file created by using an `udev` rule file is not deleted when the host is restarted.

When using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15

Use the `udev` rule file to create a character-type device file.

To create a character-type device file by using an `udev` rule file:

1. Edit the `/etc/udev/rules.d/60-raw.rules` file.

For example, you might edit the file as follows:

```
ACTION=="add", KERNEL=="sddlmaa", RUN+="/bin/raw /dev/raw/raw1
%N"
```

2. Restart the host or execute the `start_udev` command.

The editing performed in step 1 is applied when the host is restarted or the `start_udev` command is executed.

The following shows an example of executing the `start_udev` command:

```
# /sbin/start_udev
```

When using SUSE LINUX Enterprise Server 11

A character-type device file is created from the HDLM device using the Linux `raw` command. The following is an example of executing the `raw` command for an HDLM device.

```
# raw /dev/raw/raw1 /dev/sddlmaa  
/dev/raw/raw1: bound to major 253, minor 0
```

Figure 3-15 Executing the raw command

In this example, the command creates `/dev/raw/raw1` as a character-type device file for `/dev/sddlmaa` (major number of 253, minor number of 0).

Creating file systems for HDLM (when volume management software is not used)

This section describes how to build a file system in an HDLM-managed device without using volume management software.

Mounting a file system

To mount an HDLM-managed device as a file system by specifying the logical device file name for an HDLM device:

1. Create a file system by using an HDLM device.
If the file system already exists, skip to step 2.
Note that the file systems supported by HDLM are ext2, ext3, ext4, GFS2, ReiserFS, VxFS, xfs, and Btrfs. For details about creating a file system, see [Creating a file system on page 3-193](#).
2. Create a directory on which to mount the file system.

```
# mkdir /mnt/hdlm
```

In this example, the command creates `/mnt/hdlm` to be used for the mount point.

3. Mount the file system.
Execute a command such as the following:

```
# mount /dev/sddlmaa /mnt/hdlm
```

In this example, the command mounts `/dev/sddlmaa` (the logical device file name for an HDLM device) `/mnt/hdlm`.

Creating a file system

The file systems supported by HDLM are ext2, ext3, ext4, GFS2, ReiserFS, VxFS, xfs, and Btrfs. The following example shows how to create an ext2 file system in `/dev/sddlmaa1`.

```
# mkfs -t ext2 /dev/sddlmaal
mke2fs 1.26 (3-Feb-2002)
warning: 184 blocks unused.

Filesystem label=
OS type: Linux
Block size=1024 (log=0)
Fragment size=1024 (log=0)
100744 inodes, 401409 blocks
20079 blocks (5.00%) reserved for the super user
First data block=1
49 block groups
8192 blocks per group, 8192 fragments per group
2056 inodes per group
Superblock backups stored on blocks:
    8193, 24577, 40961, 57345, 73729, 204801, 221185

Writing inode tables: done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 39 mounts or
180 days, whichever comes first. Use tune2fs -c or -i to override.
```

Figure 3-16 Example of creating an ext2 file system

Settings for automatic mounting

If you specify the name of a logical device file of an HDLM device at host startup, an HDLM-managed device is automatically mounted in the same way as if you had specified the name of a logical device file of a SCSI device. To mount an HDLM-managed device automatically, you need to edit the `/etc/fstab` file. In this file, you can specify the name of the logical device file of the SCSI device and the mount point of its disk. After this file has been created, the specified HDLM-managed device is mounted automatically when Linux is started. Linux functionality for specifying a file system to be mounted by using LABEL or UUID instead of using a device is not supported by HDLM. Do not use this functionality.

The following subsections describe the tasks that are required for using HDLM.

Setting the HDLM device for the first time

To mount an HDLM-managed device automatically by setting a new HDLM device:

1. Identify the name of the logical device file of the HDLM device to be mounted automatically.

Execute the `view` operation of the HDLM command, and identify the applicable name of the logical device file of the HDLM and SCSI devices. For details on the `view` operation, see [view \(displays information\) on page 6-31](#). The following is an actual example.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV
000000 sddlmaa /dev/sdh VSP_G1000.10182.00280B
000001 sddlmaab /dev/sdi VSP_G1000.10182.00280C
000002 sddlmac /dev/sdj VSP_G1000.10182.00280D
000003 sddlmaa /dev/sdk VSP_G1000.10182.00280B
000004 sddlmaab /dev/sdl VSP_G1000.10182.00280C
000005 sddlmac /dev/sdm VSP_G1000.10182.00280D
000006 sddlmaa /dev/sdn VSP_G1000.10182.00280B
000007 sddlmaab /dev/sdo VSP_G1000.10182.00280C
000008 sddlmac /dev/sdp VSP_G1000.10182.00280D
000009 sddlmaa /dev/sdq VSP_G1000.10182.00280B
000010 sddlmaab /dev/sdr VSP_G1000.10182.00280C
000011 sddlmac /dev/sds VSP_G1000.10182.00280D
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
```

Figure 3-17 Example of executing the dlnkmgr command's view operation (with -drv specified)

In the example, the name of the logical device file of the HDLM device that corresponds to `/dev/sdh` can be identified as `sddlmaa`.

2. Add the name of the logical device file of the HDLM device that was confirmed in step 1 to the `/etc/fstab` file.

The following is an example of editing the `/etc/fstab` file:

- o For FC-SAN environments

```
/dev/sddlmaa /mnt/sdh ext2 defaults 0 0
```

- o For IP-SAN environments

- If the OS is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7:

```
/dev/sddlmaa /mnt/sdh ext2 _netdev 0 0
```

- If the OS is SUSE LINUX Enterprise Server 11, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```
/dev/sddlmaa /mnt/sdh ext2 nofail 0 0
```

- o For QLogic 8400 Series (FCoE) environments

- If the OS is Red Hat Enterprise Linux 6 or Red Hat Enterprise Linux 7:

```
/dev/sddlmaa /mnt/sdh ext2 _netdev 0 0
```

This example adds a line for `/dev/sddlmaa` (name of the logical device file of the HDLM device). For IP-SAN environments, specify `_netdev` or `nofail` for the mount option. In addition, for QLogic 8400 Series (FCoE) environments, specify `_netdev` for the mount option.

- Restart the host or manually mount the HDLM device.
HDLM-managed devices are mounted by using the logical device file name of the HDLM device.

Migrating from an environment where a SCSI device is already set

To move an already set SCSI device to an HDLM device:

- Identify the name of the logical device file of the HDLM device to be mounted automatically.
Execute the `dlmkmgr` command's `view` operation, and identify the applicable name of the logical device file of the HDLM and SCSI devices. For details on the `view` operation, see [view \(displays information\) on page 6-31](#). The following is an actual example.

```
# /opt/DynamicLinkManager/bin/dlmkmgr view -drv
PathID HDevName Device LDEV
000000 sddlmaa /dev/sdh VSP_G1000.10182.00280B
000001 sddlmaab /dev/sdi VSP_G1000.10182.00280C
000002 sddlmac /dev/sdj VSP_G1000.10182.00280D
000003 sddlmaa /dev/sdk VSP_G1000.10182.00280B
000004 sddlmaab /dev/sdl VSP_G1000.10182.00280C
000005 sddlmac /dev/sdm VSP_G1000.10182.00280D
000006 sddlmaa /dev/sdn VSP_G1000.10182.00280B
000007 sddlmaab /dev/sdo VSP_G1000.10182.00280C
000008 sddlmac /dev/sdp VSP_G1000.10182.00280D
000009 sddlmaa /dev/sdq VSP_G1000.10182.00280B
000010 sddlmaab /dev/sdr VSP_G1000.10182.00280C
000011 sddlmac /dev/sds VSP_G1000.10182.00280D
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
```

Figure 3-18 Example of executing the `dlmkmgr` command's `view` operation (with `-drv` specified)

In the example, the name of the logical device file of the HDLM device that corresponds to `/dev/sdh` can be identified as `sddlmaa`.

- In the `/etc/fstab` file, change the logical device file name for a SCSI device to that for the HDLM device that you confirmed in step 1.

The following is an example of editing the `/etc/fstab` file:

- For FC-SAN environments

```
# /dev/sdh /mnt/sdh ext2 defaults 0 0
/dev/sddlmaa /mnt/sdh ext2 defaults 0 0
```

- For IP-SAN environments

- If the OS is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7:

```
# /dev/sdh /mnt/sdh ext2 _netdev
0 0
```

```

/dev/sddlmaa      /mnt/sdh          ext2      _netdev          0 0

```

- If the OS is SUSE LINUX Enterprise Server 11, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```

# /dev/sdh          /mnt/sdh          ext2      nofail          0 0
/dev/sddlmaa      /mnt/sdh          ext2      nofail          0 0

```

- For QLogic 8400 Series (FCoE) environments
 - If the OS is Red Hat Enterprise Linux 6 or Red Hat Enterprise Linux 7:

```

# /dev/sdh          /mnt/sdh          ext2      _netdev
0 0
/dev/sddlmaa      /mnt/sdh          ext2      _netdev          0 0

```

This example comments out the line for `/dev/sdh` (logical device file name of the SCSI device) and adds a line for `/dev/sddlmaa` (logical device file name of the HDLM device). For IP-SAN environments, add the line if neither `_netdev` nor `nofail` is specified for the mount option. In addition, for QLogic 8400 Series (FCoE) environments, make sure `_netdev` is specified for the mount option.

3. Restart the host or manually mount the HDLM device.
The HDLM-managed device is mounted using the logical device file name of the HDLM device.

Canceling the settings for HDLM

Return the HDLM environment to the way it was before HDLM was installed by following the procedure flow shown in [Figure 3-19 Overview of HDLM removal on page 3-198](#).

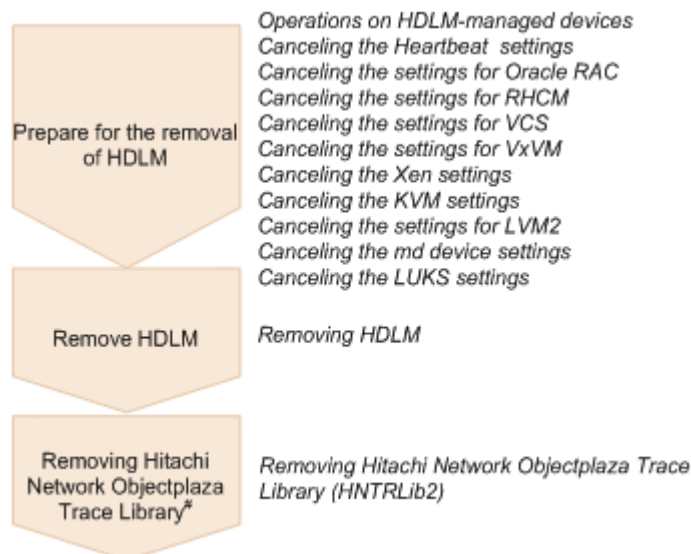


Figure 3-19 Overview of HDLM removal

#

Perform as required.

Operations on HDLM-managed devices

The following procedure must be performed before removing HDLM:

1. Back up all HDLM-managed devices as required (for example, using a tape backup).
2. Collect all information on the correspondence between logical device file names for the HDLM devices and LU numbers of the LUs in the storage system.
This step enables you to keep the correspondence between LUs and the logical device file names for SCSI devices once removal is complete.
3. Cancel HDLM device registration in an application.
An application uses an HDLM device when accessing an LU, so after HDLM is removed, the application cannot use the same HDLM device to access that LU. If an HDLM-managed device is registered in an application (including cluster software, but excluding volume management software), cancel registration of the HDLM device.
For details on how to cancel the Heartbeat settings, see [Canceling the Heartbeat settings on page 3-199](#). For details on how to cancel the Oracle RAC settings, see [Canceling the settings for Oracle RAC on page 3-200](#). For details on how to cancel the RHCM settings, see [Canceling the settings for RHCM on page 3-200](#). For details on how to cancel the VCS settings, see [Canceling the settings for VCS on page 3-201](#). For details on how to cancel the VxVM settings, see [Canceling the settings for VxVM on page 3-201](#).
4. Cancel the Xen settings.
Set up Xen so that the HDLM devices cannot be used in domainU.

For details on how to cancel the Xen settings, see [Canceling the Xen settings on page 3-202](#).

5. Cancel the KVM settings.
Delete the HDLM devices from the hardware configuration file.
For details on how to cancel the KVM settings, see [Canceling the KVM settings on page 3-203](#).
6. Unmount the HDLM device.
If HDLM-managed devices have been mounted by specifying HDLM devices, unmount them. Also, if the disks are set to be mounted automatically when the host starts, delete this setting in the `/etc/fstab` file.
For details on how to cancel the setting, see [Operations required for devices to be managed by HDLM on page 3-95](#).
However, perform the procedure by releasing an HDLM disk that is already defined and adding a SCSI device.
7. Cancel HDLM device registration in volume management software.
If HDLM devices are registered in volume management software, cancel the registration.
For details on how to cancel the LVM settings, see [Canceling the settings for LVM2 on page 3-204](#).
8. Migrate the md device to the SCSI devices.
If you have constructed the md device by using HDLM-managed devices, you need to migrate the HDLM-managed devices to the SCSI devices.
For details on how to cancel the md device settings, see [Canceling the md device settings on page 3-211](#).
9. Cancel the LUKS settings.
Migrate to the SCSI devices from an environment where HDLM devices use LUKS.
For details on how to cancel the LUKS settings, see [Canceling the LUKS settings on page 3-217](#).

Canceling the Heartbeat settings

If Heartbeat is being used with SUSE LINUX Enterprise Server 11, the HDLM device settings must be cancelled from Heartbeat.

The following is the procedure for migrating an environment in which HDLM devices have already been used for Heartbeat to an environment that uses character-type SCSI devices.

1. Stop the Heartbeat service in the cluster.
If the Heartbeat service is running, stop it by executing the following command:


```
# etc/init.d/heartbeat stop
```
2. Migrate the SCSI devices used by Heartbeat to HDLM devices.

If a SCSI device that is subordinate to an HDLM device is being used as a file system resource, edit the settings as shown in the following example:

```
# host1 172.26.4.321 Filesystem::/dev/sddlmaa::/mnt/point::ext3
host1 172.26.4.321 Filesystem::/dev/sda::/mnt/point::ext3
```

In this example, the HDLM device `/dev/sddlmaa` is commented out, and the SCSI device `/dev/sda` is added.

3. Start the Heartbeat service in the cluster.
Execute the following command to start the Heartbeat service:

```
# /etc/init.d/heartbeat start
```

Canceling the settings for Oracle RAC

This section describes how to cancel the values set for HDLM in an environment where Oracle RAC is used.

- When using release 10.1.0.3.0 or later of Oracle RAC 10g, the value set in the `MISSCOUNT` parameter, for which the threshold of the I/O timeout of the voting disk is set, must be returned to the value that was set before HDLM was installed. For details on how to set the value of the `MISSCOUNT` parameter, contact the company with which you have a support service contract for Oracle.
- When using release 10.2.0.2.0 or later of Oracle RAC 10g, the value set in the `DISKTIMEOUT` parameter, must be returned to the value that was set before HDLM was installed. For details on how to set the value of the `DISKTIMEOUT` parameter, contact the company with which you have a support service contract for Oracle.

Canceling the settings for RHCM

This section describes how to cancel the HDLM device settings in RHCM in an environment where RHCM is used. If the environment is one where an HDLM device is already being used in RHCM, the following procedure must be executed in order to change to an environment that uses a character-type device of a SCSI device.

When using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8

To cancel the settings for RHCM:

1. Stop the cluster service of RHCM.
If the RHCM service is running, stop the service by executing the following command:

```
# service rgmanager stop
# service cman stop
```

2. Replace the HDLM device used by RHCM with a SCSI device.
Edit as shown below to use the SCSI device `/dev/sda`, which is the lower SCSI device of the HDLM device `/dev/sddlmaa`, as `/dev/raw/raw1`.

```
# ACTION=="add", KERNEL=="sddlmaa", RUN+="/bin/raw /dev/raw/raw1
%N"
ACTION=="add", KERNEL=="sda", RUN+="/bin/raw /dev/raw/raw1 %N"
```

Comment out `KERNEL=="sddlmaa"` and add `KERNEL=="sda"`.

3. If you will restart the host, go to step 4. If you will not restart the host, go to step 5.
4. Restart the host to apply the changes made in step 2.
Execute the following command to restart the host:

```
# shutdown -r now
```

RHCM setup is complete.

5. Execute the following command to apply the changes made in step 2:

```
# /sbin/start_udev
```

6. Start the cluster service of RHCM.
Executing the following command to start the service:

```
# service cman start
# service rgmanager start
```

Canceling the settings for VCS

This section describes how to cancel the HDLM device settings in VCS in an environment where VCS is used. For details on how to perform operations from the VCS GUI, see the VCS documentation.

To cancel the HDLM settings in an environment where VCS is used:

1. Stop the cluster service of VCS.
2. Change the HDLM device used by VCS to a SCSI device.
Change the `Block Devices` parameter in `Mount` resource from an HDLM device to SCSI device.

Canceling the settings for VxVM

This section describes how to release an HDLM device that is registered as an external device.

1. Execute the following command to confirm that the HDLM device is registered in the VX list.

```
# vxdisk list
```

The following is an example of executing the command:

```
# vxdisk list
DEVICE      TYPE      DISK      GROUP      STATUS
sddlmaa     simple    -         -          online
sddlmaab    simple    -         -          online
```

2. Execute the following command to release the HDLM device from the VxVM volume.

Example of executing the command to release `/dev/sddlmaa`:

```
# vxddladm rmforeign blockpath=/dev/sddlmaa charpath=/dev/sddlmaa
```

3. Execute the following command to release the device from the VX list.

```
# vxdctl enable
```

4. Execute the following command to confirm that the HDLM device has been released.

```
# vxdisk list
```

The following is an example of executing the command:

```
# vxdisk list
DEVICE      TYPE      DISK      GROUP      STATUS
hus_1500_316 auto:none  -         -          online
invalid
hus_1500_317 auto:none  -         -          online
invalid
```

Canceling the Xen settings

This subsection describes how to cancel the HDLM device settings in an environment in which Xen is being used.

The following is the procedure for migrating a domainU environment that uses the HDLM device `/dev/sddlmaa` in a multi-path configuration to an environment that uses the SCSI device `/dev/sda` in a single-path configuration.

1. Check the correspondence between the HDLM and SCSI devices.
Execute the HDLM configuration definition utility (`dlmcfgmgr`) with the `-v` parameter.

```
# /sbin/dlmcfgmgr -v
HDevName      Management Device      Host Channel Target Lun
/dev/sddlmaa   configured /dev/sda    2      0      0      0
              -          2      0      1      0
/dev/sddlmaab configured /dev/sdb    2      0      0      1
              :
              :
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

#

The HDLM devices are listed in the `HDevName` column, and the SCSI devices are listed in the `Device` column.

2. Check whether the HDLM devices can be migrated to the SCSI devices. Execute the command shown below.

In the following example, the `domU` configuration information is checked from the management domain:

```
# /usr/sbin/xm list -l domU
:
:
(device
  (vbd
    (uuid 6b393aaa-89e7-44dc-7a57-24d477dee43d)
    (bootable 0)
    (driver paravirtualised)
    (dev sdx)
    (uname phy:/dev/sddlmaa)
    (mode w)
  )
)
:
:
```

The HDLM device displayed on the `uname phy` line is an HDLM device that appeared in the check in step 1.

3. If domainU is running, stop it.
If domainU has been set to automatically start when domain0 starts, temporarily change the setting so that domainU will not start automatically.
4. Change the multi-path configuration to a single-path configuration.
5. Specify the settings so that HDLM devices are not used in domainU.
Disable the block device settings from domainU. For details, see the Linux documentation.
6. Specify the settings so that the SCSI devices are used in domainU.
Set (export) the block devices to domainU. For details, see the Linux documentation.
Make sure that you specify the settings based on the correspondence between the HDLM and SCSI devices displayed in step 1.
7. Start domainU.
If you have temporarily changed the settings so that domainU does not automatically start in step 3, restore the previous settings.

Canceling the KVM settings

If you are using KVM, you need to delete the HDLM device from the hardware configuration file (`/etc/libvirt/qemu/domain-name.xml`). For details on the hardware configuration file, see the OS documentation.

To cancel the KVM settings by using the `virsh` command:

1. Execute the following command to check the domain name and operating status of the guest OS.

```
# virsh list --all
 Id Name                               State
-----
 1  domK                               running
```

The underlined part indicates the domain name.

2. If the guest OS is running, stop it.
For details on how to stop the guest OS, see the OS documentation.
3. If necessary, delete the HDLM device from the hardware configuration file.

If you want to delete the HDLM device (`/dev/sddlmac`), delete the following lines:

```
<disk type='block' device='disk'>
  <source dev='/dev/sddlmac' />
  <target dev='hdb' bus='ide' />
</disk>
```

4. To migrate an environment that uses an HDLM device to an environment that uses a SCSI device, change the HDLM device registered in the hardware configuration file to a SCSI device.

The following example shows how to edit the hardware configuration file when migrating the HDLM device (`/dev/sddlmac`) to the SCSI device (`/dev/sda`):

Before:

```
<source dev='/dev/sddlmac' />
```

After:

```
<source dev='/dev/sda' />
```

For details on which HDLM device correspond to which SCSI device, see [Displaying corresponding information about an HDLM device, SCSI device, and LDEV on page 4-18](#).

5. Execute the following command to enable the settings in the hardware configuration file.

```
# virsh define /etc/libvirt/qemu/domK.xml
```

6. Start the guest OS.
For details on how to start the guest OS, see the OS documentation.

Canceling the settings for LVM2

This section explains how to change from an environment where HDLM devices are used as LVM physical volumes, to an environment where SCSI devices are used as LVM physical volumes.

This section provides the procedure for moving a logical volume on an HDLM device in a multipath configuration to a SCSI device in a single path configuration when using LVM2.

To create the environment shown in [Figure 3-20 Device configuration when a logical volume on an HDLM device is moved to a SCSI device on page 3-205](#), carry out the procedure below. To remove HDLM, carry out the steps before the removal.

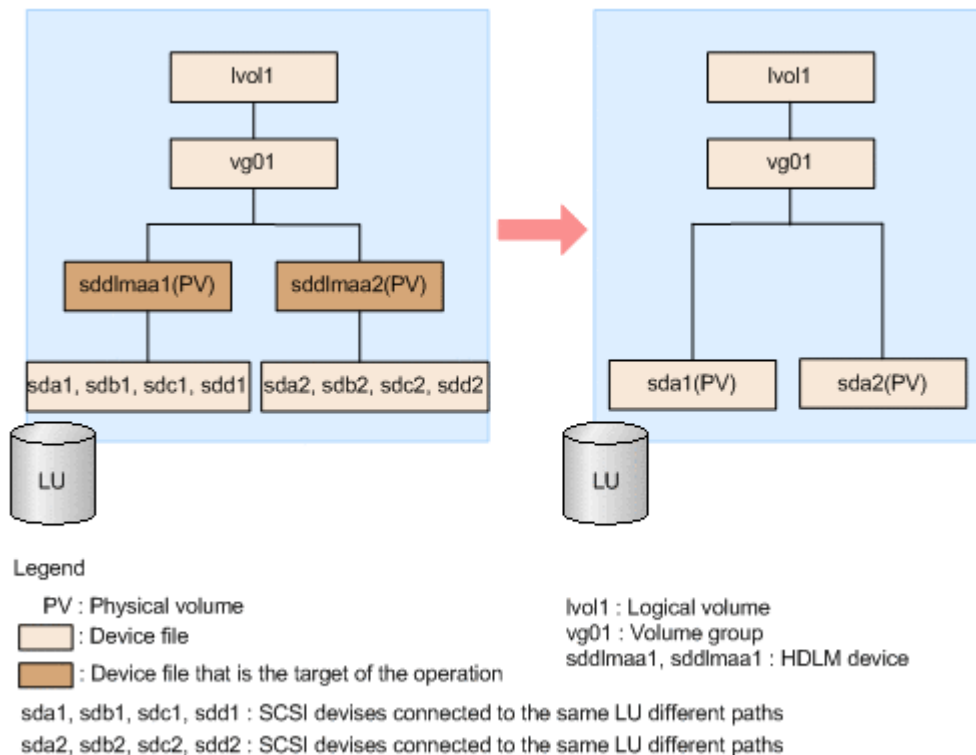


Figure 3-20 Device configuration when a logical volume on an HDLM device is moved to a SCSI device

In [Figure 3-20 Device configuration when a logical volume on an HDLM device is moved to a SCSI device on page 3-205](#), sda1, sdb1, sdc1, and sdd1 indicate the same LU. Likewise, sda2, sdb2, sdc2, and sdd2 indicate the same LU. sddlmaa1 and sddlmaa2 indicate the HDLM devices corresponding to each LU.

To move the logical volume to a SCSI device:

1. Stop all processes and services that are using the SCSI and HDLM devices.
2. Unmount the logical volume to be moved.
In the following example, the logical volume subject to the move has been mounted on /mnt/lvol1:

```
# umount /mnt/lvol1
```

3. Deactivate the volume group.

In the following example, the logical volume to be moved belongs to the vg01 volume group:

```
# vgchange -an vg01
0 logical volume(s) in volume group "vg01" now active
```

4. Export the volume group.

In the following example, the command exports information about the vg01 volume group:

```
# vgexport vg01
Volume group "vg01" successfully exported
```

5. If the LVM environment uses an HDLM device in a multi-path configuration, configure the path to an existing LU as a single path. Change the path to an existing LU as a single-path configuration by performing the procedure described in [Deleting a path to an existing LU on page 4-43](#).

Note

When you restart the host, if the `/etc/fstab` file contains a description about mounting the target logical volume, comment out the description. Also, stop the applications that access the target logical volume.

6. Edit the `/etc/lvm/lvm.conf` file.

Edit the device section in the file as shown below to enable the SCSI device configuration and disable the HDLM device configuration:

The following shows an example of editing the `/etc/lvm/lvm.conf` file. The underlined parts show the locations that were edited.

- For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:

Before:

```
devices {
    :
    # global_filter = [ "a/*/" ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
    :
    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
    :
    # md_component_detection = 1
    md_component_detection=0
    :
    # allow_changes_with_duplicate_pvs = 0
    allow_changes_with_duplicate_pvs = 1
    :
}
```

After:

```
devices {
    :
```



```

# global_filter = [ "a./.*/" ]
#_global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
:
# types = [ "fd", 16 ]
#_types = [ "sddlmfdrv", 16 ]
:
md_component_detection = 1
#_md_component_detection=0
:
allow_changes_with_duplicate_pvs = 0
#_allow_changes_with_duplicate_pvs = 1
:
}

```

Comment out the existing `global_filter` and `types` lines, and then add the underlined parts.

Comment out the line where `md_component_detection` is set to 0 and the line where `allow_changes_with_duplicate_pvs` is set to 1.

Then, reset `md_component_detection` and `allow_changes_with_duplicate_pvs` to the original values by removing the comments from the lines that include the values that were set before the HDLM device configuration was enabled.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:

If 1 is set for `allow_changes_with_duplicate_pvs`, change the value to 0.

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

Before:

```

# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {

```

```

:

# filter = [ "a./.*/" ]
filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
:

# write_cache_state = 1
write_cache_state = 0
:

# types = [ "fd", 16 ]
types = [ "sddlmfdrv", 16 ]
:

# md_component_detection = 1
md_component_detection=0

```

```

                                :
}
After:
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {

                                :

    # filter = [ "a/./" ]
    #_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
    filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
                                :

    write_cache_state = 1
    #_write_cache_state = 0
                                :

    # types = [ "fd", 16 ]
    #_types = [ "sddlmfdrv", 16 ]
                                :

    md_component_detection = 1
    #_md_component_detection=0
                                :
                                :
}

```

Comment out the existing `filter` and `types` lines, and then add the underlined parts.

Return `md_component_detection` and `write_cache_state` to their original values by commenting out the lines `md_component_detection = 0` and `write_cache_state = 0` and then removing the comment marks from the lines containing the original values from before the HDLM device configuration was enabled.

- o For OSs other than the above:

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

Before:

```

# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {

                                :

    # filter = [ "a/./" ]
                                :

    # global_filter = [ "a/./" ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
                                :

    # write_cache_state = 1
    write_cache_state = 0
                                :
}

```

```

# types = [ "fd", 16 ]
types = [ "sddlmfdrv", 16 ]
:

# md_component_detection = 1
md_component_detection=0
:
}

```

After:

```

# This section allows you to configure which block devices
should
# be used by the IVM system.
devices {
:

# filter = [ "a./.*/" ]
:

# global_filter = [ "a./.*/" ]
#_global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
:

write_cache_state = 1
#_write_cache_state = 0
:

# types = [ "fd", 16 ]
#_types = [ "sddlmfdrv", 16 ]
:

md_component_detection = 1
#_md_component_detection=0
:
}

```

Comment out the existing `global_filter` and `types` lines, and then add the underlined parts.

Return `md_component_detection` and `write_cache_state` to their original values by commenting out the lines `md_component_detection = 0` and `write_cache_state = 0` and then removing the comment marks from the lines containing the original values from before the HDLM device configuration was enabled.

To remove HDLM, perform the following operations:

- For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:
Delete `global_filter = ["a|sddlm[a-p][a-p].*|", "r|/dev/sd|"]` and `types = ["sddlmfdrv", 16]`.

Delete the comment out character (#) from the `global_filter` entry to return the definition file to the state it was in before the HDLM device configuration was enabled.

- For OSs other than the above:

Delete `filter = ["a|sddlm[a-p][a-p].*|", "r|/dev/sd|"],`
`write_cache_state = 0` and `types = ["sddlmfdrv", 16].`

Delete the comment out character (#) from the `filter` entry to return the definition file to the state it was in before the HDLM device configuration was enabled.

7. Execute the `vgscan` command.

To re-create the volume group on the HDLM device, execute the `vgscan` command as shown in the following example:

```
# vgscan
Reading all physical volumes.  This may take a while...
Found exported volume group "vg01" using metadata type lvm2
```

8. Import the volume group.

In the following example, the command imports the `vg01` volume group:

```
# vgimport vg01
Volume group "vg01" successfully imported
```

9. Execute the `pvscan` command to check that the environment has been changed successfully.

The following shows an example of executing the `pvscan` command:

```
# pvscan
PV /dev/sda1   VG vg01   lvm2 [468.00 MB / 368.00 MB free]
PV /dev/sda2   VG vg01   lvm2 [548.00 MB / 548.00 MB free]
Total: 2 [1016.00 MB] / in use: 2 [1016.00 MB] / in no VG: 0
[0    ]
```

10. Activate the volume group.

In the following example, the logical volume subject to the move belongs to the `vg01` volume group:

```
# vgchange -ay vg01
1 logical volume(s) in volume group "vg01" now active
```

11. If the `/etc/fstab` file was edited (a section was commented out) in step 5, return the commented out section to its original state.

12. Mount the logical volume that was moved.

In the following example, the logical volume that was moved is `/dev/vg01/lvol1` and the command mounts the volume on `/mnt/lvol1`:

```
# mount /dev/vg01/lvol1 /mnt/lvol1
```

Canceling the md device settings

This subsection describes how to migrate an environment where the md devices were constructed by using HDLM-managed devices to an environment where the md devices were constructed by using SCSI devices.

When md devices have been constructed by using SCSI devices, if you do not use the MULTIPATH function for the md devices, perform the procedure described in [Migrating to md devices for which the MULTIPATH function is not used on page 3-211](#). If you want to use the MULTIPATH function for the md devices, perform the procedure described in [Migrating to md devices for which the MULTIPATH function is used on page 3-214](#).

Migrating to md devices for which the MULTIPATH function is not used

This section describes the procedure for migrating an environment where the md devices were created on an HDLM device to an environment where the md devices were created on a SCSI device, by using an example where the RAID functionality is used for the md devices.

In this procedure, the device `/dev/md0` on `/dev/sddlmaa1` and `/dev/sddlmaab1` is migrated to the device `/dev/md0` on `/dev/sdh1` and `/dev/sdi1`. Use the following procedure to configure the environment shown in [Figure 3-21 Device configuration when an md device on an HDLM device is moved to a SCSI device \(an environment that uses the md device's RAID functionality\) on page 3-211](#), carry out the procedure below.

To remove HDLM, carry out the steps before the removal.

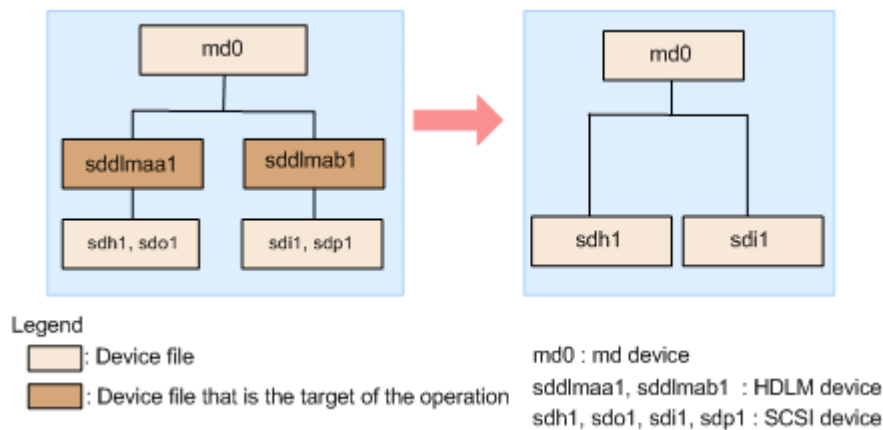


Figure 3-21 Device configuration when an md device on an HDLM device is moved to a SCSI device (an environment that uses the md device's RAID functionality)

To migrate `/dev/md0`:

1. Stop the host and change the multi-path configuration to a single-path configuration.
2. Start the host.
3. Stop all applications that are using the existing md device.

4. If necessary, back up the application data residing on the md device.
5. If file systems have been mounted on the md device, unmount them.
6. Check the status of the md device.

Execute the following command to check the configuration of the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sddlmaa1[0] sddlma1[1]
      5238528 blocks [2/2] [UU]
unused devices: <none>
```

Make sure that `md0 : active` and the HDLM devices are displayed:

7. Execute the following command to deactivate the md device:

```
# mdadm -Ss /dev/md0
```

8. Make sure that the md device has been deactivated.

In the following example, RAID1 (mirroring) is used for the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
unused devices: <none>
```

Make sure that `md0 : active` is not displayed.

9. Check the correspondence between the HDLM devices and SCSI devices.
Execute the HDLM-configuration definition utility `dlmcfgmgr` with the `-v` parameter specified:

```
# dlmcfgmgr -v
HDevName      Management Device      Host Channel Target Lun
/dev/sddlmaa configured /dev/sdh      1          0      0      0
/dev/sddlma1 configured /dev/sdi      1          0      0      1
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

The `HDevName` and `Device` columns display HDLM devices and SCSI devices, respectively.

10. Edit the configuration file.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 9, change the HDLM device names on the `DEVICE` line to the SCSI device names.

Before the correction:

```
DEVICE /dev/sddlmaa1 /dev/sddlma1
```

After the correction:

```
DEVICE /dev/sdh1 /dev/sdi1
```

When you edit the `DEVICE` line, change only the device names. Do not change the partition numbers.

11. If necessary, change the disk partition type of the SCSI devices back to fd.

When you change the disk partition type to fd, the md device is automatically activated when the host restarts, even if the `/etc/mdadm.conf` file does not exist.

The following example shows how to execute the `fdisk` command to change the disk partition type to fd:

```
# fdisk /dev/sddlmaa

Command (m for help): p

Disk /dev/sddlmaa: 5368 MB, 5368709120 bytes
166 heads, 62 sectors/track, 1018 cylinders
Units = cylinders of 10292 * 512 = 5269504 bytes
Device Boot      Start          End      Blocks   Id  System
/dev/sddlmaa1    1          1018     5238597    83  Linux

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): fd
Changed system type of partition 1 to fd (Linux raid autodetect)

Command (m for help): p

Disk /dev/sddlmaa: 5368 MB, 5368709120 bytes
166 heads, 62 sectors/track, 1018 cylinders
Units = cylinders of 10292 * 512 = 5269504 bytes

Device Boot      Start          End      Blocks   Id  System
/dev/sddlmaa1    1          1018     5238597    fd  Linux raid
autodetect

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
```

Also perform the above operation for `/dev/sddlmaab`.

12. Execute the following command to activate the md device:

```
# mdadm -As /dev/md0
mdadm: /dev/md0 has been started with 2 drives.
```

13. Make sure that the md device has been activated.

In the following example, RAID1 (mirroring) is used for the md device:

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdh1[0] sdi1[1]
      5238528 blocks [2/2] [UU]
unused devices: <none>
```

Make sure that `md0 : active` and the SCSI devices are displayed.

14. If you need to mount the file systems on the md device, mount them.

Migrating to md devices for which the MULTIPATH function is used

This section describes the procedure for migrating an environment where md devices were created on an HDLM device to an environment where the md devices were created on a SCSI device. The example below describes how to migrate the md devices created on the HDLM device for which the LINEAR function is used to the md devices created on the SCSI device for which the MULTIPATH function is used.

In this procedure, the device `/dev/md0` on `/dev/sddlmaa1` is migrated to the device `/dev/md0` on `/dev/sdh1` and `/dev/sdo1`. To create the environment shown in [Figure 3-22 Device configuration when an md device on an HDLM device is moved to a SCSI device \(an environment that uses the md device's MULTIPATH functionality\) on page 3-214](#), carry out the procedure below. To remove HDLM, carry out the steps before the removal.

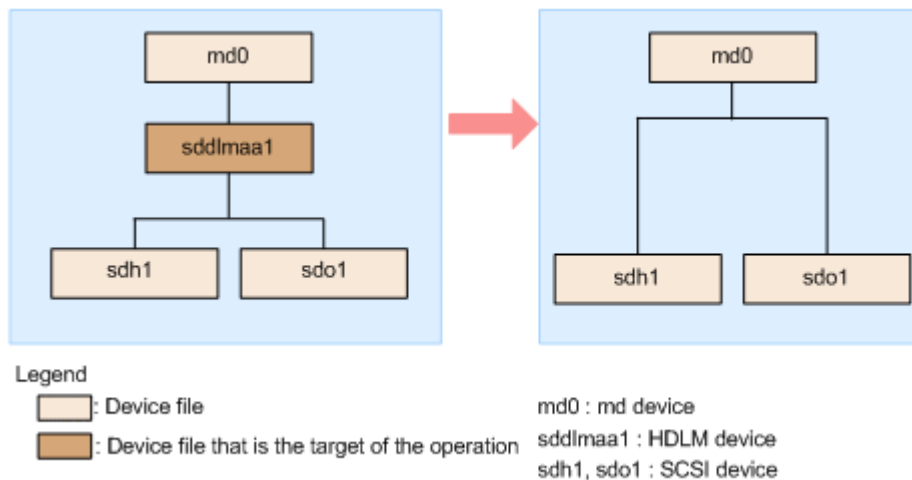


Figure 3-22 Device configuration when an md device on an HDLM device is moved to a SCSI device (an environment that uses the md device's MULTIPATH functionality)

To migrate `/dev/md0`:

1. Deactivate the md device.
Perform steps 3 to 5 in [Migrating to md devices for which the MULTIPATH function is not used on page 3-211](#).
2. Check the status of the md device.
Execute the following command to check the configuration of the md device:

```
# cat /proc/mdstat
Personalities : [linear]
md0 : active linear sddlmaa1[0]
      5238528 blocks [2/2] [UU]
```



```
unused devices: <none>
```

Make sure that `md0` : active and the HDLM devices are displayed:

3. Execute the following command to deactivate the md device:

```
# mdadm -Ss /dev/md0
```

4. Make sure that the md device has been deactivated.

In the following example, the `LINEAR` function is used for the md device:

```
# cat /proc/mdstat
Personalities : [linear]
unused devices: <none>
```

Make sure that `md0` : active is not displayed.

5. Check the correspondence with HDLM device.

Execute the HDLM-configuration definition utility `dlmcfmgmgr` with the `-v` parameter specified:

```
# dlmcfmgmgr -v
HDevName      Management Device    Host Channel Target Lun
/dev/sddlmaa configured /dev/sdh  1      0      0  0
               /dev/sdo  2      0      0  1
KAPL10302-I /sbin/dlmcfmgmgr completed normally.
```

The `HDevName` and `Device` columns display HDLM devices and SCSI devices, respectively.

6. Create an md device.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 5, create an md device.

When you specify a device name, you must also specify the partition number that is displayed in step 2.

Specify all SCSI devices that correspond to HDLM devices:

```
# mdadm -C /dev/md0 -lmp -n2 /dev/sdh1 /dev/sdo1
mdadm: /dev/sdh1 appears to contain an ext2fs file system
      size=5238528K mtime=Wed Feb  6 20:02:45 2008
mdadm: /dev/sdh1 appears to be part of a raid array:
      level=-1 devices=1 ctime=Wed Feb  6 19:31:04 2008
mdadm: /dev/sdo1 appears to contain an ext2fs file system
      size=5238528K mtime=Wed Feb  6 20:02:45 2008
mdadm: /dev/sdo1 appears to be part of a raid array:
      level=-1 devices=1 ctime=Wed Feb  6 19:31:04 2008
Continue creating array? y
mdadm: array /dev/md0 started.
```

7. Create a configuration file.

Execute the following command to add an md device definition to the existing configuration file `/etc/mdadm.conf`:

```
# mdadm --detail --scan | grep -w "/dev/md0" >> /etc/mdadm.conf
```

The following example shows the contents of the created configuration file:

The underlined part indicates the lines added in this step.

```
# cat /etc/mdadm.conf
DEVICE /dev/sddlmaa1
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102 auto=yes
ARRAY /dev/md0 level=multipath num-devices=2
UUID=8db667ff:e7472a25:3a84b801:025a6a57
```

For details about the contents of the configuration file, see the Linux documentation or use the `man` command.

8. If the configuration file `/etc/mdadm.conf` has been recreated, delete the unnecessary `ARRAY` line in that configuration file.

Delete the `ARRAY` line that includes the same name as the md device name (`md0`) created in step 7. In the following example, the underlined lines are to be deleted.

```
# cat /etc/mdadm.conf
DEVICE /dev/sddlmaa1
ARRAY /dev/md0 level=linear num-devices=1 UUID=426a9f1c:
9cfa6310:6aa9a80b:11ea2102 auto=yes
ARRAY /dev/md0 level=multipath num-devices=2
UUID=8db667ff:e7472a25:3a84b801:025a6a57
```

9. Edit the `/etc/mdadm.conf` file to add `auto=yes` to the `ARRAY` line in the configuration file:

```
DEVICE /dev/sd01 /dev/sdh1
ARRAY ARRAY /dev/md0 level=multipath num-devices=2
UUID=8db667ff:e7472a25:3a84b801:025a6a57 auto=yes
```

10. On the `DEVICE` line of the configuration file, change an HDLM device name to a SCSI device name.

Based on the correspondence between the HDLM devices and SCSI devices checked in step 5, change the HDLM device names on the `DEVICE` line to the SCSI device names.

Before the correction:

```
DEVICE /dev/sddlmaa1
```

After the correction:

```
DEVICE /dev/sdh1 /dev/sd01
```

Specify all SCSI devices that correspond to HDLM devices.

When you edit the `DEVICE` line, change only the device names. Do not change the partition numbers.

11. Execute the following command to deactivate the md device:

```
# mdadm -Ss /dev/md0
```

12. Make sure that the md device has been deactivated.

In the following example, the `MULTIPATH` function is used for the md device:

```
# cat /proc/mdstat
Personalities : [linear]# [multipath]
unused devices: <none>
```

Make sure that `md0 : active` is not displayed.

```
#
```

Although `[linear]` will be displayed until the host is restarted, there are no operational problems.

13. Activate the md device.

Perform steps 11 to 14 in [Migrating to md devices for which the MULTIPATH function is not used on page 3-211](#).

Note that, in step 13 in [Migrating to md devices for which the MULTIPATH function is not used on page 3-211](#), `[linear]` will be displayed until the host is restarted. However, there are no operational problems.

Canceling the LUKS settings

This subsection describes how to migrate LUKS from an HDLM device environment using LUKS to SCSI devices.

To migrate from `/dev/sddlmaa` to `/dev/sdh`:

1. Change the multi-path configuration to a single-path configuration.

2. Check the SCSI device to be migrated from the HDLM device.

Execute the HDLM-configuration definition utility (`dlmcfgmgr`) with the `-v` parameter specified to check the correspondence between the SCSI device and the HDLM device.

The following shows an example of executing the `dlmcfgmgr` utility with the specified `-v` parameter:

```
# dlmcfgmgr -v
HDevName      Management  Device      Host Channel Target Lun
/dev/sddlmaa  configured  /dev/sdh    1      0      0      0
/dev/sddlmaab configured  /dev/sdj    1      0      0      1
:
:
KAPL10302-I /sbin/dlmcfgmgr completed normally.
#
```

The HDLM devices are listed in the `HDevName` column, and the SCSI devices are listed in the `Device` column.

3. Execute the following command to check the correspondence between the UUID and the SCSI device name.

In this command, specify the SCSI device name checked in step 2.

```
# cryptsetup luksUUID /dev/sdh
050f9901-3ab8-4556-a091-9c6e4a404f09
#
```

4. In the `/etc/crypttab` file's second field, change the setting to the UUID output executed in step 3.

Before:

```
luks-volume /dev/sddlmaa /etc/cryptpassword
```

After:

```
luks-volume UUID="050f9901-3ab8-4556-a091-9c6e4a404f09" /etc/
cryptpassword
```

Removing HDLM

This subsection describes how to remove HDLM.

Removing HDLM

Note

- If the system initiates path health checking or automatic failback while HDLM is being removed, an error message (KAPL04023) might be output to syslog. However, HDLM operations are not affected.
- If you remove HDLM, the error logs (`/var/tmp/hdlminstlog/installhdlm[01-10].log`) generated during installation of HDLM are not removed. Delete the `/var/tmp/hdlminstlog/installhdlm[01-10].log` files as needed.

For details on the `installhdlm[01-10].log` files, see [Knowledge required before you install HDLM on page 3-84](#).

- When removing 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 removal. Also, do not remove HDLM while executing any of the following Device Manager agent commands:

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

To remove HDLM:

1. Log on to Linux as a root user.
2. Stop all processes and services that are using HDLM-managed paths.
Stop all DBMS, various application processes, and services that are using a path managed by HDLM.
If Xen is being used, make sure that domainU has been stopped. If domainU has been set to automatically start whenever domain0 starts, temporarily change the setting so that domainU will not start automatically.

3. Unmount all HDLM devices.
Execute the following command:

```
# umount mount-point
```

4. Change the setting of the environment variable PATH in the root environment setup file.
Remove /opt/DynamicLinkManager/bin from the environment variable PATH in the environment setup file for the shell used by the root user.
5. Make sure that no HDLM devices are being used.
Run the following command and make sure either that 0 is displayed for Used for sddlmfdrv or that sddlmfdrv is not displayed.

```
# /sbin/lsmmod
Module              Size  Used by
:
:
sddlmfdrv            254092  0
```

If sddlmfdrv is displayed and a value other than 0 is displayed for Used, perform the operation described in [Operations on HDLM-managed devices on page 3-198](#), and then perform steps 2 and 3 in [Removing HDLM on page 3-218](#) so that the HDLM devices can no longer be used.

6. Execute the remove command.
Execute the following command to remove HDLM:
7. Make sure that the remove processing has finished.
Execute the following command to make sure that the remove processing has finished. The following shows the information that is output.

```
# rpm -qi HDLM
package HDLM is not installed
```

8. Start the processes and services stopped in step 2.
The cluster software and volume management software will start up after the host starts.
If you have temporarily changed the settings so that domainU will not automatically start in step 2, restore the previous settings.

Migration to a single-path boot disk environment

This subsection explains how to remove HDLM from a multi-path boot disk environment that uses an HDLM device, and to change the environment to a boot disk environment that uses a SCSI device. (Note that if settings are incorrect, the OS might not start.)

The following procedure describes how to set up a boot disk environment that uses LVM2. This procedure assumes that `grub` is used as the boot loader.

To remove HDLM in such a configuration:

1. Log in to Linux as a user with root permissions.
2. Check whether LVM is used in the boot disk environment.
Execute the `mount` command to check the name of the devices mounted on the root partition (/). If LVM is used, device names that contain the VG name and LV name appear. The following shows an example of executing the command.

- If LVM is used:

```
# mount
/dev/mapper/vg00-lv00 on / type ext3 (rw)
#
```

- If LVM is not used:

```
# mount
/dev/sddlmaa9 on / type ext3 (rw)
#
```

3. If LVM is used in a boot disk environment, edit the `/etc/lvm/lvm.conf` file so that the LVM2 recognizes the SCSI device, not the HDLM device.
When the utility for creating an HDLM boot disk environment (`dlnbootstart`) is used to configure a boot disk environment, the lines that were enabled before the utility was executed are commented out by adding `# Backed up by HDLM`. In this case, disable the lines that are currently enabled, and enable the lines that contain `# Backed up by HDLM`.

The following shows examples of editing the `/etc/lvm/lvm.conf` file when the boot disk environment was configured by performing the procedure described in [Settings for a multipath boot disk environment on page C-2](#).

- For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:
Before:

```
devices {
    :
    global_filter = [ "a|sddl[a-p][a-p].*|", "r|/dev/
sd|" ]
    :
    # types = [ "fd", 16 ]
    types = [ "sddlmdrv", 16 ]
    :
    md_component_detection=0
    # md_component_detection=1
    :
    # allow_changes_with_duplicate_pvs = 0
    allow_changes_with_duplicate_pvs = 1
    :
}
```

After:

```
devices {  
    :  
    # global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/  
sd|" ]  
    global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/  
sd|" ]  
    :  
    # types = [ "fd", 16 ]  
    #_types = [ "sddlmfdrv", 16 ]  
    :  
    #_md_component_detection=0  
    md_component_detection=1  
    :  
    allow_changes_with_duplicate_pvs = 0  
    #_allow_changes_with_duplicate_pvs = 1  
    :  
}
```

Comment out the existing `global_filter` and `types` lines, and then add the underlined parts.

Comment out the line where `md_component_detection` is set to 0 and the line where `allow_changes_with_duplicate_pvs` is set to 1.

Then, reset `md_component_detection` and `allow_changes_with_duplicate_pvs` to the original values by removing the comments from the lines containing the pre-installation values.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Unbreakable Enterprise Kernel 7:

If 1 is set for `allow_changes_with_duplicate_pvs`, change the value to 0.

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

Before:

```
# This section allows you to configure which block devices  
should  
# be used by the LVM system.  
devices {
```

```
    :  
    filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]  
    :  
    # write_cache_state = 1  
    write_cache_state = 0  
    :  
    # types = [ "fd", 16 ]  
    types = [ "sddlmfdrv", 16 ]  
    :  
    md_component_detection=0  
    # md_component_detection=1  
    :
```

```
}
```

After:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
```

```
:
```

```
#_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/sd|" ]
```

```
:
```

```
write_cache_state = 1
#_write_cache_state = 0
```

```
:
```

```
# types = [ "fd", 16 ]
#_types = [ "sddlmfdrv", 16 ]
```

```
:
```

```
#_md_component_detection=0
md_component_detection=1
```

```
:
```

```
}
```

Mark the existing `filter` and `types` lines as comments, and then add the underlined parts.

Return `md_component_detection` and `write_cache_state` to their original values by commenting out the lines `md_component_detection = 0` and `write_cache_state = 0` and then removing the comment marks from the lines containing the pre-installation values.

- o For OSs other than the above:

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

Before:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
```

```
:
```

```
# filter = [ "a/.*/" ]
```

```
:
```

```
sd|" ]
```

```
:
```

```
# write_cache_state = 1
write_cache_state = 0
```

```
:
```

```
# types = [ "fd", 16 ]
types = [ "sddlmfdrv", 16 ]
```

```
:
```



```

md_component_detection=0
# md_component_detection=1
:
}
After:
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
:

# filter = [ "a./.*/" ]
:

#_global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
global_filter = [ "r|sddlm[a-p][a-p].*|", "a|/dev/
sd|" ]
:

write_cache_state = 1
#_write_cache_state = 0
:

# types = [ "fd", 16 ]
#_types = [ "sddlmfdrv", 16 ]
:

#_md_component_detection=0
md_component_detection=1
:
}

```

Mark the existing `global_filter` and `types` lines as comments, and then add the underlined parts.

Return `md_component_detection` and `write_cache_state` to their original values by commenting out the lines `md_component_detection = 0` and `write_cache_state = 0` and then removing the comment marks from the lines containing the pre-installation values.

After editing the file, execute the following command.

```
# /sbin/vgscan
```

4. In the next step, you will edit the `/etc/fstab` file so that a SCSI device is mounted on each mount point. To do this, first execute the `blkid {device-name}` command to check LABEL and UUID.

If the `dlmbootstart` utility was used to configure the boot disk environment that uses HDLM, you do not need to check LABEL and UUID by executing the `blkid` command.

The following shows an example of executing the command.

```

# /sbin/blkid /dev/sddlmaa2
/dev/sddlmaa2: LABEL="/" UUID="19597725-5d20-4d1d-9906-
f9f891b7711a" TYPE="ext2"
#

```

Note

Depending on the environment you are using, you might not be able to obtain information even if you specify a swap device for blkid. Specify the LABEL or UUID that you recorded during migration to the HDLM boot disk environment.

If you did not record the LABEL or UUID, disable the swap and then recreate the swap with LABEL specified. After the swap is created, make sure to enable the swap.

The following example shows the edited settings when a swap is used:

```
# /sbin/swapoff /dev/{HDLM-device-name}
# /sbin/mkswap -L {LABEL} {HDLM-device-name}
# /sbin/swapon /dev/{HDLM-device-name}
```

5. Back up the `/etc/fstab` file.

6. Edit the `/etc/fstab` file.

Change the mount point of HDLM-managed devices from the HDLM device to the SCSI device.

When the `dlmbootstart` utility is used to configure a boot disk environment, the lines that were enabled before the utility was executed are commented out by adding `# Backed up by HDLM`. In this case, disable the lines that are currently enabled, and enable the lines that contain `# Backed up by HDLM`.

If the boot disk environment was configured by performing the procedure described in [Settings for a multipath boot disk environment on page C-2](#), mark the existing HDLM device specification as a comment by placing a hash mark (`#`) at the beginning of each line. Then, specify the SCSI device by using the SCSI device name (in LABEL or UUID notation) that you checked in step 4.

The following shows an example of editing the `/etc/fstab` file.

```
                                :
#/dev/sddlmaa2 / ext2 defaults 1 1
LABEL=/ / ext2 defaults 1 1
#/dev/sddlmaa1 /boot ext2 defaults 1 2
LABEL=/boot /boot ext2 defaults 1 2
                                :
```

7. Create an initial RAM disk image file for SCSI.

From the following, perform the procedure that corresponds to the host OS.

For details on OS commands, see the documentation for the `mkinitrd` command or the `dracut` command.

- SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6 or Oracle Unbreakable Enterprise Kernel 7:

- a. Check the `hdlm_dracut` specification that is defined in `/etc/opt/DynamicLinkManager/hdlm.conf`. If `hdlm_dracut=y` is specified, change it to `hdlm_dracut=n`.
- b. Execute the `dracut` command.

The following shows an example of executing the command:

Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6 or Oracle Unbreakable Enterprise Kernel 7:

```
# dracut /boot/initramfs-{kernel-version}.img {kernel-version}
```

SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15:

```
# /usr/bin/dracut /boot/initrd-{kernel-version} {kernel-version}
```

If the OS is SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8 or Oracle Unbreakable Enterprise Kernel 7, back up the initial RAM disk image used in the SAN boot environment, and then execute the command using the same file name. After executing the command, go to step 14.

- o SUSE LINUX Enterprise Server 11:

Execute the `mkinitrd` command.

The following shows an example of executing the command:

```
# mkinitrd -i initrd-{kernel-version} -k {kernel-image#}
```

```
#
```

`kernel-image` is the kernel image used during startup (Specify the file whose name starts with `vmlinux` and that appears in the `kernel` line of the boot loader configuration file).

- o For OSs other than the above:

Execute the `mkinitrd` command.

The following shows an example of executing the command:

```
# mkinitrd /boot/initrd-{kernel-version}.img {kernel-version}
```

8. Back up the boot loader configuration file.

9. Edit the boot loader configuration file.

When the `dlmbootstart` utility is used to configure a boot disk environment, the lines that were enabled before the utility was executed are commented out by adding `# Backed up by HDLM`.

If the boot loader is GRUB:

In the `/boot/grub/grub.conf` file, `# Backed up by HDLM` is added to the lines that were enabled before the utility was executed, thereby commenting out those lines. In this case, disable the lines that are currently enabled, and enable the lines that contain `# Backed up by HDLM`. After editing the file, go to step 14.

If the boot loader is GRUB2:

- a. In the `/etc/default/grub` file, `# Backed up by HDLM` is added to the lines that were enabled before the utility was executed, thereby commenting out those lines. In this case, disable the lines that are currently enabled, and enable the lines that contain `# Backed up by HDLM`.
- b. Execute the `grub2-mkconfig` command provided by the OS to create `/boot/grub2/grub.cfg` again. After editing the file, go to step 14.

If the boot disk environment was configured by performing the procedure described in [Settings for a multipath boot disk environment on page C-2](#), copy the settings contained in the boot loader configuration file that was used for the current startup.

10. Change the name of the configuration contained in the boot loader configuration file.

Change the name of the configuration copied in step 9. Choose a name that indicates use for a SCSI device specification.

Change the underlined text as follows:

Before:

```
title Red Hat Enterprise Linux (2.6.32-71.el6.i686)_hdlm
```

After:

```
title Red Hat Enterprise Linux (2.6.32-71.el6.i686)_sd
```

11. In `root`, specify the SCSI device (in the form of LABEL or UUID) you checked in step 4.

If you are using a kernel that supports Xen on SUSE LINUX Enterprise Server, add the root device by using the definition conventions for the boot loader configuration file.

12. In `initrd`, specify the initial RAM disk image file for the SCSI device.

If you are using a kernel that supports Xen on SUSE LINUX Enterprise Server, change the `initrd` file name specified in `module` to the initial RAM disk image file for the SCSI device.

When editing the file, be careful of the following:

- When an option that depends on the user environment is specified:
Be careful not to delete the option.

13. Edit the boot loader configuration file, and specify the settings to be used during startup.

Change the number specified for `default` so that the settings copied in step 9 are used during startup. This number represents the number of the valid `title` when counted from 0.

The following shows an example of settings when the first `title` is valid:
`default=0`

14. Edit the `/etc/opt/DynamicLinkManager/hdlm.conf` file.
Change the `hdlm_cfg_all` setting to `hdlm_cfg_all=n` so that HDLM is not configured when the server starts.
15. If any application directly specifies the HDLM device name, change the application settings so that the SCSI device is specified. For details on how to configure settings for each application, see the documentation for that application.
If you restart the server, HDLM is not configured. Note that, if an application directly specifies the HDLM device name, an error message appears when you restart the server.

16. Shut down the host.
Execute the following command to shut down the host:

```
# shutdown -h now
```

17. Reduce the number of paths to the LU (system disk) and then change the configuration from a multi-path configuration to a single-path configuration.

18. Start the host.

19. After the host starts, check that migration to the SCSI boot disk environment was successful and that the HDLM boot disk environment is not used.
See `/proc/mounts` to check the devices that are mounted on the root (`/`). Execute the following command to output the root information, and then check the devices that are output.

```
# /bin/cat /proc/mounts | /bin/grep -w / | /bin/grep -v rootfs
```

Check as follows, depending on the devices that are output.

- If `/dev/{SCSI-device}` is output:
The SCSI boot disk environment is used.
The HDLM boot disk environment is not used.
- If another device is output:
 - a. Execute the `/usr/bin/readlink -f {output-device}` command.
The full path of the file is output.
 - b. Execute the `/bin/ls -l {output-device}` command.
In a general file, the `major` and `minor` values are displayed where the file size is displayed.
 - c. Execute the following command with the `major` value specified for the argument:

```
# /bin/cat /proc/devices | /bin/grep -w {major}
```

 - If `sd` is output, the SCSI boot disk environment is used.
The HDLM boot disk environment is not used.

- If device-mapper is output:

Execute `/sbin/dmsetup ls --tree` to check the major and minor values of the device associated with the major and minor values displayed in b..

Display example:

```
# /sbin/dmsetup ls --tree
vg00-lv_tmp (253:1)
|- (8:2)
vg00-lv_var (253:2)
|- (8:2)
vg00-lv_swap (253:3)
|- (8:2)
vg00-lv_root (253:0)
|- (8:2)
#
```

If the major and minor values in b. are 253 and 0 respectively, then, in the example above, the corresponding device is (8:2), which has major and minor values of 8 and 2 respectively.

Execute the following command with the major value specified for the argument:

```
/bin/cat /proc/devices | /bin/grep -w {major}
```

If `sddlmfdrv` is not output, the HDLM boot disk environment is not used.

- If another device is output:

The HDLM boot disk environment is not used.

20. Delete the initial RAM disk image file for HDLM.

To do this, execute the following command:

- When an IA32 host is used:

```
# rm /boot/initrd-hdlm-2.6.32-71.el6.i686.img
```

21. Remove HDLM.

To remove HDLM, execute the following command:

```
# /opt/DynamicLinkManager/remover/removehdlm
```

22. Make sure that the removal has been completed.

You must execute the following command to make sure that the removal has been completed. The following information is output.

```
# rpm -qi HDLM
package HDLM is not installed
```

HDLM operation

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

- ☐ [Notes on using HDLM](#)
- ☐ [Updating kernel packages and applying OS update packages](#)
- ☐ [HDLM operations using commands](#)
- ☐ [Starting and stopping the HDLM manager](#)
- ☐ [HDLM resident processes](#)
- ☐ [Reconfiguring the HDLM operating environment](#)

Notes on using HDLM

Note the following when using HDLM.

Notes common to OSs

The following notes are common to OSs:

- Do not activate the same volume group concurrently from multiple servers.
- When a path error exists, the period of time required to return a response to the application that made an I/O request to HDLM depends on the timeout values specified for the Fibre Channel switch and HBA.

Therefore, if an error occurs in all the paths for a single LU, this response time will be the total period of time required for the corresponding Fibre Channel switches and HBAs to detect a timeout for the I/O requested for each path.

For details on the timeout values for Fibre Channel switches and HBAs, see the appropriate manual for the device. The following figure gives an overview of the period required to return a response from the time an application requests an I/O to the time the application receives the response.

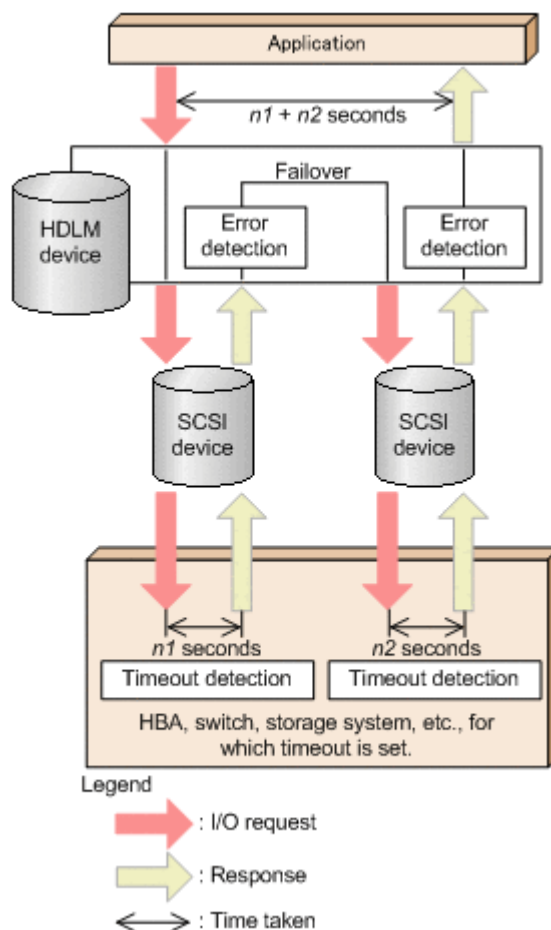


Figure 4-1 Overview of the period required to respond to an application's I/O request

As shown in the preceding diagram, when an HDLM device has two paths (SCSI devices), the maximum period of time required to respond to the application's I/O request is $n1 + n2$ seconds; where $n1$ indicates the timeout value specified for the path that uses SCSI device A, and $n2$ indicates the timeout value specified for the path that uses SCSI device B.

- When using HDLM in a cluster environment, a node in the cluster may fail over before the path completes failover. To avoid this, when you set up the failover timeout value for the node by using cluster software, make sure that you specify a period longer than the response time that is calculated as described in the preceding note.
- If a path error occurs while creating a file system, or formatting, or executing `fsck`, the operation may not finish. In such a case, perform the operation again after restoring the path error.
- The name of the HDLM device file will not be displayed on the Hardware Browser of Red Hat Enterprise Linux.
- The Linux functionality that adds `LABEL=` or `UUID=` to a SCSI device is not supported in HDLM. Do not use this functionality. With HDLM, access can constantly be made to the same LU if the name of the HDLM device file is the same.

- If all the following conditions are satisfied, even a path in the normal status might become Offline(E) or Online(E):
 - A storage system that has a SATA drive is being used.
 - There is a heavy I/O load on the storage system.
 - Path health checking is set to ON.
 If this problem happens, reduce the I/O load, and then return the path status to Online by performing an online operation.
- Although the following messages are output when you load the alert driver and the filter driver respectively, HDLM operations are not affected.

```
sddlmadv: unsupported module, tainting kernel.
sddlmadv: module license 'Proprietary: Contact your HDLM vendor
or the maintenance company for any bugs' taints kernel.
```

- An HDLM device supports a maximum of 15 partitions.
You cannot use an HDLM device with more than 15 partitions created in an LU.

Notes when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, or Oracle Unbreakable Enterprise Kernel

Note the following when your OS is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, or Oracle Unbreakable Enterprise Kernel:

- SCSI devices corresponding to an HDLM device can be removed dynamically even while the HDLM device is in use. Before doing so, perform the following operations:
 - a. Unmount any devices mounted on the HDLM device.
 - b. Execute the `dlmcfmgr -o` command to exclude the HDLM device from management.
- HDLM devices cannot be used to create an md device.
- When a device is dynamically configured by using the udev function, the messages shown below might be output to the console or syslog. However, HDLM operations are not affected.

Output example:

```
scsi_id[a01]: scsi_id: unable to access parent device of '/block/
sddlma01'
```

For *a01* in the above examples, any alphanumeric character can be output.

Notes when using SUSE LINUX Enterprise Server 11

Note the following when your OS is SUSE LINUX Enterprise Server 11:

- To update a kernel package or apply an OS update package, remove HDLM first. Perform the update and then install HDLM again.
For detailed procedures, see [Updating kernel packages and applying OS update packages on page 4-6](#).
- SCSI devices corresponding to an HDLM device can be removed dynamically even while the HDLM device is in use. Before doing so, perform the following operations:
 - a. Unmount any devices mounted on the HDLM device.
 - b. Execute the `dlmcfmgmgr -o` command to exclude the HDLM device from management.
- HDLM devices cannot be used to create an md device.
- If you execute the `sync` command on the file system that is mounted by ext3/ReiserFS, the following message is output to syslog, but there is no problem with HDLM operations.

```
JBD: barrier-based sync failed on sddlmaa1 - disabling barriers
```

- If the number of I/O operations that have occurred in the system exceeds the execution performance of the system (in an environment in which all of the conditions below exist), the KAPL05008-E message and the call trace of a kernel might be output.
 - In the utility for setting HDLM driver option (`dlmsetopt`), the number of retries for allocating memory is set to 0 through 2,147,483,646. In this case, the system might become unstable, and an error might occur in the I/O that is being executed. In the `dlmsetopt` utility, set -1 or a value greater than the current value for the number of retries for allocating memory, and then restart the system. If a call trace is output even after the retry count is set to -1, consider adding memory and stopping unnecessary processes.
- Sometimes a hyphen is displayed for the SCSI device name in the `Device` column of the results of the `dlmcfmgmgr` utility (`dlmcfmgmgr -v`) or the view operation of the HDLM command (with either the `-lu` or `-drv` parameter specified). This might happen if one of the problems listed below occurs while the system is running, even if the SCSI devices are not erased. This problem is related to the OS's hot-plug function. HDLM operations are not affected:
 - A path gets disconnected.
 - An LU is deleted.
 - A fiber cable connection is changed.
 - A Fibre Channel switch's zone setting is changed.

Updating kernel packages and applying OS update packages

This section explains how to update a kernel package or apply an OS update package on a host on which HDLM is installed.

#

A kernel package refers to any package named "kernel-xxx.rpm". An OS update package refers to any package named "initscripts-xxx.rpm" or "lvm2-xxx.rpm". (In each of the aforementioned package names, xxx represents the version number.)

You can also update a kernel package or apply an OS update package in single user mode.

If you create an initial RAM disk image file for HDLM, specify a file name that is supported by the kernel after the kernel is upgraded. In addition, if you edit the boot loader configuration file, copy the startup settings of the SCSI device that was added after the kernel update, and then change the definition so that the OS starts in a state in which HDLM is configured.

Notes when using the kernel to handle CPU vulnerabilities (by using the retpoline method)

There are no notes for Red Hat Enterprise Linux 8.

Note the following when performing a version upgrade of the kernel in Red Hat Enterprise Linux 6 or Red Hat Enterprise Linux 7 when HDLM is installed:

- Upgrading from a version of the kernel that supports the retpoline method to another version that also supports the retpoline method
There are no restrictions regarding CPU vulnerabilities.
- Upgrading from a version of the kernel that does not support the retpoline method to another version that does not support the retpoline method
There are no restrictions regarding CPU vulnerabilities.
- Upgrading from a version of the kernel that does not support the retpoline method to a version that supports the retpoline method
Perform the following procedure:
 - a. If you are using a version of HDLM that is earlier than version 8.6.2, perform an upgrade installation of HDLM.
 - b. Upgrade the version of the kernel, and then start the upgraded kernel.
 - c. Reinstall HDLM.
- Upgrading from a version of the kernel that supports the retpoline method to a version that does not support the retpoline method
This type of upgrade is not supported.

For details about whether the kernel supports the retpoline method, see [Appendix D, HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method on page D-1](#). For further details, consult with the OS provider.

The following table shows whether version upgrades are supported, using Red Hat Enterprise Linux 6.5 as an example.

Table 4-1 Combinations of the retpoline-compatible kernels that can be upgraded when HDLM is installed

Kernel currently in use	The kernel after upgrade			
	Red Hat Enterprise Linux 6.5 With the retpoline method supported	Red Hat Enterprise Linux 6.5 With the retpoline method unsupported	Red Hat Enterprise Linux 6.6 With the retpoline method supported	Red Hat Enterprise Linux 6.6 With the retpoline method unsupported
Red Hat Enterprise Linux 6.5 With the retpoline method unsupported	Y [#]	Y	Y [#]	Y
Red Hat Enterprise Linux 6.5 With the retpoline method supported	Y	--	Y	--

Legend:

Y: Upgrade is possible

--: Not applicable

#

You must perform the procedure described in "Upgrading from a version of the kernel that does not support the retpoline method to a version that supports the retpoline method".

The following table lists the sections you can refer to for procedures that apply to different OSs and installation environments.

Table 4-2 Sections you can refer to for procedures for updating a kernel package or applying an OS update package

Host OS	HDLM installation environment	See:
Oracle Linux 6 Oracle Linux 7 Oracle Unbreakable Enterprise Kernel	Environments where an HDLM device is not used as the boot disk	<i>When you are not using the HDLM device as a boot disk on page 4-10</i>

Host OS	HDLM installation environment		See:
SUSE LINUX Enterprise Server Red Hat Enterprise Linux 7 ^{#1}	Boot disk environment	HDLM device	When you are using the HDLM device as a boot disk on page 4-10
		Logical volume (LVM2) on an HDLM device	When you are using a logical volume (LVM2) on the HDLM device as a boot disk on page 4-11
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 ^{#2}	Environments where an HDLM device is not used as the boot disk		When you are not using the HDLM device as a boot disk on page 4-12
	Boot disk environment	HDLM device	When you are using the HDLM device or the logical volume (LVM2) on the HDLM device as a boot disk on page 4-12
		Logical volume (LVM2) on an HDLM device	

#1

For combinations of kernel versions for which a version upgrade cannot be performed while HDLM is installed.

These combinations are those indicated by an ^N in [Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed on page 4-9](#).

#2

For combinations of kernel versions for which a version upgrade can be performed while HDLM is installed.

These combinations are those indicated by a ^Y in [Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed on page 4-9](#).

Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed

Version of the currently running kernel	Version of the kernel after upgrade			
	Red Hat Enterprise Linux 7.0	Red Hat Enterprise Linux 7.1	Red Hat Enterprise Linux 7.2	Red Hat Enterprise Linux 7.3 or later
Red Hat Enterprise Linux 7.0	Y	N	N	N
Red Hat Enterprise Linux 7.1	--	Y	N	N
Red Hat Enterprise Linux 7.2 or later	--	--	Y [#]	Y [#]

Legend:

- Y: Upgrade is possible
- N: Upgrade is not possible
- : Not applicable

#

- o Kernel downgrades are not supported.
- o The installed version of HDLM must support the upgraded kernel version.
- o To upgrade from a kernel version that does not support the retpoline method to a version that supports the retpoline method, you must use HDLM 8.6.2-00 or a later version.

When using Oracle Unbreakable Enterprise Kernel, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or SUSE Linux Enterprise Server

For some versions of Linux, such as Oracle Unbreakable Enterprise Kernel, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or SUSE LINUX Enterprise Server[#], you need to uninstall HDLM before updating a kernel package or applying an OS update package.

After HDLM is removed, the mappings between HDLM devices and LDEV information are not inherited even if you reinstall HDLM. The procedures provided here assume that you want the mappings between HDLM devices and LDEV information inherited.

If the mappings between HDLM devices and LDEV information do not need to be inherited, the procedures provided here are unnecessary. Remove HDLM by following the procedure in [Removing HDLM on page 3-218](#), and then

update the kernel package or apply the OS update package. Afterwards, follow the procedure in [Installing HDLM on page 3-94](#) to install HDLM again.

#

This applies to combinations of kernel versions for which a version upgrade cannot be performed while HDLM for Red Hat Enterprise Linux 7 is installed.

These combinations are those for which N is indicated in [Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed on page 4-9](#).

When you are not using the HDLM device as a boot disk

To update a kernel package or apply an OS update package when an HDLM device is not used as the boot disk:

1. Copy the following files into a directory:

- o /etc/opt/DynamicLinkManager/.dlmfdrv.conf
- o /etc/opt/DynamicLinkManager/.dlmfdrv.unconf#

#

If this file does not exist, you do not have to copy it into a directory.

2. Remove HDLM.

For details on HDLM removal, see [Removing HDLM on page 3-218](#).

3. Update the kernel package or apply the OS update package.

4. Install HDLM.

For details on HDLM installation, see [Installing HDLM on page 3-94](#).

When you install HDLM, replace step 10 in [Performing a new installation of HDLM on page 3-99](#) with the following:

- o Copy the files acquired from before HDLM was removed (.dlmfdrv.conf and .dlmfdrv.unconf) into the directory /etc/opt/DynamicLinkManager.

Go to step 13 to reboot the host.

When you are using the HDLM device as a boot disk

To update a kernel package or apply an OS update package when an HDLM device is used as the boot disk:

1. Copy the following files into a directory:

- o /etc/opt/DynamicLinkManager/.dlmfdrv.conf
- o /etc/opt/DynamicLinkManager/.dlmfdrv.unconf#

#

If this file does not exist, you do not have to copy it into a directory.

2. Remove HDLM.

For details on HDLM removal, see [Removing HDLM on page 3-218](#).

3. Update the kernel package or apply the OS update package.
4. Install HDLM.
For details on HDLM installation, see [Installing HDLM for managing boot disks on page 3-127](#).

When you install HDLM, replace step 2 in [Settings for a multipath boot disk environment on page 3-131](#) with the following:

- To install HDLM, see [Performing a new installation of HDLM on page 3-99](#) perform steps 2 to 10, 12, and 13 to create an HDLM device.

Also, replace step 10 in [Performing a new installation of HDLM on page 3-99](#) with the following:

- Copy the files acquired from before HDLM was removed (.dlmfdrv.conf and .dlmfdrv.unconf) into the directory /etc/opt/DynamicLinkManager.
Go to step 13 to reboot the host.

When you are using a logical volume (LVM2) on the HDLM device as a boot disk

To update a kernel package or apply an OS update package when a logical volume (LVM2) on an HDLM device is used as the boot disk:

1. Copy the following files into a directory:
 - /etc/opt/DynamicLinkManager/.dlmfdrv.conf
 - /etc/opt/DynamicLinkManager/.dlmfdrv.unconf##
If this file does not exist, you do not have to copy it into a directory.
2. Remove HDLM.
For details on HDLM removal, see [Removing HDLM on page 3-218](#).
3. Update the kernel package or apply the OS update package.
4. Install HDLM.
For details on HDLM installation, see [Installing HDLM for managing boot disks on page 3-127](#).
Also, replace step 10 in [Performing a new installation of HDLM on page 3-99](#) with the following:
 - Copy the files acquired from before HDLM was removed (.dlmfdrv.conf and .dlmfdrv.unconf) into the directory /etc/opt/DynamicLinkManager.
Go to step 13 to reboot the host.

When using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, or Red Hat Enterprise Linux 8

For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7[#] or Red Hat Enterprise Linux 8, you can update a kernel package or apply an OS update package while HDLM is installed.

#

This applies to combinations of kernel versions for which a version upgrade can be performed while HDLM is installed. These combinations are those for which `Y` is indicated in [Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed on page 4-9](#).

For the combinations for which `N` is indicated in [Table 4-3 Combinations of kernel versions of Red Hat Enterprise Linux 7 for which a version upgrade can be performed while HDLM is installed on page 4-9](#), follow the procedures described in [When using Oracle Unbreakable Enterprise Kernel, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or SUSE Linux Enterprise Server on page 4-9](#).

To upgrade the version of the kernel that does not support the retpoline method to a version that supports the retpoline method, perform the procedure described in the notes of [Updating kernel packages and applying OS update packages on page 4-6](#).

When you are not using the HDLM device as a boot disk

To update a kernel package or apply an OS update package when an HDLM device is not used as the boot disk:

1. Update the kernel package or apply the OS update package.
2. Execute the `dlmupdatesysinit` utility for updating system scripts.
For details about this utility, see [dlmupdatesysinit utility for updating system scripts on page 7-57](#).
3. Restart the host.

When you are using the HDLM device or the logical volume (LVM2) on the HDLM device as a boot disk

To update the kernel package or apply an OS update package when the HDLM device or the logical volume (LVM2) on the HDLM device is used as the boot disk:

1. Log in to Linux as a user with root permissions.
2. Check the `hdlm_dracut` setting in `/etc/opt/DynamicLinkManager/hdlm.conf`.
Make sure that `hdlm_dracut=y` is specified.
If `hdlm_dracut=n` is specified, change it to `hdlm_dracut=y`.
3. Update the kernel package or apply the OS update package.
4. Change the settings of the boot loader.
The procedure varies depending on the OS and the environment in which HDLM is installed.
 - o For Red Hat Enterprise Linux 6:
For Red Hat Enterprise Linux 6 when the HDLM device is used as a boot disk, perform the procedure from step 6 to step 9.

For Red Hat Enterprise Linux 6 when the logical volume on the HDLM device (LVM2) is used as a boot disk, perform the procedure from step 6 to step 8.

- o For Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8:
For Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8 when the HDLM device is used as a boot disk, perform step 5.
For Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8 when the logical volume on the HDLM device (LVM2) is used as a boot disk, proceed to step 10.

5. If the HDLM device is used as a boot disk, re-create `grub.cfg` by using the `grub2-mkconfig` command. After re-creating `grub.cfg`, proceed to step 10.

```
# /sbin/grub2-mkconfig -o /boot/grub2/grub.cfg
```

6. Use the `mv` command to change the file name of the initial RAM disk image file that was created in step 3 to a file name for HDLM.

The following shows an example of executing the command:

```
# /bin/mv /boot/initramfs-2.6.32-131.0.15.el6.i686.img  
/boot/initramfs-hdlm-2.6.32-131.0.15.el6.i686.img
```

7. Change the name of the configuration contained in the boot loader configuration file.

Change the name of the configuration that was added to the boot loader configuration file in step 3.

Choose a name that indicates use for an updated HDLM device specification.

Change the underlined text as follows:

Before:

```
title Red Hat Enterprise Linux (2.6.32-131.0.15.el6)
```

After:

```
title HDLM-Red Hat Enterprise Linux (2.6.32-131.0.15.el6)
```

8. For `initrd` in the boot loader configuration file, specify the initial RAM disk image file whose file name you changed in step 6.

Change the `initrd` specification for the configuration that was added in step 3.

If any options have been specified to suit the user environment, take care not to delete those options.

9. If the HDLM device is used as a boot disk, edit the root specification included in the boot loader configuration file.

The following shows an example of editing the root specification:

Specify the UUID of the root device for `root` by doing the following:

- a. Execute the `mount` command to check the name of the device mounted on the root partition (/).

The following shows an example of executing the command.

```
# mount  
/dev/sddlmaa2 on / type ext4 (rw)
```

```
proc on /proc type proc (rw)
:
:
```

Check the underlined device name.

- b. Execute the `blkid` command to check the UUID of the device that you checked in a..

The following shows an example of executing the command.

```
# blkid /dev/sddlmaa2
/dev/sddlmaa2: UUID="19597725-5d20-4d1d-9906-f9f891b7711a"
TYPE="ext4"
```

- c. Change the root specification for the configuration that was added to the boot loader configuration file in step 3 to the UUID checked in b..

Before:

```
root=/dev/sddlmaa2
```

After:

```
root=UUID=19597725-5d20-4d1d-9906-f9f891b7711a
```

10. Execute the `dmlupdatesysinit` utility for updating system scripts.
For details about this utility, see [dmlupdatesysinit utility for updating system scripts on page 7-57](#).

11. Restart the host.

12. Execute the `mount` command to make sure that the HDLM device is mounted.

The following shows an execution example for when GRUB is used as the boot loader:

```
# mount
/dev/sddlmaa2 on / type ext4 (rw)
:
:
/dev/sddlmaa1 on /boot type ext4 (rw)
/dev/sddlmaa4 on /tmp type ext4 (rw)
/dev/sddlmaa5 on /var type ext4 (rw)
/dev/sddlmaa6 on /usr type ext4 (rw)
none on /dev/shm type tmpfs (rw)
```

Check the underlined section.

13. If you are using the HDLM device as the boot disk, make sure that the HDLM device is allocated to the swap partition.

Make sure that the HDLM device name is displayed in the `Filename` column of the `/proc/swaps` file.

14. If you are using the logical volume (LVM2) on the HDLM device as the boot disk, update the information about the volume group.

- a. Execute the following command to update the information about the volume group.

```
# vgscan
Reading all physical volumes. This may take a while...
```

```
Found volume group "VolGroup00" using metadata type lvm2
```

- b. Check the relationship between the volume group and HDLM devices.
Execute the following command to make sure that the physical volumes that make up the volume group are HDLM devices.

```
# vgdisplay -v
```

HDLM operations using commands

This section explains how to use the HDLM command. For details on the various command operations, see [Chapter 6, Command reference on page 6-1](#).

Notes on using commands

- Execute the command as a user with root permissions.
- To specify a parameter value containing one or more spaces, enclose the entire value in double quotation marks ("").

Viewing path information

This section 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:

```
# /opt/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:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hdev sddmaa
Paths:000004 OnlinePaths:000004
PathStatus IO-Count IO-Errors
Online 0 0

PathID PathName DiskName LU CtePort Status Type IO-Count IO-Errors DNum HDevName
000013 0007.0000.0000000000000003.0001 HITACHI .OPEN-V .39303 000035 0A Online Own 0 0 0 sddmaa
000021 0007.0000.0000000000000005.0001 HITACHI .OPEN-V .39303 000035 1A Online Own 0 0 0 sddmaa
000029 0008.0000.0000000000000003.0001 HITACHI .OPEN-V .39303 000035 0A Online Own 0 0 0 sddmaa
000037 0008.0000.0000000000000005.0001 HITACHI .OPEN-V .39303 000035 1A Online Own 0 0 0 sddmaa
KAPLD10014 The HDLM command completed normally. Operation name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see [view \(displays information\) on page 6-31](#).

Changing the status of paths

This section explains how to change path statuses.

Changing the status of paths to Online

To change the status of paths to online:

1. Check the current status of the paths.
To place paths online by specifying an HBA port, CHA port, or single path check the path name or PATH_ID used to manage the path.
The following example shows how to execute the command:

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

To place paths online by specifying a SCSI device name, check the SCSI device name of the path.

The following shows an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
```

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

The paths to be placed Online can be specified by using an HBA port, CHA port, or single path. Instead of specifying a path, you can also specify a SCSI device name. For details on how to specify paths, see [online \(places paths online\) on page 6-10](#).

For example, if you want to place all the paths that pass through a specific HBA port online, execute the `dlnkmgr` command's `online` operation with the `-hba` parameter specified. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0010.0000
KAPL01057-I All the paths which pass the specified HBA will be
changed to the Online status. Is this OK? [y/n]:y
KAPL01061-I 3 path(s) were successfully placed Online; 0 path(s)
were not. Operation name = online
#
```

3. Check to see if the statuses of all the applicable paths have changed.
The following is an example of executing the command:

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

Changing the status of paths to Offline(C)

To change the status of paths to Offline(C):

1. Check the current status of the paths.
To change the status of a path to Offline(C) by specifying an HBA port, CHA port, or single path check the path name or PATH_ID used to manage the path.

The following is an example of executing the command:

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

To place a path Offline(C) by specifying a SCSI device name, check the SCSI device name of the path.

The following shows an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
```

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

The paths to be placed Offline(C) can be specified by using an HBA port, CHA port, or single path. Instead of specifying a path, you can also specify a SCSI device name. For details on how to specify paths, see [offline \(places paths offline\) on page 6-6](#).

For example, if you want to place all the paths that pass through a specific HBA port offline, execute the dlnkmgr command's offline operation with the -hba parameter specified. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0010.0000
KAPL01055-I All the paths which pass the specified HBA port will
be changed to the Offline(C) status. Is this OK? [y/n]:y
KAPL01056-I If you are sure that there would be no problem when
all the paths which pass the specified HBA are placed in the
Offline(C) status, enter y. Otherwise, enter n. [y/n]:y
KAPL01061-I 3 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline

#
```

3. Check to see if the statuses of all the applicable paths have changed. The following is an example of executing the command:

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

Viewing LU information

This section explains how to display LU information by using an HDLM command.

To display LU information, execute the dlnkmgr command's view operation with the -lu parameter specified. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product       : HUS_VM
SerialNumber  : 210945
LUs           : 3
```

```

iLU   HDevName Device    PathID Status
0960  sddlmaa  /dev/sda 000000 Online
        /dev/sdg 000003 Online
0961  sddlmac  /dev/sdb 000002 Online
        /dev/sdh 000004 Online
0962  sddlmac  /dev/sdc 000001 Online
        /dev/sdi 000005 Online

Product      : VSP_G1000
SerialNumber  : 10051
LUs          : 3

iLU   HDevName Device    PathID Status
001836 sddlmac  /dev/sdj 000006 Online
        /dev/sdd 000011 Online
001837 sddlmaf  /dev/sdk 000009 Online
        /dev/sde 000010 Online
001838 sddlmae  /dev/sdl 000007 Online
        /dev/sdf 000008 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 [view \(displays information\) on page 6-31](#).

Displaying corresponding information about an HDLM device, SCSI device, and LDEV

This subsection explains how to display corresponding information about an HDLM device, SCSI device, and LDEV by using an HDLM command.

You can display corresponding information about an HDLM device, SCSI device, and LDEV by executing the `dlmkmgr` command's `view` operation with the `-drv` parameter specified. For details on the `view` operation, see [view \(displays information\) on page 6-31](#). The execution result of this operation is displayed on a single line for each path.

The following is an example of executing the `dlmkmgr` command's `view` operation:

```

# /opt/DynamicLinkManager/bin/dlmkmgr view -drv
PathID HDevName Device    LDEV
000000 sddlmaa  /dev/sdh VSP_G1000.10182.00280B
000001 sddlmac  /dev/sdi VSP_G1000.10182.00280C
000002 sddlmac  /dev/sdj VSP_G1000.10182.00280D
000003 sddlmaa  /dev/sdk VSP_G1000.10182.00280B
000004 sddlmac  /dev/sdl VSP_G1000.10182.00280C
000005 sddlmac  /dev/sdm VSP_G1000.10182.00280D
000006 sddlmaa  /dev/sdn VSP_G1000.10182.00280B
000007 sddlmac  /dev/sdo VSP_G1000.10182.00280C
000008 sddlmac  /dev/sdp VSP_G1000.10182.00280D
000009 sddlmaa  /dev/sdq VSP_G1000.10182.00280B
000010 sddlmac  /dev/sdr VSP_G1000.10182.00280C
000011 sddlmac  /dev/sds VSP_G1000.10182.00280D
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 [view \(displays information\) on page 6-31](#).

Initializing statistical information for paths

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

This procedure is useful when you want to check the number of I/O operations and I/O errors that have occurred since the last time the I/O counts and I/O errors were initialized to 0.

To initialize statistical information for paths:

1. Check the current status of the path.

The following is an example of executing the command:

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

2. To initialize statistical information for all the paths managed by HDLM, execute the `dlnkmgr` command's `clear` operation with the `-pdst` parameter specified.

The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr clear -pdst  
KAPL01049-I Would you like to execute the operation? Operation  
name = clear [y/n]:y  
KAPL01001-I The HDLM command completed normally. Operation name  
= clear, completion time = yyyy/mm/dd hh:mm:ss  
#
```

3. Check to see whether the statistical information for all the paths has been initialized.

The following is an example of executing the command:

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

Viewing and setting up the operating environment

This section explains how to display and set up the HDLM operating environment.

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 is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : x.x.x-xx
Service Pack Version   :
Load Balance           : on(extended lio)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : on(1)
Reservation Status     :
Intermittent Error Monitor : off
Dynamic I/O Path Control : off(10)
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To display the operating environment of the audit log, execute the HDLM command's `view` operation with the `-sys` and `-audlog` parameters specified.

The following example shows how to execute the command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log              : off
Audit Log Category     : -
Audit Log Facility     : -
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see [view \(displays information\) on page 6-31](#).

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 up the following functions:

- Load balancing
- Path health checking
- Automatic failback
- Intermittent error monitoring
- Dynamic I/O path control
- Displaying the physical storage system information
- Error log collection level
- Trace level
- Error log file size
- The number of error log files
- Trace file size

- The number of trace files
- Audit log data collection
- Audit log facility
- Number of times the same path can be used for load balancing
- Number of times the same path can be used for extended load balancing (sequential I/O)
- Number of times the same path can be used for extended load balancing (random I/O)

For details on how to set up each function, see [set \(sets up the operating environment\) on page 6-15](#).

For example, to set up the log level, execute the `dlkmgr` 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 is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlkmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation name
= set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation name =
set, completion time = yyyy/mm/dd hh:mm:ss
#
```

To check whether the settings have been applied, see [Viewing the operating environment on page 4-19](#).

Viewing license information

This section explains how to display license information.

To display license information, execute the `dlkmgr` command's `view` operation with the `-sys` and `-lic` parameters specified.

The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlkmgr view -sys -lic
License Type Expiration
Permanent -
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see [view \(displays information\) on page 6-31](#).

Updating the license

This section explains how to update the license.

To update the license, execute the `dlnmgr` command's `set` operation with the `-lic` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command. If the license key file does not exist, a message asking you to enter the license key appears, so enter the license key.

Note

When you use the `dlnmgr` 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 `dlnmgr` command containing the `set` operation with the `-lic` parameter, a core file is created and the following message may appear:

```
KAPL01075-E A fatal error occurred in HDLM. The system
environment is invalid.
```

If this message appears, execute the `dlnmgr` command's `view` operation with the `-sys -lic` parameter to make sure that the license is installed correctly.

The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnmgr set -lic
KAPL01049-I Would you like to execute the operation? Operation name
= set [y/n]: y
KAPL01071-I A permanent license was installed.
#
```

Viewing HDLM version information

This section explains how to display HDLM version information.

To display HDLM version information, execute the `dlnmgr` command's `view` operation with the `-sys` parameter specified. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version           : x.x.x-xx
Service Pack Version   :
Load Balance           : on(extended lio)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 1000
Number Of Elog Files    : 2
Trace Level            : 0
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : on(1)
Reservation Status     :
Intermittent Error Monitor : off
Dynamic I/O Path Control : off(10)
HDLM Manager Ver       WakeupTime
Alive      x.x.x-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver  WakeupTime           ElogMem Size
```

```

Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss 1000
HDLN Driver Ver      WakeupTime
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss
LicenseType Expiration
Permanent      -
KAPL01001-I The HDLN command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

The value displayed in HDLN version indicates the HDLN version.

Viewing HDLN component information

This section explains how to display HDLN component information.

To display HDLN component information, execute the `dlmkmgr` command's `view` operation with the `-sys` parameter specified. The following is an example of executing the command:

```

# /opt/DynamicLinkManager/bin/dlmkmgr view -sys
HDLN Version          : x.x.x-xx
Service Pack Version  :
Load Balance          : on(extended lio)
Support Cluster       :
Elog Level            : 3
Elog File Size (KB)   : 9900
Number Of Elog Files  : 2
Trace Level           : 0
Trace File Size(KB)   : 1000
Number Of Trace Files : 4
Path Health Checking  : on(30)
Auto Failback         : on(1)
Reservation Status    :
Intermittent Error Monitor : off
Dynamic I/O Path Control : off(10)
HDLN Manager Ver      WakeupTime
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss
HDLN Alert Driver Ver      WakeupTime          ElogMem Size
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss 1000
HDLN Driver Ver      WakeupTime
Alive          x.x.x-xx    yyyy/mm/dd hh:mm:ss
LicenseType Expiration
Permanent      -
KAPL01001-I The HDLN command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

Among the displayed items, HDLN Manager, HDLN Alert Driver, and HDLN Driver indicate the HDLN component information.

Also, you can view information for each HDLN component. Execute the `dlmkmgr` command's `view` operation with the `-sys` and subsequent parameter specified. The following is an example of executing the command:

```

# /opt/DynamicLinkManager/bin/dlmkmgr view -sys -msrv
# /opt/DynamicLinkManager/bin/dlmkmgr view -sys -adrv
# /opt/DynamicLinkManager/bin/dlmkmgr view -sys -pdrv

```

Starting and stopping the HDLM manager

If an error occurs in the system, such as in an HDLM program, you may need to manually stop or start HDLM to recover from the error.

Starting the HDLM manager

To start the HDLM manager, log in to Linux as a user with root permissions and then execute the following command.

- For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```
# /opt/DynamicLinkManager/bin/dlmmanager start
Starting DLMManager: [ OK ]
```
- For OSs other than the above:

```
# /etc/init.d/DLMManager start
Starting DLMManager: [ OK ]
```

Lower case characters can be used for the command name (dlmmanager).

```
# /etc/init.d/dlmmanager start
Starting DLMManager: [ OK ]
```

The startup script that was set up during HDLM installation runs, and starts the HDLM manager.

Note

When you start the HDLM manager immediately after stopping it, confirm that the HDLM manager has stopped (Dead is displayed when executing `/opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv`), and then start it.

Important

When stopping the HDLM manager, even if a message indicating that the HDLM manager has successfully stopped, it takes a few seconds more to stop processes. Therefore, if you start the HDLM manager immediately after stopping it, the HDLM manager is regarded as being started, and a message indicating that the HDLM manager has successfully started is output. However, starting of the HDLM manager is cancelled, and it will remain inactivate.

Use one of the following procedures to confirm that the HDLM manager is active:

Use the `dlnkmgr` command's `view` operation:

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive      x.x.x-xx    yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
```

#

When the HDLM Manager column shows `Alive`, the HDLM manager is active.

Use a script for confirmation:

Execute the following command to confirm that the HDLM manager is active:

- For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```
# /opt/DynamicLinkManager/bin/dlmmanager status
.dlmmgr_exe (pid 14889 14886 14884 14880) is running...
```

- For OSs other than the above:

```
# /etc/init.d/DLManager status
.dlmmgr_exe (pid 14889 14886 14884 14880) is running...
```

Note

If an error occurs, the execution results of the `dlnmgr` command's view operation might be different from those of the `DLManager status` command. In this case, see the execution results of the `dlnmgr` command.

Stopping the HDLM manager

To stop the HDLM manager, log in to Linux as a user with root permissions, and then execute the following command:

- For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```
# /opt/DynamicLinkManager/bin/dlmmanager stop
Stopping DLManager: [ OK ]
```

- For OSs other than the above:

```
# /etc/init.d/DLManager stop
Stopping DLManager: [ OK ]
```

Lower case characters can be used for the command name (`dlmmanager`).

```
# /etc/init.d/dlmmanager stop
Stopping DLManager: [ OK ]
```

The stop script that was set up during HDLM installation runs, and stops the HDLM manager.

Use one of the following procedures to confirm that the HDLM manager has stopped:

Use the `dlmkmgr` command's `view` operation:

Execute the following command.

```
# /opt/DynamicLinkManager/bin/dlmkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Dead
KAPL01001-I The HDLM command completed normally. operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

When the `HDLM Manager` column shows `Dead`, the HDLM manager is inactive.

Use a script for confirmation:

Execute the following command to confirm that the HDLM manager is inactive:

- For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15:

```
# /opt/DynamicLinkManager/bin/dlmmgr status
Stopping DLManager: [ OK ]
```

- For OSs other than the above:

```
# /etc/init.d/DLManager status
Stopping DLManager: [ OK ]
```

Note

If an error occurs, the execution results of the `dlmkmgr` command's `view` operation might be different from those of the `DLManager status` command. In this case, see the execution results of the `dlmkmgr` command.

HDLM resident processes

The table below lists and describes the resident processes in HDLM. To monitor these processes, use the names below.

Table 4-4 HDLM resident processes

Process	Description
<code>.dlmgr_exe</code>	HDLM manager process
<code>hbsa_service</code>	Hitachi Command Suite Common Agent Component [#] process

#

You only need to monitor this process when HDLM is linked to Global Link Manager.

Reconfiguring the HDLM operating environment

This section describes tasks required for reconfiguring the HDLM operating environment.

The tasks described in this section are required when you perform any of the following operations:

- Replace hardware devices that make up a path
- Add new LUs
- Remove existing LUs
- Add paths to or remove paths from an LU
- Add devices to or remove devices from the list of devices to be managed by HDLM
- Expand the capacity of an LU (a device managed by HDLM)

Replacing HBAs

You can replace HBAs without stopping any applications when all of the following conditions are satisfied:

This function only applies to the operating systems in which HBA replacement is supported by Hitachi Compute Blade.

- The host allows HBA replacement, and the new HBAs are of the same type as the HBAs you replace.
- Multiple HBAs are used, and the paths that pass through these HBAs are connected to the same LU.
- Multiple paths to the LU are active.
- HDLM is in a Hitachi Compute Blade environment.

For details on how to replace HBAs, see [Procedure for replacing HBAs on page 4-28](#).

Preparation for replacing HBAs

Before you replace HBAs, perform the following procedure to ensure that the `acpiphp` module has been loaded.

To ensure that the `acpiphp` module has been loaded:

1. Execute the `lsmod` OS command.

```
# /sbin/lsmod | grep acpiphp
acpiphp                58713      0
```

If the `acpiphp` module has been loaded, replace the HBAs as described in [Procedure for replacing HBAs on page 4-28](#). If the `acpiphp` module has not been loaded, continue to step 2.

2. Create the `acpiphp.modules` file.

First, execute the following command:

```
# vi /etc/sysconfig/modules/acpiphp.modules
```

Next, edit the `acpiphp.modules` file as follows:

```
#!/bin/bash
/sbin/modprobe acpiphp
```

Save the changes to the file, and then use the `chmod` OS command to set execution permissions as follows:

```
# chmod 755 /etc/sysconfig/modules/acpiphp.modules
```

Finally, after the `chmod` command has been executed, confirm that the execution permissions have been set as indicated by the underlined portion below.

```
# ls -l /etc/sysconfig/modules/acpiphp.modules
-rwxr-xr-x 1 root root 35 mm dd hh:mm /etc/sysconfig/modules/
acpiphp.modules
```

3. Load the `acpiphp` module.

Execute the `acpiphp.modules` file you created in step 2.

```
# /etc/sysconfig/modules/acpiphp.modules
```

After the above command has been executed, confirm that the `acpiphp` module has been loaded.

```
# /sbin/lsmmod | grep acpiphp
acpiphp          58713    0
```

Procedure for replacing HBAs

Before you can replace HBAs, the paths that pass through the HBAs to be replaced must be blocked. The following procedure is used for replacing HBAs.

To replace HBAs:

1. Check the WWN information of the HBAs to be replaced.
Execute the following command:

```
# /opt/hitachi/drivers/hba/hfcmgr -g
Time:yyyy/mm/dd hh:mm:ss
...
```

```

...
Model      : HFC0402-E
Parts Number : 3HAC82101-A
Firmware    : 260803
WWPN:2400000047010278 Device:hfcldd0 [LinkUp]
WWPN:240000004701027a Device:hfcldd1 [LinkUp]

```

```

Model      : HFC0402-E
Parts Number : 3HAC82101-A
Firmware    : 260803
WWPN:2400000047010270 Device:hfcldd2 [LinkUp]
WWPN:2400000047010272 Device:hfcldd3 [LinkUp]

```

The number that follows a WWPN keyword is the port WWN information of an HBA.

The following steps assume that the HBAs whose WWN information is underlined above are to be replaced.

2. Execute the `view` operation of the `dlnmgr` command (`dlnmgr view -path -hba:portwwn`) to check the information about the paths that pass through the HBAs you want to replace.

```

# /opt/DynamicLinkManager/bin/dlnmgr view -path -hba:portwwn
Paths:000007 OnlinePaths:000007
PathStatus IO-Count IO-Errors
Online      39783      0
PathID PathName
iLU      ChaPort Status Type IO-Count IO-Errors DNum HDevName
000000 0000.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000035 1C Online Own 30 0 0 sddlmaa
000001 0000.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000036 1C Online Own 30 0 0 sddlmaab
000002 0000.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000037 1C Online Own 30 0 0 sddlmaac
000003 0003.0000.0000000000000000.0000 2400000047010272 HITACHI .OPEN-V .416044
00000C 0A Online Own 39693 0 0 sddlmaad
000004 0002.0000.0000000000000000.0001 2400000047010270 HITACHI .OPEN-V .39303
000035 0A Online Own 0 0 0 sddlmaa
000005 0002.0000.0000000000000000.0002 2400000047010270 HITACHI .OPEN-V .39303
000036 0A Online Own 0 0 0 sddlmaab
000006 0002.0000.0000000000000000.0003 2400000047010270 HITACHI .OPEN-V .39303
000037 0A Online Own 0 0 0 sddlmaac
KAPL01001-I The HDLM command completed normally. Operation name = view(-vstv), completion time = yyyy/
mm/dd hh:mm:ss

```

See the port WWN information of the HBAs you checked in step 1 and `HBA:PortWWN` displayed as the execution result to check the host port number and the bus number displayed in `PathName`.

In `PathName`, the leftmost number is the host port number. The number between the period to the right of the host port number and the next period is the bus number.

Specify the host port number and the bus number when you place the path in the `Offline(C)` status in step 3.

In this execution example, the host port number and the bus number corresponding to the port WWN information of the HBAs to be replaced (the underlined section) are shaded.

3. Execute the `offline` operation of the `dlnmgr` command (`dlnmgr offline -hba`) to place in `Offline(C)` status all paths that pass through the HBA ports that you identified in step 2.

For the `-hba` parameter, specify the host port number and the bus number by separating them with a period.

The following shows an example of placing the path (host port number is 0000 and path number is 0000) in the Offline(C) status.

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0000.0000
```

After you have executed the `offline` operation, execute the `view` operation of the `dlnkmgr` command (`dlnkmgr view -path -hbaportwwn`) to confirm that all the paths passing through the HBAs being replaced are in Offline(C) status.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hbaportwwn
```

4. Replace the HBAs.
5. Execute the `dlnmcfmgmgr` utility (`dlnmcfmgmgr -r`) to change the HDLM device configuration.

```
# dlnmcfmgmgr -r
```

6. Execute the `view` operation of the `dlnkmgr` command (`dlnkmgr view -path -hbaportwwn`) to confirm that the new paths have been added.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hbaportwwn
Paths:000010 OnlinePaths:000007
PathStatus IO-Count IO-Errors
Online      214      0
PathID PathName
ILU          ChaPort Status      Type IO-Count  IO-Errors  DNum HDevName
000000 0000.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000035 0000.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000001 0000.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000036 0000.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000002 0000.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000037 0000.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000003 0003.0000.0000000000000000.0000 2400000047010272 HITACHI .OPEN-V .416044
0000DC 0A      Online      Own      214      0      0 addlma
000004 0002.0000.0000000000000000.0001 2400000047010270 HITACHI .OPEN-V .39303
000035 0A      Online      Own      0        0      0 addlma
000005 0002.0000.0000000000000000.0002 2400000047010270 HITACHI .OPEN-V .39303
000036 0A      Online      Own      0        0      0 addlma
000006 0002.0000.0000000000000000.0003 2400000047010270 HITACHI .OPEN-V .39303
000037 0A      Online      Own      0        0      0 addlma
000007 000A.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000035 1C      Online      Own      0        0      0 addlma
000008 000A.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000036 1C      Online      Own      0        0      0 addlma
000009 000A.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000037 1C      Online      Own      0        0      0 addlma
KAPL01001-I The HDLM command completed normally. Operation name = view(-vstv), completion time = yyyy/
mm/dd hh:mm:ss
```

In the above figure, new paths that have been added are indicated by shading.

Although the information about the old paths (underlined information) that were placed in Offline(C) status before the HBAs were replaced remains, this information will be deleted in step 8.

7. Execute the `dlnmcfmgmgr` utility (`dlnmcfmgmgr -v`) to confirm that new SCSI devices have been added.

```
# dlmcfmgmr -v
```

HDevName	Management	Device	Host	Channel	Target	Lun
/dev/sddlmaa	configured	/dev/sda	0	0	0	0
		/dev/sde	2	0	0	1
		/dev/sda	10	0	0	0
/dev/sddlmaab	configured	/dev/sdf	2	0	0	2
		/dev/sdb	0	0	0	1
		/dev/sdb	10	0	0	1
/dev/sddlmac	configured	/dev/sdc	0	0	0	2
		/dev/sdg	2	0	0	3
		/dev/sdc	10	0	0	2
/dev/sddlmad	configured	/dev/sdh	3	0	0	0

KAPL10302-I /sbin/dlmcfmgmr completed normally.

New SCSI devices that have been added are indicated by shading in the above figure.

Although the information about the old SCSI devices (the underlined information) before the HBAs were replaced remains, this information will be deleted when step 8 is performed.

8. Execute the `dlmcfmgmr` utility (`dlmcfmgmr -u`) to delete the information about the old paths and SCSI devices.

In the `-u` parameter, specify an `HDevName` device for which old SCSI device information is displayed in step 7. Note that you need to execute the utility for each `HDevName` device that contains old SCSI device information.

The following shows an example of the command you execute if the `HDevName` value is `/dev/sddlmaa`:

```
# dlmcfmgmr -u /dev/sddlmaa
```

9. Execute the `view` operation of the `dlmkmgr` command (`dlmkmgr view -path -hbaportwnn`) to confirm that all the old information for the paths that were placed in `Offline(C)` status has been deleted.

```
# /opt/DynamicLinkManager/bin/dlmkmgr view -path -hbaportwnn
```

10. Execute the `dlmcfmgmr` utility (`dlmcfmgmr -v`) to confirm that all the old SCSI device information has been deleted.

```
# dlmcfmgmr -v
```

HBA replacement has been completed.

If you have restarted the host after HBA replacement, update the path information as described in [Updating the path information after the host is restarted on page 4-31](#).

Updating the path information after the host is restarted

When the host is restarted after HBA replacement, the host port numbers in the HCTL information are set again. As a result, the information about the paths that existed when HBAs were replaced is now old, causing the old paths

to remain in Offline(E) status. To correct this, use the following procedure to delete the old path information:

1. Execute the view operation of the dlnkmgr command (dlnkmgr view - path -hbaportwnn) to check the path status.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hbaportwnn
Paths:000010 OnlinePaths:000007
PathStatus IO-Count IO-Errors
Online 31367 0
PathID PathName HBAPortWNN DskName
ILU ChaPort Status Type IO-Count IO-Errors DNum HDevName
000000 0002.0000.0000000000000000.0001 2400000047010270 HITACHI .OPEN-V .39303
000035 0A Online Own 29 0 0 sddlmaa
000001 0002.0000.0000000000000000.0002 2400000047010270 HITACHI .OPEN-V .39303
000036 0A Online Own 29 0 0 sddlmab
000002 0002.0000.0000000000000000.0003 2400000047010270 HITACHI .OPEN-V .39303
000037 0A Online Own 29 0 0 sddlmac
000003 0003.0000.0000000000000000.0000 2400000047010272 HITACHI .OPEN-V .416044
0000DC 0A Online Own 31280 0 0 sddlmd
000004 000A.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000035 1C Offline(E) Own 0 0 0 sddlmaa
000005 000A.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000036 1C Offline(E) Own 0 0 0 sddlmab
000006 000A.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000037 1C Offline(E) Own 0 0 0 sddlmac
000007 0000.0000.0000000000000000.0000 2400000047010278 HITACHI .OPEN-V .39303
000035 1C Online Own 0 0 0 sddlmaa
000008 0000.0000.0000000000000000.0001 2400000047010278 HITACHI .OPEN-V .39303
000036 1C Online Own 0 0 0 sddlmab
000009 0000.0000.0000000000000000.0002 2400000047010278 HITACHI .OPEN-V .39303
000037 1C Online Own 0 0 0 sddlmac
KAPL01001-I The HDLM command completed normally. Operation name = view(-vstv), completion time = yyyy/
mm/dd hh:mm:ss
```

The paths existing when the HBAs were replaced remain in Offline(E) status.

2. Execute the dlmcfmgmgr utility (dlmcfmgmgr -v) to check the HDLM device status.

```
# dlmcfmgmgr -v
HDevName Management Device Host Channel Target Lun
/dev/sddlmaa configured /dev/sde 2 0 0 1
- 10 0 0 0
/dev/sddlmab configured /dev/sda 0 0 0 0
- 10 0 0 1
/dev/sddlmac configured /dev/sdf 2 0 0 2
/dev/sdb 0 0 0 1
/dev/sdbg 2 0 0 3
- 10 0 0 2
/dev/sddlmd configured /dev/sdc 0 0 0 2
/dev/sdh 3 0 0 0
KAPL10302-I /sbin/dlmcfmgmgr completed normally.
```

Because the paths existing when HBAs were replaced are in Offline(E) status, a hyphen (-) is displayed for Device.

3. Execute the dlmcfmgmgr utility (dlmcfmgmgr -u) to delete the old information about paths and SCSI devices.

In the -u parameter, specify an HDevName device for which a hyphen (-) is displayed for Device in step 2. Note that you need to execute the utility for each HDevName device for which a hyphen (-) is displayed for Device.

The following shows an example of the command you execute if the HDevName value is /dev/sddlmaa:

```
# dlmcfgmgr -u /dev/sddlmaa
```

4. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to confirm that all the lines on which a hyphen (-) was displayed for `Device` have been deleted.

```
# dlmcfgmgr -v
```

5. Execute the `view` operation of the `dlmkmgr` command (`dlmkmgr view -path -hbaportwwn`) to confirm that all the information about the paths that were placed in `Offline(E)` status has been deleted.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hbaportwwn
```

Replacing a fiber cable

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

The following steps show an example procedure for replacing a fiber cable. Note that this procedure only applies to replacing a fiber cable.

This example assumes the system configuration shown below:

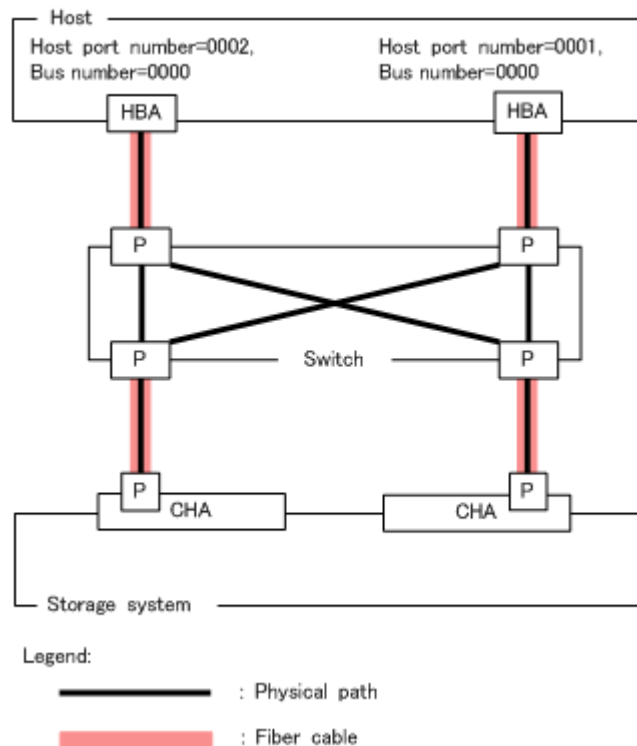


Figure 4-2 System configuration for replacing a fiber cable (explained in the following steps)

To replace a fiber cable:

1. Place in Offline (C) status the path that goes through the fiber cable to be replaced (path that goes through the HBA to which the fiber cable is connected).

For example, to place in Offline (C) status the path that goes through the HBA with host port number 0001 and bus number 0000, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0001.0000
```

While the path that goes through the HBA with host port number 0001 is placed Offline, the status of the path that goes through the HBA with host port number 0002 is Online.

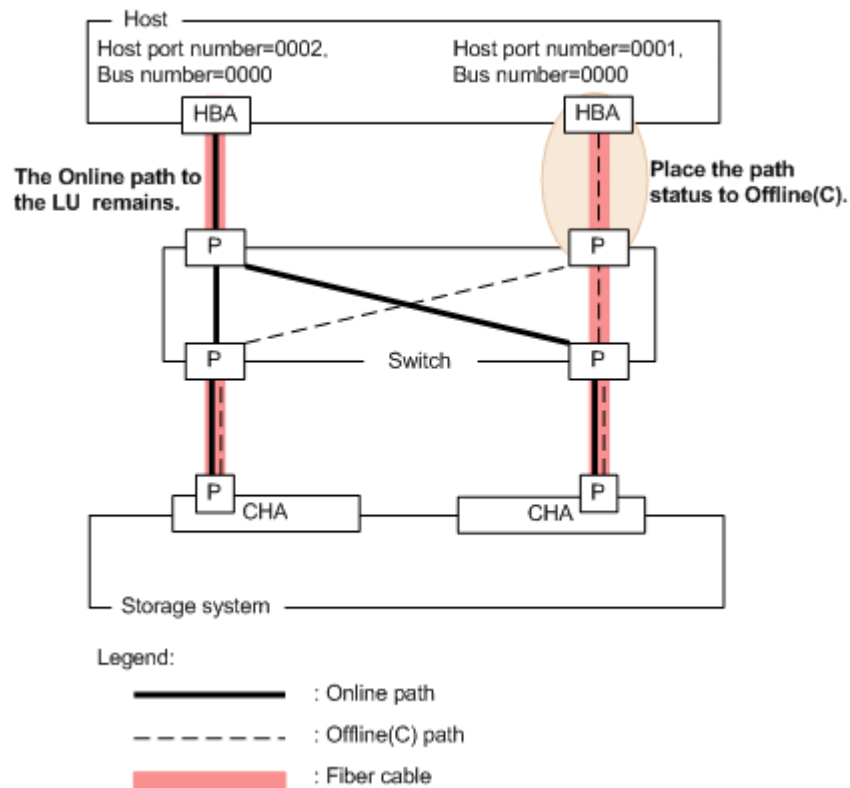


Figure 4-3 When the status of the path that goes through the fiber cable to be replaced is Offline(C)

2. Replace the fiber cable for the path that has been placed in Offline(C) status.

In this example, replace the fiber cable connected to the HBA with host port number 0001.

3. Place in Online status the path that goes through the replaced fiber cable (that is, the path that goes through the HBA connected to the fiber cable).

For example, to place in Online status the path that goes through the HBA with host port number 0001 and bus number 0000, execute the following command:


```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0001.0000
```

4. Check the path information.
For example, execute the following command:

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

For details about the path information, see [view \(displays information\) on page 6-31](#).

Replacing the Fibre Channel switch

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

The following steps show an example procedure for replacing a Fibre Channel switch. Note that this procedure only applies for replacing a Fibre Channel switch.

This example assumes the system configuration as below:

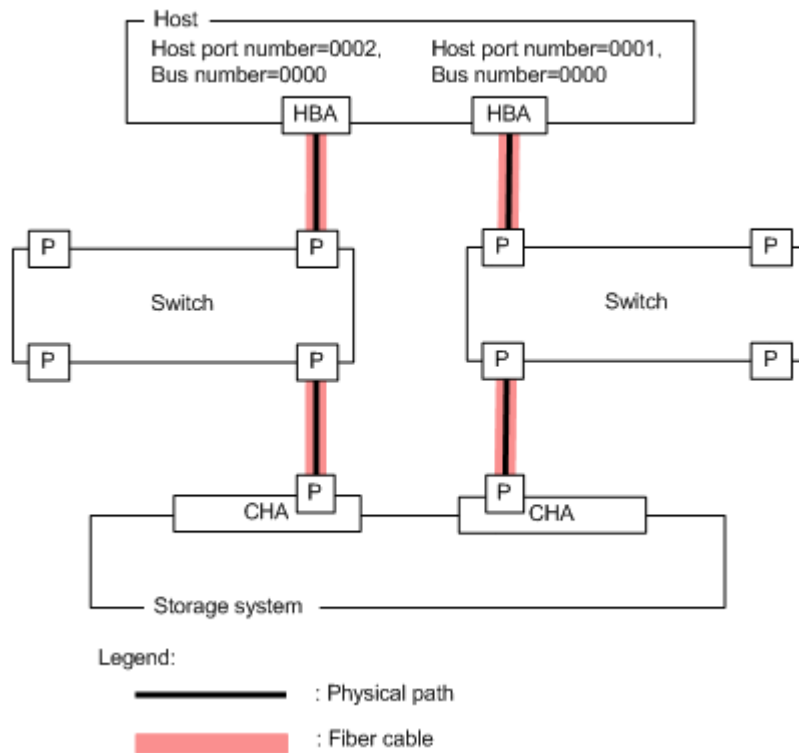


Figure 4-4 System configuration for replacing a Fibre Channel switch (explained in the following steps)

To replace the Fibre Channel switch:

1. Place in Offline (C) status the path that goes through the Fibre Channel switch to be replaced (path that goes through the HBA to which the Fibre Channel switch is connected).

For example, to place in Offline (C) status the path that goes through the HBA with host port number 0001 and bus number 0000, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0001.0000
```

While the path that goes through the HBA with host port number 0001 is placed Offline, the status of the path that goes through the HBA with host port number 0002 is Online.

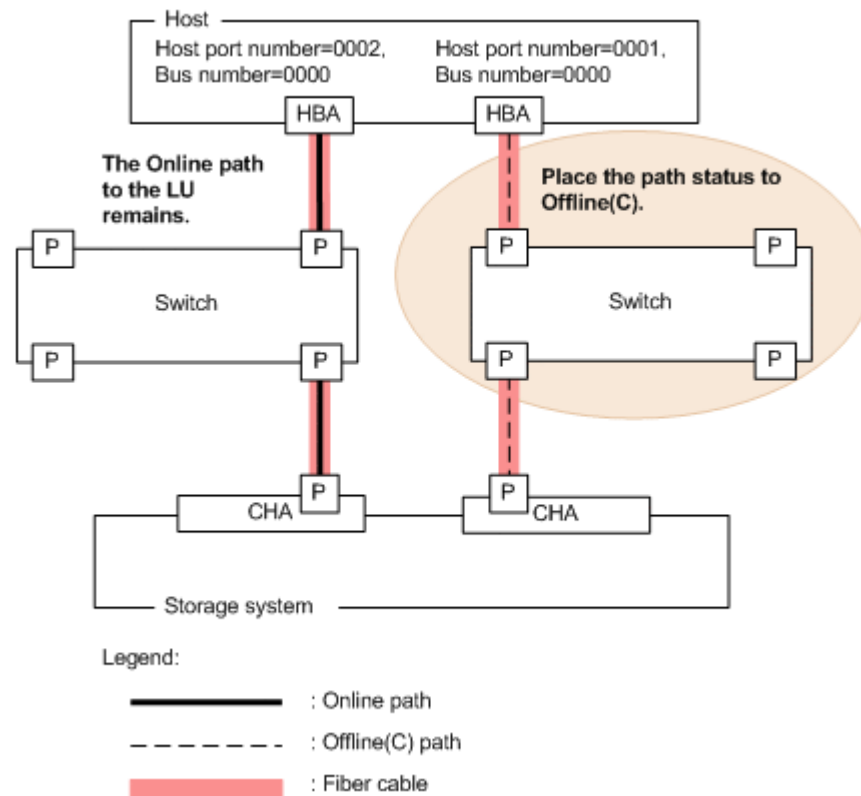


Figure 4-5 When the status of the path that goes through the Fibre Channel switch to be replaced is Offline(C)

2. Replace the Fibre Channel switch for the path that has been placed in Offline(C) status.

In this example, replace the Fibre Channel switch connected to the HBA with host port number 0001.

3. Place in Online status the path that goes through the replaced Fibre Channel switch.

For example, to place in Online status the path that goes through the HBA with host port number 0001 and bus number 0000, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0001.0000
```

4. Check the path information.
For example, execute the following command:

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

For details about the path information, see [view \(displays information\) on page 6-31](#).

Changing the HDLM device configuration

This section describes the actions and procedures to change the HDLM device configuration.

To set up or change (add, change or delete) an LU in a storage system, use the management program of the storage system, rather than the HDLM functionality. For more information on configuring or changing an LU, see the manual provided with the storage system.

All the actions performed via the HDLM-configuration definition utility (`dlnmcfgmgr`) are logged in the `/var/opt/DynamicLinkManager/log/dlnmcfgmgr1.log` file. By looking in this file, you can examine the change(s) made to the configuration, or the reason why the execution of the `dlnmcfgmgr` utility failed. For more information on the `dlnmcfgmgr` utility log, see also [Types of collected logs on page 2-34](#). For more information on the `dlnmcfgmgr` utility, see [dlnmcfgmgr utility for managing the HDLM configuration on page 7-26](#).

Notes on changing the HDLM device configuration

Note the following when changing the HDLM device configuration:

- When an HDLM device is excluded from HDLM management, the `AutoPATH_IDS` assigned to the paths for that device will be released. Because of this, after paths for an HDLM device are released, the `AutoPATH_IDS` of the paths may be displayed in a non-consecutive sequence.
- When an HDLM device is included in HDLM management, HDLM assigns an `AutoPATH_ID` in sequential order (from the lowest available number) to the path of that HDLM device.
- When an HDLM device that is not managed by HDLM is included in HDLM management, HDLM places online all the normal paths to that HDLM device regardless of the previous status (such as `Online(E)` or `Offline(C)`) of the path.
- Do not execute the HDLM-configuration definition utility (`dlnmcfgmgr`) with the `-o`, `-i`, or `-u` parameter while the LU is in use (for example, when performing I/O or a mount).

- If a disk partition is created or changed while some of the paths for an LU are disconnected, the disk partition may not be recognized even after the disconnected paths have been recovered. After connecting the disconnected paths, execute the `dlmcfgmgr` utility or restart the host.
- When the `dlmcfgmgr` utility is executed to change the HDLM device configuration, memory might become insufficient due to the HAL daemon#. In this case, the host will not respond.

To avoid this, stop the HAL daemon when executing the `dlmcfgmgr` utility. For details on how to stop the HAL daemon, see [Notes on installing HDLM on page 3-92](#).

This does not apply to Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Unbreakable Enterprise Kernel 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8.

#

The HAL daemon detects hardware configuration changes, for example, when a USB device or CD-ROM is inserted.

- If you execute the `dlmcfgmgr` utility with the `-v` parameter specified, a hyphen (-) might be displayed in the `Device` column as shown below:

```
# dlmcfgmgr -v
HDevName      Management  Device  Host  Channel  Target  Lun
/dev/sddlmaa  configured  /dev/sdd  3      0        0      0
                /dev/sdk  3      0        1      0
                /dev/sdr  4      0        0      0
                -        4      0        1      0
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

This state might be caused by the following operations:

- Restarting the host when the paths are disconnected
- Restarting the host after deleting an LU
- Restarting the host after changing the fiber cable connection
- Restarting the host after changing the zone settings for the Fibre Channel switch

When using SUSE LINUX Enterprise Server 11, this state might also be caused if one of the following problems occurs while the system is running:

- A path gets disconnected.
- An LU is deleted.
- A fiber cable connection is changed.
- A Fibre Channel switch's zone setting is changed.

If you want to delete the path whose status is indicated by a hyphen (-), execute the `dlmcfgmgr` utility with the `-u` parameter specified.

For details on this utility, see [dlmcfgmgr utility for managing the HDLM configuration on page 7-26](#).

- If you deallocate an existing LU and then allocate a new LU to the path that was used by the deallocated LU, the HDLM device that is allocated to

the LU is also changed. In this case, the HDLM device that had been allocated to the deallocated LU is deleted and a new HDLM device is allocated to the new LU.

Also, if you replace an existing storage system by a new storage system, a new HDLM device is allocated to each LU in the storage system even if the LU configuration of the new storage system is the same as the LU configuration of the replaced storage system.

Adding a new LU

To add a new LU (HDLM device) to the host on which the HDLM is installed:

1. Use the management program of the storage system to allocate an LU, which is not yet allocated to the relevant host, to a port of the storage system that has a path to the relevant host and configure the path.
For more information on configuring the path, see the manual provided with the storage system.
2. When you want to add an LU without restarting the host, perform step 3 and step 4. When you want to add an LU while restarting the host, go to step 5.
3. Create a SCSI device for each path configured in step 1.
Since the host has not been restarted, a SCSI device for the LU that was added in step 1 was not created. Execute the command for adding the device shown in the following table to manually create a SCSI device.

Table 4-5 Adding or deleting a SCSI device

Operation	Command
Adding a device (for FC-SAN environments)	<ul style="list-style-type: none"> When using any of the following OS and HBA driver combinations: <ul style="list-style-type: none"> - Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8^{#1}, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8^{#2} or Oracle Unbreakable Enterprise Kernel 8 and a QLogic HBA driver - SUSE LINUX Enterprise Server and a QLogic HBA driver - Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8 and an Emulex HBA driver - SUSE LINUX Enterprise Server and an Emulex HBA driver - Red Hat Enterprise Linux 6 and a Brocade HBA driver - SUSE LINUX Enterprise Server 11 and a Brocade HBA driver <p>Execute the following command:</p> <pre># echo "- - -" > /sys/class/scsi_host/hostn/scan# #</pre> <p>If LUs for which I/O processing is being performed exist, execute the <code>echo</code> command for each device as follows:</p> <pre># echo "b c d" > /sys/class/scsi_host/hostn/scan</pre>

Operation	Command
	<p>Execute the following command to check whether the OS has recognized any devices:</p> <pre># cat /proc/scsi/scsi</pre> <p>If the OS has not recognized any devices, stop the I/O processing, and then execute the following commands in the order shown:</p> <pre># echo "1" > /sys/class/fc_host/hostn/issue_lip # echo "- - -" > /sys/class/scsi_host/hostn/scan</pre> <p>If you are using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or SUSE LINUX Enterprise Server, the devices might be automatically recognized by the OS hot plug function. If the devices are recognized, the above procedure is not necessary.</p>
Adding a device (for IP-SAN environments)	<ul style="list-style-type: none"> For a device added to the target for which no session is established with the iSCSI initiator Execute the following command to make the OS recognize the target: <pre># iscsiadm -m discovery -t sendtargets -p IP-address-of-the-target</pre> <p>Then, log in to the target to establish a session.</p> <pre># iscsiadm -m node -T target-name -p IP-address-of-the-target:port-number-of-the-target --login</pre> For a device added to the target for which a session is established with the iSCSI initiator Execute the following command: <pre># iscsiadm -m session -R</pre>
Deleting a device (for FC-SAN environments)	<pre># dlmcfmgr -o logical-device-file-name-of-the-relevant-HDLM-device # echo "scsi remove-single-device a b c d" > /proc/scsi/scsi # dlmcfmgr -i logical-device-file-name-of-the-relevant-HDLM-device</pre> <p>If you are using SUSE Linux Enterprise Server 11, SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or Oracle Unbreakable Enterprise Kernel, the above procedure is not necessary for deleting a path that is in disconnected status.</p>
Deleting a device (for IP-SAN environments)	<pre># echo "scsi remove-single-device a b c d" > /proc/scsi/scsi</pre> <p>If you are using SUSE Linux Enterprise Server 11, Red Hat Enterprise Linux 6, or Oracle Unbreakable Enterprise Kernel 6, the above procedure is not necessary for deleting a path that is in disconnected status.</p>

Legend:

a: Host ID (host port number)

b: Channel number (bus number)
c: Target ID
d: Lun (host LU number)
n: host port number
driver-name: qlaxxxx (driver name in use)

#1

Red Hat Enterprise Linux 8.1 does not support QLogic HBA drivers.

#2

Oracle Linux 8 Update 1 does not support QLogic HBA drivers.

4. Execute the HDLM-configuration definition utility (`dlnmcfgmgr -r`).
Based on the SCSI device created in step 3, an HDLM device for the path configured in step 1 is added.
The following is an example of executing the `dlnmcfgmgr` utility:

```
# /sbin/dlnmcfgmgr -r
```
5. Restart the host on which the HDLM is installed.
If you performed step 3 and step 4, the host does not have to be restarted. Go to step 6.
While restarting, the HDLM device mapped with the path configured in the above step 1 is added automatically.
6. Refer to `/var/opt/DynamicLinkManager/log/dlnmcfgmgr1.log` or execute the `dlnmcfgmgr` utility (`dlnmcfgmgr -v`) to check if an LU was created with a new HDLM device name.
The following is an example of executing the `dlnmcfgmgr` utility:

```
# /sbin/dlnmcfgmgr -v
```

Adding a path to an existing LU

To add a path to an existing LU (HDLM device):

1. Use the management program of the storage system to configure an additional path from an LU mapped with the relevant HDLM device to the relevant host.
For more information on configuring an additional path, see the manual provided with the storage system.
2. When you want to add a path to the LU without restarting the host, perform step 3 and step 4. When you want to add a path to the LU while restarting the host, go to step 5.
3. Create a SCSI device for each path configured in step 1.
Since the host has not been restarted, the SCSI device for the path that was added in step 1 was not created. Execute the command for adding the device shown in [Table 4-5 Adding or deleting a SCSI device on page 4-39](#) to manually create a SCSI device.
4. Execute the HDLM-configuration definition utility (`dlnmcfgmgr -r`).

Based on the SCSI device created in step 3, the path configured in step 1 is added as a path for the HDLM device.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -r
```

5. Restart the host on which the HDLM is installed.
If you performed step 3 and step 4, the host does not have to be restarted. Go to step 6.
While restarting, the additional path configured in the above step 1 is automatically added as a path to the relevant HDLM device.
6. Refer to `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to check if the number of paths of the relevant HDLM device has increased.
The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Deleting an existing LU

To delete an HDLM device that corresponds to an existing LU:

1. Stop all accesses to the relevant LU.
2. Use the management program of the storage system to cancel all of the path allocations (that is, to delete the paths) to the relevant LU from ports of the storage system.
For details on canceling path allocations (deleting paths), see the manual provided with the storage system.
3. If you want to delete an HDLM device that corresponds to the LU without restarting the host, perform steps 4 and 5. If you want to delete the LU and restart the host, go to step 6.
4. Delete the SCSI device for the path whose allocation was cancelled in step 2.
Since the host has not been restarted, the SCSI device for the path whose allocation was cancelled in step 2 was not deleted. To delete the SCSI device, you need to manually execute the command for deleting the device shown in [Table 4-5 Adding or deleting a SCSI device on page 4-39](#).
5. Execute the HDLM-configuration definition utility (`dlmcfgmgr -r`).
Apply, to the HDLM device, the information about the SCSI device that was deleted in step 4.
The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -r
```

6. Restart the host on which HDLM is installed.
If you performed steps 4 and 5, you do not need to restart the host. Go to step 7.

7. Execute the `dlnmcfgmgr` utility (`dlnmcfgmgr -v`) or the `view` operation (`dlnkmgr view -drv`).

Make sure that all the SCSI device names corresponding to the LU for which path allocations were cancelled in step 2 are represented with a hyphen (-) (optional).

The following is an example of executing the `dlnmcfgmgr` utility with the `-v` option:

```
# /sbin/dlnmcfgmgr -v
```

The following is an example of executing the `view` operation with the `-drv` option:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
```

8. Execute the `dlnmcfgmgr` utility (`dlnmcfgmgr -u logical_device_file_name_of_HDLM_device`) on all the HDLM devices corresponding to the LU for which path allocations were cancelled in step 2 to unregister the HDLM devices.

Path information on the relevant HDLM device is deleted.

The following is an example of executing the `dlnmcfgmgr` utility:

```
# /sbin/dlnmcfgmgr -u logical_device_file_name_of_HDLM_device
```

9. Check `/var/opt/DynamicLinkManager/log/dlnmcfgmgr1.log` or execute the `dlnmcfgmgr` utility (`dlnmcfgmgr -v`) to make sure that the HDLM device that corresponds to the deleted LU was deleted.

The following is an example of executing the `dlnmcfgmgr` utility:

```
# /sbin/dlnmcfgmgr -v
```

Deleting a path to an existing LU

To delete a path to an existing LU (HDLM device):

1. Stop all accesses to the relevant LU.
2. Use the management program of the storage system to delete a path to the relevant LU.
For more information on deleting a path, see the manual provided with the storage system.
3. When you want to delete a path to the LU without restarting the host, go to step 4. When you want to delete a path while restarting the host, go to step 5.
4. Delete the SCSI device for the path that was deleted in step 2.
Since the host has not been restarted, the SCSI device for the path that was deleted in step 2 was not deleted. Execute the command for deleting the device shown in [Table 4-5 Adding or deleting a SCSI device on page 4-39](#) to manually delete the SCSI device.

5. Restart the host on which the HDLM is installed.
If you performed step 4, the host does not have to be restarted. Go to step 6.
6. Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) or the view operation of the `dlnmgr` command (`dlnmgr view -drv`) (optional).

Check if the SCSI device name of the HDLM device whose path was deleted in the above step 2 is represented with a hyphen (-).

The following are examples of executing the command or utility:

When executing the `dlmcfgmgr` utility with the `-v` option:

```
# /sbin/dlmcfgmgr -v
```

When executing the `view` operation with the `-drv` option:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -drv
```

Perform this operation if necessary. If it is not necessary to check this, go to step 7.

If the SCSI device name is not represented with a hyphen (-), to change the SCSI device name to a hyphen, wait until the path health checking has been executed or execute the following `dlnmgr` command with the `AutoPATH_ID` of the HDLM device.

Example:

```
# /opt/DynamicLinkManager/bin/dlnmgr online -pathid AutoPATH_ID
```

7. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -u logical_device_file_name_of_HDLM_device`) on the relevant HDLM device whose path was deleted in the above step 2 to unregister the HDLM device.

Path information on the relevant HDLM device is deleted.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -u name-of-logical-device-file-for-HDLM-device
```

If you execute the `dlmcfgmgr` utility (`dlmcfgmgr -u`) when a path to the HDLM device exists (for example, when you change a multi-path configuration to a single-path configuration), the KAPL10340-E message is output. In this case, take action according to this message and refer to the `/var/opt/DynamicLinkManager/log/dlmcfgmgrn.log` file (where *n* is 1 or 2). If the KAPL10362-W message was output to the `/var/opt/DynamicLinkManager/log/dlmcfgmgrn.log` file, HDLM operations are not affected. Go to step 8.

8. Refer to the `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` (`dlmcfgmgr -v`) to check if the path mapped with the relevant HDLM device is deleted.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Changing a device managed by HDLM into one not managed by HDLM:

The following operation can be done without restarting the host.

To change a device managed by HDLM into one not managed by HDLM:

1. Stop all accesses to the relevant LU.
2. Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) to check if the device you want to exclude from HDLM management is being managed by HDLM.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

If the Management status of the relevant HDLM device is represented as `configured` in the execution result, this means that the device is managed by HDLM.

3. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -o logical_device_file_name_of_HDLM_device`) on the relevant device you want to exclude from HDLM management.

The specified device is excluded from HDLM management.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -o name-of-logical-device-file-for-HDLM-device
```

4. Refer to `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) or the `view` operation (`dlmkmgr view -path`) of the `dlmkmgr` command to make sure that the relevant device is no longer managed by HDLM.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Changing a device not managed by HDLM into one managed by HDLM

The following operation can be done without restarting the host.

To change a device not managed by HDLM into one managed by HDLM:

1. Stop all accesses to the relevant LU.
2. Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) to check if the device you want HDLM to manage is not being managed.

If the Management status of the relevant HDLM device is represented as `unconfigured` in the execution result, the device is not being managed by

HDLM. Perform this operation if necessary. If it is not necessary to check this, go to step 3.

3. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -i logical_device_file_name_of_HDLM_device`) on the relevant device you want to HDLM to manage.

The specified device is managed by HDLM.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -i name-of-logical-device-file-for-HDLM-device
```

4. Refer to `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) or the view operation (`dlnmgr view -path`) of the HDLM command to make sure that the relevant device is now managed by HDLM.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Restoring the path of an HDLM device started in disconnected status (when a restart is required)

This subsection describes how to restore the path to an HDLM device that was in disconnected status (the cable was pulled out or broken) when the host first started. In this method, the host is restarted. Note that this operation is applicable to an HDLM device managed by HDLM only. Also note that the target path of restoration can be a single, multiple, or all paths to the relevant HDLM device.

To restore the path of an HDLM device started in disconnected status (this procedure restarts the host):

1. Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) or the view operation (`dlnmgr view -drv`) of the `dlnmgr` command to check if the host was started while the path to the relevant HDLM device was in disconnected status.

The following are examples of executing the command or utility:

When executing the `dlmcfgmgr` utility with the `-v` option:

```
# /sbin/dlmcfgmgr -v
```

When executing the `view` operation with the `-drv` option:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -drv
```

If the SCSI device name mapped with the path to the relevant HDLM device is represented with a hyphen (-) in the execution result, this means that the path was in disconnected status.

Perform this operation if necessary. If it is not necessary to check this, go to step 2.

2. Connect the cable.
If the cable is broken, replace it.
3. Restart the host on which the HDLM is installed.
The SCSI device is recreated, the path to the HDLM device, which was determined in step 1 to be in disconnected status when the host was started, is restored automatically, and the status changes to online.
4. Refer to `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to check if the path to the relevant HDLM device is restored.
The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Restoring the path of an HDLM device started in disconnected status (when a restart is not required)

This subsection describes how to restore the path to an HDLM device that was in disconnected status (the cable was pulled out or broken) when the host first started. In this method, the host is not restarted. Note that this operation is applicable to the HDLM device managed by HDLM only. Also note that the target path of restoration can be a single, multiple, or all path to the HDLM device.

To restore the path of an HDLM device started in disconnected status (this procedure does not restart the host):

1. Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) or the `view` operation (`dlnmgr view -drv`) of the HDLM command to check if the host was started while the path to the relevant HDLM device was in disconnected status.

The following are examples of executing the command or utility:

When executing the `dlmcfgmgr` utility with the `-v` option:

```
# /sbin/dlmcfgmgr -v
```

When executing the `view` operation with the `-drv` option:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -drv
```

If the SCSI device name mapped with the path to the relevant HDLM device is represented with a hyphen (-), in the execution result, this means that the path was in disconnected status.

Perform this operation if necessary. If it is not necessary to check this, go to step 2.

2. Connect the cable.
If the cable is broken, replace it.
3. Create the SCSI device for the path to be restored.

Since you restore the path without restarting, the path for the SCSI device which was in disconnected status during bootup will not be created and you must execute the command for adding a device, shown in the following table, to manually create the SCSI device.

Table 4-6 Add SCSI devices

Purpose	Command
Add a device (for FC-SAN environments)	<ul style="list-style-type: none"> When using any of the following OS and HBA driver combinations: <ul style="list-style-type: none"> Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8^{#1}, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8^{#2} or Oracle Unbreakable Enterprise Kernel 8 and a QLogic HBA driver SUSE LINUX Enterprise Server and a QLogic HBA driver Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel 8 and an Emulex HBA driver SUSE LINUX Enterprise Server and an Emulex HBA driver Red Hat Enterprise Linux 6 and a Brocade HBA driver SUSE LINUX Enterprise Server 11 and a Brocade HBA driver <p>Execute the following command:</p> <pre># echo "- - -" > /sys/class/scsi_host/hostn/scan#</pre> <p>#</p> <p>If LUs for which I/O processing is being performed exist, execute the <code>echo</code> command for each device as follows:</p> <pre># echo "b c d" > /sys/class/scsi_host/hostn/scan</pre> <p>Execute the following command to check whether the OS has recognized any devices:</p> <pre># cat /proc/scsi/scsi</pre> <p>If the OS has not recognized any devices, stop the I/O processing, and then execute the following commands in the order shown:</p> <pre># echo "1" > /sys/class/fc_host/hostn/issue_lip</pre> <pre># echo "- - -" > /sys/class/scsi_host/hostn/scan</pre> <p>If you are using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8, or SUSE LINUX Enterprise Server, the devices might be automatically recognized by the OS hot plug function. If the devices are recognized, the above procedure is not necessary.</p>
Adding a device (for IP-SAN environments)	<ul style="list-style-type: none"> For a device added to the target for which no session is established with the iSCSI initiator <p>Execute the following command to make the OS recognize the target:</p> <pre># iscsiadm -m discovery -t sendtargets -p IP-address-of-the-target</pre> <p>Then, log in to the target to establish a session.</p>

Purpose	Command
	<pre># iscsiadm -m node -T <i>target-name</i> -p <i>IP-address-of-the-target:port-number-of-the-target</i> --login</pre> <ul style="list-style-type: none"> For a device added to the target for which a session is established with the iSCSI initiator <p>Execute the following command:</p> <pre># iscsiadm -m session -R</pre>

Legend:

- a*: Host ID (Port number of the host)
- b*: Channel number (Bus number)
- c*: Target ID
- d*: Lun (LU number of the host)
- n*: host port number
- driver-name*: qlaxxxx (driver name in use)

#1

Red Hat Enterprise Linux 8.1 does not support QLogic HBA drivers.

#2

Oracle Linux 8 Update 1 does not support QLogic HBA drivers.

- Wait until the automatic failback function starts, or execute the `dlmkmgr` command (`dlmkmgr online -pathidAutoPATH_ID`).

The relevant path is placed online.

The following is an example of executing the HDLM command:

```
# /opt/DynamicLinkManager/bin/dlmkmgr online -pathid AutoPATH_ID
```

- Refer to `/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log` or execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to check if the path to the relevant HDLM device is restored.

The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Restoring the path in disconnected status

This subsection describes how to restore the path to an HDLM device that was in disconnected status (the cable was pulled out or broken).

- Execute the HDLM-configuration definition utility (`dlmcfgmgr -v`) to check while the path to the relevant HDLM device was in disconnected status.

The following are examples of executing the command:

```
# /sbin/dlmcfgmgr -v
```

If the SCSI device name mapped with the path to the relevant HDLM device is represented with a hyphen (-), in the execution result, this means that the path was in disconnected status.

2. Connect the cable.
If the cable is broken, replace it.
When the restart of the host is possible, go to step 3. When the restart of the host is not possible, go to step 4.
3. Restart the host.
The SCSI device is recreated, and the status changes to online. Go to step 6.
4. Create the SCSI device for the path to be restored.
You must execute the command for adding a device, shown in [Table 4-6 Add SCSI devices on page 4-48](#): Add SCSI Devices, to manually create the SCSI device.
5. Wait until the automatic failback function starts, or execute the `dlmkmgr` command (`dlmkmgr online -pathid AutoPATH_ID`).
The following is an example of executing the HDLM command:

```
# /opt/DynamicLinkManager/bin/dlmkmgr online -pathid AutoPATH_ID
```

The relevant path is placed online.

6. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to check if the path to the relevant HDLM device is restored.
The following is an example of executing the `dlmcfgmgr` utility:

```
# /sbin/dlmcfgmgr -v
```

Expanding the capacity of an LU

For an LU managed by HDLM and whose capacity can be expanded, this subsection describes how to expand the capacity of the LU without stopping the system and how to make HDLM recognize that capacity again. By performing this procedure, you can expand the capacity of a file system without unmounting the file system.

Notes

- Before performing this procedure, change the statuses of all paths to `Online`. If an error has occurred on a path, you cannot perform this procedure.
- Before changing the capacity of an LU, be sure to back up the data.
- Before changing the capacity of an LU, verify the following items:
 - The storage system you are using supports the expansion of the capacity of LUs while they are in use.
 - The OS you are using supports the expansion of capacity of paths (SCSI devices) while they are in use.

- To expand the capacity of an LU, check the specifications of the program used to manage the storage system.
- To expand the capacity of a SCSI device, check the specifications of the OS.
- The HDLM function used in this procedure expands the capacity of an LU, not that of a partition. To expand the capacity of a file system created in a partition, you will need to unmount the file system.

In the following procedure, the capacity of an XFS file system is expanded from 1 GB to 2 GB. This file system is created in `/dev/sddlmaa` and mounted on `/data`, in a Red Hat Enterprise Linux 7 environment.

1. Check the correspondence between the file system (mount point) whose capacity is to be expanded, and the HDLM device (file).
 - a. Check the capacity of the file system.

```
# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/sddlmaa              1014M        33M   982M   4% /data
:
```

Based on the above, you can confirm that the size of `/data` is 1 GB.

- b. Check the correspondence between the file system and the HDLM device.

```
# mount
/dev/sddlmaa on /data type xfs
(rw,relatime,seclabel,attr2,inode64,noquota)
:
```

Based on the above, you can confirm that `/dev/sddlmaa` is mounted on `/data`.

2. Check the correspondence between the HDLM device and the LU information in the program used to manage the storage system.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : X
SerialNumber : Y
LUs          : 3

iLU  HDevName Device   PathID Status
ZZZZ sddlmaa  /dev/sdb 000000 Online
      /dev/sde 000003 Online
      /dev/sdh 000006 Online
      /dev/sdk 000007 Online
      :
      :
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
```

Based on the above, you can confirm that `sddlmaa` corresponds to the iLU `ZZZZ` of the storage system whose model ID is `X` and whose serial number is `Y`.

3. In the program used to manage the storage system, expand the capacity of the LU. For details on how to expand an LU, see the manual provided with the storage system.
4. On the server, expand the capacity of all paths (SCSI devices) of the HDLM device.
 - a. Check the correspondence between the HDLM device and the paths (SCSI devices).

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : X
SerialNumber : Y
LUs          : 3

iLU  HDevName Device  PathID Status
ZZZZ sddlmaa  /dev/sdb 000000 Online
                /dev/sde 000003 Online
                /dev/sdh 000006 Online
                /dev/sdk 000007 Online
      :
      :
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

Based on the above, you can confirm that `sddlmaa` corresponds to `/dev/sdb`, `/dev/sde`, `/dev/sdh`, and `/dev/sdk`.

- b. Expand the capacity of all corresponding SCSI devices.
- In the following, the capacities of `/dev/sdb`, `/dev/sde`, `/dev/sdh`, and `/dev/sdk` are expanded.

```
# echo 1 > /sys/block/sdb/device/rescan
# echo 1 > /sys/block/sde/device/rescan
# echo 1 > /sys/block/sdh/device/rescan
# echo 1 > /sys/block/sdk/device/rescan
```

5. On the server, expand the capacity of the HDLM device.
 - a. Make sure that the statuses of all paths are Online.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : X
SerialNumber : Y
LUs          : 3

iLU  HDevName Device  PathID Status
ZZZZ sddlmaa  /dev/sdb 000000 Online
                /dev/sde 000003 Online
                /dev/sdh 000006 Online
                /dev/sdk 000007 Online
      :
      :
```

```
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
```

Based on the above, you can confirm that the statuses of all sddlmaa paths are Online.

- b. Expand the capacity of the HDLM device.

In the following, the capacity of /dev/sddlmaa is expanded.

```
# dlmcfmgr -extenddev /dev/sddlmaa -s
KAPL10341-I The HDLM device configurations have been changed.
KAPL10302-I /usr/sbin/dlmcfmgr completed normally.
```

6. Expand the capacity of the file system on the server.

- a. Expand the capacity of the file system.

In the following, the capacity of /data is expanded.

```
# xfs_growfs /data
meta-data=/dev/sddlmaa      isize=256    agcount=4,
agsize=65536 blks
      =                       sectsz=512    attr=2,
projid32bit=1
      =                       crc=0        finobt=0
data      =                  bsize=4096    blocks=262144,
imaxpct=25
      =                       sunit=0      swidth=0 blks
naming    =version 2        bsize=4096    ascii-ci=0
ftype=0
log        =internal        bsize=4096    blocks=2560,
version=2
      =                       sectsz=512    sunit=0 blks,
lazy-count=1
realtime  =none             extsz=4096    blocks=0,
rtextents=0
data blocks changed from 262144 to 524288
```

- b. Check the capacity of the file system.

```
# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sddlmaa    2.0G   33M   2.0G   2% /data
:
```

Based on the above, you can confirm that the size of /data is now 2 GB.

Changing an HDLM device name

This subsection describes how to change HDLM device names.

An HDLM device name is assigned depending on the HDLM specifications when `dlmcfmgr` is executed the first time after the OS recognizes a new LU. You can execute the HDLM device name replacement utility (`dlmchname`) to

change the HDLM device name. For details about the `dlnmchname` utility, see [Chapter 7, Utility reference on page 7-1](#).

1. Create a device name replacement definition file based on the current HDLM device configuration information. When the `dlnmchname` utility is executed with the `-o` parameter, a device name replacement definition file (`/etc/opt/DynamicLinkManager/dlnmchname.conf`) is created based on the current HDLM device configuration information.

```
# /opt/DynamicLinkManager/bin/dlnmchname -o
```

2. Check the current HDLM device configuration information, and then identify the HDLM device name to be changed.

Execute the `view` operation of the HDLM command. In the execution results, check the correspondence between the LUs and HDLM devices, and then identify the HDLM device name to be changed.

An execution example is as follows:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product       : VSP_Ex00
SerialNumber  : 416032
LUs           : 3
```

iLU	HDevName	Device	PathID	Status
000090	sddlmaab	/dev/sda	000004	Online
		/dev/sdd	000005	Online
		/dev/sdj	000008	Online
		/dev/sdg	000009	Online
000091	sddlmac	/dev/sdb	000006	Online
		/dev/sde	000007	Online
		/dev/sdh	000010	Online
		/dev/sdk	000011	Online
000092	sddlmaa	/dev/sdc	000000	Online
		/dev/sdf	000001	Online
		/dev/sdi	000002	Online
		/dev/sdl	000003	Online

```
KAPL01001-I The HDLM command completed normally. Operation name
= view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
```

Note that LUs that are not managed by HDLM are not output. Therefore, configure the setting so that LUs are managed by HDLM before the check. If you can identify the correspondence between LUs and HDLM devices, edit the device name replacement definition file in step 3.

3. Edit the device name replacement definition file.

Change HDLM device names specified in the device name replacement definition file (`/etc/opt/DynamicLinkManager/dlnmchname.conf`) by using an editor such as `vi`.

In the following example, the name of the HDLM device whose the serial number is 85011299 and whose iLU is 0090 was identified as `sddlmaab` in step 2 and is then changed to `sddlmaad`.

(Before change)

```
# /bin/cat /etc/opt/DynamicLinkManager/dlnmchname.conf
3585011299 0090 sddlmaab
3585011299 0091 sddlmac
3585011299 0092 sddlmaa
```

(After change)

```
# /bin/cat /etc/opt/DynamicLinkManager/dlmchname.conf
3585011299 0090 sddlmac
3585011299 0091 sddlmac
3585011299 0092 sddlmaa
```

Lines for which the HDLM device name is not changed can be deleted from the `dlmchname.conf` file, without causing any problems.

To change the name of an HDLM device used as a boot disk, go to step 5.

4. Stop access to the HDLM device whose name is to be changed.

To stop access to the HDLM device, perform the following operations:

- Unmount the HDLM device if the HDLM device is mounted.
- Deactivate the volume group if the HDLM device is used in an LVM.
- Stop applications that are using the HDLM device.

To prevent I/Os from causing failures during HDLM device name replacement, execute the `dlmcfgmgr` utility (`dlmcfgmgr -o`) so that the HDLM device is not managed.

If you execute the `dlmcfgmgr` utility (`dlmcfgmgr -o`), execute the `dlmcfgmgr` utility (`dlmcfgmgr -i`) so that the HDLM device is managed again after the `dlmchname` utility.

5. Execute the `dlmchname` utility.

To change the name of an HDLM device that is a member of an LVM volume group, execute the `dlmchname` utility and then the `vgscan` command.

To change the name of an HDLM device that is not used as a boot disk
Execute the `dlmchname` utility as follows to change the HDLM device name.

```
# /opt/DynamicLinkManager/bin/dlmchname
```

To change the name of an HDLM device that is used as a boot disk

Execute the `dlmchname` utility with the `-f` parameter.

```
# /opt/DynamicLinkManager/bin/dlmchname -f
```

To change the name of an HDLM device that is not used as a boot disk, go to step 8.

6. Edit the setting files in which the HDLM device name is specified.

When changing the name of an HDLM device that is used as a boot disk, check and edit the `/etc/fstab` file.

7. Reboot the host.

When changing the name of an HDLM device that is used as a boot disk, you must reboot the host.

```
# shutdown -r now
```

8. Check that the HDLM device name has been changed in the current HDLM device configuration information.

Execute the `view` operation of the HDLM command. In the execution results, check that the HDLM device name has been changed.

An execution example is as follows:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : VSP_Ex00
```

```
SerialNumber : 416032
LUs          : 3
```

iLU	HDevName	Device	PathID	Status
000090	sddlmac	/dev/sda	000004	Online
		/dev/sdd	000005	Online
		/dev/sdj	000008	Online
		/dev/sdg	000009	Online
000091	sddlmac	/dev/sdb	000006	Online
		/dev/sde	000007	Online
		/dev/sdh	000010	Online
		/dev/sdk	000011	Online
000092	sddlmaa	/dev/sdc	000000	Online
		/dev/sdf	000001	Online
		/dev/sdi	000002	Online
		/dev/sdl	000003	Online

```
KAPL01001-I The HDLM command completed normally. Operation name
= view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
```

Note that LUs that are not managed by HDLM are not output. Therefore, configure the setting so that the LUs are managed by HDLM before the check.

9. Access the HDLM device whose name was changed, and then check that the HDLM device can be used.

Check that applications that access the HDLM device whose name was changed are running normally.

About creating a new HDLM device

While restarting the host, HDLM may detect a new path. The HDLM device to be allocated depends on whether the SCSI device for the detected path is already registered or a new SCSI device is registered. This section describes a situation where the HDLM device that is to be allocated to the newly detected path is already registered and a situation where a new HDLM device is created.

If the SCSI device of the new path that HDLM detected is already registered, the HDLM device mapped with the path already registered is allocated. For example, if the path between the host and an LU of the storage system already exists and a new path is added, the HDLM device that already exists is allocated to the path.

If the SCSI device of the new path that HDLM detected is not yet registered, a new HDLM device is allocated to the path. For example, if you define a new path from the host to an LU of the storage system, a new HDLM device is allocated to the path. The lowest available alphabetical letter is allocated as the logical device file name of the HDLM device.

Examples of the logical device file names for HDLM devices when a new HDLM device is allocated are shown in the following table.

Table 4-7 Example: allocation of new HDLM devices

Allocation before restarting the host	Allocation after restarting the host
none	/dev/sddlmaa [#]
/dev/sddlmaa	/dev/sddlmaa /dev/sddlmaab [#]
/dev/sddlmaa /dev/sddlmaab	/dev/sddlmaa /dev/sddlmaab /dev/sddlmac [#]
/dev/sddlmaa /dev/sddlmac	/dev/sddlmaa /dev/sddlmaab [#] /dev/sddlmac
/dev/sddlmaab /dev/sddlmac	/dev/sddlmaa [#] /dev/sddlmaab /dev/sddlmac
/dev/sddlmaa : /dev/sddlmp	/dev/sddlmaa : /dev/sddlmp /dev/sddlmaa [#]
/dev/sddlmaa : /dev/sddlmaap	/dev/sddlmaa : /dev/sddlmaap /dev/sddlmbaa [#]

#

The newly allocated logical device file name of the HDLM device

If the error message KAPL10357-E is displayed, HDLM does not add an HDLM device even though a new LU was recognized. In this case, you must execute the HDLM-configuration definition utility (`dlmcfgmgr -u`) to delete the HDLM device(s) not in use (or, represented with a hyphen (-)) to release the available name(s) to create an HDLM device file for the new LU.

Even if you add a path to an HDLM device that is not managed by HDLM and restart the host, the HDLM device will not be managed by HDLM.

An `AutoPATH_ID` is allocated sequentially as the HDLM recognizes a SCSI device during start up of the host. Therefore, an `AutoPATH_ID` for the same path may change whenever the host starts.

If a different LU is allocated to the same path name, a new HDLM device will be allocated to the newly allocated LU after restarting the host restarts. In such case, the previous HDLM device is unregistered automatically.

Note on adding a Hitachi Compute Blade I/O drawer[#]

When you restart the host after adding a Hitachi Compute Blade I/O drawer[#], and if you execute the HDLM-configuration definition utility (`dlmcfgmgr -v`), a hyphen (-) might be displayed in the `Device` column of the execution results.

```
# dlmcfgmgr -v
HDevName      Management      Device      Host      Channel Target
Lun
/dev/sddlmaa  configured      /dev/sde    2          0         0
1
0
0
0
/dev/sddlmaab configured      -           0          0         0
1
2
1
/dev/sdf      2          0         0
/dev/sdb      1          0         0
1
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

To change to a status that does not display a hyphen, execute the `dlmcfgmgr` utility with the `-u` parameter specified.

For details on the `dlmcfgmgr` utility, see [dlmcfgmgr utility for managing the HDLM configuration on page 7-26](#).

#

An I/O drawer is considered added in either of the following situations:

- When adding an I/O drawer to the host
- When adding an HBA to an I/O drawer that is already connected to the host

Troubleshooting

This chapter describes how to properly use HDLM error information, and then how to resolve the problem, if an error has occurred in HDLM. The resolutions for path errors, HDLM program errors, and other types of errors are all described separately. If you need technical support, see [Getting help on page xix](#).

- ☐ [Information collected by the DLMgetras utility for collecting HDLM error information](#)
- ☐ [Checking error information in messages](#)
- ☐ [What to do for a path error](#)
- ☐ [What to do for a program error](#)
- ☐ [What to do for other errors](#)

Information collected by the DLMgetras utility for collecting HDLM error information

Immediately after an error occurs, execute the `DLMgetras` utility for collecting HDLM error information, since restarting the machine might delete error information before the information is collected by `DLMgetras`.

For details about the `DLMgetras` utility and the error information it collects, see [DLMgetras utility for collecting HDLM error information on page 7-3](#).

Checking error information in messages

When you want to configure the system so that HDLM messages are output to syslog, specify `user` for the system function name (Facility) in the `syslogd` settings file.

The following shows an example when `syslogd` is used, the system function name (Facility) is `user`, and the priority level (Priority) is an information message (`info`) level or higher are output to the `/tmp/syslog.user.log` file:

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

You can check path errors by referring to the `KAPL08xxx` messages that are output to the syslog.

To obtain detailed information about a path failure, check the execution results of the `view` operation as indicated by the error message.

For details on the `view` operation, see [view \(displays information\) on page 6-31](#).

The following is an example of a message:

```
KAPL08022-E Error in path occurred. 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
```

The message elements are explained below:

`ErrorCode`

The error number generated when Linux detects a 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. 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 `dlmcfgmgr` utility. This path ID is also the same as `PathID` displayed by the `dlmkmgr` command's `view` operation. For details on this `view` operation, see [view \(displays information\) on page 6-31](#).

PathName

The path name indicates a path. When you modify the system configuration or replace a piece of hardware, you should check the path names to identify the paths that will be affected by the change.

A path name consists of the following four elements, separated by periods:

- Host port number (hexadecimal)
- Bus number (hexadecimal)
- Target ID (hexadecimal)
- Host LU number (hexadecimal)

This path name is also the same as `PathName` displayed by the command's `view` operation. For details on the path name, see [view \(displays information\) on page 6-31](#).

DNum

A Dev number, which is equivalent to a partition number in Linux.

A device number beginning from 0 is assigned to the device in the LU.

In Linux, this value is fixed to 0.

This is the same as the `DNum` that is displayed by the `view` operation. For details on the `view` operation, see [view \(displays information\) on page 6-31](#).

HDevName

The name of the host device.

The logical device file name of the HDLM device to which access is made by way of the path, minus the partition number, is displayed in the format `sddlm[aa-pop]` (for example, `sddlmaa`, or `sddlmaaa`). For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

This is the same as the `HDevName` that is displayed by the `view` operation. For details on the `view` operation, see [view \(displays information\) on page 6-31](#).

What to do for a path error

When a path error is detected, HDLM performs a failover on the path and outputs the KAPL08022-E message. This message indicates that an error has occurred in the components, shown in the following figure, that make up the path.

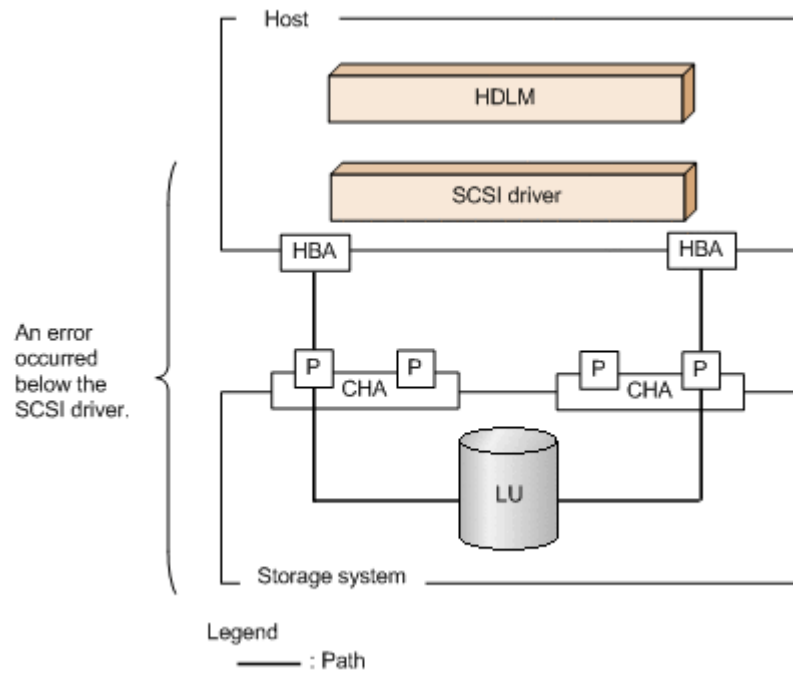


Figure 5-1 Error location when the KAPL08022-E message is output

The following figure shows the troubleshooting procedure when the KAPL08022-E message is output.

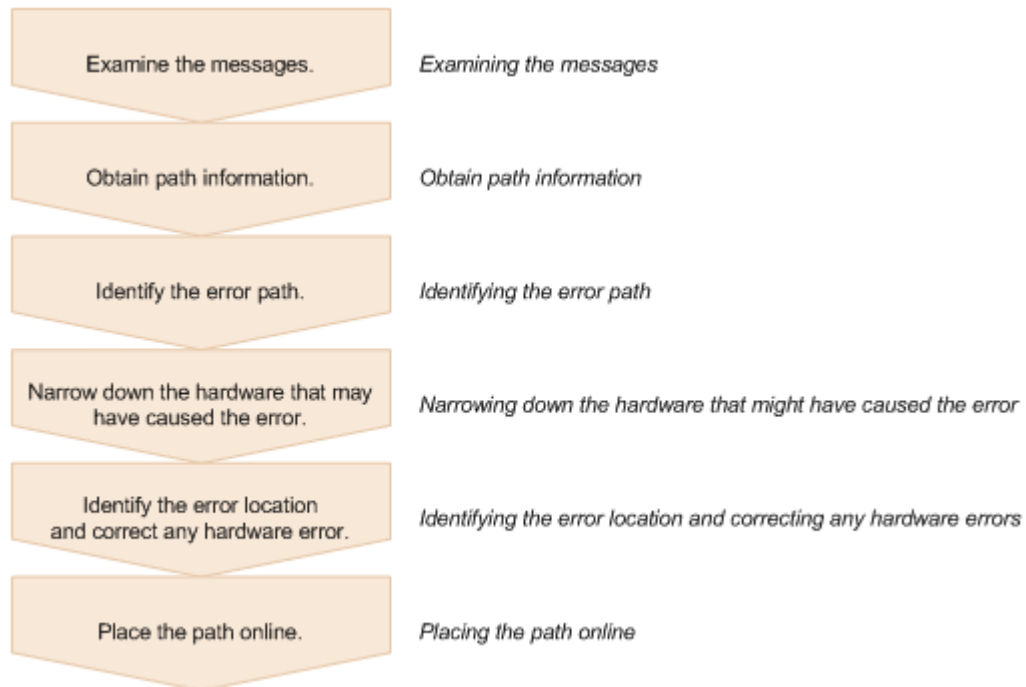


Figure 5-2 Troubleshooting procedure when a path error occurs

The following shows the procedure for using the HDLM command (`dladmgr`) to handle a path error.

Examining the messages

Examine the message that is output to syslog in the host by using applications or tools for monitoring messages. If the KAPL08022-E message is output, view the message to check the path in which the error has occurred. For details on each item displayed in messages, see [Checking error information in messages on page 5-2](#).

Obtain path information

Obtain path information.

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -iem -hbaportwnn > pathinfo.txt
```

pathinfo.txt is the redirection-output file name. Use a file name that matches your environment.

Identifying the error path

Check the obtained path information to find the path with the error. In the Status column, the error path has the status Offline(E) or Online(E).

Narrowing down the hardware that might have caused the error

Check the DskName, iLU, ChaPort, and HBAPortWWN columns of the path with the error to narrow down the hardware that may be the cause of the error. To physically identify the hardware corresponding to DskName, iLU, and ChaPort, use the information provided by the storage-system management program.

Identifying the error location and correcting any hardware errors

Use the Linux and hardware management tools to identify the error location, and then resolve the problem. For hardware maintenance, contact your hardware vendor or maintenance company, if there is a maintenance contract.

Placing the path online

After the path has recovered from the error, use the dlnkmgr command's online operation to place the path back online. For details on the online operation, see [online \(places paths online\) on page 6-10](#). Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online
```

Executing this command places all the offline paths online.

If any path cannot be placed online due to an error, the KAPL01039-W message will appear. To ignore such paths and to continue processing, type `y`. Type `n` to cancel processing.

Check the statuses of the paths that cannot be placed online, and resolve the problem.

What to do for a program error

The following describes what to do to handle errors that occur in an HDLM program. The following figure shows the troubleshooting procedure.

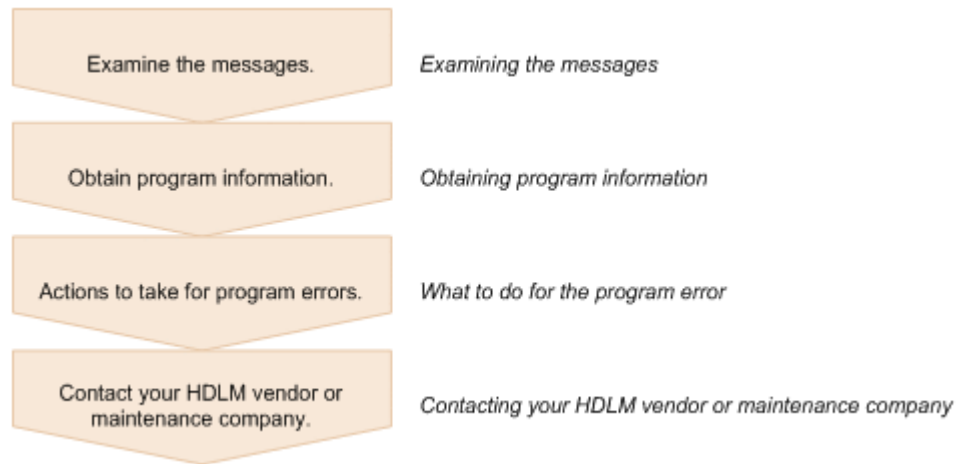


Figure 5-3 Troubleshooting procedure when a program error occurs

The following shows the procedure for handling a program error by using the HDLM command (`dlnkmgr`).

Examining the messages

Examine the messages that are output to the host syslog. If an error occurs in an HDLM program, a message other than KAPL08xxx is output to syslog. Examine the content of the message. Messages with error level `E` (Error) or higher require corrective action.

Obtaining program information

Obtain the information that you need to report to your HDLM vendor or maintenance company.

Use the `DLMgetras` utility to collect the error information. For details on this utility and the information it collects, see [DLMgetras utility for collecting HDLM error information on page 7-3](#).

Some of the information collected by the `DLMgetras` utility might be cleared when the host is restarted. Because of this, whenever an error occurs, execute the `DLMgetras` utility as soon as possible.

What to do for the program error

Follow the recommended actions for messages in [Chapter 8, Messages on page 8-1](#).

If the error occurs again after you thought that you had resolved the problem, use the `dlnmgr` command's `view` operation to check the status of the HDLM program, and then do whatever is necessary to resolve the problem. For details on the `view` operation, see [view \(displays information\) on page 6-31](#).

For example, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys
```

If the KAPL01012-E message appears as a result of executing the command:

The KAPL01012-E message is as follows:

```
KAPL01012-E Could not connect the HDLM manager. Operation name =  
view
```

In this situation, start the HDLM manager. For details about how to do this, see [Starting the HDLM manager on page 4-24](#).

If the KAPL01013-E message appears as a result of executing the command:

The following shows the KAPL01013-E message:

```
KAPL01013-E An error occurred in internal processing of the HDLM  
command. Operation name = view, details = aa...aa
```

aa...aa are character strings.

In this situation, restart the host.

If the same error re-occurs after you thought you had resolved the problem, go to the subsection [Contacting your HDLM vendor or maintenance company on page 5-7](#).

Contacting your HDLM vendor or maintenance company

If the error cannot be resolved, contact your HDLM vendor or maintenance company, and report the information that was collected by the `DLMgetras` utility.

What to do for other errors

When the cause of an error may be related to HDLM but is neither a path error nor an HDLM program error, execute the `DLMgetras` utility, 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 [DLMgetras utility for collecting HDLM error information on page 7-3](#).

Command reference

This chapter describes the HDLM command (`dlnkmgr`) and its operations.

- [Overview of the HDLM command dlnkmgr](#)
- [clear \(returns the path statistics to the initial value\)](#)
- [help \(displays the operation format\)](#)
- [offline \(places paths offline\)](#)
- [online \(places paths online\)](#)
- [set \(sets up the operating environment\)](#)
- [view \(displays information\)](#)
- [add \(adds a path dynamically\)](#)
- [delete \(deletes a path dynamically\)](#)
- [refresh \(applies storage system settings to HDLM\)](#)

Overview of the HDLM command `dlnkmgr`

This section describes how to specify the HDLM command `dlnkmgr` and its subcommands (called *operations* in HDLM).

Command format

Enter the command using the following format:

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

`dlnkmgr`

The command name.

`operation`

The type of operation entered after `dlnkmgr`.

`parameter`

A value required for an operation.

`parameter-value`

A value required for an operation parameter.

Operations of the `dlnkmgr` command

[Table 6-1 Operations of the `dlnkmgr` command on page 6-2](#) shows the operations of `dlnkmgr` and their functions.

Table 6-1 Operations of the `dlnkmgr` command

Operation	Functions
<code>clear</code>	Initializes(0) the statistics (I/O count and I/O errors) of all paths managed by the HDLM system. For details, see clear (returns the path statistics to the initial value) on page 6-3 .
<code>help</code>	Displays the format of the operations used for HDLM. For details, see help (displays the operation format) on page 6-4 .
<code>offline</code>	Places offline an online path or paths. For details, see offline (places paths offline) on page 6-6 .
<code>online</code>	Places online an offline path or paths. For details, see online (places paths online) on page 6-10 .
<code>set</code>	Sets the HDLM operating environment. For details, see set (sets up the operating environment) on page 6-15 .
<code>view</code>	Displays HDLM program information, path information, LU information, and corresponding information about each HDLM device, SCSI device, and LDEV. For details, see view (displays information) on page 6-31 .
<code>add</code>	Dynamically adds a path as an HDLM-management target. For details, see add (adds a path dynamically) on page 6-69 .
<code>delete</code>	Dynamically deletes a path that is an HDLM-management target. For details, see delete (deletes a path dynamically) on page 6-70 .

Operation	Functions
refresh	Applies the storage system settings to HDLM. For details, see refresh (applies storage system settings to HDLM) on page 6-72 .

Notes

- Execute the command as a user with root permissions.
- To specify a value that contains a space in its parameter, enclose the entire value in double quotes (").

clear (returns the path statistics to the initial value)

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

Format

To set the path statistics to 0

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

To display the format of the clear operation

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

Parameters

To set the path statistics to 0

`-pdst`

Clears statistics (I/O count and I/O errors) of all paths managed by HDLM to the initial value (0).

Example

```
# /opt/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
#
```

`-s`

Executes the command without displaying a message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for

example, when you want to execute the command in a shell script or batch file.

Example

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

To display the format of the clear operation

-help

Displays the format of the `clear` operation.

Example

```
# /opt/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
#
```

help (displays the operation format)

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

Format

```
/opt/DynamicLinkManager/bin/dlnkmgr help [operation]
[operation] ...
```

Parameter

operation

Specify the HDLM command operation whose format you want to know. You can specify one of the following operations:

- o clear
- o help
- o offline
- o online
- o set
- o view
- o add

- o delete
- o refresh

If you do not specify any operations, the `help` operation displays all operations available for the HDLM command.

Examples

Example 1

The following example shows how to display all the operations available in the HDLM command.

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

Example 2

The following example shows how to display the formats of multiple operations.

```
# /opt/DynamicLinkManager/bin/dlnkmgr help online offline help
online:
  Format
    dlnkmgr online [-path] [-s]
    dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
    dlnkmgr online [-path] [-device SCSI_Device_Name] [-s]
    dlnkmgr online [-path] -hapath [-lu -pathid AutoPATH_ID] [-s]
    dlnkmgr online [-path] -dfha [-lu -pathid AutoPATH_ID] [-s]

  Valid value
    AutoPATH_ID      { 000000 - 999999 }(Decimal)
offline:
  Format
    dlnkmgr offline [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr offline [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -device SCSI_Device_Name [-s]
  Valid value
    AutoPATH_ID      { 000000 - 999999 }(Decimal)
help:
  Format
    dlnkmgr help { clear | offline | online | set | view | add |
delete | refresh }
KAPL01001-I The HDLM command completed normally. Operation name
= help, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 3

The following example shows how to display the operations that can be specified by the `help` operation

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

offline (places paths offline)

The `dlnkmgr` command's `offline` operation places online paths offline. Specify the paths to be placed offline by specifying an HBA port, CHA port, or single path. Instead of specifying a path, you can also specify a SCSI device name.

There must always be at least one online path accessing each LU.

Note that, for a path that is placed offline by the `offline` operation and whose status changes to Offline(C), the path status will not be inherited when the host is restarted. If the path is in a normal condition when the host is restarted, the path will become active and its status will be Online.

Placing too many paths offline might prevent paths from being able to switch if an error occurs. Before placing a path offline, use the `view` operation to check how many online paths remain. For details about the `view` operation, see [view \(displays information\) on page 6-31](#).

Format

To place paths offline

```
/opt/DynamicLinkManager/bin/dlnkmgr offline
[-path]
{-hba host-port-number.bus-number
|-cha -pathid AutoPATH_ID
|-pathid AutoPATH_ID
|-device SCSI-device-name}
[-s]
```

To display the format of the offline operation

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

Parameters

To place paths offline

`-path`

Indicates that the target of the operation is a path managed by HDLM.

This parameter is optional because `offline` is always used for paths, so it is assumed.

Make sure that you specify the paths to be taken offline by using the `-hba`, `-cha`, `-pathid`, or `-device` parameter.

`-hba host-port-number.bus-number`

Use this parameter to place offline, at one time, all the paths that pass through a specific HBA port. The command will place offline all the paths connected to the HBA port that has the specified host port number and bus number.

Specify the host port number and bus number of the target HBA port: the numbers are found in the `PathName` field displayed using the `view` operation. Enter a period between these two parameter values. For details about the `view` operation, see [view \(displays information\) on page 6-31](#).

Example

The following example shows how to place offline all paths connected to the HBA port whose host port number is 0010 and bus number is 0000:

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0010.0000
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]:
KAPL01061-I 3 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline
#
```

`-cha -pathid AutoPATH_ID`

Use this parameter to place offline, at one time, all the paths that pass through a specific CHA port. The command will place offline all the paths that pass through the CHA port to which the path with the specified `AutoPATH_ID` is connected. Paths that pass through a physical CHA port on a physical storage system will be offline.

Specify the current `AutoPATH_ID` of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see [view \(displays information\) on page 6-31](#). Leading zeros can be omitted (000001 and 1 indicate the same `AutoPATH_ID`); however, when the target `AutoPATH_ID` is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the `dlmcfgmgr` utility for managing the HDLM configuration. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation.

Example

The following example shows how to place offline all the paths connected to the CHA port 0A. In this example, a path whose AutoPATH_ID is 000001 is connected to the target CHA port:

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /opt/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]:
KAPL01061-I 2 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline
#
```

`-pathid AutoPATH_ID`

Use this parameter to place a single path offline.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see [view \(displays information\) on page 6-31](#). Leading zeros can be omitted (000001 and 1 indicate the same AutoPATH_ID); however, when the target AutoPATH_ID is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the `dlmcfgmgr` utility for managing the HDLM configuration. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation.

`-device SCSI-device-name`

Use this parameter to place offline a path connected to the specified SCSI device.

For *SCSI-device-name*, specify the value of `Device` displayed by executing the `view` operation as follows:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
```

For details on how to execute the `view` operation and display the SCSI device name, see [To display LU information on page 6-54](#). Only one case-sensitive parameter value can be specified.

Example

The following shows an example of how to place offline a path whose SCSI device name is `/dev/sde` while confirming command operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -path -
device /dev/sde
KAPL01052-I The currently selected paths will be changed to
the Offline(C) status. Is this OK? [y/n]:y
KAPL01053-I If you are sure that there would be no problem
when the path is placed in the Offline(C) status, enter y.
Otherwise, enter n. [y/n]:y
KAPL01061-I 1 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline
```

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

The following example shows how to place a path, whose AutoPATH_ID is 000001, offline without asking for confirmation of command execution from the user:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -pathid 1 -s
KAPL01061-I 1 path(s) were successfully placed Offline(C); 0
path(s) were not. Operation name = offline
#
```

To display the format of the offline operation

-help

Displays the format of the `offline` operation.

Example

The following example shows how to display the format of the `offline` operation:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -help
offline:
  Format
    dlnkmgr offline [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr offline [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -pathid AutoPATH_ID [-s]
    dlnkmgr offline [-path] -device SCSI_Device_Name [-s]
  Valid value
    AutoPATH_ID      { 000000 - 999999 }(Decimal)
KAPL01001-I The HDLM command completed normally. Operation
name = offline, completion time = yyyy/mm/dd hh:mm:ss
#
```

Reference

Using the `view` operation together with standard UNIX commands enables you to filter the path information listed for a specific HBA port or CHA port. For details about the `view` operation, see [view \(displays information\) on page 6-31](#).

We recommend that you use the following command and verify the information on the target paths before you execute the `offline` operation to place offline all the paths connected to a specific HBA port or CHA port.

Example 1

The following example shows how to filter and display the information on all paths that pass through the HBA port whose host port number is 0004 and bus number is 0000:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path | grep 0004.0000
```

The above command will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all the paths that pass through the CHA port 1B of the VSP G1000 series:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -stname | grep  
VSP_G1000 | grep 1B
```

The above command will display information pertaining to only those paths that pass through the specified CHA port.

online (places paths online)

The `dlnkmgr` command's `online` operation places offline paths online. Specify the paths to be placed online by specifying an HBA port, CHA port, or single path. Instead of specifying a path, you can also specify a SCSI device name.

Format

To place paths online

```
/opt/DynamicLinkManager/bin/dlnkmgr online  
[-path]  
[-hba host-port-number.bus-number  
|-cha -pathid AutoPATH_ID  
|-pathid AutoPATH_ID  
|-device SCSI-device-name  
|-hapath [-lu -pathid AutoPATH_ID]  
|-dfha [-lu -pathid AutoPATH_ID]]
```

[-s]

To display the format of the online operation

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

Parameters

To place paths online

`-path`

Indicates that the target of the operation is a path managed by HDLM. This parameter is optional because `online` is always used for paths, so it is assumed.

Make sure that you specify the path to be taken online by using the `-hba`, `-cha`, `-pathid`, or `-device` parameter. If you do not specify any of these parameters, the command will place all the offline paths online. If there is a path that cannot be placed online, a message asking whether you would like to continue processing will be displayed. To ignore the offline path that cannot be placed online and to continue processing, enter `y`. To stop the processing, enter `n`.

`-hba host-port-number.bus-number`

Use this parameter to place online, at one time, all the paths that pass through a specific HBA port. The command will place online all the paths connected to the HBA port that has the specified host port number and bus number.

Specify the host port number and bus number of the target HBA port: the numbers are found in the `PathName` field displayed using the `view` operation. Enter a period between these two parameter values. For details about the `view` operation, see [view \(displays information\) on page 6-31](#).

Example

The following example shows how to place online all paths connected to an HBA port whose host port number is `0010` and bus number is `0000`:

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0010.0000
KAPL01057-I All the paths which pass the specified HBA will
be changed to the Online status. Is this OK? [y/n]:y
KAPL01061-I 3 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

`-cha -pathid AutoPATH_ID`

Use this parameter to simultaneously place online all paths that pass through a specific CHA port. The command will place online all paths that

pass through the CHA port in the path specified by the `-pathid` parameter. Paths that pass through a specific physical CHA port on a physical storage system will be online.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see [view \(displays information\) on page 6-31](#). Leading zeros can be omitted (000001 and 1 indicate the same AutoPATH_ID); however, when the target AutoPATH_ID is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the HDLM-configuration definition utility (`dlnmcfgmgr`). Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation.

Example

The following example shows how to place online the paths connected to the CHA port 0A. In this example, a path whose AutoPATH_ID is 000002 is connected to the target CHA port:

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -cha -pathid
000002
KAPL01057-I All the paths which pass the specified CHA port
will be changed to the Online status. Is this OK? [y/n]:y
KAPL01061-I 2 path(s) were successfully placed Online; 0
path(s) were not. Operation name = online
#
```

`-pathid AutoPATH_ID`

Use this parameter to place a single path online.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see [view \(displays information\) on page 6-31](#). Leading zeros can be omitted (000001 and 1 indicate the same AutoPATH_ID); however, when the target AutoPATH_ID is 000000, enter 000000 or 0 for the parameter value.

AutoPATH_IDs are re-assigned every time the host is restarted. When you want to add a new LU without restarting the host, AutoPATH_IDs are re-assigned to each path of the LU when you execute the `dlnmcfgmgr` utility. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation.

`-device SCSI-device-name`

Use this parameter to place online a path connected to the specified SCSI device.

For *SCSI-device-name*, specify the value of *Device* displayed by executing the *view* operation as follows:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
```

For details on how to execute the *view* operation and display the SCSI device name, see [To display LU information on page 6-54](#). Only one case-sensitive parameter value can be specified.

Example

The following shows an example of how to place online a path whose SCSI device name is */dev/sde* while confirming command operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -path -  
device /dev/sde  
KAPL01050-I The currently selected paths will be changed to  
the Online status. Is this OK? [y/n]:y  
KAPL01061-I 1 path(s) were successfully placed Online; 0  
path(s) were not. Operation name = online
```

-hapath

Use this parameter to change to the *Online* status when the paths to the primary volume (P-VOL) in an HAM environment are in the *Online(S)* or *Online(D)* status. To change the status of a specific LU, use the *-lu* and *-pathid* parameters to specify the path to the LU. To change the status of all the paths in the *Online(S)* and *Online(D)* statuses, specify only *-hapath*.

-dfha

Use this parameter to change the paths to the primary volume (P-VOL) in an HAM environment to *Online(D)*. The *Online(S)* status changes to the *Online(D)* status. When you do not specify this parameter, the status of the P-VOL paths in the HAM environment will be changed to the *Online(S)* status. If I/O operations to the secondary volume (S-VOL) have never occurred and only the paths to the P-VOL recover from an error, the path to the P-VOL will be in the *Online* status regardless of this parameter specification. To change the status of a specific LU, use the *-lu* and *-pathid* parameters to specify the path to the LU. To change the status of all the paths, specify only *-dfha*. A regular *online* operation is executed on the paths other than the P-VOL in an HAM environment.

-lu -pathid AutoPATH_ID

Specify management-target paths for each LU (P-VOL). The target LUs are the LUs that belong to a path ID that you specify in the *-pathid AutoPATH_ID* parameter.

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

The following example shows how to place a path, whose AutoPATH_ID is 000002, online without asking for confirmation of command execution from the user:

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

To display the format of the online operation

-help

Displays the format of the `online` operation.

Example

The following example shows how to display the format of the `online` operation:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -help
online:
  Format
    dlnkmgr online [-path] [-s]
    dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr online [-path] [-pathid AutoPATH_ID] [-s]
    dlnkmgr online [-path] [-device SCSI_Device_Name] [-s]
    dlnkmgr online [-path] -hapath [-lu -pathid AutoPATH_ID]
[-s]
    dlnkmgr online [-path] -dfha [-lu -pathid AutoPATH_ID] [-s]

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

Reference

Using the `view` operation together with standard UNIX commands enables you to filter the path information listed for a specific HBA port or CHA port. For details about the `view` operation, see [view \(displays information\) on page 6-31](#).

We recommend that you use the following command and verify the information on the target paths before you execute the `online` operation to place online all the paths connected to a specific HBA port or CHA port.

Example 1

The following example shows how to filter and display the information on all paths that pass through the HBA port whose host port number is 0004 and bus number is 0000:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path | grep 0004.0000
```

The above command will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all paths that pass through the CHA port 1B of the VSP G1000 series:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -stname | grep  
VSP_G1000 | grep 1B
```

The above command will display information pertaining to only those paths that pass through the specified CHA port.

set (sets up the operating environment)

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

Format

To set up the HDLM operating environment

```
/opt/DynamicLinkManager/bin/dlnkmgr set  
{-lb {on [-lbtype {rr|exrr|lio|exlio|lbk|exlbk}]}|off}  
|-ellv error-log-collection-level  
|-elfs error-log-file-size  
|-elfn number-of-error-log-files  
|-systflv trace-level  
|-systfs trace-file-size  
|-systfn number-of-trace-files  
|-pchk {on [-intvl checking-interval]}|off}  
|-afb {on [-intvl checking-interval]}|off}  
|-iem {on [-intvl error-monitoring-interval] [-iemnum number-of-times-error-is-to-occur]}|off}  
|-lic  
|-audlog {on [-audlv audit-log-data-collection-level] [-category [[ss] [a] [ca]|all]]}|off}  
|-audfac facility-value  
|-lbpathusetimes number-of-path-use-times  
|-expathusetimes number-of-path-use-times  
|-exrndpathusetimes number-of-path-use-times  
|-dpc {on|off} [-pathid path-ID -lu|-pathid path-ID -storage]  
|-dpcintvl checking-interval
```

```
|-pstv {on|off}
}
[-s]
```

To display the format of the set operation

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

Parameters

To set up the HDLM operating environment

The table below shows the defaults and recommended values for each setting. If you change the value of the `set` operation, the new value takes effect immediately.

Table 6-2 Default and recommended values

Item name	Default value	Recommended value
Load balancing	on The Extended Least I/Os algorithm is used.	on 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	on (Interval is 30 minutes.)	on The recommended checking interval depends on the operating environment.
Automatic failback	on (Interval is 1 minutes.)	The recommended checking interval depends on the operating environment.
Intermittent error monitoring	off	off
Collecting audit log data	off	The recommended value depends on the operating environment. Set on, if you want to collect audit log data.

Item name	Default value	Recommended value
Audit log facility	user	local0 to local7 [#]
Number of times the same path can be used for load balancing	32	The recommended value depends on the operating environment.
Number of times the same path can be used for extended load balancing (sequential I/O)	100	The recommended value depends on the operating environment.
Number of times the same path can be used for extended load balancing (random I/O)	1	The recommended value depends on the operating environment.
Dynamic I/O path control [#]	off The checking interval is 10 minutes.	off The recommended checking interval depends on the operating environment.
Displaying the physical storage system information	off	The recommended value depends on the operating environment. Set to on if you want to display the physical storage system information.

#

This item is applied only when HUS100 series storage is used.

```
-lb {on [-lbtype {rr|exrr|lio|exlio|lbk|exlbk}]}|off}
```

Enables or disables load balancing.

on: Enabled

off: Disabled

```
-lbtype {rr|exrr|lio|exlio|lbk|exlbk}
```

Specify the algorithm to be used for load balancing.

rr: The Round Robin algorithm

exrr: The Extended Round Robin algorithm

lio: The Least I/Os algorithm

exlio: The Extended Least I/Os algorithm

lbk: The Least Blocks algorithm

exlbk: The Extended Least Blocks algorithm

The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even when you disable the load balancing function by specifying `-lb off`. Therefore, if you re-enable the load balancing function without specifying an algorithm,

load balancing will be performed according to the algorithm that is stored in the system.

`-ellv error-log-collection-level`

Specify the level of error information you want to collect for an error log. The HDLM manager log (`dldmgr[1-16].log`) contains log files in which an error log collection level can be set.

[Table 6-3 Values of the error log collection levels on page 6-18](#) shows the values of the error log collection level. If an error occurs, you may have to set the error log collection level to 1 or higher to collect log information.

Table 6-3 Values of the error log collection levels

Value	Description
0	Collects no error log.
1	Collects error information for the Error or higher level.
2	Collects error information for the Warning or higher level.
3	Collects error information for the Information or higher level.
4	Collects error information for the Information (including maintenance information) or higher level.

The higher the error log collection level value, the more log information will be output. As the amount of log information that is output increases, the amount of time before existing information will be overwritten becomes shorter.

Example

```
# /opt/DynamicLinkManager/bin/dldmgr set -ellv 1
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation
name = set, completion time = yyyy/mm/dd hh:mm:ss
#
```

`-elfs error-log-file-size`

Specify a value from 100 to 2,000,000 (in KB) for the size of the error log files (`dldmgrn.log` (n indicates a file number from 1 to 16)). The specified files size is applied to HDLM manager logs.

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

When the size of all the log files in a log file group reaches their maximum value, the new log data will overwrite the existing log data, starting with the oldest log data.

`-elfn number-of-error-log-files`

Specify the number of error log files (`dldmmgrn.log` (*n* indicates a file number from 1 to 16)). Specify a value from 2 to 16.

By specifying both the error log file size and the number of error 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.

Log files for which the trace level can be set are `hdlmtrn.log` (where *n* is a value from 1 to 64).

[Table 6-4 Trace level values on page 6-19](#) shows the values of the trace level. When an error occurs, we recommend that you set the value of the trace level to 1 or higher and re-collect log information.

Table 6-4 Trace level values

Value	Description
0	Does not output any trace.
1	Only outputs error information.
2	Outputs a summary of program operation.
3	Outputs details of program operation.
4	Outputs all information.

The higher the error log collection level value, the more log information will be output. As the amount of log information that is output increases, the amount of time before existing information will be overwritten becomes shorter.

`-systfs trace-file-size`

Specify a value from 100 to 16,000 for the size of the trace log file (in KB).

By specifying both the trace file size and the number of trace files, you can collect up to 1,024,000 KB of trace files in total.

If you specify a value smaller than the set value, the `KAPL01097-W` message is displayed to confirm execution, and the trace file is temporarily deleted.

Trace files for which the trace file size can be set are `hdlmtrn.log` (where *n* is a value from 1 to 64). The length of a trace file is fixed. Therefore, even if the amount of written trace information is less than the set file size, the file 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 a value from 2 to 64 for the number of trace log files.

By specifying both the trace file size and the number of trace files, you can collect up to 1,024,000 KB of trace data in total.

If you specify a value smaller than the set value, the `KAPL01097-W` message is displayed to confirm execution, and the trace file is temporarily deleted.

Trace files for which the number of files can be set are `hdlmtrn.log` (where `n` is a value from 1 to 64).

`-pchk {on [-intvl checking-interval] | off}`

Enables or disables path health checking.

`on`: Enabled

`off`: Disabled

For a standby host, we recommend that you activate path health checking so that you can detect errors in paths where I/Os operations do not occur.

When you specify `on`, specify the checking interval of path health checking by specifying the parameter immediately following `on`. If you do not specify a checking interval, path health checking is executed in the following interval:

- When the checking interval has not been specified before:
Every 30 minutes (default setting)
- When the checking interval has been specified before:
The previously specified interval

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

`-intvl checking-interval`

Specify the checking interval between path health checks. Specify a value from 1 to 1440 minutes depending on the user environment.

When you change the checking interval, the new setting takes effect immediately. When the checking interval is shortened and the checking interval after the change (from the end of the previous path health check) has already elapsed, the path health check will start over.

The path health check interval setting remains stored in the system even if you disable the function by changing the path health checking to `off`. Therefore, when you re-enable path health checking and do not change the interval, the path health interval stored in the system is used.

`-afb {on [-intvl checking-interval] | off}`

Enables or disables automatic failback.

`on`: Enabled

`off`: Disabled

Enabling automatic failbacks might automatically place paths online that were intentionally placed offline (for example, paths placed offline for maintenance work).

When intermittent errors occur in paths or storage systems, path status alternates between the online and offline status frequently, so I/O performance might deteriorate.

Automatic failbacks are performed on the following types of paths:

- Paths where an error occurred and for which the KAPL08022-E message was displayed.
- Path where an error occurred during the startup of the HDLM manager.

To prevent intermittent errors from deteriorating I/O performance, we recommend that you also enable intermittent error monitoring when the automatic failback function is enabled. Intermittent error monitoring is specifiable only when automatic failbacks are enabled.

See [*Table 6-5 Relationship between the setting for the automatic failback function and intermittent error monitoring and the executable operations on page 6-24*](#) for the relationship between automatic failbacks and intermittent error monitoring.

When you specify `on`, specify the checking interval by specifying the parameter immediately following `on`. If you do not specify a checking interval, path statuses will be checked in the following way:

- When the checking interval has not been specified before:
Every minute (default setting)
- When the checking interval has been specified before:
The previously used interval

The explanation for the following sub-parameter describes how to specify the interval between path status checks.

`-intvl checking-interval`

Specify the interval between path status checks. Specify a value from 1 to 1440 minutes. The default is 1. Specify an interval appropriate for your operating environment.

If intermittent error monitoring is `on` and the number of times that the error is to occur is set to a value of 2 or more, the following condition must be satisfied:

`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 will be output and an error will occur. If this happens, change any of the following settings: the checking interval for automatic failbacks, the intermittent error-monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

When you changed the error monitor interval during monitoring an intermittent error, the new setting takes effect immediately. When the checking interval is shortened and the checking interval after the

change (from the end of the previous path status check) has already elapsed, the path status check will start immediately.

This setting remains stored in the system, even if you disable the function by changing the setting of automatic failbacks to `off`.

Therefore, if you re-enable automatic failbacks and do not change the interval, path status checks will be executed at the interval already stored in the system.

```
-iem { on [-intvl error-monitoring-interval] [-iemnum number-of-  
times-error-is-to-occur] | off }
```

Enables or disables intermittent error monitoring.

`on`: Enabled

`off`: Disabled

Intermittent error monitoring can be set automatic failback is set to `on`.

The default is `off`. When you use automatic failback, we recommend that you set intermittent error monitoring to `on` to prevent an intermittent error from reducing I/O performance.

If `on` is specified, be sure to also specify the intermittent error monitoring interval and the number of times that the error is to occur. The system assumes that an intermittent error is occurring if the specified number of times that the error is to occur is reached during the monitoring interval. A path that is assumed to have an intermittent error is excluded from automatic failbacks. Intermittent error monitoring is performed on each path. Intermittent error monitoring starts when a path is recovered from an error by performing an automatic failback.

If you omit the intermittent error monitoring interval or the number of times that the error is to occur, each setting is specified as follows:

- When the intermittent error monitoring interval or the number of times that the error is to occur has not been specified before:
The intermittent error monitoring interval is set to 30 minutes, and the number of times that the error is to occur is set to 3.
- When the intermittent error monitoring interval or the number of times that the error is to occur has been specified before:
The values specified from the last time are used.

When a value of 2 or more is specified for the number of times, the following condition must be satisfied:

```
error-monitoring-interval >= 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 will be output and an error will occur. If this happens, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

The following shows the sub-parameters that should be specified: the error monitoring interval and the number of times that the error is to occur:

`-intvl error-monitoring-interval`

Specify the monitoring interval for an intermittent error. Use a value from 1 to 1440 minutes. The default is 30.

During intermittent error monitoring, if changes are made to the intermittent error monitoring interval setting or the setting for the number of times that an error is to occur, the error count and the elapsed time measured since monitoring has started are reset to 0.

When intermittent error monitoring is not being performed, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the new settings will take effect after the next time an automatic fallback is successful. Because the errors and elapsed time are not counted or measured while intermittent errors are not being monitored, the values will not change.

The monitoring interval specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and a monitoring interval is not specified, error monitoring will be performed by using the stored monitoring interval.

`-iemnum number-of-times-error-is-to-occur`

Specify the number of times the error is to occur. Valid values are from 1 to 99. The default is 3.

During intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the number of errors and the time that has passed since intermittent error monitoring has started are reset to 0. The changed setting will take effect immediately and intermittent error monitoring will restart.

When intermittent error monitoring is not being performed, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the new value will take effect after the next automatic fallback successfully completes. When intermittent error monitoring is not being performed, the number of errors that determine that an intermittent error has occurred is not counted and this value is not changed.

The number of times that the error is to occur is stored in the system, even when `-iem off` is specified and intermittent error monitoring is disabled. Therefore, when you re-enable intermittent error monitoring without specifying the number of times, the error monitoring will be executed using the value stored in the system.

When the `set -iem on` operation is executed during error monitoring, even though you do not change the conditions for intermittent error monitoring, the number of errors and the time that has passed since the error monitoring has started are reset to 0. Intermittent error monitoring will then resume with the changed settings.

If you set the automatic failback function to `off` while intermittent error monitoring is `on`, intermittent error monitoring will be disabled. Note, however, that if you use the `view -sys` operation to display the HDLM functionality configuration, `Intermittent Error Monitor` will be shown as `on`. When the automatic failback function is returned to `on`, intermittent error monitoring will once again be enabled.

The executable operations for the automatic failback function and intermittent error monitoring depend on the settings for those functions. The following table shows the relationship between the settings and available operations for automatic failback and intermittent error monitoring.

Table 6-5 Relationship between the setting for the automatic failback function and intermittent error monitoring and the executable operations

Setting		Available operation	Result of operation
AFB	IEM		
on	on	Set AFB to <code>on</code> .	The operations of AFB and IEM do not change.
		Change the AFB setting.	AFB is performed under the new settings. ^{#1}
		Set AFB to <code>off</code> .	<ul style="list-style-type: none"> AFB and IEM are disabled. The error count, elapsed monitoring time, and information about paths not subject to automatic failback are cleared.
		Set IEM to <code>on</code> .	<ul style="list-style-type: none"> When a path is being monitored (during a period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring will restart. When a path is not being monitored, nothing changes.
		Change the IEM settings.	<ul style="list-style-type: none"> While a path is being monitored, the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring will restart.^{#1} When a path is not being monitored, the IEM settings will take effect again when the path is recovered from the error status by performing an automatic failback.
		Set IEM to <code>off</code> .	<ul style="list-style-type: none"> IEM is disabled. The error count, elapsed monitoring time, and information about paths

Setting		Available operation	Result of operation
AFB	IEM		
			not subject to automatic failbacks are cleared.
	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.# ¹
off	on# ²	Set AFB to on.	AFB and IEM are enabled.# ¹
		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.

Legend:

AFB: Automatic failback

IEM: Intermittent error monitoring

#1

When this condition is not satisfied, the KAPL01080-W message is output and an error occurs. The status of intermittent error monitoring does not change.

#2

Because automatic failback is off, intermittent error monitoring is disabled.

Example

The following example shows how to monitor for intermittent errors.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -iem on -intvl 20 -
iemnum 2
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation
name = set, completion time = yyyy/mm/dd hh:mm:ss
#
```

-lic

Specify this option for when a license is updated. The HDLM license is provided via a license key or license key file. A license key file is a file that stores the HDLM license key.

If a license key file is provided:

Store the license key file named `hdlm_license` directly under `/var/tmp`, and then execute the `set -lic` operation. A message confirming that the license key has been registered is displayed, depending on the license key type defined in the license key file. When a temporary license key or emergency license key has been registered, the expiration period is displayed (KAPL01071-I, KAPL01072-I).

If a license key is provided:

When the `set -lic` operation is executed, a message (KAPL01068-I) asking the user to enter a license key appears. Enter the license key. A message confirming that the license key has been registered is displayed, depending on the license key type described in the license key file. For a temporary license key or emergency license key, the expiration period is also displayed (KAPL01071-I, KAPL01072-I).

The following table lists and describes the license key types.

Table 6-6 License key types

Type	Description
Permanent license key	Permanent license keys are valid for using HDLM permanently.
Temporary license key [#]	Temporary license keys are used temporarily, for example, when a user needs to perform product evaluations. Temporary license keys are valid for 120 days after the installation. You cannot reuse a temporary license key.
Emergency license key	Emergency license keys are used temporarily, for example, when waiting for a permanent license key to be issued. Emergency license keys are valid for 30 days after they are entered. You cannot reuse an emergency license key.

[#]

A temporary license key cannot be installed by using the `dlnmgr` command's `set` operation.

Example 1

The following example shows how to update the license key when the license key file exists:

```
# /opt/DynamicLinkManager/bin/dlnmgr set -lic
KAPL01049-I Would you like to execute the operation?
Operation name = set [y/n]: y
KAPL01071-I A permanent license was installed.
#
```

Example 2

The following example shows how to update the license key when the license key file does not exist:

```
# /opt/DynamicLinkManager/bin/dlnmgr set -lic
KAPL01049-I Would you like to execute the operation?
```

```

Operation name = set [y/n]: y
KAPL01083-I There is no license key file. File name
=/var/tmp/hdlm_license
KAPL01068-I Enter a license key:*****
KAPL01071-I A permanent license was installed.
#

```

```

-audlog {on [-audlv audit-log-data-collection-level] [-category
[[ss] [a] [ca]|all]]|off}

```

Specifies whether to collect audit log data.

on: Audit Log data is collected.

off: Audit Log data is not collected.

```

-audlv audit-log-data-collection-level

```

Specifies the severity level of audit log data to be collected. The table below lists and describes the values used for this setting. The default is 6.

Table 6-7 Values indicating audit log data collection levels

Value (severity)	Explanation
0	No audit log data is collected.
1	
2	Critical-level audit log data is collected.
3	Critical-level and Error-level audit log data is collected.
4	Critical-level, Error-level, and Warning-level audit log data is collected.
5	
6	Critical-level, Error-level, Warning-level, and Informational-level audit log data is collected.
7	

```

-category [[ss] [a] [ca]|all]

```

Specifies the categories of audit log data to be collected. The table below lists and describes the values used for this setting. The default is all. If you specify the `-category` parameter without specifying a value, all is assumed.

Table 6-8 Values indicating audit log data categories

Value	Explanation
ss	Audit log events of the <code>StartStop</code> category are collected.
a	Audit log events of the <code>Authentication</code> category are collected.
ca	Audit log events of the <code>ConfigurationAccess</code> category are collected.

Value	Explanation
all	Audit log events of the StartStop, Authentication, and ConfigurationAccess categories are collected.

`-audfac facility-value`

Specifies the audit log facility.

The table below lists the values used for this setting. The default is `user`.

Table 6-9 Values of the audit log facility

Value	Corresponding facility value in the syslog settings file
user or 1	user
local0 or 16	local0
local1 or 17	local1
local2 or 18	local2
local3 or 19	local3
local4 or 20	local4
local5 or 21	local5
local6 or 22	local6
local7 or 23	local7

`-lbpathusetimes number-of-path-use-times`

Specifies the number of times the same path can be used for I/O operations when the Round Robin (`rr`), Least I/Os (`lio`), or Least Blocks (`lbk`) algorithm is used for load balancing.

You can specify a decimal (base 10) value from 0 to 999999. The default is 32.

If you specify 0, operation is the same as when load balancing is disabled.

`-expathusetimes number-of-path-use-times`

Specifies the number of times the same path can be used for sequential I/O operations when the extended Round Robin (`exrr`), Least I/Os (`exlio`), or Least Blocks (`exlbk`) algorithm is used for load balancing.

You can specify a decimal (base 10) value from 0 to 999999. The default is 100.

If you specify 0, the same path is used as long as the sequential I/O operations continue.

`-exrndpathusetimes number-of-path-use-times`

Specifies the number of times the same path can be used for random I/O operations when the extended Round Robin (`exrr`), Least I/Os (`exlio`), or Least Blocks (`exlbk`) algorithm is used for load balancing.

You can specify a decimal (base 10) value from 0 to 999999. The default is 1.

If you specify 0, the same path is used as long as the random I/O operations continue.

`-dpc {on|off} [-pathid path-ID -lu | -pathid path-ID -storage]`

Enables or disables the dynamic I/O path control function for each storage system or LU. The default value is "off".

on: Enabled

off: Disabled

`-pathid path-ID -lu`

Sets the dynamic I/O path control function to enabled or disabled for each LU. Specify one of the IDs of the paths connected to the target LU.

`-pathid path-ID -storage`

Sets the dynamic I/O path control function to enabled or disabled for each storage system. Specify one of the IDs of the paths connected to the target storage system.

If the `-pathid` parameter is not specified, the setting is performed for each system, and the setting for each storage system or LU is cleared.

`-dpcintvl checking-interval`

Specifies the checking interval (in minutes) for reviewing information about switching of controllers performed by the storage system which is used in the dynamic I/O path control function. Specify a value in the range from 1 to 1440. The default value is "10".

`-pstv {on|off}`

Enables or disables the display of the physical storage system information. The default value is "off".

on: Enabled

off: Disabled

If the display of the physical storage system information is enabled, information about the physical storage system is displayed. If the display of the physical storage system information is disabled, information about the storage system recognized by the operating system is displayed. For a virtualized storage system, virtual information is displayed, and for a non-virtualized storage system, physical information is displayed.

The display results of view operations depend on whether the display of the physical storage system information is enabled or disabled. The following table shows the display items for which the display results differ.

Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification

Operation	Display item
<code>view -path</code>	DskName

Operation	Display item
	iLU
	ChaPort (CP)
view -lu	Product
	SerialNumber (S/N)
	iLU
	ChaPort
view -drv	LDEV

-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.

To display the format of the set operation

-help

Displays the format of the `set` operation.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -help
set:
  Format
    dlnkmgr set { -lb on [ -lbtype { rr | exrr | lio | exlio | lbk |
exlbnk } ]
| -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
| -audlog on
|           [ -audlv AudlogLevel ]
|           [ -category Category-Value ]
| -audlog off
| -audfac { Facility-Name | Facility-Number }
| -lbpathusetimes Number-Of-PathUseTimes
| -expathusetimes Number-Of-ExPathUseTimes
```

```

| -exrndpathusetimes Number-Of-ExRndPathUseTimes
| -dpc { on | off } [-pathid AutoPATH_ID { -lu | -
storage } ]
| -dpcintvl Dpc-Interval
| -pstv { on | off }
}
[-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
1)
(afb)
Error-Monitor-Interval { 1 - 1440 }(Minute) (Default Value
30)
Number-Of-Times { 1 - 99 }(Times) (Default Value
3)
AudlogLevel { 0 - 7 } (Default Value
6)
Category-Value { [ss] [a] [ca] |
all } (Default Value
all)
Facility-Name { user |
local0 - local7 } (Default Value
user)
Facility-Number { 1 | 16 - 23 } (Default Value
1)
Number-Of-PathUseTimes { 0 - 999999 }(Times) (Default Value
32)
Number-Of-ExPathUseTimes { 0 - 999999 }(Times) (Default Value
100)
Number-Of-ExRndPathUseTimes { 0 - 999999 }(Times) (Default Value
1)
AutoPATH_ID { 000000 - 999999 }(Decimal)
Dpc-Interval { 1 - 1440 }(Minute) (Default Value
10)
KAPL01001-I The HDLM command completed normally. Operation name =
set, completion time = yyyy/mm/dd hh:mm:ss
#

```

view (displays information)

The `dlmkmgr` command's `view` operation displays HDLM program information, path information, LU information, and corresponding information about an HDLM device, SCSI device, and LDEV.

Format

To display program information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -sys  
[-sfunc|-msrv|-adrv|-pdrv|-lic|-audlog|-lbpashtimes|-  
expashtimes|-exrndpashtimes|-pstv]  
[-t]
```

To display path information

To display path information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path  
[-pstv|-vstv]  
[-hdev host-device-name]  
[-stname]  
[-iem]  
[-srt {pn|lu|cp}]  
[-hbaportwn]  
[-t]
```

To display path information (by selecting a display item)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path -item  
[pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]  
[hbaportwn] [phys] [virt] [vid] [ha]  
[-pstv|-vstv]  
[-hdev host-device-name]  
[-stname]  
[-srt {pn|lu|cp}]  
[-t]
```

To display path information (by abbreviating the list items)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path -c  
[-pstv|-vstv]  
[-stname]  
[-srt {lu|cp}]  
[-t]
```

To display LU information

To display LU information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu  
[-pstv|-vstv]
```



```
[-hdev host-device-name|-pathid AutoPATH_ID]  
[-t]
```

To display LU information (by selecting items to be displayed)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -item  
[ [slpr] [pn] [cp] [clpr] [type] [ic] [ie] [dnu] [iep]  
[htl] [dpc] [phys] [virt] [vid] [ha] [hastat] |all]  
[-pstv|-vstv]  
[-hdev host-device-name|-pathid AutoPATH_ID]  
[-t]
```

To display a summary of LU information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -c [-pstv|-vstv] [-  
t]
```

To display a summary of LU information (by adding items to be displayed)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -c -item  
[slpr]  
[-pstv|-vstv]  
[-t]
```

To display corresponding information about an HDLM device, SCSI device, and LDEV

```
/opt/DynamicLinkManager/bin/dlnkmgr view -drv [-pstv|-vstv] [-t]
```

To display the format of the view operation

```
/opt/DynamicLinkManager/bin/dlnkmgr view -help
```

Parameters (to display program information)

This section describes the parameters for the `view` operation, in the following order:

[*To display program information on page 6-34*](#)

[*To display path information on page 6-41*](#)

[*To display LU information on page 6-54*](#)

[*To display corresponding information about an HDLM device, SCSI device, and LDEV on page 6-67*](#)

[*To display the format of the view operation on page 6-68*](#)

To display program information

```
-sys [-sfunc|-msrv|-adv|-pdrv|-lic|-audlog|-lbpathusetimes|-  
expathusetimes|-exrndpathusetimes|-pstv]
```

Displays the HDLM program information.

Use one of the sub-parameters (following `-sys`) to specify the program information that you want to display. If you do not specify a sub-parameter, the command displays all of the program information except the information about the audit log data collection settings, the number of times the same path can be used for load balancing, the number of times the same path can be used for extended load balancing, and the value of the display-of-the-physical-storage-system-information setting.

[Table 6-11 Displayed program information on page 6-34](#) shows the parameters you can specify and the displayed information.

`-t`

Does not display the title for each information item.

Table 6-11 Displayed program information

Parameter and program information to be displayed	Item	Description
-sfunc Information about the HDLM function settings	HDLM Version	HDLM version number
	Service Pack Version	HDLM SP version number. This item is blank if no SP is present.
	Load Balance	Settings for load balancing <ul style="list-style-type: none"> Setting status: <ul style="list-style-type: none"> on: Enabled off: Disabled Algorithm: <p>When the setting status of load balancing is on, one of the following types of algorithms is used for load balancing is displayed in the parentheses following on.</p> <ul style="list-style-type: none"> rr: The Round Robin algorithm extended rr: The Extended Round Robin algorithm lio: The Least I/Os algorithm extended lio: The Extended Least I/Os algorithm lbk: The Least Blocks algorithm extended lbk: The Extended Least Blocks algorithm
	Support Cluster	Blank [#]
	Elog Level	Error logging level:

Parameter and program information to be displayed	Item	Description
		<ul style="list-style-type: none"> 0: Collects no error information. 1: Collects error information at the Error level or higher. 2: Collects error information at the Warning level or higher. 3: Collects error information at the Information level or higher. 4: Collects error information at the Information level or higher (including maintenance information).
	Elog File Size (KB)	Size of the error log file in kilobytes
	Number Of Elog Files	Number of error log files
	Trace Level	Trace output level: <ul style="list-style-type: none"> 0: Does not output any trace. 1: Only outputs error information. 2: Outputs a summary of program operation. 3: Outputs details of program operation. 4: Outputs all information.
	Trace File Size (KB)	Trace file size in kilobytes
	Number Of Trace Files	Number of trace files.
	Path Health Checking	<ul style="list-style-type: none"> Settings for path health checking: on: Enabled off: Disabled Checking interval: When the setting of the path health checking is on, the checking interval of path health checking is displayed within the parentheses following on. The time is in minutes.
	Auto Failback	<ul style="list-style-type: none"> Settings for an automatic failback: on: Enabled off: Disabled Checking interval: When the setting of the automatic failback is on, the checking interval of automatic

Parameter and program information to be displayed	Item	Description
		failback is displayed within the parentheses following <code>on</code> . The time is in minutes.
	Reservation Status	Blank
	Intermittent Error Monitor	<ul style="list-style-type: none"> Setting for intermittent error monitoring: <code>on</code>: Enabled <code>off</code>: Disabled When automatic failback is <code>off</code>, intermittent error monitoring is disabled although <code>Intermittent Error Monitor</code> will be shown as <code>on</code>. When the automatic failback function is <code>on</code>, intermittent error monitoring will be enabled. Intermittent error monitoring interval and number of times that the error needs to occur When intermittent error monitoring is <code>on</code>, the specified intermittent error monitoring interval and number of times that the error needs to occur are displayed within the parentheses following <code>on</code>. The format is <i>number-of-times-error-is-to-occur/monitoring-interval</i>. The time is in minutes.
	Dynamic I/O Path Control	Setting status of the dynamic I/O path control function <ul style="list-style-type: none"> Setting status <code>on</code>: Enabled <code>off</code>: Disabled Checking interval The parentheses following the setting status shows the checking interval for reviewing information about the switching of controllers performed by the storage system. "Minute" is used as the unit. If different settings have been specified for each storage system or LU, an asterisk (*) is added after the parentheses in which the checking interval is displayed.
-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

Parameter and program information to be displayed	Item	Description
-adrv Information about the HDLM alert driver	HDLM Alert Driver	Status of the HDLM alert driver: Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM alert driver
	WakeupTime	Startup time of the HDLM alert driver
	ElogMem Size	Size of error log memory for the HDLM alert driver in kilobytes. Number of error log files.
-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 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: <code>yyyy/mm/dd (ndays after)</code> . When the view <code>-sys -lic</code> operation is executed, <code>(ndays after)</code> appears if there are <i>n</i> days left until the license period expires. <ul style="list-style-type: none"> For example, when there are 100 days left until the license period (2006/08/21) expires, the following appears: <code>2006/08/21(100days after)</code>
-audlog Information about audit log data collection settings	Audit Log	Settings for audit log data collection: <ul style="list-style-type: none"> Whether collection is enabled on: Enabled off: Disabled Audit log data collection level: When audit log data collection is on, the collection level that has been set is displayed within the parentheses following on. The collection level indicates a severity level. A value from 0 to 7 is displayed as the collection value.

Parameter and program information to be displayed	Item	Description
	Audit Log Category	<p>The categories of audit log data to be output are displayed. When more than one category is displayed, commas (,) are used as separators.</p> <p>ss: StartStop a: Authentication ca: ConfigurationAccess</p> <p>If all the above categories are specified, all is displayed.</p> <p>If the collection of audit log data is disabled, a hyphen (-) is displayed.</p>
	Audit Log Facility	<p>The name of the audit log facility is displayed. user, local0, local1, local2, local3, local4, local5, local6, or local7 is displayed.</p> <p>If the collection of audit log data is disabled, a hyphen (-) is displayed.</p>
<p>- lbpathusetimes</p> <p>The number of times the same path can be used for load balancing</p>	Times Same Path Was Used	<p>The number of times the same path can be used for I/O operations when the Round Robin (rr), Least I/Os (lio), or Least Blocks (lbk) algorithm is used for load balancing.</p> <p>If you used Global Link Manager to set the number of times the same path can be used in units of LUs, an asterisk (*) is added after the value.</p>
<p>- expathusetimes</p> <p>The number of times the same path can be used for extended load balancing (sequential I/O)</p>	Times Same ExPath Was Used	<p>The number of times the same path can be used for sequential I/O operations when the extended Round Robin (exrr), Least I/Os (exlio), or Least Blocks (exlbk) algorithm is used for load balancing.</p> <p>If you used Global Link Manager to set the number of times the same path can be used in units of LUs, an asterisk (*) is added after the value.</p>
<p>- exrndpathusetimes</p> <p>The number of times the same path can be used for extended load balancing (random I/O)</p>	Times Same ExPath Was Used (R)	<p>The number of times the same path can be used for random I/O operations when the extended Round Robin (exrr), Least I/Os (exlio), or Least Blocks (exlbk) algorithm is used for load balancing.</p> <p>If you used Global Link Manager to set the number of times the same path can be used in units of LUs, an asterisk (*) is added after the value.</p>
-pstv	Physical Storage View	The value of the display-of-the-physical-storage-system-information setting is displayed.

Parameter and program information to be displayed	Item	Description
The display-of-the-physical-storage-system-information setting		on: Enabled off: Disabled

#

When you use cluster software, the settings of the cluster function and the kinds of cluster servers are not displayed. However, the cluster function will operate normally.

Examples

Example 1

The following example shows how to display information about the HDLM function settings.:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : x.x.x-xx
Service Pack Version   :
Load Balance           : on(extended lio)
Support Cluster        :
Elog Level             : 3
Elog File Size(KB)     : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace Files Size(KB)   : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : on(1)
Reservation Status     :
Intermittent Error Monitor : off
Dynamic I/O Path Control : off(10)
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 2

The following example shows how to display information about the HDLM manager:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive      x.x.x-xx    yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 3

The following example shows how to display information about the HDLM alert driver:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -adrv
HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss 1000
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 4

The following example shows how to display information about the HDLM driver:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv
HDLM Driver Ver      WakeupTime
Alive      x.x.x-xx      yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 5

The following example shows how to display information about the HDLM license:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -lic
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 6

The following example shows how to display information about the audit log settings:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -audlog
Audit Log      : off
Audit Log Category      : -
Audit Log Facility      : -
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Example 7

The following example shows how to display the number of times the same path can be used for load balancing:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -lbpathusetimes
Times Same Path Was Used      : 32
KAPL01001-I The HDLM command completed normally. Operation name
```



```
= view, completion time = yyyy/mm/dd hh:mm:ss  
#
```

Example 8

The following example shows how to display the number of times the same path can be used for extended load balancing (sequential I/O):

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -expathusetimes  
Times Same ExPath Was Used      : 100  
KAPL01001-I The HDLM command completed normally. Operation name  
= view, completion time = yyyy/mm/dd hh:mm:ss  
#
```

Example 9

The following example shows how to display the number of times the same path can be used for extended load balancing (random I/O):

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -  
exrndpathusetimes  
Times Same ExPath Was Used(R)   : 1  
KAPL01001-I The HDLM command completed normally. Operation name  
= view, completion time = yyyy/mm/dd hh:mm:ss  
#
```

Example 10

The following example shows how to display the value of the display-of-the-physical-storage-system-information setting:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -pstv  
Physical Storage View           : off  
KAPL01001-I The HDLM command completed normally. Operation name  
= view, completion time = yyyy/mm/dd hh:mm:ss  
#
```

To display path information

When displaying path information, if you specify either the `-item` or `-c` parameter and also specify the `-path` parameter, you can select the items to display and display a summary of path information. This section describes each parameter, path information and displayed items.

To display path information

`-path`

When you specify the `-path` parameter and do not specify either the `-c` or `-item` parameter, the information will be displayed about the HDLM managed paths without abbreviating or selecting items.

In the sub-parameters (following `-path`), you can filter the paths to be listed using `-hdev` and sort the list using `-srt`. When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

For details on what is displayed in each item, see [Table 6-13 Path information on page 6-48](#).

AutoPATH_IDs displayed by the `-path` parameter depend on the sequence in which HDLM detects the paths after a host is started up. Because of this, make sure that you use the path name `PathName` to identify a path.

The sub-parameters are as follows:

`-pstv|-vstv`

If the `-pstv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-pstv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-pstv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#).

`-hdev host-device-name`

Displays information only for the paths accessing the specified host device.

Specify the name of the logical device file (minus the partition number), `/dev/sddlm[aa-pap]`, for the HDLM device. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

The *host-device-name* string is case-sensitive.

`-stname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information displayed for product IDs, see [Table 6-15 Product ID displayed by the view -path operation on page 6-53](#).

`-iem`

Use this parameter to add `IEP` to path information and display information about intermittent errors.

`-srt {pn|lu|cp}`

Use this parameter to sort the path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `pn`: Path name

- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in ascending order of AutoPATH_IDs.

`-hbaportwwn`

Displays port WWN information for the HBAs connected to the storage system.

`-t`

Omits the title for each information item.

Example

The following example shows how to display information about the paths that access a host device whose name is `sddlmaa`.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hdev sddlmaa
Paths:000004 OnlinePaths:000004
PathStatus IO-Count IO-Errors
Online 0 0

PathID PathName DskName iLU ChaPortStatus Type IO-Count IO-Errors DNum HDevName
000013 0007.0000.00000000000003.0001 HITACHI_OPEN-V .39303 000035 0A Online Own 0 0 0 sddlmaa
000021 0007.0000.00000000000005.0001 HITACHI_OPEN-V .39303 000035 1A Online Own 0 0 0 sddlmaa
000029 0009.0000.00000000000003.0001 HITACHI_OPEN-V .39303 000035 0A Online Own 0 0 0 sddlmaa
000037 0009.0000.00000000000005.0001 HITACHI_OPEN-V .39303 000035 1A Online Own 0 0 0 sddlmaa
KAPLO1001-I The HDLM command completed normally. Operation name = view(-vstiv), completion time = yyyy/mm/dd hh:mm:ss
#
```

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.

When the value of the `-item` parameter is omitted, only the `PathID` and the `Status` fields are displayed.

The following table lists the correspondence between the display items that can be selected by using the `-item` parameter and the parameter values that can be specified after the `-item` parameter.

Table 6-12 Correspondence between the items displayed by the `dlnkmgr view -path -item` command and the values of the `-item` parameter

Items displayed by the <code>dlnkmgr view -path -item</code> command	Values specified after the <code>-item</code> parameter
PathID#	None
PathName	pn
DskName	dn
iLU	lu
ChaPort	cp

Items displayed by the dlnkmgr view -path -item command	Values specified after the -item parameter
Status#	None
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
HDevName	hd
IEP	iep
HBAPortWWN	hbaportwwn
Physical-LDEV	phys
Virtual-LDEV	virt
Physical-DskName	vid
Physical-iLU	vid
Physical-ChaPort	vid
Org-DskName	ha
Org-iLU	ha

#

Because both `PathID` and `Status` are always displayed, you do not have to specify any parameters.

In the sub-parameters following `-path -item`, you can list the paths (`-hdev`) and sort the list (`-srt`). If you omit both parameters, the command displays information for all the paths in ascending order of `AutoPATH_IDs`.

These sub-parameters are:

`-pstv|-vstv`

If the `-pstv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-pstv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-pstv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#).

`-hdev host-device-name`

Displays information only for the paths accessing the specified host device.

Specify the name of the logical device file (minus the partition number), `/dev/sddlm[aa-pap]`, for the HDLM device. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

The *host-device-name* string is case-sensitive.

When you specify this parameter, `HDevName` is displayed by default. It is not necessary to specify `hd` for the `-item` parameter.

`-stname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information to be displayed for product IDs, see [Table 6-15 Product ID displayed by the view -path operation on page 6-53](#).

When you use this parameter, `DskName` is displayed by default. It is not necessary to specify `dn` for the `-item` parameter.

`-srt {pn|lu|cp}`

Use this parameter to sort the path information in ascending order, according to the specified sorting key.

The sorting keys are as follows: the first sorting key is the name of the storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `pn`: Path name
- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in order of ascending `AutoPATH_ID`s.

When you use this parameter, the items used for the sorting keys (`DskName`, `AutoPATH_ID`, and the item specified by this parameter) are displayed by default. Therefore, it is not necessary to specify these items for the `-item` parameter.

`-t`

Omits the title for each information item.

Example

In the following example, `IO-Count` is selected as the display item and the path information is sorted in ascending order of the by LUs.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -item ic -srt lu -sname
Paths:000012 OnlinePaths:000012
PathStatus IO-Count IO-Errors
Online 660 0

PathID DskName iLU Status IO-Count
000000 HITACHI .HUS_VM .210945 0960 Online 107
000003 HITACHI .HUS_VM .210945 0960 Online 3
000002 HITACHI .HUS_VM .210945 0961 Online 107
000004 HITACHI .HUS_VM .210945 0961 Online 3
000001 HITACHI .HUS_VM .210945 0962 Online 107
000005 HITACHI .HUS_VM .210945 0962 Online 3
000006 HITACHI .VSP_G1000 .10051 001836 Online 107
000011 HITACHI .VSP_G1000 .10051 001836 Online 3
000009 HITACHI .VSP_G1000 .10051 001837 Online 107
000010 HITACHI .VSP_G1000 .10051 001837 Online 3
000007 HITACHI .VSP_G1000 .10051 001838 Online 107
000008 HITACHI .VSP_G1000 .10051 001838 Online 3
KAPLO1001-I The HDLM command completed normally. Operation name = view, completion time = yyyy/mm/dd
hh:mm:ss
#
```

To display path information, by abbreviating the list items

`-path -c`

When you specify the `-path` parameter together with the `-c` parameter, the command selects certain items to be displayed, and shortens the contents of each item so that the information about each path fits into a single line on the screen.

The items that are displayed are `PathID`, `DskName`, `iLU`, `CP`, `Status`, and `Type`.

For details on what is displayed for each item, see [Table 6-13 Path information on page 6-48](#).

When you use the `-c` parameter, the number of characters that can be displayed in the product ID element of the `DskName` field is limited to 10. When there are 11 or more characters in the product ID, the 8th and following characters are abbreviated to ellipses (...).

The sub-parameters (following `-path -c`) are:

`-pstv|-vstv`

If the `-pstv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-pstv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-pstv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#).

`-sname`

Use this parameter to display the model ID of the storage system in the product ID element of the `DskName` field. When this parameter is

omitted, the command displays the product ID or emulation type of the storage system instead.

For details about the information about product IDs, see [Table 6-15 Product ID displayed by the view -path operation on page 6-53](#).

`-srt {lu|cp}`

Use this parameter to sort the path information in ascending order, according to the specified sorting key.

The sorting keys are as follows: the first sorting key is the name of the storage system (`DskName`), the second sorting key is the value specified by the `-srt` parameter, and the third sorting key is `AutoPATH_ID`.

The available parameter values to specify the second sorting key are:

- `lu`: LU number of the storage system
- `cp`: Port number of the CHA

When the `-srt` parameter is omitted, the path information is listed in ascending order of `AutoPATH_ID`s.

`-t`

Omits the title for each information item.

Example

The following example shows how to abbreviate the display of information about the paths, ordered by iLU.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -c -srt lu
Paths:000012 OnlinePaths:000012
PathStatus IO-Count IO-Errors
Online      1616      0

PathID DskName          .OPEN-V      .39303      iLU          CP Status      Type
000000 HITACHI          .OPEN-V      .39303      000035       0A Online      Own
000003 HITACHI          .OPEN-V      .39303      000035       1A Online      Own
000001 HITACHI          .OPEN-V      .39303      000036       0A Online      Own
000004 HITACHI          .OPEN-V      .39303      000036       1A Online      Own
000002 HITACHI          .OPEN-V      .39303      000037       0A Online      Own
000005 HITACHI          .OPEN-V      .39303      000037       1A Online      Own
000006 HITACHI          .OPEN-V      .416044      0000DC       0A Online      Own
000009 HITACHI          .OPEN-V      .416044      0000DC       1A Online      Own
000007 HITACHI          .OPEN-V      .416044      0000DD       0A Online      Own
000010 HITACHI          .OPEN-V      .416044      0000DD       1A Online      Own
000008 HITACHI          .OPEN-V      .416044      0000DE       0A Online      Own
000011 HITACHI          .OPEN-V      .416044      0000DE       1A Online      Own
KAPL01001-I The HDLM command completed normally. Operation name = view(-vstv),
completion time = yyyy/mm/dd hh:mm:ss
#
```

Items of path information

[Table 6-13 Path information on page 6-48](#) describes the displayed path information. The following explains the table headings:

- No summary displayed: The user specifies only the `-path` parameter or the `-path -item` parameter.

- Summary displayed: The user specifies the `-path -c` parameter.

Table 6-13 Path information

Displayed item		Description
No summary displayed	Summary displayed	
Paths		Total number of displayed paths, indicated by a decimal number.
OnlinePaths		Number of online paths from within the displayed paths, indicated by a decimal number. When the value of <code>Paths</code> equals the value of <code>OnlinePaths</code> , 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		<p>Status of the displayed paths. The displayed status indicates the following:</p> <ul style="list-style-type: none"> • Online: All paths are available. • Reduced: Some paths are not available. <p>Reduced means that some paths might have an error status, in which case you should check the status of individual paths and resolve the problem for any paths that have an error status.</p>
IO-Count		Total I/O count for all 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 will re-start from 0.
IO-Errors		Total I/O error count for all 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 will re-start from 0..
PathID		<p>The AutoPATH_ID indicated by a decimal number.</p> <p>The AutoPATH_ID is assigned every time the host is restarted. When a new LU was added and the host has not been restarted, AutoPATH_ID is re-assigned to each path of the LU when you execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>).</p>
PathName ^{#1}	-	<p>The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the physical path that will be affected by the change. Path name consists of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> • Host port number (hexadecimal number) • Bus number (hexadecimal number) • Target ID (hexadecimal number) • Host LU number (hexadecimal number)

Displayed item		Description
No summary displayed	Summary displayed	
		For details about each element of the path name and its representation in Linux, see Table 6-14 Elements of a path name on page 6-53 .
DskName#1	DskName	<p>Storage system name, which identifies the storage system that is accessed by a path.</p> <p>A storage system name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> Vendor ID: The name of the storage system vendor (for example, <code>HITACHI</code>). Product ID: Indicates the storage system product ID, emulation type, or model ID (for example, <code>OPEN-3</code>). For more details, see Table 6-15 Product ID displayed by the view -path operation on page 6-53. Serial number: The serial number of the storage system (for example, <code>15001</code>). <p>You can identify an actual storage system by referencing the above information from the storage system management program.</p>
iLU#1	iLU	<p>LU number of the storage system.</p> <p>This number combined with the storage system name (shown in <code>DskName</code>) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> For HUS VM, 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 P9500, XP8, and XP7, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are 00, the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU. For the HUS100 series indicated by a decimal number. The entire value of <code>iLU</code> is the internal LU number within the storage system. You can identify an actual LU by referencing <code>iLU</code> from the storage system management program. For Hitachi Virtual Storage Platform, VSP 5000 series, VSP G1000, G1500, VSP F1500, VSP E series, VSP Gx00 models, VSP Fx00 models, and VSP N series 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#1	CP	Port number of the CHA, which identifies the CHA port that is mounted on the storage system.

Displayed item		Description
No summary displayed	Summary displayed	
		You can identify an actual CHA port by referencing this number from the storage system management program.
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.) Online(S) : I/O operations to the primary volume (P-VOL) in an HAM environment are suppressed. Online(D) : The paths to the primary volume (P-VOL) in an HAM environment can be recovered automatically. <p>Paths that are Offline(E) or Online(E) require corrective action. The appropriate action can be determined by referring to What to do for a path error on page 5-3.</p>
Type#1	Type	<p>Attribute of the path</p> <ul style="list-style-type: none"> Own: Owner path Non: Non-owner path <p>If the storage system is supported by HDLM, usually all paths are owner paths.#2</p>
IO-Count#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 will re-start from 0.</p> <p>To reset the IO-Count value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (IO-Errors) to 0. For details about the <code>clear</code> operation, see clear (returns the path statistics to the initial value) on page 6-3.</p>
IO-Errors#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 will re-start from 0.</p> <p>To reset the IO-Errors value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to 0.</p> <p>For details about the <code>clear</code> operation, see clear (returns the path statistics to the initial value) on page 6-3.</p>
DNum#1	-	<p>Dev number, where 0 (fixed) is displayed.</p> <p>This item pertains to a partition number.</p>

Displayed item		Description
No summary displayed	Summary displayed	
HDevName#1	-	<p>Host device name.</p> <p>The name of the logical device file (minus the partition number), <code>/dev/sddlm[aa-pap]</code>, for the HDLM device.</p> <p>For details on logical device files for HDLM devices, see Logical device files for HDLM devices on page 2-11.</p>
IEP#1	-	<p>Information about the intermittent error.</p> <p>This item is displayed only when you specify <code>-iem</code> with the <code>-path</code> parameter.</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 fallbacks do not check the path).
HBAPortWWN#1	-	<p>A 16-digit hexadecimal number indicating the WWN information for an HBA connected to the storage system.</p> <p>This item is displayed only when you specify <code>-iem</code> together with the <code>-hbaportwwn</code> parameter.</p> <p>For an iSCSI interface, a hyphen (-) is displayed.</p>
Physical-LDEV	-	<p>The model ID, serial number, and iLU number of a physical volume are separated by periods and displayed.</p> <p>You can identify the physical volume from this information. If the volume is not virtualized, a hyphen (-) is displayed.</p>
Virtual-LDEV	-	<p>Displays the model ID, serial number, and iLU number of a virtual volume, separated by periods.</p> <p>You can identify the virtual volume from this information. If the volume is not virtualized, a hyphen (-) is displayed.</p>
Physical-DskName	-	<p>When a path is migrated using a virtual ID, displays the name of the storage system that is connected by the migration-destination path.</p> <p>A storage system name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> Vendor ID: The name of the storage system vendor. Product ID: Indicates the storage system product ID, emulation type, or model ID. <p>For more details, see Table 6-15 Product ID displayed by the view -path operation on page 6-53.</p>

Displayed item		Description
No summary displayed	Summary displayed	
		<ul style="list-style-type: none"> Serial number: The serial number of the storage system. <p>When a virtual ID is not used, a hyphen (-) is displayed.</p>
Physical-iLU	-	<p>When a path is migrated using a virtual ID, displays LU number in the storage system that is connected by the migration-destination path.</p> <ul style="list-style-type: none"> For Hitachi Virtual Storage Platform, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU. <p>When a virtual ID is not used, a hyphen (-) is displayed.</p>
Physical-ChaPort	-	<p>When a path is migrated using a virtual ID, displays port number of the CHA that is connected by the migration-destination path.</p> <p>When a virtual ID is not used, a hyphen (-) is displayed.</p>
Org-DskName	-	<p>For HAM environments, the name of the storage system on the secondary volume (S-VOL) is displayed.</p> <p>A storage system name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> Vendor ID: The name of the storage system vendor. Product ID: Indicates the storage system product ID, emulation type, or model ID. <p>For more details, see Table 6-15 Product ID displayed by the view -path operation on page 6-53.</p> <ul style="list-style-type: none"> Serial number: The serial number of the storage system. <p>If an HAM environment is not used, a hyphen (-) is displayed.</p>
Org-iLU	-	<p>For HAM environments, an LU number on the secondary volume (S-VOL) is displayed.</p> <ul style="list-style-type: none"> For HUS VM, 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 Hitachi Virtual Storage Platform, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU. <p>If an HAM environment is not used, a hyphen (-) is displayed.</p>

Legend:

- : Not displayed

#1

The path information is displayed only when a value is specified for the `-path -item` parameter.

#2

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

Table 6-14 Elements of a path name

Element	Linux representation
Host port number (example: 0000)	Host ID (host port number)
Bus number (example: 0000)	Channel number (bus number)
Target ID (example: 000000000000003A)	Target ID
Host LU number(example: 0005)	Lun (host LU number)

To obtain information about each element, use the HDLM-configuration definition utility (`dlnmcfgmgr`). For details about this utility, see [dlnmcfgmgr utility for managing the HDLM configuration on page 7-26](#).

Table 6-15 Product ID displayed by the view -path operation

Model names of storage systems	Product ID	
	Without the -sname parameter	With the -sname parameter (displays the following for the model name)
HUS100 series	product identifier ^{#1}	HUS100
Hitachi Virtual Storage Platform	Emulation type ^{#1}	VSP
VSP 5000 series		VSP_5000
VSP G1000		VSP_G1000
VSP G1500		VSP_G1500
VSP F1500		VSP_F1500
Virtual storage system "VSP G1000, G1500 and VSP F1500" ^{#2}		VSP_G1000
VSP E series		VSP_Ex00

Model names of storage systems	Product ID	
	Without the -sname parameter	With the -sname parameter (displays the following for the model name)
VSP Gx00 models		VSP_Gx00
VSP Fx00 models		VSP_Fx00
VSP N series ^{#3}		VSP_Gx00
		VSP_Fx00
HUS VM		HUS_VM
P9500		P9500
XP8		XP8
XP7		XP7

#1

If the `-c` parameter is specified together with the `-path` parameter, when the number of characters exceeds 10, any characters after the 7th character are displayed as an ellipsis (...).

#2

When the primary volume of the global-active device is not registered to a virtual storage system, the model ID of the storage system of the primary volume is displayed. Note that `VSP_G1000` is displayed when the primary volume is not connected to a host.

#3

`VSP_Gx00` or `VSP_Fx00` is displayed.

To display LU information

When displaying LU information, if the `-item` parameter, `-c` parameter, or the `-c -item` parameter is specified at the same time as the `-lu` parameter, you can add and display items and display a summary of LU information. This section describes each parameter and the LU information and displayed items.

To display LU information

`-lu`

When neither the `-c` nor `-item` parameter is specified with the `-lu` parameter, the information about the LU recognized by HDLM is displayed without selecting items to be displayed or displaying a summary. The sorting key is `iLU` and its configuration information is displayed for each LU.

For details on the content of each displayed item, see [Table 6-18 LU information on page 6-60](#). The sub-parameters are:

`-pstv|-vstv`

If the `-psv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-psv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-psv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -psv parameter specification on page 6-29](#).

`-hdev host-device-name|-pathid AutoPATH_ID`

Displays information only for the paths accessing the specified host device, if the `-hdev` parameter is specified.

Specify the name of the logical device file (minus the partition number), `/dev/sddl[m[aa-pap]`, for the HDLM device. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

If the `-pathid` parameter is specified, only information about the LU connected to the path with the specified `AutoPATH_ID` is displayed.

`-t`

Omits the title for each information item.

Example

The following example shows how to display the LU information without selecting items to be displayed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : HUS_VM
SerialNumber  : 210945
LUs          : 3
```

iLU	HDevName	Device	PathID	Status
0960	sddlmaa	/dev/sda	000000	Online
		/dev/sdg	000003	Online
0961	sddlmac	/dev/sdb	000002	Online
		/dev/sdh	000004	Online
0962	sddlma	/dev/sdc	000001	Online
		/dev/sdi	000005	Online

```
Product      : VSP G1000
SerialNumber  : 10051
LUs          : 3
```

iLU	HDevName	Device	PathID	Status
001836	sddlma	/dev/sdj	000006	Online
		/dev/sdd	000011	Online
001837	sddlmaf	/dev/sdk	000009	Online
		/dev/sde	000010	Online
001838	sddlmae	/dev/sdl	000007	Online
		/dev/sdf	000008	Online

```
KAPL01001-I The HDLM command completed normally. Operation
```

```
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To display LU information (by adding items to be displayed)

`-lu -item`

The items specified with the `-item` option are displayed among with those displayed by the `-lu` option.

When the value of the `-item` parameter is omitted or `all` is specified, all the items, except for `DPC`, `Physical-LDEV`, `Virtual-LDEV`, `Physical-Product`, `Physical-SerialNumber`, `Physical-iLU`, `Physical-ChaPort`, `Org-Product`, `Org-SerialNumber`, and `Org-iLU`, that can be displayed are displayed.

The table below lists the correspondence between the display items that can be added by using the `-item` parameter and the parameter values that can be specified after the `-item` parameter.

Table 6-16 Correspondence between the items displayed by the `dlmkmgr view -lu -item` command and the values of the `-item` parameter

Items displayed by the <code>dlmkmgr view -lu -item</code> command	Values specified after the <code>-item</code> parameter
SLPR	slpr
PathName	pn
ChaPort	cp
CLPR	clpr
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
IEP	iep
HCTL	hctl
DPC	dpc
Physical-LDEV	phys
Virtual-LDEV	virt
Physical-Product	vid
Physical-SerialNumber	vid
Physical-iLU	vid
Physical-ChaPort	vid

Items displayed by the dlnkmgr view -lu -item command	Values specified after the -item parameter
Org-Product	ha
Org-SerialNumber	ha
Org-iLU	ha
HaStat	hastat
All items are displayed	all

For details on the contents of each displayed item, see [Table 6-18 LU information on page 6-60](#).

The sub-parameters are:

-pstv|-vstv

If the **-pstv** parameter is specified, information about the physical storage system is displayed. If the **-vstv** parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the **-pstv** parameter of **set** operations.

For information about the items that are displayed differently depending on the specified **-pstv** and **-vstv** parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#).

-hdev host-device-name|-pathid AutoPATH_ID

Displays information only for the paths accessing the specified host device, if the **-hdev** parameter is specified.

Specify the name of the logical device file (minus the partition number), **/dev/sddlm[aa-pap]**, for the HDLM device. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

If the **-pathid** parameter is specified, only information about the LU connected to the path with the specified **AutoPATH_ID** is displayed.

-t

Omits the title for each information item.

Example 1

The following example shows how to display LU information by using iLUs as a sorting key, and selecting the items to be displayed. Execute the following command to display **SLPR**, **PathName**, **ChaPort**, **CLPR**, **Type**, **IO-Count**, **IO-Errors**, **DNum**, **IEP**, and **HCTL**:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -item alpr pr cp clpr type io io dno sep hndl
Product      : VSE_S1000
SerialNumber : 10182
LUs         : 4

iLU  SLPN HDevName Device PathID PathName ChkPct CLPR Status Type IO-Count IO-Errors BNum IOP HCTL
00290A - sddlma - /dev/sdd 000000 0002,0000,0000000000000000,0000 0B 0 Offline(E) Own 0 0 0 0 2.0.0.0
          /dev/sch 000004 0002,0000,0000000000000000,0000 1B 0 Offline(E) Own 0 0 0 0 2.0.1.0
          /dev/scd 000006 0003,0000,0000000000000000,0000 1B 0 Online Own 60 0 0 0 3.0.0.0
          /dev/scp 000009 0003,0000,0000000000000000,0000 0B 0 Online Own 68 0 0 0 3.0.1.0
00290B - sddlmaa - /dev/sdc 000001 0002,0000,0000000000000000,0001 0B 0 Offline(E) Own 0 0 0 0 2.0.0.1
          /dev/sdc 000005 0002,0000,0000000000000000,0001 1B 0 Offline(E) Own 0 0 0 0 2.0.1.1
          /dev/sch 000010 0003,0000,0000000000000000,0001 1B 0 Online Own 155817 0 0 0 2 3.0.0.1
          /dev/scq 000011 0003,0000,0000000000000000,0001 0B 0 Online Own 155815 0 0 0 3 3.0.1.1
00290C - sddlmaB - /dev/scf 000002 0002,0000,0000000000000000,0002 0B 0 Offline(E) Own 0 0 0 0 2.0.0.2
          /dev/scj 000006 0002,0000,0000000000000000,0002 1B 0 Offline(E) Own 0 0 0 0 2.0.1.2
          /dev/sch 000012 0003,0000,0000000000000000,0002 1B 0 Online Own 0 0 0 0 3.0.0.2
          /dev/scr 000013 0003,0000,0000000000000000,0002 0B 0 Online Own 269035 0 0 0 3.0.1.2
00290D - sddlmaC - /dev/scg 000003 0002,0000,0000000000000000,0003 0B 0 Offline(E) Own 0 0 0 0 2.0.0.3
          /dev/sck 000007 0002,0000,0000000000000000,0003 1B 0 Offline(E) Own 0 0 0 0 2.0.1.3
          /dev/sdo 000014 0003,0000,0000000000000000,0003 1B 0 Online Own 10868 0 0 0 3.0.0.3
          /dev/sds 000015 0003,0000,0000000000000000,0003 0B 0 Online Own 11124 0 0 0 3.0.1.3

KAPL01001-I The HDLM command completed normally. Operation name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
#

```

Example 2

When using HUS100 series storage and displaying LU information with DPC added to the display items:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -item dpc
Product      : HUS100
SerialNumber : 9203008
LUs         : 3
Dynamic I/O Path Control : on*

iLU  HDevName DPC PathID Status
000006 sddlmaD on 000000 Online
          000003 Online
000007 sddlmaa off 000001 Online
          000004 Online
000008 sddlmaB on 000002 Online
          000005 Online

KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#

```

To display a summary of LU information

`-lu -c`

When the `-c` parameter is specified with the `-lu` parameter, a summary of LU configuration information is displayed on one line. The total number of paths recognized by HDLM and the number of online paths are displayed for each LU.

You cannot specify the `-c` parameter together with the `-hdev` or `-pathid` parameter.

For details on the contents of each display item, see [Table 6-18 LU information on page 6-60](#).

The sub-parameters are as follows:

`-pstv|-vstv`

If the `-pstv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-pstv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-pstv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#).

`-t`

Omits the title for each information item.

Example

The following example shows how to display a summary of LU information (without selecting items to be displayed):

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -c
Product      S/N      LUs iLU      HDevName Paths OnlinePaths
HUS_VM       210945    3 0960     sddlmaa  2        2
              0961     sddlmac  2        2
              0962     sddlmab  2        2
VSP_G1000 10051    3 001836   sddlmad  2        2
              001837   sddlmaf  2        2
              001838   sddlmae  2        2
KAPL01001-I The HDLM command completed normally. Operation
name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To display a summary of LU information (by selecting items to be displayed)

`-lu -c -item`

The items displayed when the `-item` option is added to the `-lu -c` options.

When the value of the `-item` parameter is omitted, all the items that can be displayed are displayed.

The following table lists the correspondence between the display items that can be added by using the `-item` parameter and the parameter values that can be specified after the `-item` parameter.

Table 6-17 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

The sub-parameter is:

-pstv|-vstv

If the -ps_{tv} parameter is specified, information about the physical storage system is displayed. If the -vs_{tv} parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the -ps_{tv} parameter of set operations.

For information about the items that are displayed differently depending on the specified -ps_{tv} and -vs_{tv} parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -ps_{tv} parameter specification on page 6-29](#).

-t

Omits the title for each information item.

Example

The following example shows how to display a summary of LU information, and selecting the items to be displayed. Execute the following command to display SLPR:

```
#optDynamicLinkManager/bin/dlmgview-lu-c-item
Product SN LUs LU SLPR HDevName Paths OnlinePaths
HUS_VM 210945 30960 -sddlmaa 2 2
      0961 -sddlmac 2 2
      0962 -sddlmab 2 2
VSP_G100010051 3001836 -sddlmad 2 2
      001837 -sddlmaf 2 2
      001838 -sddlmae 2 2
KAPL010014: The HDLM command completed normally. Operation name = view, completion time = yyyy/mm/dd hh:mm:ss
#
```

Items of LU information

[Table 6-18 LU information on page 6-60](#) describes the displayed LU information. The following explains the table headings:

- No summary displayed: The user specifies the -lu parameter or -lu -item parameter.
- Summary displayed: The user specifies the -lu -c parameter or -lu -c -item parameter.

Table 6-18 LU information

Displayed item		Description
No summary displayed	Summary displayed	
Product		Model ID of the storage system
SerialNumber	S/N	Serial number of the storage system
LUs		Total number of LUs managed by HDLM among the LUs in the storage system

Displayed item		Description
No summary displayed	Summary displayed	
Dynamic I/O Path Control	-	<p>The setting information about the dynamic I/O path control function is displayed for each storage system.</p> <p>on: The dynamic I/O path control function is enabled.</p> <p>off: The dynamic I/O path control function is disabled.</p> <p>-: The dynamic I/O path control function is not supported.</p> <p>If an LU whose settings differ from the settings based on the system storage unit is included, an asterisk (*) is added after the on or off being displayed.</p>
iLU		<p>LU number in the storage system.</p> <p>This number combined with the storage system name (shown in DskName) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> For HUS VM, indicated by a hexadecimal number. The first two characters of iLU are the internal CU number within the CU, and the last two characters are the internal LU number within the CU. For P9500, XP8, and XP7, indicated by a hexadecimal number. The first two characters of iLU are 00, the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU. For the HUS100 series, indicated by a decimal number. The entire value of iLU is the internal LU number within the storage system. You can identify an actual LU by referencing iLU from the storage system management program. For Hitachi Virtual Storage Platform, VSP 5000 series, VSP G1000, G1500, VSP F1500, VSP E series, VSP Gx00 models, VSP Fx00 models, and VSP N series indicated by a hexadecimal number. The first two characters of iLU are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU.
SLPR#1	SLPR#2	<p>The number of the SLPR to which an LU belongs, indicated by a number from 0 to 31. A hyphen (-) is displayed if the storage logical partition functionality for the storage system for the target LU is not supported.</p>

Displayed item		Description
No summary displayed	Summary displayed	
		Note that a hyphen (-) is displayed even if the iLU is a virtualized volume.
HDevName ^{#1}	HDevName	<p>Host device name.</p> <p>The name of the logical device file (minus the partition number), <code>/dev/sddl[m[aa-pap]</code>, for the HDLM device.</p> <p>For details on logical device files for HDLM devices, see Logical device files for HDLM devices on page 2-11.</p>
DPC	-	<p>The setting information about the dynamic I/O path control function is displayed for each LU.</p> <p>on: The dynamic I/O path control function is enabled.</p> <p>off: The dynamic I/O path control function is disabled.</p> <p>-: The dynamic I/O path control function is not supported.</p>
Device	-	<p>SCSI device associated with an HDLM device. If the SCSI device is not connected when a host starts, or the assigned LU is released, this column displays a hyphen (-).</p> <p>This problem might also occur when the OS is SUSE LINUX Enterprise Server 11 and one of the following problems occurs while the system is running:</p> <ul style="list-style-type: none"> • A path gets disconnected. • An LU is deleted. • A fiber cable connection is changed. • A Fibre Channel switch's zone setting is changed.
PathID	-	<p>The AutoPATH_ID.</p> <p>AutoPATH_ID is assigned every time the host is restarted. When a new LU was added and the host has not been restarted, AutoPATH_ID is re-assigned to each path of the LU when you execute the HDLM-configuration definition utility (<code>dlmcfmgr</code>).</p>
PathName ^{#1}	-	<p>The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the path that will be affected by the change. Path name consists of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> • Host port number (hexadecimal number) • Bus number (hexadecimal number) • Target ID (hexadecimal number)

Displayed item		Description
No summary displayed	Summary displayed	
		<ul style="list-style-type: none"> Host LU number (hexadecimal number) <p>For details about each element of the path name and its representation in Linux, see Table 6-14 Elements of a path name on page 6-53.</p>
ChaPort#1	-	<p>Port number of the CHA, which identifies the CHA port that is mounted on the storage system.</p> <p>You can identify an actual CHA port by referencing this number from the storage system management program.</p>
CLPR#1	-	<p>The number of the CLPR to which the CHA belongs, indicated by a number from 0 to 31. Note that a hyphen (-) is displayed if the following items are subject to display:</p> <ul style="list-style-type: none"> CHA ports in the storage system that do not support the cache logical partition function
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 Dev have an Online status, one of those paths is changed to the Online(E) status.) Online(S): I/O operations to the primary volume (P-VOL) in an HAM environment are suppressed. Online(D): The paths to the primary volume (P-VOL) in an HAM environment can be recovered automatically. <p>Paths that are Offline(E) or Online(E) require corrective action. The appropriate action can be determined by referring to What to do for a path error on page 5-3.</p>
Type#1	-	<p>Attribute of the path</p> <ul style="list-style-type: none"> Own: Owner path Non: Non-owner path <p>If the storage system is supported by HDLM, usually all paths are owner paths.^{#3}</p>
IO-Count#1	-	<p>Total I/O count for a path. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.</p> <p>To reset the IO-Count value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing</p>

Displayed item		Description
No summary displayed	Summary displayed	
		the <code>clear</code> operation also resets the number of I/O errors (<code>IO-Errors</code>) to 0. For details about the <code>clear</code> operation, see clear (returns the path statistics to the initial value) on page 6-3.
<code>IO-Errors</code> #1	-	<p>Total I/O error count for a path. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.</p> <p>To reset the <code>IO-Errors</code> value to 0, execute the <code>dlmkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (<code>IO-Count</code>) to 0.</p> <p>For details about the <code>clear</code> operation, see clear (returns the path statistics to the initial value) on page 6-3.</p>
<code>DNum</code> #1	-	<p>Dev number, where 0 (fixed) is displayed.</p> <p>This item pertains to a partition number.</p>
<code>IEP</code> #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 fallbacks.</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 fallback does not check the path).
<code>HCTL</code> #1	-	<p>SCSI device configuration information. The following information is shown in "a.b.c.d" format:</p> <p>a: Host port number (decimal number)</p> <p>b: Bus number (decimal number)</p> <p>c: Target ID (decimal number)</p> <p>d: Host LU number (decimal number)</p>
<code>Physical-LDEV</code>	-	The model ID, serial number, and iLU number of a physical volume are separated by periods and displayed.

Displayed item		Description
No summary displayed	Summary displayed	
		You can identify the physical volume from this information. If the volume is not virtualized, a hyphen (-) is displayed.
Virtual-LDEV	-	Displays the model ID, serial number, and iLU number of a virtual volume, separated by periods. You can identify the virtual volume from this information. If the volume is not virtualized, a hyphen (-) is displayed.
Physical-Product	-	When a path is migrated using a virtual ID, displays model ID of the storage system that is connected by the migration-destination path. When a virtual ID is not used, a hyphen (-) is displayed.
Physical-SerialNumber	-	When a path is migrated using a virtual ID, displays serial number of the storage system that is connected by the migration-destination path. When a virtual ID is not used, a hyphen (-) is displayed.
Physical-iLU	-	When a path is migrated using a virtual ID, displays LU number in the storage system that is connected by the migration-destination path. <ul style="list-style-type: none"> For Hitachi Virtual Storage Platform, indicated by a hexadecimal number. The first two characters of iLU 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. When a virtual ID is not used, a hyphen (-) is displayed.
Physical-ChaPort	-	When a path is migrated using a virtual ID, displays port number of the CHA that is connected by the migration-destination path. When a virtual ID is not used, a hyphen (-) is displayed.
-	Paths	Total number of the paths recognized by HDLM for the LU to be displayed.
-	OnlinePaths	Number of available paths in the displayed paths, indicated by a decimal number. When the value of 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.

Displayed item		Description
No summary displayed	Summary displayed	
Org-Product	-	For HAM environments, the model ID of the storage system on the secondary volume (S-VOL) is displayed. If an HAM environment is not used, a hyphen (-) is displayed.
Org-SerialNumber	-	For HAM environments, the serial number of the storage system on the secondary volume (S-VOL) is displayed. If an HAM environment is not used, a hyphen (-) is displayed.
Org-iLU	-	For HAM environments, an LU number in the storage system on the secondary volume (S-VOL) is displayed. <ul style="list-style-type: none"> For HUS VM, 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 Hitachi Virtual Storage Platform, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU. If an HAM environment is not used, a hyphen (-) is displayed.

Legend:

- : Not displayed

#1

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -item` parameter.
- `all` was specified.
- No value was specified for the parameter.

#2

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -c -item` parameter.
- No value was specified for the parameter.

#3

Non-owner paths exist in the following cases:

- When the HUS100 series is being used, and the dynamic I/O path control function is enabled
- When a global-active device is being used, and the non-preferred path option is set

To display corresponding information about an HDLM device, SCSI device, and LDEV

`-drv`

Using this parameter displays the PathID, the HDLM device, SCSI device for the HDLM device, and information on the LDEV in the storage system (storage system model name, serial number, and LU number, separated by period).

For details on the contents of each display item, see [Table 6-19 To display corresponding information about an HDLM device, SCSI device, and LDEV on page 6-67](#).

The sub-parameters are as follows:

`-pstv|-vstv`

If the `-pstv` parameter is specified, information about the physical storage system is displayed. If the `-vstv` parameter is specified, information about the storage system recognized by the operating system is displayed. If neither parameter is specified, information is displayed according to the value specified in the `-pstv` parameter of `set` operations.

For information about the items that are displayed differently depending on the specified `-pstv` and `-vstv` parameters, see [Table 6-10 Display items for which the display results of the view operation differ depending on the -pstv parameter specification on page 6-29](#) in [Parameters on page 6-16](#).

`-t`

Does not display the title for each information item.

Table 6-19 To display corresponding information about an HDLM device, SCSI device, and LDEV

Item	Description
PathID	AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the host is restarted. When a new LU was added and the host has not been restarted, AutoPATH_ID is re-assigned to each path of the LU when you execute the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>).
HDevName	Host device name. The name of the logical device file (minus the partition number), <code>/dev/sddlm[aa-pap]</code> , for the HDLM device. For details on logical device files for HDLM devices, see Logical device files for HDLM devices on page 2-11 .

Item	Description
Device	<p>SCSI device associated with an HDLM device. If the SCSI device is not connected when a host starts, or the assigned LU is released, this column displays a hyphen (-).</p> <p>This problem might also occur when the OS is SUSE LINUX Enterprise Server 11 and one of the following problems occurs while the system is running:</p> <ul style="list-style-type: none"> • A path gets disconnected. • An LU is deleted. • A fiber cable connection is changed. • A Fibre Channel switch's zone setting is changed.
LDEV	The model ID, serial number, and iLU number for the storage system, separated by periods. Information about LDEV can identify an actual device that is managed by HDLM.

Example

To display corresponding information about an HDLM device, SCSI device, and LDEV

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV
000000 sddlmaa - VSP_G1000.10182.00280B
000001 sddlmaab /dev/sdi VSP_G1000.10182.00280C
000002 sddlmac /dev/sdj VSP_G1000.10182.00280D
000003 sddlmaa /dev/sdk VSP_G1000.10182.00280B
000004 sddlmaab /dev/sdl VSP_G1000.10182.00280C
000005 sddlmac /dev/sdm VSP_G1000.10182.00280D
000006 sddlmaa /dev/sdn VSP_G1000.10182.00280B
000007 sddlmaab /dev/sdo VSP_G1000.10182.00280C
000008 sddlmac /dev/sdp VSP_G1000.10182.00280D
000009 sddlmaa /dev/sdq VSP_G1000.10182.00280B
000010 sddlmaab /dev/sdr VSP_G1000.10182.00280C
000011 sddlmac /dev/sds VSP_G1000.10182.00280D
KAPL01001-I The HDLM command completed normally. Operation name
= view, completion time = yyyy/mm/dd hh:mm:ss
#
```

To display the format of the view operation

-help

Use this parameter to display the `view` operation format.

Example

The following example shows how to display the format of the `view` operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -help
view:
Format
dlnkmgr view -sys [ -sfunc | -msrv | -adrv | -pdrv | -lic | -
audlog
| -lbpathusetimes | -expathusetimes | -
```

```

exrndpathusetimes | -pstv ] [-t]
    dlncmgr view -path [-pstv | -vstv] [ -hdev HostDeviceName ] [-
stname] [-iem]
                                [-srt {pn | lu | cp}}] [-
hbaportwwn] [-t]
    dlncmgr view -path
        -item [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu]
            [hd] [iep] [hbaportwwn] [phys] [virt] [vid] [ha]
            [-pstv | -vstv] [-hdev HostDeviceName] [-
stname] [-srt {pn | lu | cp}}] [-t]
    dlncmgr view -path -c [-pstv | -vstv] [-stname] [-srt {lu | cp}}]
[-t]
    dlncmgr view -lu [-pstv | -vstv] [ -hdev HostDeviceName | -
pathid AutoPATH_ID ] [-t]
    dlncmgr view -lu
        -item [ [slpr] [pn] [cp] [clpr] [type] [ic] [ie]
[dnu]
                                [iep] [hctl] [dpc] [phys] [virt] [vid]
[ha] [hastat] | all ]
                                [-pstv | -vstv] [ -hdev HostDeviceName | -
pathid AutoPATH_ID ] [-t]
    dlncmgr view -lu -c [-pstv | -vstv] [-t]
    dlncmgr view -lu -c -item [slpr] [-pstv | -vstv] [-t]
    dlncmgr view -drv [-pstv | -vstv] [-t]
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss
#

```

add (adds a path dynamically)

The `dlncmgr` command's `add` operation batch-adds paths that are connected to the host and not configured on the host. You can execute this command dynamically without any effects on existing paths.

Format

To add a path dynamically

```
/opt/DynamicLinkManager/bin/dlncmgr add -path [-s]
```

To display the format of the add operation

```
/opt/DynamicLinkManager/bin/dlncmgr add -help
```

Parameters

To add a path dynamically

`-path`

Indicates that the target of the operation is a path managed by HDLM.

Example

```
# /opt/DynamicLinkManager/bin/dlncmgr add -path
```

```
KAPL01161-I This operation will change the path configuration.
Do you want to continue? [y/n]:y
KAPL01162-I A path was added. (path ID = 00010, storage =
HITACHI.HUS100.9100163, iLU = 0030)
:
KAPL01159-I Paths were added. (number of paths added = 2,
completion time = yyyy/mm/dd hh:mm:ss)
```

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr add -path -s
KAPL01162-I A path was added. (path ID = 00010, storage =
HITACHI.HUS100.9100163, iLU = 0030)
:
KAPL01159-I Paths were added. (number of paths added = 2,
completion time = yyyy/mm/dd hh:mm:ss)
```

Note

The path to be managed by HDLM must be recognized by the OS before executing this command. To add paths, execute the command for adding the device shown in [Table 4-5 Adding or deleting a SCSI device on page 4-39](#).

To display the format of the add operation

-help

Use this parameter to display the add operation format.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr add -help
add:
Format
dlnkmgr add -path [-s]
KAPL01001-I The HDLM command completed normally. Operation name
= add, completion time = yyyy/mm/dd hh:mm:ss
#
```

delete (deletes a path dynamically)

The `dlnkmgr` command's `delete` operation batch-removes paths previously deleted from the OS from the HDLM management targets. You can execute this command dynamically without any effects on existing paths.

Format

To delete a path dynamically

```
/opt/DynamicLinkManager/bin/dlnkmgr delete -path [-s]
```

To display the format of the delete operation

```
/opt/DynamicLinkManager/bin/dlnkmgr delete -help
```

Parameters

To delete a path dynamically

-path

Indicates that the target of the operation is a path managed by HDLM.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr delete -path
KAPL01161-I This operation will change the path configuration.
Do you want to continue? [y/n]:y
KAPL01165-I A path was deleted. (path ID = 00010, storage =
HITACHI.HUS100.9100163, iLU = 0030)
:
KAPL01164-I Paths were deleted. (number of paths deleted = 2,
completion time = yyyy/mm/dd hh:mm:ss)
```

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr delete -path -s
KAPL01165-I A path was deleted. (path ID = 00010, storage =
HITACHI.HUS100.9100163, iLU = 0030)
:
KAPL01164-I Paths were deleted. (number of paths deleted = 2,
completion time = yyyy/mm/dd hh:mm:ss)
```

Note

Any paths excluded from the HDLM-management targets must be deleted from the OS before executing this command. To delete paths, execute the command for deleting the device shown in [Table 4-5 Adding or deleting a SCSI device on page 4-39](#).

To display the format of the delete operation

-help

Use this parameter to display the `delete` operation format.

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr delete -help
delete:
  Format
    dlnkmgr delete -path [-s]
KAPL01001-I The HDLM command completed normally. Operation name
= delete, completion time = yyyy/mm/dd hh:mm:ss
#
```

refresh (applies storage system settings to HDLM)

The refresh operation applies the storage system settings to HDLM.

Format

To apply storage system settings to HDLM

```
/opt/DynamicLinkManager/bin/dlnkmgr refresh -gad
```

To apply the latest model ID to HDLM

```
/opt/DynamicLinkManager/bin/dlnkmgr refresh -stname
```

To display the format of the refresh operation

```
/opt/DynamicLinkManager/bin/dlnkmgr refresh -help
```

Parameters

To apply storage system settings to HDLM

-gad

The non-preferred path option that is set to the paths to global-active device pair volumes is applied to the HDLM path attribute. A path for which the non-preferred path option is set becomes a non-owner path, and a path for which the non-preferred path option is not set becomes an owner path.

If you specify the -gad parameter for the refresh operation, make sure the statuses of all paths to global-active device pair volumes are *Online*.

If you restart the host, the settings at the time of restart are applied to the HDLM path attribute.

Example

To apply the attribute of a path to a global-active device volume:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -item type phys
Product : VSP_G1000
SerialNumber : 10051
LUs : 1
```



```

iLU      HDevName Device    PathID Status Type Physical-LDEV
001910 sddlmaa  /dev/sdc 000000 Online Own
VSP_G1000.10051.001910
           /dev/sdd 000001 Online Own
VSP_G1000.10051.001910
           /dev/sde 000002 Online Own
VSP_G1000.10057.001A10
           /dev/sdf 000003 Online Own
VSP_G1000.10057.001A10
KAPL01001-I The HDLM command completed normally. Operation
name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
#

# /opt/DynamicLinkManager/bin/dlnkmgr refresh -gad
KAPL01001-I The HDLM command completed normally. Operation
name = refresh, completion time = yyyy/mm/dd hh:mm:ss
#

# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -item type phys
Product : VSP_G1000
SerialNumber : 10051
LUs : 1

iLU      HDevName Device    PathID Status Type Physical-LDEV
001910 sddlmaa  /dev/sdc 000000 Online Own
VSP_G1000.10051.001910
           /dev/sdd 000001 Online Own
VSP_G1000.10051.001910
           /dev/sde 000002 Online Non
VSP_G1000.10057.001A10
           /dev/sdf 000003 Online Non
VSP_G1000.10057.001A10
KAPL01001-I The HDLM command completed normally. Operation
name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss

```

To apply the latest model ID to HDLM

-stname

The latest model ID of the storage system is applied to HDLM. Execute the `refresh -stname` operation after changing the storage system from VSP G1000 to VSP G1500.

When the host is restarted, the latest model ID is applied to HDLM. (Executing the `refresh -stname` operation is not required when the host is restarted.)

Example

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product : VSP_G1000
SerialNumber : 10051
LUs : 1

iLU      HDevName Device    PathID Status
001910 sddlmaa  /dev/sdc 000000 Online
           /dev/sdd 000001 Online

```

```

KAPL01001-I The HDLM command completed normally. Operation
name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss
#

# /opt/DynamicLinkManager/bin/dlnkmgr refresh -stname
KAPL01001-I The HDLM command completed normally. Operation
name = refresh, completion time = yyyy/mm/dd hh:mm:ss
#

# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product : VSP_G1500
SerialNumber : 10051
LUs : 1

iLU      HDevName Device   PathID Status
001910 sddlmaa /dev/sdc 000000 Online
         /dev/sdd 000001 Online
KAPL01001-I The HDLM command completed normally. Operation
name = view(-vstv), completion time = yyyy/mm/dd hh:mm:ss

```

Note

If no paths are connected when you restart the host after executing the `refresh` operation to refresh the storage system name, the storage system name before the refresh might be displayed even after the host restarts. In this case, perform the procedure for recovering paths and then execute the `refresh` operation, or restart the host after the paths are recovered.

To display the format of the refresh operation

`-help`

Use this parameter to display the format of the `refresh` operation.

Example

```

# /opt/DynamicLinkManager/bin/dlnkmgr refresh -help
refresh:
  Format
    dlnkmgr refresh [-gad | -stname]
KAPL01001-I The HDLM command completed normally. Operation
name = refresh, completion time = yyyy/mm/dd hh:mm:ss
#

```

Utility reference

This chapter explains the utilities used by HDLM.

- ☐ [Overview of the utilities](#)
- ☐ [DLMgetras utility for collecting HDLM error information](#)
- ☐ [dlmbootstart utility for creating an HDLM boot disk environment](#)
- ☐ [dlmcfmgr utility for managing the HDLM configuration](#)
- ☐ [dlmchname HDLM device name replacement utility](#)
- ☐ [dlmmkinitrd utility for supporting a boot disk](#)
- ☐ [The utility for displaying HDLM performance information \(dlmperfinfo\)](#)
- ☐ [dlmpr utility for clearing HDLM persistent reservation](#)
- ☐ [dlmsetopt utility for setting HDLM driver options](#)
- ☐ [dlmstart utility for starting HDLM](#)
- ☐ [dlmupdatesysinit utility for updating system scripts](#)
- ☐ [installgetras utility for collecting HDLM installation error information](#)
- ☐ [installhdlm utility for installing HDLM](#)
- ☐ [installux.sh utility for HDLM common installer](#)
- ☐ [Utility for removing HDLM \(removehdlm\)](#)

Overview of the utilities

HDLM provides the following utilities:

- The `DLMgetras` utility for collecting HDLM error information
When an error occurs, this utility collects the files that contain information to be submitted to your HDLM vendor or maintenance company. For details on the `DLMgetras` utility, see [DLMgetras utility for collecting HDLM error information on page 7-3](#).
- The utility for creating an HDLM boot disk environment (`d1mbootstart`)
This utility allows you to edit the `/etc/fstab` file and the `/etc/lvm/lvm.conf` file, make changes to the boot loader configuration file, and create an HDLM boot disk environment by automatically creating an initial RAM disk image file for HDLM. For details on the `d1mbootstart` utility, see [d1mbootstart utility for creating an HDLM boot disk environment on page 7-24](#).
- The `d1mcfgmgr` HDLM-configuration definition utility
This utility enables you to add, update, or delete information that HDLM requires to manage paths. For details on the `d1mcfgmgr` utility, see [d1mcfgmgr utility for managing the HDLM configuration on page 7-26](#).
- The `d1mchname` utility for replace HDLM device name
This utility changes an HDLM device name. Before changing an HDLM device name, stop access to the HDLM device. When changing the name of an HDLM device that is used as a boot disk, restart the host after the utility is executed. For details about the `d1mchname` utility, see [d1mchname HDLM device name replacement utility on page 7-37](#).
- The `d1mmkinitrd` utility for supporting a boot disk
This utility creates an initial RAM disk image file for using an HDLM device as a boot disk. For details on the `d1mmkinitrd` utility, see [d1mmkinitrd utility for supporting a boot disk on page 7-38](#).
- The utility for displaying HDLM performance information (`d1mperfinfo`)
This utility collects performance information about the paths managed by HDLM, and then displays the information or outputs it to a file. For details on the `d1mperfinfo` utility, see [The utility for displaying HDLM performance information \(d1mperfinfo\) on page 7-40](#).
- The `d1mpr` utility for clearing HDLM persistent reservation
If the persistent reservation of the LU is not canceled for some reason, this utility clears the reservation key to cancel the persistent reservation. For details on the `d1mpr` utility, see [d1mpr utility for clearing HDLM persistent reservation on page 7-50](#).
- The `d1msetopt` utility for setting HDLM driver options
This utility changes the settings for the HDLM filter driver. Restart the host machine to apply the changed set values. For details on the `d1msetopt` utility, see [d1msetopt utility for setting HDLM driver options on page 7-52](#).
- The `d1mstart` utility for starting HDLM

This utility performs the following operations that are required after the installation of HDLM:

- Loading an HDLM alert driver and a filter driver
- Configuring an HDLM device
- Starting the HDLM manager

For details, see [dlnstart utility for starting HDLM on page 7-57](#).

- The `dlnupdatesysinit` utility for updating system scripts
This utility re-registers HDLM information that is lost as a result of updating the `initscripts` package. For details, see [dlnupdatesysinit utility for updating system scripts on page 7-57](#).
- The `installgetras` utility for collecting HDLM installation error information
If an error occurred during installation, this utility collects files that contain information to be submitted to your HDLM vendor or maintenance company. For details on the `installgetras` utility, see [installgetras utility for collecting HDLM installation error information on page 7-58](#).
- The `installhdlm` utility for installing HDLM
This utility performs a new installation, upgrade installation, or re-installation of HDLM. For details on the `installhdlm` utility, see [installhdlm utility for installing HDLM on page 7-59](#). For details about how to perform an unattended installation, see [Installing HDLM on page 3-94](#).
- The `installux.sh` utility for HDLM common installer
HDLM will be installed on, and installs the corresponding version of HDLM from the DVD-ROM. This utility can also perform unattended installations via a parameter specification. For details about the `installux.sh` utility, see [installux.sh utility for HDLM common installer on page 7-67](#). For details about how to use this utility to install HDLM, see [Installing HDLM on page 3-94](#).
- The utility for removing HDLM (`removehdlm`)
This utility removes HDLM. For details on the `removehdlm` utility, see [Utility for removing HDLM \(removehdlm\) on page 7-68](#). For details on how to remove HDLM, see [Removing HDLM on page 3-218](#).

Note

The utilities must be executed by a user with root permissions.

DLMgetras utility for collecting HDLM error information

This utility collects information that is needed to analyze HDLM errors that have occurred, such as error logs, process-specific-trace information files, trace files, definition files, core files, and libraries. The collected information is archived in a file and saved to the directory that you specified. The following files are output:

- `cluster.tar.gz`

This file contains compressed cluster information.

- `hbsa.tar.gz`

This file contains compressed error information of the Hitachi Command Suite products other than HDLM.

This file is output only when using a Hitachi Command Suite product that is the target for collecting error information.

- `getras.tar.gz`

This file contains compressed HDLM information and system information.

For details about the information that is stored in each file, see [List of collected error information on page 7-6](#).

When you want to collect information other than that in [List of collected error information on page 7-6](#), define the information to be collected in the information collection definition file. Information defined in the information collection definition file is compressed into `getras.tar.gz`.

When the host is restarted, some of the information that was collected by the `DLMgetras` utility will be deleted. If an error occurs, immediately execute this utility.

Format

```
/opt/DynamicLinkManager/bin/DLMgetras {directory-to-which-collected-  
information-is-output  
[-f file-that-defines-information-to-be-collected] |-h}
```

You can also use lower-case characters (`dmlmgetras` instead of `DLMgetras`) as follows:

```
/opt/DynamicLinkManager/bin/dlmgetras {directory-to-which-collected-  
information-is-output  
[-f file-that-defines-information-to-be-collected] |-h}
```

Parameters

directory-to-which-collected-information-is-output

Specify the output directory for the information that is to be collected by the `DLMgetras` utility for collecting HDLM error information. The collected information is compiled into the three files shown in *Function* and output in the specified directory.

-f file-that-defines-information-to-be-collected

Use this parameter when you want to specify certain directories or files to be collected. In this parameter, specify the file that defines information to be collected, which defines the files and directories you want to collect.

Use an absolute path to specify the file that defines information to be collected.

The following is an example of the coding in the file that defines the information to be collected. In this example, the information specified to be collected is as follows: the OS files that are not collected by the

DLMgetras utility by default, and the PostgreSQL files when PostgreSQL is an upper-level application program.

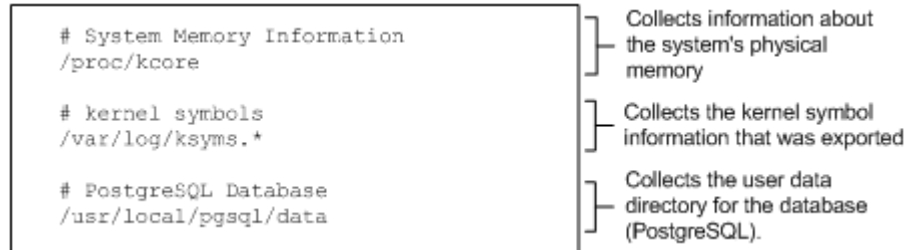


Figure 7-1 Coding example of a file that defines the information to be collected

Rules for coding a file that defines the information to be collected

- Use an absolute path to specify a directory or file whose information is to be collected. If you use a relative path to specify a directory or file, that directory or file will be searched for only within the directory in which the DLMgetras utility was executed, and the files found will be collected.
- Do not specify a directory that contains the directory to which the collected information is output. If you specify this directory, the DLMgetras utility will run indefinitely.
- Lines beginning with the hash mark (#) are handled as comment lines.
- If the hash mark (#) is encountered anywhere other than at the beginning of a line, it is assumed to be part of a path name.
- Only one file or directory can be specified per line.
- The root directory (/) cannot be specified.
- When a directory is specified, the DLMgetras utility collects all the files in that directory, including files contained in the directory's subdirectories. If no files are found in a specified directory, the utility does not perform file collection for that directory and does not create a directory for it in the destination directory.
- Set up the specified file or directory so that it can be read by users with root permissions. The DLMgetras utility can only obtain information for a file or directory that can be read.

-h

Displays the format of the DLMgetras utility.

Notes

- Because the DLMgetras utility first stores error information in the specified output directory before compressing, ensure that the allocated information collection areas are of adequate size.
- If the specified directory to which collected information is output already exists, an overwrite confirmation message is displayed. Responding by entering `y` instructs the DLMgetras utility to overwrite

the existing files; entering `n` (or anything other than `y`) instructs the utility to terminate without executing.

In the latter case, you can either rename the existing directory before re-executing the utility, or you can execute the utility with a different directory name specified.

- If you execute the `DLMgetras` utility, an error message (KAPL10034-E) might be output to the `getras.log` file when copying a file in the `/proc` directory or `/sys` directory. However, HDLM operations are not affected.

List of collected error information

The following illustrates the error information collected by executing the `DLMgetras` utility, which is explained separately in each output file.

- `cluster.tar.gz`
This file contains cluster information. [Table 7-1 Information stored in the cluster.tar.gz file on page 7-7](#) shows the detailed error information stored in the `cluster.tar.gz` file. [Table 7-2 Information stored in the cluster.tar.gz file, which is recorded by the OS and HDLM commands when the DLMgetras utility is executed on page 7-7](#) lists and describes the detailed information stored in the `cluster.tar.gz` file, which is recorded by the OS and cluster commands when the `DLMgetras` utility is executed.
- `hbsa.tar.gz`
This file contains compressed error information of the Hitachi Command Suite products other than HDLM.
This file is output only when using a Hitachi Command Suite product that is the target for collecting error information.
- `getras.tar.gz`
This file contains HDLM information and system information.
When you execute the `DLMgetras` utility, specifying the file that defines information to be collected, the `getras.tar.gz` file contains the information stored in the file that defines information to be collected. [Table 7-3 Information stored in the getras.tar.gz file on page 7-9](#) lists the detailed information stored in the `getras.tar.gz` file. [Table 7-4 Information stored in the getras.tar.gz file, which is recorded by the OS and HDLM commands when the DLMgetras utility is executed on page 7-17](#) lists and describes the detailed information stored in the `getras.tar.gz` file, which is recorded by the OS and HDLM commands when the `DLMgetras` utility is executed.
[Table 7-3 Information stored in the getras.tar.gz file on page 7-9](#) lists the collected information with or without specifying the file that defines information to be collected.

Table 7-1 Information stored in the cluster.tar.gz file

Output directory ^{#1}	Files	Explanation
/etc or /etc/cluster	cluster.conf ^{#2} or cluster.xml ^{#2}	RHCM configuration file (when using Red Hat Enterprise Linux)
/etc/ha.d	authkeys	Heart Beat setting information (when using SUSE LINUX Enterprise Server)
	ha.cf	
	haresources	
/etc/ha.d/resource.d	All subdirectories and files	SUSE Heart Beat cluster resource information (when using SUSE LINUX Enterprise Server)
/etc/VRTSvcs/conf/config	All subdirectories and files ^{#2}	VCS setting file
/var/log	ha-log	Heart Beat log file (when using SUSE LINUX Enterprise Server)
	ha-debug	Heart Beat debug log file (when using SUSE LINUX Enterprise Server)
/var/VRTSvcs/log	All subdirectories and files ^{#2}	VCS log

#1

Each output directory is created in the directory that is specified when the user expands the cluster.tar.gz file.

#2

This information is collected only if software for which information is to be collected is installed.

Table 7-2 Information stored in the cluster.tar.gz file, which is recorded by the OS and HDLM commands when the DLMgetras utility is executed

Executed command	Files	Explanation
/bin/rpm -qlv clumanager or /bin/rpm -qlv rgmanager	RHCM_rpm-qlv.txt #	RHCM package file information (when using Red Hat Enterprise Linux)
/bin/rpm -qlv heartbeat	HA_rpm-qlv.txt	HeartBeat package file information
/bin/rpm -qlv VRTSvcs	VCS_rpm-qlv.txt #	VCS package file information
/etc/init.d/heartbeat status	HA_status.txt	HeartBeat cluster status information (when using SUSE LINUX Enterprise)

Executed command	Files	Explanation
/opt/VRTSvcs/bin/haclus -display	VCS_haclus-display.txt #	VCS cluster configuration information
/opt/VRTSvcs/bin/haclus -notes	VCS_haclus-notes.txt #	VCS management information
/opt/VRTSvcs/bin/hagrp -display	VCS_hagrp-display.txt #	VCS group information
/opt/VRTSvcs/bin/hagrp -dep	VCS_hagrp-dep.txt #	VCS group dependent information
/opt/VRTSvcs/bin/hagrp -state	VCS_hagrp-state.txt #	VCS group status information
/opt/VRTSvcs/bin/hares -display	VCS_hares-display.txt #	VCS resource information
/opt/VRTSvcs/bin/hares -dep	VCS_hares-dep.txt #	VCS resource dependent information
/opt/VRTSvcs/bin/hares -state	VCS_hares-state.txt #	VCS resource status information
/opt/VRTSvcs/bin/hastatus -summary	VCS_hastatus-summary.txt #	VCS cluster status information
/opt/VRTSvcs/bin/hasys -display	VCS_hasys-display.txt #	VCS node information
/opt/VRTSvcs/bin/hasys -state	VCS_hasys-state.txt #	VCS node status information
/sbin/cluconfig -l	RHCM_cluconfig-l.txt #	RHCM cluster configuration information (when using Red Hat Enterprise Linux)
/sbin/clustat	RHCM_clustat.txt #	RHCM cluster status information (when using Red Hat Enterprise Linux)
/sbin/clustonith -L	RHCM_Clustonith-L.txt #	RHCM utility information (when using Red Hat Enterprise Linux)
/sbin/clustonith -vSl	RHCM_Clustonith-vSl.txt #	RHCM utility list information (when using Red Hat Enterprise Linux)
/usr/sbin/stonith -L	HA_stonith-L.txt	HeartBeat utility list information (when using SUSE LINUX Enterprise Server)
/usr/sbin/stonith -vSl	HA_stonith-vSl.txt	HeartBeat utility list information (when using SUSE LINUX Enterprise Server)

#

This information is collected only if software for which information is to be collected is installed.

Table 7-3 Information stored in the getras.tar.gz file

Output directory#1	Files	Explanation
The output destination directory specified when the DLMgetras utility is executed	getras.log	DLMgetras utility log file
/boot/default	grub	Boot loader GRUB2 configuration file (when using SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8)
/boot/efi/EFI	grub.cfg	Boot loader GRUB2 configuration file for UEFI (when using Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8)
	All files	Boot loader GRUB configuration file for UEFI (when using Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8)
/boot/grub	menu.lst	Boot selection list (when using SUSE LINUX Enterprise Server (IA32/EM64T/AMD64))
	grub.conf	Boot loader configuration file (when using Red Hat Enterprise Linux (IA32/EM64T/AMD64))
/boot/grub2	grub.cfg	Boot loader configuration file (when using SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7 or Red Hat Enterprise Linux 8)
/boot/loader/entries	All files	Boot loader configuration file (when using Red Hat Enterprise Linux 8)
/etc	crypttab	Block device information encrypted using LUKS (when using Red Hat Enterprise Linux 6 or Oracle Linux 6)
	dracut.conf	dracut settings file
	drbd.conf	DRBD settings file
	exports	File system information exported to the network file system
	evms.conf	Default value information file (when using SUSE LINUX Enterprise Server)
	fstab	Auto-mount information for the file system at startup

Output directory#1	Files	Explanation
	hba.conf	HBA settings file
	inittab	Boot process script
	kdump.conf	kdump settings file
	lilo.conf	Boot loader configuration file (when using IA32, EM64T, or AMD64)
	lpfc.conf	Emulex driver settings file
	mdadm.conf	md device settings
	modprobe.conf	Load module information file (when using SUSE LINUX Enterprise Server)
	modprobe.conf.local	Load module information file (when using SUSE LINUX Enterprise Server)
	mtab	Mount information
	qla*.conf	QLogic driver settings file
	raidtab	md device configuration file
	raw	Character-type device information (when using SUSE LINUX Enterprise Server)
	rc.sysinit	Start-up initialization script (when using Red Hat Enterprise Linux)
	rsyslog.conf	rsyslog settings file (when using SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/etc/ais	openais.conf	OpenAIS settings file
/etc/cron*	All subdirectories and files	cron file
/etc/dracut.conf.d	All subdirectories and files	dracut settings directory
/etc/hotplug	blacklist	Information about modules that have not been loaded by a hot plug
/etc/init.d	boot	Script for starting and initializing (when using SUSE LINUX Enterprise Server)
	boot.*	Script for starting and initializing (when using SUSE LINUX Enterprise Server)
	halt	Shutdown script

Output directory#1	Files	Explanation
/etc/init.d/boot.d	All subdirectories and files	Script for starting and initializing (when using SUSE LINUX Enterprise Server)
/etc/iscsi	initiatorname.iscsi	iSCSI initiator name settings file
	iscsid.conf	iSCSI settings file
/etc/iscsi/nodes	All subdirectories and files	Target settings file
/etc/libvirt/qemu	*.xml	KVM-related hardware configuration file (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/etc/lvm	.cache	Valid LVM information file (when using SUSE LINUX Enterprise Server)
	lvm.conf	LVM configuration settings file
/etc/lvm/backup	All subdirectories and files	LVM related file
/etc/lvm/cache	.cache	Valid LVM information file (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/etc/modprobe.d	All files	Load module information file (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/etc/ocfs2	cluster.conf	Oracle Cluster File System 2 settings file
/etc/opt/ DynamicLinkManager	auditlog.dat	Audit log settings file
	.dlmfdrv.conf	Configuration definition file
	.dlmfdrv1.conf .dlmfdrv2.conf .dlmfdrv3.conf	Backup files for the configuration definition file
	.dlmfdrv.unconf	File that defines non-HDLM-managed disks
	.dlmfdrv1.unconf .dlmfdrv2.unconf .dlmfdrv3.unconf	Backup files for the file that defines non-HDLM-managed disks
	d1mchname.conf	Device name replacement definition file

Output directory#1	Files	Explanation
	d1mchname1.conf d1mchname2.conf d1mchname3.conf	Backup files for the device name replacement definition file
	.d1mfdrv*.save	Configuration definition log file
	d1mmgr.xml	Manager setting information
	d1mmgr_DPC.xml	Dynamic I/O path control function settings file
	d1msnmp.properties	HDLM SNMP settings file
	d1mwebagent.properties	Hitachi Command Suite Common Agent Component settings file
	hdlm.conf	HDLM configuration information file
	hdlmboot*.log	HDLM boot log
	hdlm_kernel_version	Information about the kernel version used when HDLM was installed
	hdlm_utillog.conf	HDLM utility log settings file
/etc/rsyslog.d	*.conf	rsyslog settings file (when using SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/etc/sysconfig	boot	Boot process information file (when using SUSE LINUX Enterprise Server)
	irqbalance	Interrupt processing information (when using Red Hat Enterprise Linux)
	kdump	kdump settings file
	kernel	Kernel configuration file (when using SUSE LINUX Enterprise Server)
	lvm	Boot LVM information file (when using SUSE LINUX Enterprise Server)
	rawdevices	Character-type device information
	scsidev	SCSI device settings file (when using SUSE LINUX Enterprise Server)
	sysctl	sysrq information file (when using SUSE LINUX Enterprise Server)

Output directory#1	Files	Explanation
	xendomains	Xen settings file (when using SUSE LINUX Enterprise Server)
/etc/sysconfig/hdlm-scripts	All subdirectories and files	HDLM-related script
/etc/sysconfig/network	ifcfg-eth*	NIC network information
/etc/sysconfig/network-scripts	ifcfg-eth*	NIC network information
/etc/syslog-ng	syslog-ng.conf	syslog-ng settings file (when using SUSE LINUX Enterprise Server)
/etc/udev	udev.conf	udev configuration file#2
/etc/udev/rules.d	*.rules file	udev rule file (when using Red Hat Enterprise Linux, or SUSE LINUX Enterprise Server)
/etc/xen	*.sxp file	Xen settings file (when using SUSE LINUX Enterprise Server)
/etc/xen/auto	All subdirectories and files	Related files for enabling domains to automatically start (when using SUSE LINUX Enterprise Server)
/etc/xen/vm	All subdirectories and files	Domain-related files (when using SUSE LINUX Enterprise Server)
/lib/modules/kernel-name	modules.dep	Module dependency information
/proc	cmdline	Parameter information for kernel startup
	config.gz	Kernel configuration information (when using SUSE LINUX Enterprise Server)
	cpuinfo	CPU information
	devices	Device information
	diskstats	Disk statistics
	dma	DMA-related information
	drbd	DRBD status information
	filesystems	File system list
	interrupts	Information about interruption to a processor
	iomem	I/O memory map information
	ioports	I/O port information
	kallsyms	Kernel symbol information

Output directory#1	Files	Explanation
	loadavg	Information about average load time
	locks	File lock information
	mdstat	md device information
	meminfo	Memory information
	misc	MISC Driver information
	modules	Load module information
	mounts	Mount information
	partitions	Information about the partitions recognized by the kernel
	pci	PCI device list
	slabinfo	Slab cache information
	stat	Statistics
	swaps	SWAP information
	uptime	System's operating time information
	version	Kernel version information
/proc/irq	All subdirectories and files	IRQ information
/proc/scsi	All subdirectories and files	SCSI device information
/proc/sysvipc	All subdirectories and files	SystemV IPC object information
/proc/sys/dev	All subdirectories and files	Device-related parameter information
/proc/sys/fs	All subdirectories and files	File system parameter information
/proc/sys/kernel	All subdirectories and files	Kernel parameter information
/proc/sys/vm	All subdirectories and files	Virtual memory parameter information
/proc/xen	balloon	Xen-related information (when using SUSE LINUX Enterprise Server)
	capabilities	
/tmp	qemu.log	KVM-related log file (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/var/lib/dhclient	dhclient*	DHCP network information
/var/lib/dhcpd	dhcpd*	DHCP network information

Output directory#1	Files	Explanation
/var/lib/heartbeat/crm	cib.xml	Pacemaker settings file
/var/lib/iscsi/nodes	All subdirectories and files	Target settings file
/var/lib/xend	All subdirectories and files	domain-related files (when using SUSE LINUX Enterprise Server)
/var/log	boot.*	Startup log and message information (when using SUSE LINUX Enterprise Server)
	boot.log*	Boot log (when using Red Hat Enterprise Linux)
	cron*	Cron log file (when using Red Hat Enterprise Linux)
	messages*	Syslog file (including the cluster logs)
/var/log/xen	All subdirectories and files	Xen log files (when using SUSE LINUX Enterprise Server)
/var/opt/ DynamicLinkManager/ backups/dlmsetup/boot	grub.conf.save	Boot loader configuration file before being changed by using the <code>dlmbootstart</code> utility
	menu.lst.save	
	grub.save	
/var/opt/ DynamicLinkManager/ backups/dlmsetup/fstab	fstab.save	/etc/fstab before being changed by using the <code>dlmbootstart</code> utility
/var/opt/ DynamicLinkManager/ backups/dlmsetup/lvm	lvm.conf.save	/etc/lvm/lvm.conf before being changed by using the <code>dlmbootstart</code> utility
/var/opt/ DynamicLinkManager/log	dlmmgr1.log : dlmmgr16.log	HDLM manager log (including the driver log)
	dlmwebagent[1-N].log #3	Hitachi Command Suite Common Agent Component log files
	dlminquiry.log	Inquiry information log files
	dlmcfgmgr1.log, dlmcfgmgr2.log	dlmcfgmgr utility log files
	dlmperfinfo[1-2].log	dlmperfinfo utility execution log
	.dlmomtrace1.log .dlmomtrace2.log : .dlmomtrace5.log	On-memory trace log
	dlmkmgr1.log, dlmkmgr2.log	Process-specific-trace information file

Output directory ^{#1}	Files	Explanation
	hdlmtr1.log : hdlmtr64.log	Trace file
/var/opt/ DynamicLinkManager/log/ mmap	dlmkmgr.mm	Process-specific-trace related file
	hdlmtr.mm	Trace management file
/var/opt/ DynamicLinkManager/log/ dlmsetup	dlmbootstart.log dlmbootstart1.log : dlmbootstart3.log	dlmbootstart utility log files
	dlmbootsetup.log dlmbootsetup1.log : dlmbootsetup3.log	
	dlmfstabsetup.log dlmfstabsetup1.log : dlmfstabsetup3.log	
	dlmlvmsetup.log dlmlvmsetup1.log : dlmlvmsetup3.log	
	dlminitransetup.log dlminitransetup1.log : dlminitransetup3.log	
	dlminitransetup1.log : dlminitransetup3.log	
/var/spool/cron	All files	User-defined cron entry information (when using Red Hat Enterprise Linux)
/var/spool/cron/tabs	All files	User-defined cron entry information (when using SUSE LINUX Enterprise Server)
/var/tmp/hdlminstlog	All subdirectories and files	Installation log information

#1

Each output directory is created in the directory that is specified when the user expands the `getras.tar.gz` file.

#2

Information about the `rules` files specified for `udev_rules=` in the `udev.conf` file is also collected.

If a file name is specified, information about that file is collected.

If a directory name is specified, information about the `*.rules` files in that directory is collected.

#3

The value *N* depends on the setting in the `dmlwebagent.properties` file.

Table 7-4 Information stored in the `getras.tar.gz` file, which is recorded by the OS and HDLM commands when the DLMgetras utility is executed

Executed command	Files	Explanation
<code>/bin/df</code>	<code>bdf.txt</code>	Disk usage of the file system
<code>/bin/dmesg</code>	<code>dmesg.txt</code>	System diagnostic message
<code>/bin/ls -altR /boot/*</code>	<code>boot.txt</code>	List of files in the <code>/boot</code> directory
<code>/bin/ls -altR /dev</code>	<code>dev_dsk.txt</code>	List of disks to be handled as a block-type device
<code>/bin/ls -altR /dev/raw</code>	<code>dev_raw.txt</code>	List of disks to be handled as a character-type device
<code>/bin/ls -altR /etc/grub.d/*</code>	<code>grub_d.txt</code>	List of files in the <code>/etc/grub.d</code> directory of GRUB2
<code>/bin/ls -altR /etc/rc.d</code>	<code>rc.txt</code>	List of script files (when using Red Hat Enterprise Linux)
<code>/bin/ls -altR /etc/init.d</code>	<code>init.txt</code>	List of script files (when using SUSE LINUX Enterprise Server)
<code>/bin/ls -altR /opt/DynamicLinkManager</code> <code>/bin/ls -altR /var/opt/DynamicLinkManager/log</code> <code>/bin/ls -altRZ /var/opt/DynamicLinkManager/backups</code>	<code>DLMfilelist.txt</code>	List of files in the following directories: <ul style="list-style-type: none"> <code>/opt/DynamicLinkManager</code> <code>/var/opt/DynamicLinkManager/log</code> <code>/var/opt/DynamicLinkManager/backups</code>
<code>/bin/ls -altRZ /dev</code>	<code>dev_dsk_security.txt</code>	List of disks containing security context information that are handled as block-type devices (when using Red Hat Enterprise Linux)
<code>/bin/ls -altRZ /dev/raw</code>	<code>dev_raw_security.txt</code>	List of disks containing security context information that are handled as character-type devices (when using Red Hat Enterprise Linux)

Executed command	Files	Explanation
/bin/ls -altRZ /etc/rc.d	rc_security.txt	List of script files containing security context information (when using Red Hat Enterprise Linux)
/bin/ls -altRZ /opt/DynamicLinkManager	DLMfilelist_security.txt	List of files containing security context information in the following directories (when using Red Hat Enterprise Linux) <ul style="list-style-type: none"> • /opt/DynamicLinkManager • /var/opt/DynamicLinkManager/log
/bin/ls -l path-to-HDLM-driver /sbin/modinfo HDLM-driver-name	driver_info.txt	Information about the HDLM driver
/bin/mount -v	mount-v.txt	File system mount information
/bin/ps -elF	ps-elF.txt	Process information
/bin/ps -elL	ps-elL.txt	Thread information displayed in the LWD column
/bin/ps -elT	ps-elT.txt	Thread information displayed in the SPID column
/bin/ps -elm	ps-elm.txt	Thread information displayed after process information
/bin/ps -elZ	ps-elZ.txt	Process information that contains security context information (when using Red Hat Enterprise Linux)
/bin/rpm -qai	rpm-qai.txt	List of installed packages
/bin/rpm -qlv HDLM	HDLM_rpm-qlv.txt	HDLM package file information
/bin/rpm -V HDLM	rpm-V.txt	HDLM package revised information
/usr/bin/systemctl list-unit-files	list-unit-files.txt	Information about the service automatic-startup status
/usr/bin/systemctl status hdlm-devcfg-fcoe-pre	hdlm_systemd_service_status.txt	Unit status information (systemd hdlm-devcfg-fcoe-pre)
/bin/uname -a	uname-a.txt	OS version
/etc/init.d/drbd status	drbd-status.txt	DRBD status information
/etc/init.d/o2cb status	o2cb-status.txt	o2cb status information
/etc/init.d/openais status	openais-status.txt	OpenAIS status information

Executed command	Files	Explanation
/opt/ DynamicLinkManager/bin/ dlmgetomtrace	dlmgetomtrace.dmp	Trace information of HDLM functions
/opt/ DynamicLinkManager/bin/ dlmpr -k	dlmpr-k.txt	Persistent reservation information
/opt/ DynamicLinkManager/bin/ dlnkmgr view -lu -item slpr pn cp clpr type ic ie dnu hctl dpc phys	dlmmgr-lu.txt	HDLM LU information
/opt/ DynamicLinkManager/bin/ dlnkmgr view -lu -item all	dlmmgr-lu-all.txt	HDLM LU information (all items, including the number of times an intermittent error occurred)
/opt/ DynamicLinkManager/bin/ dlnkmgr view -path	dlmmgr-path.txt	HDLM path information
/opt/ DynamicLinkManager/bin/ dlnkmgr view -path - hbaportwwn	dlmmgr-path.txt	HDLM path information (including information about the port WWN on the HBA)
/opt/ DynamicLinkManager/bin/ dlnkmgr view -path -iem	dlmmgr-path-iem.txt	HDLM path information (including the number of times an intermittent error occurred)
/opt/ DynamicLinkManager/bin/ dlnkmgr view -drv	dlmmgr-drv.txt	Correspondence between an HDLM device, SCSI device, and LDEV information
/opt/ DynamicLinkManager/bin/ dlnkmgr view -sys, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -sfunc, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -msrv, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -adrv, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -pdrv, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -lic, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys -audlog,	dlmmgr-sys.txt	HDLM program information

Executed command	Files	Explanation
<pre>/opt/ DynamicLinkManager/bin/ dlnkmgr view -sys - lbpathusetimes, /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys - expathusetimes , /opt/ DynamicLinkManager/bin/ dlnkmgr view -sys - exrndpathusetimes</pre>		
/sbin/blkid	blkid.txt	Block device attribute information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/sbin/chkconfig --list	chkconfig.txt	Service settings
/sbin/cryptsetup luksDump <i>device-file</i>	cryptsetup-luksDump.txt	LUKS header information of SCSI or HDLM device files (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/sbin/cryptsetup status <i>device-name-used-by-the-device-mapper</i>	cryptsetup-status.txt	Device mapping information used by the HDLM devices and the device mapper (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/sbin/e2label	e2label.txt	Label information (all the SCSI device names and the corresponding label names are displayed in each line. If there is not a label, the hyphen (-) is displayed instead. If a Linux file system other than the <code>ext</code> file system is used, a label name is not recorded for label information.)
/sbin/dlmcfgmgr -v -udev	dlmcfgmgr-v.txt	Configuration information and management status of HDLM devices

Executed command	Files	Explanation
/sbin/fdisk -l	fdisk-l.txt	Disk information (when using IA32, EM64T, or AMD64)
/sbin/ifconfig -a	ifconfig-a.txt	Information about all NICs
/sbin/iscsiadm -m session -P 3	iscsi_m_session.txt#1	Session information at iSCSI (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Oracle Linux 6, Oracle Linux 7 or SUSE LINUX Enterprise Server 11)
/sbin/iscsiadm -m fw	iscsi_m_fw.txt#1	Firmware information at iSCSI (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Oracle Linux 6, Oracle Linux 7 or SUSE LINUX Enterprise Server 11)
/sbin/lilo -t	lilo-t.txt	Boot loader information (when using IA32, EM64T, or AMD64)
/sbin/lsmmod	lsmmod.txt	List of load modules
/sbin/lspci -v	lspci-v.txt	PCI information
/sbin/lvmdiskscan	lvmdiskscan.txt	Lvm disk information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server)
/sbin/lvs	lvs.txt	Logical volume information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server)
/sbin/o2cb_ctl -V	o2cb_ctl-V.txt	Oracle Cluster File System 2 version
/sbin/pvs	pvs.txt	Physical volume information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server)
/sbin/pvscan	pvscan.txt	Physical volume information

Executed command	Files	Explanation
/sbin/raw -qa	raw-qa.txt	Character-type device information (when using SUSE LINUX Enterprise Server 11)
/sbin/runlevel	runlevel.txt	Run level information
/sbin/sysctl -A	sysctl.txt	Kernel parameter information
/sbin/vgdisplay -v	vgdisplay-v.txt	Volume group information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server)
/sbin/vgs	vgs.txt	Volume group information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server)
ulimit -a	ulimit-a.txt	Limit values of the available system resources (data segment, stack segment, and file descriptor) for the process
/usr/bin/env	env.txt	Environment variables information
/usr/bin/free	free.txt	Memory information
/usr/bin/getconf PAGESIZE	getconfPAGESIZE.txt	Memory page size information
/usr/bin/ident dlnkmgr dlmmgr DLMgetras libdln.so libhdtmhcc-* libhdtmhccmp-* dlmcfmgr sddlmadv.ko sddlmadv.ko	whatlist.txt	Program build number (dlnkmgr, dlmmgr, DLMgetras, libdln.so, libhdtmhcc-*, libhdtmhccmp-*, dlmcfmgr, sddlmadv.ko, and sddlmadv.ko)
/usr/bin/iostat	iostat.txt	Device statistics
/usr/bin/iostat -p	iostat-p.txt	Block device statistics
/usr/bin/journalctl	systemd_journal.txt	systemd journal information
/usr/bin/lsdev	lsdev.txt	List of drivers (when using SUSE LINUX Enterprise Server)
/usr/bin/procinfo	procinfo.txt	Machine information (when using SUSE LINUX Enterprise Server)

Executed command	Files	Explanation
/usr/bin/raw -qa	raw-qa.txt	Character-type device information
/usr/bin/systemctl status hdlm-devcfg-pre.service	hdlm_systemd_service_status.txt	systemd hdlm-devcfg-pre.service unit status information
/usr/bin/systemctl status hdlm-devcfg-post.service	hdlm_systemd_service_status.txt	systemd hdlm-devcfg-post.service unit status information
/bin/raw -qa	raw-qa.txt	Character-type device information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/usr/bin/uptime	uptime.txt	System's operating time information
/sbin/udevadm info -e	udevadmininfo-e.txt	The udev database information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or SUSE LINUX Enterprise Server 11)
/usr/bin/virsh list --all	virsh-list.txt	KVM guest OS information (when using Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7 or Oracle Linux 8)
/usr/sbin/clvmd -V	clvmd-V.txt	clvmd version
/usr/sbin/crm_resource -L	crm_resource-L.txt	Pacemaker resource list
/usr/sbin/fcoeadm -i	fcoeadm-i.txt	FCoE management information in Open-FCoE (Information about all FCoE instances)
/usr/sbin/fcoeadm -l	fcoeadm-l.txt	FCoE management information in Open-FCoE (Information about all SCSI LUNs related to FCoE instances)
/usr/sbin/fcoeadm -t	fcoeadm-t.txt	FCoE management information in Open-FCoE (Information about all targets related to FCoE instances)

Executed command	Files	Explanation
/usr/sbin/getsebool -a	getsebool-a.txt	Security control values for daemon execution (Boolean values in SELinux) (when using Red Hat Enterprise Linux)
/usr/sbin/lsscsi	lsscsi.txt	SCSI device list information (when using SUSE LINUX Enterprise Server)
/usr/sbin/sestatus -v	sestatus-v.txt	SELinux information (when using Red Hat Enterprise Linux)
/usr/sbin/xm info	xm-info.txt	Information about domain0 (when using SUSE LINUX Enterprise Server)
/usr/sbin/xm list, /usr/sbin/xm list --long	xm-list.txt	Information about domains (when using SUSE LINUX Enterprise Server)

#1

The files will not be collected in Oracle Unbreakable Enterprise Kernel.

dlmbootstart utility for creating an HDLM boot disk environment

This utility allows you to edit the `/etc/fstab` file and the `/etc/lvm/lvm.conf` file, make changes to the boot loader configuration file, and create an HDLM boot disk environment by automatically creating an initial RAM disk image file for HDLM. Also, immediately after the HDLM boot disk environment has been configured by this utility, you can return to the original environment.

To execute this utility, all of the following conditions must be met:

- The system disk is a storage system disk.
- HDLM is installed.
- Configuration of the HDLM device is complete.

Note

Do not turn off the power of the host machine during execution of the `dlmbootstart` utility. Also, do not turn off the power of the host machine after the `dlmbootstart` utility is forced to stop.

Note that if you turn off the power to the host machine, the OS might be unable to start. If you cannot start the OS, contact your HDLM vendor or maintenance company, and report the information that was collected by the `DLMgetras` utility.

Format

```
/opt/DynamicLinkManager/bin/dlmbootstart {-set hdlm [-shutdown|-reboot]||-set restore|-h}
```

Parameters

`-set hdlm`

Configure the boot disk environment by editing the following files:

- `/etc/fstab`
- `/etc/lvm/lvm.conf`
- `/etc/opt/DynamicLinkManager/hdlm.conf` (in an OS other than SUSE LINUX Enterprise Server 11)
- Boot loader configuration file
- Initial RAM disk image file

`-shutdown`

Specify this parameter to automatically stop the host after the boot disk environment is configured.

`-reboot`

Specify this parameter to automatically restart the host after the boot disk environment is configured.

Notes

- If the processing of the utility that was run with the `-set hdlm` parameter specified ends normally, a backup of the file prior to the change will be created in `/var/opt/DynamicLinkManager/backups`.
- You must restart the host immediately after the utility is executed. If the utility is executed without specifying the `-shutdown` or `-reboot` parameter, manually restart the host.
- During execution of the utility, you can press **Ctrl+C** at the same time to stop configuration of the boot disk environment. In this situation, the status returns to the status before the utility was executed.
- If you execute the utility with the `-shutdown` or `-reboot` parameter specified, the KAPL12946-I message appears when the utility ends and the host stops or restarts one minute later. During this time, you can use **Ctrl+C** to interrupt the stop or restart processing of the host. However, the utility keeps the settings of the boot disk environment in which HDLM is used, instead of returning to the status before execution.
- Depending on the environment that you are using, internal processing of the utility might disable the swap. In this situation, even if you use **Ctrl+C** to stop the configuration of the boot disk environment, the statuses of the swap devices disabled by the utility do not revert to the statuses prior to execution of the utility, and the swap devices remain disabled.

`-set restore`

Specify this parameter to restore the state prior to the execution of `dlmbootstart -set hdlm`, by using the backup file that was created during the execution of `dlmbootstart -set hdlm`. If the environment prior to the execution of `dlmbootstart -set hdlm` was a boot disk environment that uses a SCSI device, the boot disk environment that uses a SCSI device will be restored. If the environment prior to the execution of `dlmbootstart -set hdlm` was a boot disk environment that uses an HDLM device, the boot disk environment that uses an HDLM device will be restored.

If you run the utility with the `-set restore` parameter specified, the file that was changed by running the utility with the `-set hdlm` parameter specified will be overwritten by the backup file.

Notes

- The environment built by executing the utility with the `-set hdlm` parameter can only be used to return to the original status. The initial RAM disk image file for the SCSI disk cannot be recreated. Also, if a user changes a file that was changed during execution of the utility with the `-set hdlm` parameter specified, the backup file will overwrite those user changes. For this reason, after execution of `dlmbootstart -set hdlm`, if you make important changes to a file that was changed by `dlmbootstart -set hdlm`, take a backup of that file.
- If the processing of the utility that was run with the `-set restore` parameter specified ends normally, the backup file in `/var/opt/DynamicLinkManager/backups` will be automatically deleted.
- The backup file created during execution of the utility with the `-set hdlm` parameter specified has only one generation. If unintended stops occur repeatedly during configuration of the boot disk environment with the `-set hdlm` parameter specified, the utility does not return to the status before execution even if you execute `dlmbootstart -set restore`.
- The file `/etc/opt/DynamicLinkManager/hdlm.conf` is not to be backed up. To create an initial RAM disk image file for SCSI after using this parameter to return to the original environment, set `n` for `hdlm_dracut`, which is defined in `/etc/opt/DynamicLinkManager/hdlm.conf`, and then execute the `dracut` command.

`-h`

Displays the format of the `dlmbootstart` utility.

dlmcfgmgr utility for managing the HDLM configuration

For management by HDLM, the HDLM-configuration definition utility obtains the SCSI device information stored by Linux by detecting the information on

the path between the host and storage system to register in HDLM, and then creates, updates, or deletes the HDLM devices. Also, this utility sets an HDLM device as a management target or excludes it from being managed.

When an existing device is updated during execution of this utility, the definition of the HDLM device is inherited.

Whenever you make any changes to the storage system configuration (adding or deleting an LU or path), LU partitions, or hardware configuration on the host, restart the host or execute the `dlmcfgmgr` utility to re-configure the HDLM devices.

The operation log is obtained while the `dlmcfgmgr` utility is executed.

Format

```
/sbin/dlmcfgmgr
    [-s]
    {-r
    |-o {logical-device-file-name-of-the-HDLM-device ...|all}
    |-i {logical-device-file-name-of-the-HDLM-device ...|all}
    |-v [-udev]
    |-u {logical-device-file-name-of-the-HDLM-device ...|all}
    |-extenddev {logical-device-file-name-of-the-HDLM-device ...|
all}
    |-logfs [dlmcfgmgr-utility-log-file-size]}
```

Parameters

The following table shows parameter names and functionality.

Table 7-5 Functionality of the parameters of the `dlmcfgmgr` utility

Parameter	Functionality
<code>-s</code>	Executes the <code>dlmcfgmgr</code> utility without displaying the confirmation message.
<code>-r</code>	Registers the HDLM device path while the host is running.
<code>-o</code>	Excludes a management-target HDLM device from being managed.
<code>-i</code>	Returns an HDLM device, which was excluded from being managed by HDLM, to being a management-target HDLM device.
<code>-v [-udev]</code>	Displays the management status and configuration information of all the HDLM devices recognized by HDLM.
<code>-u</code>	Deletes the paths displayed as hyphens (-) in the <code>Device</code> column of the HDLM device configuration information that is displayed by specifying the <code>-v</code> parameter.
<code>-extenddev</code>	Expands the capacity of an LU (HDLM device).
<code>-logfs</code>	Changes the size of the <code>dlmcfgmgr</code> utility log file (<code>dlmcfgmgr[1-2].log</code>).

`-s`

Specify this parameter when you do not want to display the confirmation messages during execution of the `dlnmcfmgmgr` utility. When you execute this utility with this parameter specified, the confirmation message for each HDLM device is not displayed.

Use this parameter when you want to skip a response to the confirmation message (to eliminate the manual intervention). For example, use this parameter when executing a command using a shell script or batch file.

When you specify the `-v` parameter, the message confirming that the utility is executed is not displayed even if you omit the `-s` parameter.

`-r`

Specify this parameter when you register, in HDLM, a path that HDLM has not recognized. When the `dlnmcfmgmgr` utility is executed, the logical device file of the HDLM device is created in the `/dev` directory. This enables a user to use an LDEV of the storage system as an HDLM device.

This parameter is used to create a new HDLM device definition: for example, when changing the configuration of the storage system (for example, add or delete an LU), or the host-side hardware configuration. The path definition information registered in HDLM is inherited even though the path is disconnected when the host starts.

If the SCSI device of the new path that HDLM detected is already registered (that is, when the path between the host and an LU of the storage system already exists and a new path is added), the same HDLM device mapped with the path already registered is allocated. If the SCSI device of the new path that HDLM detected is not yet registered (that is, when you define a new path from the host to an LU of the storage system), the HDLM device with the lowest available letter is allocated to the path. The following table shows examples of allocating a new HDLM device.

Table 7-6 Example: allocation of new HDLM devices

Status before executing the <code>dlnmcfmgmgr</code> utility (<code>dlnmcfmgmgr -r</code>)	Status after executing the <code>dlnmcfmgmgr</code> utility (<code>dlnmcfmgmgr -r</code>)
none	<code>/dev/sddlmaa #</code>
<code>/dev/sddlmaa</code>	<code>/dev/sddlmaa</code> <code>/dev/sddlmab #</code>
<code>/dev/sddlmaa</code> <code>/dev/sddlmab</code>	<code>/dev/sddlmaa</code> <code>/dev/sddlmab</code> <code>/dev/sddlmac #</code>
<code>/dev/sddlmaa</code> <code>/dev/sddlmac</code>	<code>/dev/sddlmaa</code> <code>/dev/sddlmab #</code> <code>/dev/sddlmac</code>
<code>/dev/sddlmab</code> <code>/dev/sddlmac</code>	<code>/dev/sddlmaa #</code> <code>/dev/sddlmab</code>

Status before executing the dlmcfgmgr utility (dlmcfgmgr -r)	Status after executing the dlmcfgmgr utility (dlmcfgmgr -r)
	/dev/sddlmac
/dev/sddlmaa : /dev/sddlmp	/dev/sddlmaa : /dev/sddlmp /dev/sddlmaa#
/dev/sddlmaa : /dev/sddlmaap	/dev/sddlmaa : /dev/sddlmaap /dev/sddlmbaa#

#

A newly assigned logical device file name of the HDLM device

Every time the host starts, the `dlmcfgmgr` utility (`dlmcfgmgr -r`) is automatically executed. This utility can be executed a number of times if necessary after starting the host. When this utility is executed, this utility checks the current HDLM settings. If a new path is detected, this utility registers the path dynamically so that the path can be used. The path status for the newly detected path or the existing path other than the Offline(C) path is changed to the current status. In this case, the path health checking and the automatic failback are executed at the same time.

If the error message KAPL10357-E is displayed, HDLM does not add an HDLM device even though a new LU was recognized. In this case, execute the `dlmcfgmgr` utility with the `-u` parameter to delete the unused HDLM device. This releases a usable name and you can create a logical device file for the HDLM device for a new LU.

Even if you execute the `dlmcfgmgr` utility (`dlmcfgmgr -r`) to add a path to an HDLM device that is not managed by HDLM, that HDLM device will not be managed by HDLM.

-o {logical-device-file-name-of-the-HDLM-device ...|all}

Use this parameter to exclude the management-target HDLM device from being managed.

You can specify one or more logical device file names of an HDLM device (`/dev/sddl[aa-pap]`) as a parameter value. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

If you want to exclude all the HDLM devices from being managed, specify `all`. Specifying `all` together with a logical device file name of the HDLM device causes an error.

Specifying the `-o` parameter without a parameter value also causes an error. If you specify a logical device file name of an HDLM device that does not exist, non-HDLM device, or HDLM device that is already defined as a non-HDLM-managed device, the specification is ignored.

The `dlmcfgmgr` utility with this parameter can be executed a number of times while Linux is running. The specified HDLM device can be excluded from being managed immediately after execution of the utility, except when the specified HDLM device is in use. If the specified HDLM device is in use, an error occurs.

You can use this parameter to exclude the HDLM devices that are no longer required to be managed by HDLM. The excluded HDLM devices are not displayed with the HDLM command's `view` operation and the HDLM device files for these devices are not created. Therefore, these devices become unavailable to the user.

`-i {logical-device-file-name-of-the-HDLM-device ...|all}`

Use this parameter to reset the HDLM device that has been excluded from being managed to an HDLM management target.

You can specify one or more logical device file names of an HDLM device (`/dev/sddlm[aa-pap]`) as a parameter value. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

If all the HDLM devices are the target, specify `all`. Specifying `all` together with a logical device file name of an HDLM device causes an error.

Specifying the `-i` parameter without a parameter value causes an error. If you specify a logical device file name of an HDLM device that does not exist, non-HDLM device, or HDLM device that is already defined as a management target, the specification is ignored.

The `dlmcfgmgr` utility with this parameter can be executed a number of times while Linux is running. The specified HDLM device becomes available immediately after execution of the utility.

You can use this parameter to reset an HDLM device that must be managed again to a management target. The HDLM devices reset to a management target are displayed with the HDLM command's `view` operation, and the HDLM device files for the devices are created. Therefore, these devices become available to the user again.

`-v [-udev]`

Use this parameter to display the management status and configuration information of all the HDLM devices recognized by HDLM.

Specify this parameter when you want to get the current status of management, configuration, or other information for the HDLM device.

With this parameter, the message confirming that the utility is executed is not displayed at execution of the utility even if you omit the `-s` parameter. Unlike the `-o`, `-i`, or `-u` parameter, the utility with this parameter specified can operate during the I/O processing to and from the HDLM device.

If you also want to check the `udev` name assigned to the SCSI device that corresponds to the HDLM device, specify the `-udev` parameter.

`-u {logical-device-file-name-of-the-HDLM-device ...|all}`

Use this parameter to delete the paths displayed as hyphens (-) in the `Device` column of HDLM device configuration information that is displayed by specifying the `-v` parameter.

You can specify one or more logical device file names of an HDLM device (`/dev/sddlm[aa-pap]`) as a value of the `-u` parameter. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#). Specifying the `-u` parameter without the parameter value causes an error.

If all the HDLM devices are the target, specify `all`. Specifying `all` together with a logical device file name of an HDLM device causes an error. If you specify the logical device file name for an HDLM device that does not exist or a non-HDLM device, the specification is ignored.

The `dlmcfgmgr` utility with this parameter can be executed a number of times while Linux is running. The re-configured HDLM device becomes available immediately after execution of the utility.

You can use this parameter to delete information about HDLM device paths for which a compatible SCSI device does not exist (paths displayed as hyphens (-) in the `Device` column of the HDLM device configuration information that is displayed by specifying the `-v` parameter), and to release the registration of the path from HDLM.

In general, the path information for the HDLM device is added at HDLM startup time once it is recognized. Even if the recognized HDLM device is not available because this path is disconnected or the LU is deallocated, the path information for the unavailable HDLM device will not be deleted automatically. Because the unused HDLM device path information is preserved, newly defined LUs and added paths cannot be used in some cases. This parameter is useful to eliminate such a problem.

If you specify this parameter with `all`, an HDLM device, which was simply disconnected at host boot time but is currently being used, might be assumed to be deleted. Before executing the `dlmcfgmgr` utility with this parameter set to a value of `all`, check the status of the HDLM device to be deleted by executing this utility with the `-v` parameter.

```
-extenddev {logical-device-file-name-of-the-HDLM-device ...|all}
```

If this parameter is specified, when the system is running, the capacity of the HDLM device specified for the `-extenddev` parameter and that of the SCSI device under the HDLM device will be compared. If the capacity of the HDLM device is smaller than that of the SCSI device, the capacity of the HDLM device will be expanded to match that of the SCSI device.

You can execute the `dlmcfgmgr` utility with this parameter specified, if the path status is Online and no error has occurred. Note that the utility will be executed regardless of whether the HDLM device is in use.

Note that you cannot reduce the capacity of an HDLM device. To reduce the capacity of an HDLM device, first execute `dlmcfgmgr -o` to remove the HDLM device from the HDLM management target, and then reduce the capacity. Then, execute `dlmcfgmgr -i` to add the HDLM device back to the HDLM management target. Alternatively, restart the server after changing the capacity, and then reconfigure the HDLM device.

You can specify one or more logical device file names of an HDLM device (`/dev/sddlma[aa-pop]`) as a parameter value. For details on logical device files for HDLM devices, see [Logical device files for HDLM devices on page 2-11](#).

If all the HDLM devices are the target, specify `all`. Specifying `all` together with a logical device file name of an HDLM device causes an error.

Specifying the `-extenddev` parameter without a parameter value causes an error. Similarly, an error occurs if you specify the file name of a logical device file of an HDLM device that does not exist, of a non-HDLM device, or of a device for which `dlnmcfmgr -o` was executed to remove the device from the HDLM management target.

`-logfs [dlnmcfmgr-utility-log-file-size]`

Use this parameter to change the size of the `dlnmcfmgr` utility log file (`dlnmcfmgr[1-2].log`).

For `dlnmcfmgr-utility-log-file-size`, specify a value in the range from 1024 to 999999 (in KB).

If the number of LUs to be managed by HDLM is 65 or more or the number of paths to be managed by HDLM is 129 or more, we recommend that you specify a value of 10240 KB or more.

When you change the log file size, the size of the current `dlnmcfmgr[1-2].log` file is not changed. The next `dlnmcfmgr[1-2].log` file will be created with the specified file size.

If you do not specify the log file size for the `dlnmcfmgr` utility, the current setting is displayed.

Examples

Example 1:

To register the path that HDLM has not identified, by confirming the execution of the utility:

In response to the confirmation message, enter `y` to execute the utility and `n` not to execute the utility.

```
# /sbin/dlnmcfmgr -r
KAPL10339-I This operation will change the configuration of HDLM devices. Do
you want to continue? [y/n] :
```

Example 2:

To exclude the HDLM device `sddlmaa` from being managed without confirming the execution of the utility:

```
# /sbin/dlmcfgmgr -s -o /dev/sddlmaa
KAPL10341-I The HDLM device configurations have been changed.
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

Example 3:

To delete the information for all the unavailable paths and unregister the path information from HDLM after confirming the execution of the utility:
In response to the confirmation message, enter *y* to execute the utility and *n* not to execute the utility.

```
# /sbin/dlmcfgmgr -u all
KAPL10339-I This operation will change the configuration of HDLM devices. Do
you want to continue? [y/n] : y
KAPL10341-I The HDLM device configurations have been changed.
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

Example 4:

```
# /sbin/dlmcfgmgr -v
HDevName      Management      Device      Host      Channel Target  Lun
/dev/sddlmaa   configured      /dev/sda    2          0          0      0
               /dev/sdb        2          0          0      1
/dev/sddlmaB   unconfigured    /dev/sdc    2          0          1      0
               -              2          0          1      1
KAPL10302-I /sbin/dlmcfgmgr completed normally.
#
```

The following table shows the items displayed.

Table 7-7 Information for the management status and configuration information of an HDLM device

Item	Description
HDevName	Indicates the logical device file name of the HDLM device, using an absolute path. This is indicated only for the first path for the relevant LU.
Management	Indicates the current management status of the HDLM device. configured: indicates that the HDLM device is to be managed. unconfigured: indicates that the HDLM device is excluded from being managed.
Device	Indicates the paths associated with the HDLM device. The logical device file of the SCSI device is indicated. The path whose allocation to an LU is canceled or path that was disconnected at boot time is temporarily registered into HDLM and indicated by a hyphen (-).

Item	Description
	<p>This problem might also occur when the OS is SUSE LINUX Enterprise Server 11 and one of the following problems occurs while the system is running:</p> <ul style="list-style-type: none"> • A path gets disconnected. • An LU is deleted. • A fiber cable connection is changed. • A Fibre Channel switch's zone setting is changed.
Host	Indicates the host ID (host port number).
Channel	Indicates the channel number (bus number).
Target	Indicates the target ID (target ID).
Lun	Indicates the Lun (host LU number).
Udev	<p>Indicates the udev name.</p> <p>The name of a device whose name has not been customized by using the <code>udev</code> function is indicated by a hyphen (-).</p>

Example 5:

The following shows an example of setting the size of the `dlmcfgmgr` utility log file:

```
#dlmcfgmgr -logfs 10240
```

In the above example, the setting value of the size of the `dlmcfgmgr` utility log file is 10240 KB.

Example 6:

The following shows an example of specifying the size of the `dlmcfgmgr` utility log file:

```
#dlmcfgmgr -logfs
KAPL10938-I dlmcfgmgr Log File Size(KB) : 10240
#
```

Reference information

If you do not specify a parameter, the syntax of the `dlmcfgmgr` utility is displayed.

```
# /sbin/dlmcfgmgr
KAPL10319-W usage: /sbin/dlmcfgmgr [-s]
                        { -r
                        | -o {special-file-name ... | all}
                        | -i {special-file-name ... | all}
                        | -v [-udev]
                        | -u {special-file-name ... | all}
                        | -extenddev {special-file-name ... | all}
                        | -logfs [log-file-size]}
```

Notes

- When an LDEV is allocated to a path and then another LDEV is allocated to the same path (host port number, bus number, target ID, and host LU number), the HDLM device name for the new LDEV might sometimes be the same as that for the old LDEV. For example, when an LDEV is deallocated while a host is running, another LDEV can be allocated to the same path. In this case, if an application preserves the settings to use that HDLM device name, a program such as a higher-level program product of HDLM accesses that HDLM device without recognizing that the LDEV was changed. This might result in data corruption. Check that the HDLM device name you previously used is nowhere to be found before deallocating the LDEV.
- You cannot execute multiple instances of the `dlnmcfgmgr` utility at the same time.
- You cannot execute the `dlnmcfgmgr` utility while the `dlnmstart` utility is executing.
- A logical device file name of the HDLM device file that can be specified with the `-i`, `-o`, or `-u` parameter of the `dlnmcfgmgr` utility can consist of up to 4,095 characters. If a name is more than 4,096 characters long, the error message KAPL10358-E is displayed.
- If an LU is allocated and another LU is reallocated using the same host LU number, HDLM does not handle them as different LUs. Therefore, restart the host whenever a configuration change is made.
- When two or more HDLM devices are specified with the `-s` parameter, the confirmation message is not displayed each time the processing for each HDLM device is executed. For example, when this utility executes an operation specified with the `-o` parameter for `/dev/sddlmaa`, `/dev/sddlmaab`, and `/dev/sddlmac`, the confirmation message KAPL10339-I is not displayed for the processing of each device. This message is displayed once at the beginning of the operation. If you enter `y`, the processing for all the specified HDLM devices (`/dev/sddlmaa`, `/dev/sddlmaab`, and `/dev/sddlmac`) is executed continuously.
- After changing partition configuration directly from a SCSI device for LUs corresponding to the HDLM devices not to be managed, if the HDLM device is returned to management target, execute the following operations:
 - a. Execute the `dlnmcfgmgr` utility with the `-i` parameter specified.
 - b. Execute the `dlnmcfgmgr` utility with the `-r` parameter specified.
- If you execute the `dlnmcfgmgr` utility with the `-i` parameter specified, the HDLM device that is not a management target can be changed to a managed status. At this time, if an error occurs anywhere on the paths to an HDLM device and you change that HDLM device to a managed status, the message KAPL08026-E might be output to the syslog. However, HDLM operations are not affected.

- If you execute the `dlmcfgmgr` utility with the `-r` parameter specified, the I/O and I/O error counts for existing paths displayed when the HDLM command (`dlmkmgr view -path`) is executed are initialized to 0.
- If an HDLM device that is managed on the active host is changed to be managed on the standby node, and then the same HDLM device is excluded from management on the standby node then, during the cluster creation, an error will occur when the active node is failed over. When the `dlmcfgmgr` utility is executed with the `-o` parameter specified to exclude an HDLM device from management on the standby node, make sure that you exclude the same HDLM device from management on the active node.
- When an HDLM device is bound to a raw device, do not attempt to exclude that HDLM device from management by executing the `dlmcfgmgr` utility with the `-o` parameter specified. If the HDLM device is not being managed, an error will occur when the raw device is accessed.
- After configuring an HDLM device by executing the `dlmcfgmgr` utility, do not change the settings of the `sysfs` interface that handles SCSI devices.
- After configuring an HDLM device by executing the `dlmcfgmgr` utility, if you unload the HBA driver, perform the operations below. If you load the HBA driver without first performing the operations, the number of HDLM paths that cannot be used might increase.
 - a. Update the HDLM device with information about unavailable SCSI devices by executing the `dlmcfgmgr` utility with the `-r` parameter specified.
 - b. Delete the HDLM device by executing the `dlmcfgmgr` utility with `all` specified in the `-u` parameter.
- If you execute the `dlmcfgmgr` utility with the `-r` parameter after dynamically deleting a SCSI device, the HDLM device will become unavailable. If you then add the SCSI device dynamically and execute the `dlmcfgmgr` utility with the `-r` parameter specified, the HDLM partition information will be lost from `/proc/partitions`. To restore the information, follow these steps:
 - a. Delete the SCSI device you just added.
 - b. Dynamically add the SCSI device once again.
 - c. Execute the `online` operation to place the device path online.
 - d. Execute the `dlmcfgmgr` utility with the `-r` parameter specified.
- If you execute the `dlmcfgmgr` utility with the `-r` parameter specified while all paths connecting to the HDLM device are disconnected, the HDLM partition information will be lost from `/proc/partitions`. To restore the HDLM partition information, follow these steps:
 - a. Connect the path and place the device online.
 - b. Execute `blockdev --rereadpt HDLM-device` to update the partition information.

dmlchname HDLM device name replacement utility

This utility changes an HDLM device name. This utility can also assign the same HDLM device name to disks that are used by multiple hosts for the same purpose and assign the same HDLM device name to a disk shared in a cluster.

For details on how to change an HDLM device name, see [Changing an HDLM device name on page 4-53](#).

Format

```
/opt/DynamicLinkManager/bin/dmlchname [-f | -o]
```

Parameters

-f

Specify this parameter to change the name of an HDLM device that is being used.

You must restart the host after the command is completed.

-o

Specify this parameter to output the correspondence between the current iLUs and HDLM device names to the device name replacement definition file (/etc/opt/DynamicLinkManager/dmlchname.conf).

The device name definition file is backed up for three generations (including the current device name definition file).

Important

- If you execute the `dmlchname` utility without specifying any parameters, initial values (0) are set for all statistics (number of I/Os and number of I/O errors) managed by HDLM.
- If the `-f` parameter is not specified, the name of an HDLM device that is being used cannot be changed.
- For disks, such as system disks, that cannot be placed in offline during system operation, execute the HDLM device name replacement utility with the `-f` parameter specified, and then restart the host to change the name.
If an HDLM device name is changed with the `-f` parameter specified, the following restrictions are applied until the host restarts:
 - An error occurs if the `dmlcfgmgr` utility is executed.
 - The HDLM device name before the change is used in I/Os.
- When changing the name of an HDLM device that is a member of an LVM volume group, execute the `dmlchname` utility, and then the `vgscan` command.
- You cannot execute the `dmlchname` utility on HDLM devices that are not configured.

Editing the device name replacement definition file

This subsection explains how to edit the device name replacement definition file (`/etc/opt/DynamicLinkManager/dlmchname.conf`).

How to edit the device name replacement definition file

Keep the following in mind when you edit the device name replacement definition file:

- Specify a storage system serial number, an iLU, and an HDLM device name on one line, separating each one with a space.
- To enter a comment line, specify a hash mark (#) at the beginning of the line.

Items to be defined in the device name replacement definition file

In the device name replacement definition file, the correspondence among storage system serial numbers, iLUs, and HDLM device names is defined.

Execute the `dlmchname` utility with the `-o` parameter to create a device name replacement definition file (`/etc/opt/DynamicLinkManager/dlmchname.conf`). An example of executing the command is as follows:

```
3585011299 0090 sddlmac
3585011299 0091 sddlmaab
3585011299 0092 sddlmaa
```

To change an HDLM device name, edit only the third field, which indicates the HDLM device name.

For details about the characters that can be used for HDLM device names, see [Logical device files for HDLM devices on page 2-11](#).

#

When several digits are output before storage system serial numbers, ignore them.

dlmmkinitrd utility for supporting a boot disk

This utility creates an initial RAM disk image file for using an HDLM device as a boot disk.

Note that, for Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15, the `dlmmkinitrd` utility is not installed. To create an initial RAM disk image file in Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15, use the `dracut` command.

Format

For SUSE LINUX Enterprise Server 11

```
/opt/DynamicLinkManager/bin/dlmmkinitrd  
    [-i initrd-image]  
    [-b boot-directory]  
    [-h]
```

Parameters

For SUSE LINUX Enterprise Server 11

When creating an initial RAM disk image file, you can do so without specifying the image file name and the path for the file to be created, or you can specify these parameters.

When omitting the parameter specification:

Use the kernel that is currently running to create an initial RAM disk image file in the `/boot` directory.

The default initial RAM disk image file name for the `vmlinuz-version` kernel is `initrd-version.hdlm`.

Example:

The name of the initial RAM disk image file for the `vmlinuz-2.6.16.46-0.14-bigsm` kernel is `initrd-2.6.16.46-0.14-bigsm.hdlm`.

`-i initrd-image`

Specify the name of the initial RAM disk image file to be created by using the `dlmmkinitrd` utility. This parameter is used to create an initial RAM disk image file with a name other than the default file name (`initrd-version.hdlm`).

If you specify the full path of the initial RAM disk image file:

Even if you specify the `-b` parameter at the same time, the parameter specification is ignored.

If you specify the relative path of the initial RAM disk image file and do not specify the `-b` parameter:

The path is assumed to be the relative path from the `/boot` directory.

If you specify the relative path of the initial RAM disk image file and the `-b` parameter:

The path is assumed to be the relative path from the location in which the initial RAM disk image file is to be created, which is specified by the `-b` parameter.

`-b boot-directory`

Specify the path for the location in which the initial RAM disk image file is to be created. This parameter is used to create an initial RAM disk image file in a directory other than the default directory (`/boot`).

`-h`

Displays the format of the `dlmmkinitrd` utility.

The utility for displaying HDLM performance information (dlmperfinfo)

This utility collects performance information about the paths managed by HDLM, and then displays the information or outputs it to a file.

If you obtain performance information before starting operation and again during operation, you can check the performance of each path by comparing the obtained information.

Notes

- When the function for displaying performance information is used, the amount of memory required by the HDLM driver increases.
The amount of additionally required memory is as follows:
Amount of memory used by each path: 352 bytes
Maximum amount of memory used: Amount of memory used by each path * the number of paths
- The amount of memory used by this utility is as follows:
3MB + (3000 bytes * the number of paths)
- Do not change the path configuration while the `dlmperfinfo` utility is running. If you change the path configuration, the processing to acquire performance information will be interrupted.

Format

To collect performance information only once, or to specify the number of times to collect performance information

```
/opt/DynamicLinkManager/bin/dlmperfinfo {[-i time-interval-for-collecting-performance-information] [-c count] [-f CSV-file-name [-o]] [-a] [-t] | -h}
```

To collect performance information repeatedly until a user stops the utility

```
/opt/DynamicLinkManager/bin/dlmperfinfo -c 0 {[-i time-interval-for-collecting-performance-information] [-f CSV-file-name [-m number-of-measurements-for-a-single-file] [-r total-number-of-files]] [-a] [-t] | -h}
```

Parameters

`-i time-interval-for-collecting-performance-information`

Specify, in seconds, the time interval for which performance information is to be collected. Collection of performance information will start when the utility is executed and continue for the specified time interval. The collected information is then displayed. If you omit this parameter, the default value will be used.

- Default value: 300 (5 minutes)
- Minimum value: 1 (1 second)
- Maximum value: 3600 (1 hour)

`-c count`

Specify this parameter if you want to collect performance information multiple times for the time interval specified for the `-i` parameter. If you omit this parameter, the default value will be used.

If you specify 0, the utility will be executed in succession until the user stops the execution. To stop the utility, press **Ctrl+C** to terminate the processing.

- Default value: 1
- Minimum value: 0
- Maximum value: 1440

`-f CSV-file-name`

Specify this parameter to output the performance information to a CSV file. If you specify this parameter, performance information will not be output to the standard output.

If you specify 0 for the `-c` parameter, `_YYYYMMDDhhmmss.csv` will be added to the end of the name of the specified CSV file to which the performance information is to be output. `YYYYMMDDhhmmss` indicates the time (coordinated universal time) at which the file was created.

Example

If a CSV file is created at 09:30:00 (coordinated universal time) on April 01, 2018 by specifying `-c 0 -f dlmperfinfo.csv`, its file name will be as follows:

```
dlmperfinfo.csv_20180401093000.csv
```

`-o`

If the file specified for the `-f` parameter already exists, the file will be overwritten. If you omit this parameter, the file will not be overwritten, and processing will be canceled.

This parameter is valid when the `-f` parameter is specified.

If you specify 0 for the `-c` parameter, the file will always be overwritten regardless of whether the `-o` parameter is specified.

`-m number-of-measurements-for-a-single-file`

Specify the number of measurements to be output to a single CSV file. When the number of measurements reaches the specified value, a new CSV file will be created.

You can specify this parameter only when 0 is specified for the `-c` parameter.

- Default value: 60
- Minimum value: 1
- Maximum value: 1440

`-r total-number-of-files`

Specify the maximum for the total number of CSV files. When the total number of CSV files reaches the specified number, the oldest CSV file will be deleted.

You can specify this parameter only when 0 is specified for the `-c` parameter.

- Default value: 192
- Minimum value: 2
- Maximum value: 10000

`-a`

Specify this parameter to display all performance information items. For details on the items that will be displayed, see [Table 7-8 Output information on page 7-43](#).

`-t`

Specify this parameter if you do not want to display the performance information header.

`-h`

Displays the format of the `dmlperfinfo` utility.

Example

```
# /opt/DynamicLinkManager/bin/dmlperfinfo -i 300 -c 2
KAPL13031-I The utility for displaying HDLM performance information
(dmlperfinfo) will now start. Start time = 2017/08/30 13:33:02
Paths:000008
StartTime : 2017/08/30 13:33:02
LDEV          HDevName Device   PathID Count_R/s Count_W/s
MB_R/s MB_W/s  Time_R   Time_W
VSP_5000.39303.000034 sddlmaa /dev/sdn 000000      39      1
0.1529 0.0020 178.7573 577.9713
VSP_5000.39303.000034 sddlmaa /dev/sdj 000001      27     15
0.1043 0.0581 296.1975 635.3980
VSP_5000.39303.000035 sdlmab /dev/sdo 000002      36      3
0.1419 0.0103 181.3033 574.9685
VSP_5000.39303.000035 sdlmab /dev/sdk 000003      28     12
0.1086 0.0486 264.5819 631.7705
VSP_Ex00.416044.0000DC sddlmac /dev/sdp 000004      36      5
0.1392 0.0201 182.9648 660.8496
VSP_Ex00.416044.0000DC sddlmac /dev/sdl 000005      31     10
```

```

0.1198 0.0408 199.3436 612.3772
VSP_Ex00.416044.0000DD sddlma /dev/sdq 000006      33      9
0.1303 0.0337 200.1740 628.4486
VSP_Ex00.416044.0000DD sddlma /dev/sdm 000007      33      7
0.1287 0.0271 209.2022 592.1750
StartTime : 2017/08/30 13:38:02
LDEV          HDevName Device    PathID Count_R/s Count_W/s
MB_R/s MB_W/s  Time_R   Time_W
VSP_5000.39303.000034 sddlmaa /dev/sdn 000000      28      4
0.1083 0.0173 191.2685 629.1892
VSP_5000.39303.000034 sddlmaa /dev/sdj 000001      25      8
0.0965 0.0311 229.8288 605.9427
VSP_5000.39303.000035 sddlma /dev/sdo 000002      31      0
0.1210 0.0005 178.9322 521.0268
VSP_5000.39303.000035 sddlma /dev/sdk 000003      21     12
0.0809 0.0472 301.9184 606.0571
VSP_Ex00.416044.0000DC sddlma /dev/sdp 000004      27      6
0.1049 0.0234 181.4669 649.0319
VSP_Ex00.416044.0000DC sddlma /dev/sdl 000005      26      6
0.0999 0.0249 200.4265 595.3118
VSP_Ex00.416044.0000DD sddlma /dev/sdq 000006      25      8
0.0967 0.0310 173.3032 600.1512
VSP_Ex00.416044.0000DD sddlma /dev/sdm 000007      28      4
0.1080 0.0173 193.9738 612.7454
KAPL13032-I The utility for displaying HDLM performance information
(dlmperfinfo) finished. End time = 2017/08/30 13:43:02

```

Displayed performance information

When you execute the `dlmperfinfo` utility, the following information is displayed.

- Number of I/Os
- I/O transfer amount
- I/O response time
- Number of I/Os and I/O blocks that are being processed

The following table provides details about the displayed information.

Table 7-8 Output information

Item	Description
Paths	Number of paths that were measured. If the <code>-t</code> parameter was specified, this item is not output.
StartTime	Time when performance measurement started. This item is output as many times as the value specified for the <code>-c</code> parameter. This item is displayed only in the console window.
UTC	Coordinated universal time. This item is output in <code>YYYYMMDDThhmmss</code> format. Example: 20170707T123000

Item	Description
	If the <code>-f</code> parameter was specified, this item is output to the CSV file.
Date	Date (year, month, and date) when measurement started. This item is output in <code>YYYYMMDD</code> format. Example: 20170707 If the <code>-f</code> parameter was specified, this item is output to the CSV file.
Time	Time (hour, minute, second) when measurement started. This item is output in <code>hhmmss</code> format. If the <code>-f</code> parameter was specified, this item is output to the CSV file.
LDEV	Information about LDEVs. The model ID, serial number, and iLU number for the storage system, separated by periods. This item is always output.
HDevName	Host device name. The name of the logical device file (minus the partition number), <code>/dev/sddlm[aa-pap]</code> , for the HDLM device. For details on logical device files for HDLM devices, see Logical device files for HDLM devices on page 2-11 . This item is always output.
Device	Device file. SCSI device associated with an HDLM device. If the SCSI device is not connected when a host starts, or the assigned LU is released, this column displays a hyphen (-). This problem might also occur when the OS is SUSE LINUX Enterprise Server 11 and one of the following problems occurs while the system is running: <ul style="list-style-type: none"> • A path gets disconnected. • An LU is deleted. • A fiber cable connection is changed. • A Fibre Channel switch's zone setting is changed. This item is always output.
PathID	The AutoPATH_ID. This item is always output.
PathName	The path name. If the <code>-a</code> parameter was specified, this item is output.
HBAPortWWN	Port WWN information of the HBAs. If the <code>-a</code> parameter was specified, this item is output.
ChaPort	Port number of the CHA If the <code>-a</code> parameter was specified, this item is output.
Status	Status of the path.

Item	Description
	If the -a parameter was specified, this item is output.
Count_R/s	Number of read I/Os per second. Unit: number of I/Os This item is always output.
Count_W/s	Number of write I/Os per second. Unit: number of I/Os This item is always output.
Count_R/s-Rnd	Number of random read I/Os per second. Unit: number of I/Os If the -a parameter was specified, this item is output.
Count_R/s-Seq	Number of sequential read I/Os per second. Unit: number of I/Os If the -a parameter was specified, this item is output.
Count_W/s-Rnd	Number of random write I/Os per second. Unit: number of I/Os If the -a parameter was specified, this item is output.
Count_W/s-Seq	Number of sequential write I/Os per second. Unit: number of I/Os If the -a parameter was specified, this item is output.
MB_R/s	Amount of data handled by read I/Os per second. Unit: MB This item is always output.
MB_W/s	Amount of data handled by write I/Os per second. Unit: MB This item is always output.
MB_R/s-Rnd	Amount of data handled by random read I/Os per second. Unit: MB If the -a parameter was specified, this item is output.
MB_R/s-Seq	Amount of data handled by sequential read I/Os per second. Unit: MB If the -a parameter was specified, this item is output.
MB_W/s-Rnd	Amount of data handled by random write I/Os per second. Unit: MB If the -a parameter was specified, this item is output.
MB_W/s-Seq	Amount of data handled by sequential write I/Os per second. Unit: MB If the -a parameter was specified, this item is output.

Item	Description
Time_R	Average response time of read I/Os. Unit: Microsecond This item is always output.
Time_W	Average response time of write I/Os. Unit: Microsecond This item is always output.
Time_R-Rnd	Average response time of random read I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Time_R-Seq	Average response time of sequential read I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Time_W-Rnd	Average response time of random write I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Time_W-Seq	Average response time of sequential write I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_R	Maximum response time of read I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_W	Maximum response time of write I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_R-Rnd	Maximum response time of random read I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_R-Seq	Maximum response time of sequential read I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_W-Rnd	Maximum response time of random write I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Max-Time_W-Seq	Maximum response time of sequential write I/Os. Unit: Microsecond If the -a parameter was specified, this item is output.
Count_Error	Number of I/O errors. Unit: number of I/Os If the -a parameter was specified, this item is output.

Item	Description
	<p>Notes</p> <ul style="list-style-type: none"> ◦ The total number of I/O errors during the time interval for which performance information was collected is output. ◦ The number of I/O errors includes both read I/O errors and write I/O errors.
Time_Error	<p>Average response time of I/O errors.</p> <p>Unit: Microsecond</p> <p>If the <code>-a</code> parameter was specified, this item is output.</p> <p>Note</p> <ul style="list-style-type: none"> ◦ The I/O error response time includes the response times for both read I/Os and write I/Os.
QueuedIO	<p>Average number of I/Os being processed if a path was selected.</p> <p>Unit: number of I/Os</p> <p>If the <code>-a</code> parameter was specified, this item is output.</p>
QueuedMB	<p>Average amount of data handled by the I/Os being processed if a path was selected.</p> <p>Unit: MB</p> <p>If the <code>-a</code> parameter was specified, this item is output.</p>
Max-QueuedIO	<p>Maximum number of I/Os being processed if a path was selected.</p> <p>Unit: number of I/Os</p> <p>If the <code>-a</code> parameter was specified, this item is output.</p>
Max-QueuedMB	<p>Maximum amount of data handled by the I/Os being processed if a path was selected.</p> <p>Unit: MB</p> <p>If the <code>-a</code> parameter was specified, this item is output.</p>

Outputting a CSV file

If the `-f` parameter is specified for the `dlmperfinfo` utility, performance information will be output to the specified file[#]. The output item names and values are enclosed in double quotation marks (") and delimited by commas (CSV format). For details on the information that is output, see [Table 7-8 Output information on page 7-43](#).

#

If you specify 0 for the `-c` parameter, `_YYYYMMDDhhmmss.csv` will be added to the end of the name of the specified CSV file to which the performance information is to be output. `YYYYMMDDhhmmss` indicates the time (coordinated universal time) at which the file was created.

An example of an output CSV file is provided below.

Example: Executing the utility

```
# /opt/DynamicLinkManager/bin/dlmpferfinfo -i 300 -c 2 -f file-name
KAPL13031-I The utility for displaying HDLM performance information
(dlmpferfinfo) will now start. Start time = 2017/08/30 13:34:55
KAPL13047-I Performance information is now being measured. (1 / 2)
KAPL13047-I Performance information is now being measured. (2 / 2)
KAPL13032-I The utility for displaying HDLM performance information
(dlmpferfinfo) finished. End time = 2017/08/30 13:44:56
```

Example: Outputting a CSV file

```
[Paths:000008]
"UTC","Date","Time","LDEV","HDevName","Device","PathID","Count_R/
s","Count_W/s","MB_R/s","MB_W/s","Time_R","Time_W"
"20170830T044335","20170830","134335","VSP_5000.39303.000034","sddlma
a","/dev/
sdn","000000","30","3","0.1173","0.0134","166.2703","625.4919"
"20170830T044335","20170830","134335","VSP_5000.39303.000034","sddlma
a","/dev/
sdj","000001","25","9","0.0970","0.0366","180.1263","637.2924"
"20170830T044335","20170830","134335","VSP_5000.39303.000035","sddlma
b","/dev/
sdo","000002","29","4","0.1137","0.0154","179.5969","663.3387"
"20170830T044335","20170830","134335","VSP_5000.39303.000035","sddlma
b","/dev/
sdk","000003","24","9","0.0952","0.0335","229.5274","683.1288"
"20170830T044335","20170830","134335","VSP_Ex00.416044.0000DC","sddlma
ac","/dev/
sdp","000004","28","7","0.1083","0.0254","186.9855","627.8596"
"20170830T044335","20170830","134335","VSP_Ex00.416044.0000DC","sddlma
ac","/dev/
sdl","000005","27","6","0.1049","0.0245","195.8313","586.1036"
"20170830T044335","20170830","134335","VSP_Ex00.416044.0000DD","sddlma
ad","/dev/
sdq","000006","27","6","0.1073","0.0240","172.0459","632.1648"
"20170830T044335","20170830","134335","VSP_Ex00.416044.0000DD","sddlma
ad","/dev/
sdm","000007","27","7","0.1059","0.0259","189.1432","605.9836"
"UTC","Date","Time","LDEV","HDevName","Device","PathID","Count_R/
s","Count_W/s","MB_R/s","MB_W/s","Time_R","Time_W"
"20170830T044835","20170830","134835","VSP_5000.39303.000034","sddlma
a","/dev/
sdn","000000","27","5","0.1069","0.0193","176.7588","657.4251"
"20170830T044835","20170830","134835","VSP_5000.39303.000034","sddlma
a","/dev/
sdj","000001","26","8","0.1007","0.0296","193.0229","576.9321"
"20170830T044835","20170830","134835","VSP_5000.39303.000035","sddlma
b","/dev/
sdo","000002","28","4","0.1100","0.0168","165.8784","586.8735"
"20170830T044835","20170830","134835","VSP_5000.39303.000035","sddlma
b","/dev/
sdk","000003","25","8","0.0975","0.0320","181.1106","594.3750"
"20170830T044835","20170830","134835","VSP_Ex00.416044.0000DC","sddlma
ac","/dev/
sdp","000004","26","7","0.1021","0.0267","168.9082","620.6742"
"20170830T044835","20170830","134835","VSP_Ex00.416044.0000DC","sddlma
ac","/dev/
sdl","000005","27","6","0.1055","0.0220","182.2214","582.3260"
```

```
"20170830T044835","20170830","134835","VSP_Ex00.416044.0000DD","sddlm
ad","/dev/
sdq","000006","26","7","0.1020","0.0264","183.5498","1642.2365"
"20170830T044835","20170830","134835","VSP_Ex00.416044.0000DD","sddlm
ad","/dev/
sdm","000007","27","6","0.1043","0.0223","192.6760","570.5610"
```

Note

- If you specify 0 for the `-c` parameter, the utility will be executed in succession until the user stops the execution. To stop the utility, press **Ctrl+C** to terminate the processing.
- Before outputting a CSV file, calculate the necessary disk capacity by using the following formula to ensure that there is sufficient space on the disk to which the CSV file is to be output. In addition, delete CSV files that are no longer required.
 - When 0 is specified in the `-c` parameter:
 - When the `-a` parameter is specified:
 $1025 \text{ bytes} * ((\text{number-of-paths} + 1) * \text{value-specified-for-the-m-parameter}) + 1 * \text{value-specified-for-the-r-parameter} \text{ (bytes)}$
 - When the `-a` parameter is not specified:
 $671 \text{ bytes} * ((\text{number-of-paths} + 1) * \text{value-specified-for-the-m-parameter}) + 1 * \text{value-specified-for-the-r-parameter} \text{ (bytes)}$
 - When 0 is not specified in the `-c` parameter:
 - When the `-a` parameter is specified:
 $1025 \text{ bytes} * ((\text{number-of-paths} + 1) * \text{value-specified-for-the-c-parameter} + 1) \text{ (bytes)}$
 - When the `-a` parameter is not specified:
 $671 \text{ bytes} * ((\text{number-of-paths} + 1) * \text{value-specified-for-the-c-parameter} + 1) \text{ (bytes)}$

Example 1: When collecting performance information 288 times with the `-a` parameter specified in an environment with 3,060 paths

When `dlmperfinfo -c 288 -f CSV-file-name -a` is executed, the file size is as follows:

$1025 * ((3060 + 1) * 288 + 1) = 903608225 \text{ (bytes)}$ (approx. 862 MB)

Example 2: When collecting files for one year by assuming that the data collected in intervals of one minute in a single day is one file, with the `-a` parameter specified in an environment with 500 paths

The `-m` parameter is calculated as follows: 60 minutes * 24 hours = 1440, and the `-r` parameter is calculated as follows: the number of days in a year + 1 = 366. Therefore, when `dlmperfinfo -i 60 -c 0 -f CSV-file-name -m 1440 -r 366 -a` is executed, the file size is as follows:

$1025 * (500 + 1) * (1440+1) * 366 = 270836166150 \text{ (bytes)}$ (approx. 252.2 GB)

Example 3: When keeping the total size of files to no more than 2 TB by assuming the number of measurements for a single file to be 1,440, with the `-a` parameter specified in an environment with the 1,000 paths

Value of the `-r` parameter = $2 * 1024^4 / (1025 * 1001 * 1441) \approx 1487.3$ (files)

This means that you can create up to 1,487 files to keep the total size of the files to no more than 2 TB, and `dmlperfinfo -c 0 -f CSV-file-name -m 1440 -r 1487 -a` can be executed.

- Use the following formula to obtain the number of lines to be output in a CSV file. Calculate the number of lines to be output in a single file to adjust the number of measurements.
 - When 0 is specified in the `-c` parameter:
 $(\text{number-of-paths} + 1) * \text{value-specified-for-the-m-parameter} + 1$
Note that, if you execute the utility with the `-t` parameter specified to hide the header, the number of lines will be as follows:
 $\text{number-of-paths} * \text{value-specified-for-the-m-parameter}$
 - When 0 is not specified in the `-c` parameter:
 $(\text{number-of-paths} + 1) * \text{value-specified-for-the-c-parameter} + 1$
Note that, if you execute the utility with the `-t` parameter specified to hide the header, the number of lines will be as follows:
 $\text{number-of-paths} * \text{value-specified-for-the-c-parameter}$

Example 1: The number of lines when the results for 500 measurements are output in a single file by hiding the header in an environment with 500 paths

$(500 + 0) * 500 + 0 = 250000$ (lines)

Example 2: The number of measurements that keeps the number of lines to no more than 1048576, including the header, in an environment with 1000 paths

$(1048576 - 1) / (1000 + 1) \approx 1047.5$ (times)

This means that the results for up to 1,047 measurements can be output to a single file.

dmlpr utility for clearing HDLM persistent reservation

If the persistent reservation of the LU is not canceled for some reason, this utility clears the reservation key to cancel the persistent reservation.

This utility can be used when one of the following OSs is used for the host OS:

- Red Hat Enterprise Linux 6
- Red Hat Enterprise Linux 7
- Red Hat Enterprise Linux 8
- Oracle Linux 6

- Oracle Linux 7
- Oracle Linux 8

Format

```
/opt/DynamicLinkManager/bin/dlmpr {-k | -c} [sdn] [sdn] ... [-a]
| -h}
```

Parameters

-k

Specify this parameter to display the reservation key. The following explains the items displayed when the -k parameter is specified:

Reservation Key

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.

sdn

Specify the SCSI device (*sdn*) for which you want to display or clear the reservation key. You can specify more than one SCSI device.

If you omit this parameter, the utility displays or clears the reservation keys for all SCSI devices.

-a

Even if an error occurs during processing, processing continues for all remaining SCSI devices.

-h

Displays the format of the utility for clearing HDLM persistent reservation.

Example

To check the reservation keys, and then clear a reservation key:

1. Execute the `dlmpr` utility to display the reservation keys for *sda*, *sdb*, *sd_c*, *sdd*, *sde*, and *sdf*.

```
# /opt/DynamicLinkManager/bin/dlmpr -k sda sdb sdc sdd sde sdf
sda  Reservation Key : [0aaaaaaaaaaaaaaaaa]
      Regist Key    : [0aaaaaaaaaaaaaaaaa], Key Count : 1
sdb  Reservation Key : [0xbbbbbbbbbbbbbbbbbb]
      Regist Key    : [0aaaaaaaaaaaaaaaaa], Key Count : 2
      Regist Key    : [0xbbbbbbbbbbbbbbbbbb], Key Count : 2
```

```
sdc  Reservation Key : [0xbbbbbbbbbbbbbbbb]
      Regist Key : [0xbbbbbbbbbbbbbbbb], Key Count : 4
sdd  Reservation Key : [0xaaaaaaaaaaaaaa]
      Regist Key : [0xaaaaaaaaaaaaaa], Key Count : 4
sde  Reservation Key : [0x0000000000000000]
sdf  Reservation Key : [0x0000000000000000]
      Regist Key : [0xaaaaaaaaaaaaaa], Key Count : 1
      Regist Key : [0xbbbbbbbbbbbbbbbb], Key Count : 1
```

2. Execute the `dlmpr` utility to clear the reservation key.

```
# /opt/DynamicLinkManager/bin/dlmpr -c sdb sdc
```

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 sdb was cleared.
KAPL10642-I Reservation Key of sdc was cleared.
```

Note

Before executing the `dlmpr` utility, make sure that the LU for which persistent reservation will be cleared is not being accessed.

If you perform the following operation while both of the following conditions exist, an error occurs when reservation-key is read, and `0x????????????????` is displayed.

Conditions

- Multiple paths are configured to the HDLM device.
- A persistent reservation has been set by the cluster software.

Operation

- a. Clear persistent reservation, specifying the SCSI device.
- b. Execute the `dlmpr` utility with the `-k` parameter specified to display the PersistentReserve information for a SCSI device associated with a different path.

If the above display error occurs, re-execute the `dlmpr` utility with the `-k` parameter specified.

dlmsetopt utility for setting HDLM driver options

This utility changes the settings for the HDLM filter driver. Restart the host machine to apply the changed settings. Note that you do not need to restart the host machine every time you execute the `dlmsetopt` utility. If you execute the `dlmsetopt` utility more than once, restart the host after you have finished specifying all settings. Restarting the host enables all the changed settings.

Format

```
/opt/DynamicLinkManager/bin/dlmsetopt {-r retrycount | -inqt  
InquiryTimeout | -inqr InquiryRetry | -prsup ReserveStatus | -h}
```

Parameters

-r

Specify the number of retries when memory is allocated in the filter driver. If memory allocation fails, the system retries at intervals of 0.05 seconds. If retrying for a long time results in I/O not being executed, set an appropriate retry count. If that retry count is exceeded and memory allocation fails, the KAPL05708-E message is output to syslog and to the HDLM manager log file.

retrycount

Specify a numeric value from -1 to 2,147,483,646.

-1 : The system retries until memory is allocated. This is the initial value of the system.

0 : The system does not retry.

1 to 2,147,483,646: The system retries the specified number of times.

If the following values are specified, the message KAPL12559-E is displayed and then the processing terminates:

- Non-numeric value
- Value less than -1
- Value more than 2,147,483,646

-inqt

Specify, in seconds, the timeout value of the `SCSI INQUIRY` command. In HDLM, the default timeout value is 30 seconds. Note that the timeout value specified by using the `-inqt` parameter only applies to the `SCSI INQUIRY` command executed from HDLM. This value has no effect on the `SCSI INQUIRY` command executed from another application.

InquiryTimeout

Specify a numeric value of -1 or in the range from 1 to 3,600.

-1: This sets the timeout value to 30 seconds, which is HDLM's default value.

1 to 3,600: Timeout value (in seconds)

If the following values are specified, the message KAPL12553-W is displayed and then the processing ends:

- 0
- Value less than -1
- Value more than 3,600
- Non-numeric value

-inqr

Specify the number of retries of the `SCSI INQUIRY` command. In HDLM, the default number of retries is 1. Note that the number of retries specified by using the `-inqr` parameter only applies to the `SCSI INQUIRY` command executed from HDLM. This value has no effect on the `SCSI INQUIRY` command executed from another application.

InquiryRetry

Specify a numeric value in the range from -1 to 2,147,483,646.

-1: This sets the number of retries to 1, which is HDLM's default value.

0: The system does not retry.

1 to 2,147,483,646: The system retries the specified number of times.

If the following values are specified, the KAPL12553-W message is displayed and then processing ends:

- Value less than -1
- Value more than 2,147,483,646
- Non-numeric value

`-prsup`

Specify this parameter when linking with a cluster that supports persistent reservations (RHCM).

ReserveStatus

Specify `on` or `off`. The default value is `off`.

`on`: Links with a cluster that supports persistent reservations.

`off`: Does not link with a cluster that supports persistent reservations.

You can use this parameter for the following OSs:

- Red Hat Enterprise Linux 6
- Red Hat Enterprise Linux 7
- Red Hat Enterprise Linux 8

`-h`

Displays the format of the `dlmsetopt` utility for setting the HDLM driver option.

Example

Example 1:

In this example, the utility sets the retry count to 100000:

```
# /opt/DynamicLinkManager/bin/dlmsetopt -r 100000
KAPL12554-I The utility for setting HDLM driver option has
started.
KAPL12555-I The utility for setting HDLM driver option completed
normally.
KAPL12558-I Please restart the computer so that the option
settings take effect.
```


Example 2:

In this example, the utility displays Help:

For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 6, Oracle Linux 7, Oracle Linux 8 or Oracle Unbreakable Enterprise Kernel:

```
# /opt/DynamicLinkManager/bin/dlmsetopt -h
KAPL12554-I The utility for setting HDLM driver option has
started.
Usage: dlmsetopt {-r retrycount | -inqt InquiryTimeout | -
inqr InquiryRetry | -prsup ReserveStatus | -h}
        retrycount:      -1          = Infinite
                        0           = No Retry
                        1-2147483646 = Retry Count
        InquiryTimeout: -1          = Default Timeout(30(s))
                        1-3600      = Inquiry Timeout Value
        InquiryRetry:   -1          = Default Retry(1)
                        0           = No Retry
                        1-2147483646 = Inquiry Retry Count
        ReserveStatus:  on          = Persistent Reserve
Support
                        off          = No Persistent Reserve
Support(Default)
KAPL12555-I The utility for setting HDLM driver option
completed normally.
```

For OSs other than the above:

```
# /opt/DynamicLinkManager/bin/dlmsetopt -h
KAPL12554-I The utility for setting HDLM driver option has
started.
Usage: dlmsetopt {-r retrycount | -inqt InquiryTimeout | -
inqr InquiryRetry | -h}
        retrycount:      -1          = Infinite
                        0           = No Retry
                        1-2147483646 = Retry Count
        InquiryTimeout: -1          = Default Timeout(30(s))
                        1-3600      = Inquiry Timeout Value
        InquiryRetry:   -1          = Default Retry(1)
                        0           = No Retry
                        1-2147483646 = Inquiry Retry Count
KAPL12555-I The utility for setting HDLM driver option
completed normally.
```

Notes

- The contents specified in the `dlmsetopt` utility are written to the `options sddlmfdrv` line of the conf files. Do not attempt to edit this line using an editor such as `vi`. The following table lists the names of `conf` files used by the `dlmsetopt` utility.

Table 7-9 conf files used by the dlmsetopt utility

OS	File name
SUSE LINUX Enterprise Server 11	/etc/modprobe.conf
Red Hat Enterprise Linux 6	/etc/modprobe.d/dlmdrvopt.conf
Red Hat Enterprise Linux 7	
Red Hat Enterprise Linux 8	
Oracle Linux 6	
Oracle Linux 7	
Oracle Linux 8	
SUSE LINUX Enterprise Server 12	
SUSE LINUX Enterprise Server 15	
Oracle Unbreakable Enterprise Kernel 6	
Oracle Unbreakable Enterprise Kernel 7	
Oracle Unbreakable Enterprise Kernel 8	

- If you use the `dlmsetopt` utility in an environment where an HDLM device is used for the boot disk, after changing the settings, you need to re-create the initial RAM disk image file. To re-create the file, use the `dracut` command for Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15, and the `dlmmkinitrd` utility for supporting a boot disk for other OSs. If you change the name of the initial RAM disk image file, change the settings file for the boot loader so that the re-created initial RAM disk image file is used during boot-up. For details on this procedure, see the following table.

Table 7-10 Setting file names for boot loaders

Boot loader			Configuration file name
GRUB	BIOS	Red Hat Enterprise Linux Oracle Unbreakable Enterprise Kernel 6	/boot/grub/grub.conf
		SUSE LINUX Enterprise Server 11	/boot/grub/menu.lst
	UEFI	Red Hat Enterprise Linux 6	/boot/efi/EFI/redhat/grub.conf
GRUB2	BIOS	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	/boot/grub2/grub.cfg
	UEFI	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/boot/efi/EFI/redhat/grub.cfg

- When you specify the `-prsup on` parameter, you need to restart the host to enable the setting. To link with Lifekeeper, do not set the `-prsup on` parameter.

dlnmstart utility for starting HDLM

You must perform the following operations after installing HDLM:

- Load an HDLM alert driver and a filter driver.
- Configure an HDLM device.
- Start the HDLM manager.

The `dlnmstart` utility performs the above operations as a batch operation.

If an HDLM alert driver and a filter driver have already been loaded or the HDLM manager is already running, the relevant operation is not performed.

Format

```
/opt/DynamicLinkManager/bin/dlnmstart
```

Notes

- You cannot execute multiple instances of the `dlnmstart` utility at the same time.
- You cannot execute the `dlnmstart` utility while the `dlnmcfmgr` utility is executing.
- If you execute the `dlnmstart` utility, the I/O and I/O error counts for existing paths displayed when the HDLM command (`dlnkmgr view - path`) is executed are initialized to 0.
- If you execute the `dlnmstart` utility, do not change the settings of the `sysfs` interface that handles SCSI devices after an HDLM device is configured.

dlnmupdatesysinit utility for updating system scripts

In an environment that uses Red Hat Enterprise Linux, if you update the `initscripts` package after installing HDLM, HDLM information in the `/etc/rc.d/rc.sysinit` file might be lost.

In an environment that uses SUSE LINUX Enterprise Server, if you update the `aaa_base`, `raidtools`, `mdadm`, or `lvm2` package after installing HDLM, HDLM information in the `/etc/init.d/boot.localfs` file, the `/etc/init.d/boot.md` file, or the `/etc/init.d/boot.lvm` file might be lost.

If the HDLM information is lost, execute the `dlnmupdatesysinit` utility to re-register the information. For details on the conditions for executing the this utility, see [Notes on Linux on page 3-86](#).

Format

`/opt/DynamicLinkManager/bin/dlmupdatesysinit`

Examples

Example 1:

In this example, the HDLM information is lost in an environment that uses Red Hat Enterprise Linux. In the following execution example, the utility re-registers the HDLM information in the `rc.sysinit` file:

```
# /opt/DynamicLinkManager/bin/dlmupdatesysinit
KAPL13501-I The utility for update system scripts started.
KAPL13503-I A system script has been modified. File name = /etc/
rc.d/rc.sysinit
KAPL13502-I The utility for update system scripts completed
successfully.
```

Example 2

In this example, the utility was executed but there was no need to re-register the HDLM information:

```
# /opt/DynamicLinkManager/bin/dlmupdatesysinit
KAPL13501-I The utility for update system scripts started.
KAPL13502-I The utility for update system scripts completed
successfully.
```

installgetras utility for collecting HDLM installation error information

This utility collects the error log information needed to analyze errors that occurred during HDLM installation. The collected information is compiled in a file and output to a specified directory. The following file is output:

- `installgetras.tar.gz`
This is a compressed file that contains information related to HDLM installation processing.

For details on the information included in this output file, see [Error information to be collected on page 7-59](#).

Format

*mount-point-of-HDLM-installation-media/HDLM_Linux/installgetras
directory-to-which-collected-information-is-output*

Parameters

directory-to-which-collected-information-is-output

Specify the output directory for the information collected by `installgetras`. The collected information is compiled in the `installgetras.tar.gz` file and output to the specified directory. You cannot specify the root directory (/) for the directory to which collected information is output.

Error information to be collected

The following shows the information collected when HDLM is being installed:

- `installgetras.tar.gz`
This file contains information related to errors that occurred during HDLM installation. The following table describes the detailed information contained in `installgetras.tar.gz`.

Table 7-11 Information contained in `installgetras.tar.gz`

Output directory [#]	File	Description
<i>output-directory-of-collected-information-specified-when-executing-the-installgetras-utility</i>	<code>installgetras.log</code>	Log file of the <code>installgetras</code> utility
<code>/var/log</code>	<code>messages</code>	OS syslog file
<code>/var/tmp/hdlminstlog</code>	All subdirectories and files	Log information created during HDLM installation

#

This directory is created in *directory-to-which-collected-information-is-output* specified when the `installgetras` utility was executed.

installhdlm utility for installing HDLM

You can use this utility to perform a new installation, upgrade installation, or re-installation of HDLM.

The utility can also be used to perform an unattended installation. An unattended installation enables a user to install HDLM without entering information. Before you perform an unattended installation, you must define the information required for installation in the installation-information settings file.

For details about how to perform an unattended installation, see [Installing HDLM on page 3-94](#).

Format

```
mount-point-of-HDLM-installation-media/installhdlm [-v | -h | [-f
installation-information-settings-file-name | -update ] ]
```

Parameters

- `-v`
Displays the version of HDLM to be installed.
- `-h`
Displays the format of the `installhdlm` utility.
- `-f installation-information-settings-file-name`
Specify this parameter when performing an unattended installation of HDLM. Specify the installation-information settings file for this parameter. For details about the installation-information settings file, see [Editing an installation-information settings file on page 7-60](#).
- `-update`
Specify this parameter when performing an upgrade installation or a reinstallation of HDLM. If you specify this parameter, an upgrade installation can be performed while HDLM is in use. However, you need to restart the server immediately after upgrade installation or reinstallation is completed. An initial RAM disk image file is automatically created after upgrade installation or reinstallation is completed. The format of the name of the created initial RAM disk image file depends on the version[#] of the current OS. If a file with the same name as the initial RAM disk image file to be created already exists, the existing file is saved by adding the extension `.save` to the file name. The backup file for one generation is saved. The format of the name of the created file is as follows:
- Red Hat Enterprise Linux6 or Oracle Unbreakable Enterprise Kernel6:
`initramfs-hdlm-version-of-the-current-OS#.img`
 - SUSE LINUX Enterprise Server11:
`initrd-version-of-the-current-OS#.hdlm`
- [#]
The value output by the `/bin/uname -r` command.

Editing an installation-information settings file

This section describes how to edit the installation-information settings file.

How to edit an installation-information settings file

Keep the following in mind when you edit an installation-information settings file:

- Enter keys in the order of the keys defined in the sample file `sample_installhdlm.conf`.
- Enter one key and one setting per line.
- Enter values in the *key-name=setting* format.

- To enter a comment line, specify a hash mark (#) at the beginning of the line.
- If a specified value is not allowed for the key setting, the KAPL09212-E and KAPL09228-W message is output.

Items to be defined in an installation-information settings file

The following describes the information defined in the installation information settings file.

[INSTALLATION_SETTINGS] section

This section defines information that is used when the `installhdlm` utility is executed. Specify this section name at the beginning of the installation information settings file (although an empty paragraph or comment line can be inserted above this section name).

The following table lists and describes the keys defined in the [INSTALLATION_SETTINGS] section.

Table 7-12 Keys in the [INSTALLATION_SETTINGS] section

Key name	Description	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>licensekeyfile#1</code>	Specify the absolute path name of a license key file that is provided in *.plk format. The default is <code>/var/tmp/hdlm_license</code> . If you perform an upgrade installation or re-installation without updating the license, delete the <code>licensekeyfile</code> key and value.	Optional# 2	Optional# 2	1024
<code>licensekey#1</code>	Specify the absolute path name of a license key file that was created by using the following command: <code># echo "license-key" > "license-key-file"</code> The default is <code>/etc/opt/DynamicLinkManager/dlm.lic_key</code> . If you perform an upgrade installation or re-installation without updating the license, delete the <code>licensekey</code> key and value.	Optional# 2	Optional# 2	1024

Key name	Description	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>driver_config</code>	Specify either of the following values to indicate whether to load the HDLM driver and configure the HDLM device: y: Load the HDLM driver and configure the HDLM device (default). n: Do not load the HDLM driver and configure the HDLM device.	Optional	Optional	1
<code>restart</code>	Specify whether to restart the host after installation. Specify either of the following values: y: Restart. n: Do not restart (default). If you are installing HDLM in an IP-SAN environment or an FCoE environment, specify n.	Optional	Optional	1

Legend:

Optional: If a key and its setting are not specified, the default value will be used.

However, for an upgrade installation or re-installation, the previous license information will be inherited for the `licensekeyfile` and `licensekey` keys.

#1

If no value is specified for either of these keys, the files below are read in the order listed:

- a. License key file (`/var/tmp/hdlm_license`)
- b. File containing the license key (`/etc/opt/DynamicLinkManager/dlm.lic_key`)

If none of these files exist when you attempt to perform a new installation, the KAPL09011-E and KAPL09212-E message is output.

If you specify a value for either the `licensekey` or `licensekeyfile` key, the specified file will not be deleted after the `installhdlm` utility is executed. If you do not specify a value for either key, the license key file (`/var/tmp/hdlm_license`) or the file in which the license key is described (`/etc/opt/DynamicLinkManager/dlm.lic_key`) will be deleted after the `installhdlm` utility is executed.

#2

When you perform a new installation of HDLM, or when you perform an upgrade installation while the license is expired, prepare the license key file.

[ENVIRONMENT_SETTINGS] section

This section defines HDLM operation information. If this section is omitted, the installer will use the following values:

- For a new installation, the installer uses the default values of the keys that are listed in the following [Table 7-13 Keys in the \[ENVIRONMENT_SETTINGS\] section on page 7-63](#).
- For an upgrade installation or re-installation, the installer uses the old HDLM setting values.

The following table lists and describes the keys defined in the [ENVIRONMENT_SETTINGS] section.

Table 7-13 Keys in the [ENVIRONMENT_SETTINGS] section

Key name#1	Description#2	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
load_balance	Specify one of the following values to indicate whether to enable or disable the load balancing function: on: Enabled (default) off: Disabled	Optional	Optional	3
load_balance_type	Specify one of the following values to indicate the load balancing algorithm: rr: The Round Robin algorithm exrr: The Extended Round Robin algorithm lio: The Least I/Os algorithm exlio: The Extended Least I/Os algorithm (default) lbk: The Least Blocks algorithm exlbk: The Extended Least Blocks algorithm	Optional	Optional	5
load_balance_same_path_use_times	Specify the number of times the same path can be used for I/O	Optional	Optional	6

Key name#1	Description#2	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
	operations when the Round Robin (rr), Least I/Os (lio), or Least Blocks (lbk) algorithm is used for load balancing. You can specify a value from 0 to 999999. The default is 32.			
lbex_usetimes_limit	Specify the number of times the same path can be used for sequential I/O operations when the extended Round Robin (exrr), Least I/Os (exlio), or Least Blocks (exlbk) algorithm is used for extended load balancing. You can specify a value from 0 to 999999. The default is 100.	Optional	Optional	6
lbex_random_io_usetimes_limit	Specify the number of times the same path can be used for random I/O operations when the extended Round Robin (exrr), Least I/Os (exlio), or Least Blocks (exlbk) algorithm is used for extended load balancing. You can specify a value from 0 to 999999. The default is 1.	Optional	Optional	6
error_log_level	Set the level of error information that is collected as error logs. You can set a level from 0 to 4. The default is 3.	Optional	Optional	1
error_log_size	Set the size of the error log files (dlmmgr[1-16].log) in kilobytes. You can set a size from 100 to 2000000. The default is 9900.	Optional	Optional	7
error_log_number	Set the number of error log files (dlmmgr[1-16].log). You can set a value from 2 to 16. The default is 2.	Optional	Optional	2
trace_level	Set the trace output level. You can set a level from 0 to 4. The default is 0.	Optional	Optional	1

Key name#1	Description#2	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
trace_file_size	Set the size of the trace files (hdlmtr[1-64].log) in kilobytes. You can set a size from 100 to 16000. The default is 1000.	Optional	Optional	5
trace_file_number	Set the number of trace files (hdlmtr[1-64].log). You can set a value from 2 to 64. The default is 4.	Optional	Optional	2
path_health_check	Specify one of the following values to indicate whether to enable or disable the path health check function: on: Enabled (default) off: Disabled	Optional	Optional	3
path_health_check_interval	Specify the interval in minutes at which the path health check is performed. You can specify a check interval from 1 to 1440. The default is 30.	Optional	Optional	4
auto_failback	Specify one of the following values to indicate whether to enable or disable the automatic failback function for failed paths: on: Enabled (default) off: Disabled	Optional	Optional	3
auto_failback_interval	Specify the interval in minutes from the time the previous path status check finished until the time the next path status check started. You can specify a check interval from 1 to 1440. The default is 1.	Optional	Optional	4
intermittent_error_monitor#3	Specify one of the following values to indicate whether to enable or disable intermittent error monitoring: on: Enabled off: Disabled (default)	Optional	Optional	3

Key name ^{#1}	Description ^{#2}	Necessity of definition		Maximum number of characters
		New installation	Upgrade installation or re-installation	
<code>intermittent_error_monitor_interval</code>	Specify the interval in minutes that monitoring for intermittent errors is performed. You can specify a check interval from 1 to 1440. The default is 30.	Optional	Optional	4
<code>intermittent_error_monitor_number</code>	Specify the number of times an error occurs. You can specify a value from 1 to 99. The default is 3.	Optional	Optional	2
<code>dynamic_io_path_control</code>	Specify whether to enable or disable the dynamic I/O path control function by using the values below. Note that, if this function is set, the setting for each storage system or LU is cleared. on: Enabled off: Disabled (default)	Optional	Optional	3
<code>dynamic_io_path_control_interval</code>	For the dynamic I/O path control function, specify the checking interval (in minutes) for reviewing the information about the switching of controllers performed by the storage system. ^{#4} You can set the checking interval from 1 to 1440. The default is 10.	Optional	Optional	4

Legend:

Optional: If a key and its setting are not specified, the installer uses the default.

#1

If you are upgrading or re-installing HDLM, the current configuration is applied for any setting that is not specified.

#2

For details about the functions set by these keys, see [set \(sets up the operating environment\) on page 6-15](#).

#3

You can specify this key only in the following cases:

- For a new installation:

When `on` is specified for the `auto_failback` key in the installation information settings file

- For an upgrade installation or re-installation:

When `on` is specified for the `auto_failback` key in the installation information settings file, or when automatic failback is enabled in the installation pre-settings

#4

The checking interval can be set regardless of whether the dynamic I/O path control function is enabled or disabled.

The following shows an example of an edited installation information settings file.

```
[INSTALLATION_SETTINGS]
licensekeyfile=/var/tmp/hdlm_license
licensekey=/etc/opt/DynamicLinkManager/dlm.lic_key
driver_config=y
restart=n

[ENVIRONMENT_SETTINGS]
load_balance=on
load_balance_type=exlio
load_balance_same_path_use_times=32
lbex_usetimes_limit=100
lbex_random_io_usetimes_limit=1
error_log_level=3
error_log_size=9900
error_log_number=2
trace_level=0
trace_file_size=1000
trace_file_number=4
path_health_check=on
path_health_check_interval=30
auto_failback=on
auto_failback_interval=1
intermittent_error_monitor=off
# intermittent_error_monitor_interval=210
# intermittent_error_monitor_number=3
# dynamic_io_path_control=off
# dynamic_io_path_control_interval=10
```

installux.sh utility for HDLM common installer

This utility determines what OS HDLM will be installed on, and installs the corresponding version of HDLM from the DVD-ROM. This utility can also perform unattended installations via a parameter specification.

For details about how to use this utility to install HDLM, see [Installing HDLM on page 3-94](#).

Format

```
HDLM-installation-media-mount-point/installlux.sh [-v | -h | [-f  
installation-information-settings-file]
```

Parameters

- v
Displays the HDLM version to be installed.
- h
Displays the format of the `installlux.sh` utility.
- f *installation-information-settings-file*
Specify this parameter to perform an unattended installation for HDLM.
Specify an installation-information settings file for this parameter.
For details about installation-information settings files, see [Editing an installation-information settings file on page 7-60](#).

Log file

The `installlux.sh` utility outputs execution information to the log file `/var/tmp/hdlm_installlux_sh.log`. If the `hdlm_installlux_sh.log` log file already exists, the utility appends execution information to the end of the log file.

If the size of the log file is equal to or greater than 1 MB when the utility is executed, the log file is renamed to `hdlm_installlux_sh2.log`, and a new log file is created and named `hdlm_installlux_sh.log`, to which the execution information is output.

Note

The `hdlm_installlux_sh.log` and `hdlm_installlux_sh2.log` log files are not deleted when HDLM is removed. Manually delete the log files, if they are no longer required.

Utility for removing HDLM (removehdlm)

This utility removes HDLM.

Format

```
/opt/DynamicLinkManager/remover/removehdlm [ -h ]
```

Parameters

- h
Displays the format of the `removehdlm` utility.

Messages

This chapter describes the format and meaning of the message IDs, and also the terms used in the messages and message explanations. For details on the meaning of the return codes output by HDLM when it receives a request from Global Link Manager and measures to take for them, see [Return codes for Hitachi Command Suite Common Agent Component on page 8-183](#).

- ☐ [Before viewing the list of messages](#)
- ☐ [KAPL01001 to KAPL02000](#)
- ☐ [KAPL03001 to KAPL04000](#)
- ☐ [KAPL04001 to KAPL05000](#)
- ☐ [KAPL05001 to KAPL06000](#)
- ☐ [KAPL06001 to KAPL07000](#)
- ☐ [KAPL07001 to KAPL08000](#)
- ☐ [KAPL08001 to KAPL09000](#)
- ☐ [KAPL09001 to KAPL10000](#)
- ☐ [KAPL10001 to KAPL11000](#)
- ☐ [KAPL11001 to KAPL12000](#)
- ☐ [KAPL12001 to KAPL13000](#)
- ☐ [KAPL13001 to KAPL14000](#)

- [KAPL15001 to KAPL16000](#)
- [Return codes for Hitachi Command Suite Common Agent Component](#)

Before viewing the list of messages

This section explains the following information that is needed to locate messages and understand the explanations in the sections from [KAPL01001 to KAPL02000 on page 8-4](#).

- Format and meaning of the message IDs
- Terms used in the messages and message explanations

The information is explained below.

Format and meaning of message IDs

Each message has a message ID. The following table shows the format and meaning of message IDs.

Table 8-1 Format and meaning of the message ID KAPLnnnnn-I

Format	Meaning
KAPL	Indicates that the message is an HDLM message.
nnnnn	Message serial number for the module
I	Message level C: Critical E: Error W: Warning I: Information

Terms used in messages and message explanations

The following table shows the terms that appear in messages and the terms that are used for explanation (meaning, description, and handling) of the messages.

Table 8-2 Terms used in the messages and message explanations

Terms	Meaning
aa...aa	Variable (If a message contains two or more variables, they are displayed as <i>bb...bb</i> , <i>cc...cc</i> , and so on.)
Operation name	The operation name that is input after <code>dlmkmgr</code> in the command.

Components that output messages to syslog

Some messages for the following components are output to syslog:

- HDLM manager
- HDLM driver (filter component)
- HDLM alert driver

- HDLM management target

KAPL01001 to KAPL02000

Message ID	Message Text	Explanation
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>When the <code>view -path</code>, <code>view -lu</code>, or <code>view -drv</code> operation is executed, <code>view(-pstv)</code> is displayed if the Physical Storage View is disabled, and <code>view(-vstv)</code> is displayed if the Physical Storage View is disabled.</p> <p><i>aa...aa</i>: Specified operation name</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>: Specified operation name</p> <p>Action</p> <p>None.</p>
KAPL01003-W	No operation name is specified.	<p>Details</p> <p>An 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><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 help (displays the operation format) on page 6-4.</p>
KAPL01005-W	A parameter is invalid. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Specified operation name</p> <p><i>bb...bb</i>: Specified parameter</p> <p>Action</p>

Message ID	Message Text	Explanation
		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 help (displays the operation format) on page 6-4 .
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>: Specified operation name</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, see help (displays the operation format) on page 6-4.</p>
KAPL01007-W	A duplicate parameter is specified. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Specified operation name</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><i>aa...aa</i>: Specified operation name</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><i>aa...aa</i>: Specified operation name</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 a correct value for the parameter, and then retry.</p>
KAPL01012-E	Could not connect the HDLM manager. Operation name = <i>aa...aa</i>	<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><i>aa...aa</i>: view</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlmkmgr</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 view (displays information) on page 6-31.</p>
KAPL01013-E	An error occurred in internal processing of the HDLM command. Operation name = <i>aa...aa</i> details = <i>bb...bb</i>	<p>Details</p> <p>An error unrelated to a user operation occurred during command processing.</p> <p><i>aa...aa</i>: Specified operation name</p> <p><i>bb...bb</i>: The name of the function and processing on which the error occurred</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL01014-W	No authority to execute the HDLM command. Operation name = <i>aa...aa</i>	<p>Details</p> <p>You do not have the administrator permissions necessary to execute the HDLM command.</p> <p><i>aa...aa</i>: Specified operation name</p> <p>Action</p> <p>Execute the command as a user with root permissions.</p>
KAPL01015-W	The target HBA was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The path having the host port number and bath number specified in the <code>-hba</code> parameter could not be found.</p> <p><i>aa...aa</i>: <code>offline</code> or <code>online</code></p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlmkmgr view -path</code>) and check the value displayed in <code>PathName</code>. Use the two leftmost digits of <code>PathName</code> for the relevant HBA port, and then</p>

Message ID	Message Text	Explanation
		retry. For details on the <code>view</code> operation, see view (displays information) on page 6-31 .
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 or 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. For details on the <code>view</code> operation, see view (displays information) on page 6-31.</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>) 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. For details on the <code>view</code> operation, see view (displays information) on page 6-31.</p>
KAPL01019-W	The target path was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: offline, online, or view</p> <ul style="list-style-type: none"> offline/online operation <p>The specified path does not exist.</p> <ul style="list-style-type: none"> view operation <p>The paths have not been configured because creation of the HDLM environment or configuration changes to the HDLM operating environment have not finished.</p> <p>Action</p> <ul style="list-style-type: none"> offline/online operation

Message ID	Message Text	Explanation
		<p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the settings, and then retry. For details on the <code>view</code> operation, see view (displays information) on page 6-31.</p> <ul style="list-style-type: none"> view operation <p>Refer to Chapter 3, Creating an HDLM environment on page 3-1. Creating an HDLM Environment or Reconfiguring the HDLM operating environment on page 4-27, and then configure any paths that exist. If the same message appears 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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>Stop unnecessary applications, increase the amount of free memory, and then re-execute the HDLM command.</p>
KAPL01023-W	The last Online path for the device cannot be placed Offline(C).	<p>Details</p> <p>The path specified for the offline operation cannot be set to Offline(C) because that is the last, available path to the LU from the host.</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the status of the paths. For details on the <code>view</code> operation, see view (displays information) on page 6-31.</p>
KAPL01024-W	The specified parameters cannot be specified at the same time.	<p>Details</p> <p><i>aa...aa</i>: Specified operation name</p>

Message ID	Message Text	Explanation
	Operation name = <i>aa...aa</i> , parameters = <i>bb...bb</i>	<p><i>bb...bb</i>: Parameters that cannot be specified at the same time</p> <p>Action</p> <p>Execute <code>help operation</code> of the HDLM command (<code>dlmkmgr</code>) to check which parameters can be specified at the same time, and then retry. For details on the <code>help operation</code>, see help (displays the operation format) on page 6-4.</p>
KAPL01036-E	The Offline path cannot be placed online. PathID = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Path ID (decimal (base-10) number)</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p> <p>If the paths which a value equal or greater than 0000000000000100 is displayed for the target ID (hexadecimal number) in PathName as a result of executing the <code>dlmkmgr</code> command's <code>view operation</code> (with either the <code>-path</code> or <code>-lu</code> parameter specified) are Offline(E), these are not changed to online by using the <code>online</code> command or the automatic failback function. To change the paths status online, execute the <code>dlmcfgmgr utility(dlmcfgmgr -r)</code>.</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 = <i>aa...aa</i> 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 multi-path 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><i>aa...aa</i>: Path ID (decimal (base-10) 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 processing, enter <code>n</code>. For details on the <code>online</code> operation, see online (places paths online) on page 6-10.</p>

Message ID	Message Text	Explanation
KAPL01040-W	The entered value is invalid. Re-enter [y/n]:	<p>Details</p> <p>A value other than y and n was entered. Enter y or n.</p> <p>Action</p> <p>Enter <i>y</i> or <i>n</i>.</p>
KAPL01041-E	The entered value is invalid. The operation stops. Operation name = <i>aa...aa</i>	<p>Details</p> <p>Command processing will be aborted because an incorrect value was entered three times in a row for a request.</p> <p><i>aa...aa</i>: clear, offline, online, or set</p> <p>Action</p> <p>Check the correct value, and then re-execute the HDLM command.</p>
KAPL01044-W	A duplicate parameter value is specified. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter value = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Duplicate parameter value</p> <p>Action</p> <p>Delete the duplicate parameter value, and then retry.</p>
KAPL01045-W	Too many parameter values are specified. Operation name = <i>aa...aa</i> , parameters = <i>bb...bb</i> , parameter value = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: offline, online, set, or 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 value, and then retry. For details on the <code>help</code> operation, see help (displays the operation format) on page 6-4.</p>
KAPL01048-W	Help information cannot be found. Operation name = <i>aa...aa</i> .	<p>Details</p> <p>The specified operation is not an operation of the HDLM command.</p> <p><i>aa...aa</i>: Specified operation name</p> <p>Action</p> <p>Use 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 help (displays the operation format) on page 6-4.</p>

Message ID	Message Text	Explanation
KAPL01049-I	Would you like to execute the operation? Operation name = <i>aa...aa</i> [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><i>aa...aa</i>: <code>clear</code> or <code>set</code></p> <p>Action</p> <p>If you want to execute the operation, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. For details on the <code>clear</code> operation, see clear (returns the path statistics to the initial value) on page 6-3. For details on the <code>set</code> operation, see set (sets up the operating environment) on page 6-15.</p>
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 <code>online</code> processing, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. For details on the <code>online</code> operation, see online (places paths online) on page 6-10.</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 <code>Online</code> because the path selection parameter is not specified for the <code>online</code> operation. To place all the paths <code>Online</code>, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute <code>online</code> processing, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. Before you execute the processing, be sure to execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the path status. For details on the <code>view</code> operation, see view (displays information) on page 6-31. For details on the <code>online</code> operation, see online (places paths online) on page 6-10.</p>

Message ID	Message Text	Explanation
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 <code>offline</code> processing, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. For details on the <code>offline</code> operation, see offline (places paths offline) on page 6-6.</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 <code>offline</code> processing, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. For details on the <code>offline</code> operation, see offline (places paths offline) on page 6-6.</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 set to Offline(C) was detected during multi-path 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 (base-10) number)</p> <p>Action</p> <p>If you want to continue processing the <code>offline</code> operation of the HDLM command for other paths, enter <code>y</code>. If you want to terminate processing, enter <code>n</code>. For details on the <code>offline</code> operation, see offline (places paths offline) on page 6-6.</p>
KAPL01055-I	All the paths which pass the specified <code>aa...aa</code> will be changed to the Offline(C) status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively set to Offline(C) because the <code>-hba</code> or <code>-cha</code> parameter was specified. To collectively set multiple paths to Offline(C), enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p>

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: CHA port or HBA</p> <p>Action</p> <p>If you want to execute <i>offline</i> processing for the paths that meet the specified requirements, enter <i>y</i>. If you want to terminate processing, enter <i>n</i>.</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 <i>y</i> . Otherwise, enter <i>n</i> . [<i>y/n</i>]:	<p>Details</p> <p>This message re-asks the user whether they want to set all the paths to Offline(C). To set all the paths to Offline(C), enter <i>y</i>. To cancel the operation, enter <i>n</i>.</p> <p><i>aa...aa</i>: CHA port or HBA</p> <p>Action</p> <p>If you want to execute <i>offline</i> processing for the paths that meet the specified requirements, enter <i>y</i>. If you want to terminate processing, enter <i>n</i>.</p>
KAPL01057-I	All the paths which pass the specified <i>aa...aa</i> will be changed to the Online status. Is this OK? [<i>y/n</i>]:	<p>Details</p> <p>All multiple paths will place online status because the <i>-hba</i> or <i>-cha</i> parameter was specified. To continue this operation, enter <i>y</i>. To discontinue this operation, enter <i>n</i>.</p> <p><i>aa...aa</i>: CHA port or HBA</p> <p>Action</p> <p>If you want to execute <i>online</i> processing for the paths that meet the specified requirements, enter <i>y</i>. If you want to terminate processing, enter <i>n</i>.</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 a parameter value.</p> <p><i>aa...aa</i>: Specified operation name <i>bb...bb</i>: Parameter name <i>cc...cc</i>: Parameter value</p> <p>Action</p> <p>Execute <i>help operation-name</i> of the HDLM command (<i>dlnkmgr</i>) to check the parameter and parameter value, and then retry. For details on the <i>help</i> operation,</p>

Message ID	Message Text	Explanation
		see help (displays the operation format) on page 6-4 .
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 is conflicting with the value of another parameter.</p> <p><i>aa...aa</i>: Parameter name <i>bb...bb</i>: Parameter name <i>cc...cc</i>: Parameter value <i>dd...dd</i>: view or set</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnmgr</code>) to check the parameter and parameter value, and then retry. For details on the <code>help</code> operation, see help (displays the operation format) on page 6-4.</p>
KAPL01060-I	The user terminated the operation. Operation name = <i>aa...aa</i>	<p>Details</p> <p>Command processing will be aborted because <code>n</code> was entered for a required confirmation.</p> <p><i>aa...aa</i>: online, offline, set, or 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 an <code>online/offline</code> operation.</p> <p><i>aa...aa</i>: Number of paths where the <code>online/offline</code> operation was successful (decimal (base-10) number) <i>bb...bb</i>: Online, Online(S), Online(D) or Offline(C) <i>cc...cc</i>: Number of paths where the <code>online/offline</code> operation was unsuccessful (decimal (base-10) number) <i>dd...dd</i>: online or offline</p> <p>Action</p> <p>None. For details on the <code>online</code> operation, see online (places paths online) on page 6-10. For details on the <code>offline</code> operation, see offline (places paths offline) on page 6-6.</p>

Message ID	Message Text	Explanation
KAPL01063-I	The target path(s) are already <i>aa...aa</i> .	<p>Details</p> <p>As a result of a previous <code>online/</code> <code>offline</code> operation, the specified path has already been set to <code>Online/Online (S)/Online (D)/</code> <code>Offline (C)</code>.</p> <p><i>aa...aa</i>: <code>Online</code>, <code>Online (S)</code>, <code>Online (D)</code> or <code>Offline (C)</code></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 view (displays information) on page 6-31. For details on the <code>online</code> operation, see online (places paths online) on page 6-10. For details on the <code>offline</code> operation, see offline (places paths offline) on page 6-6.</p> <p>For <code>Online (S)</code> or <code>Online (D)</code> paths:</p> <p>To change the status of a path from <code>Online (S)</code> or <code>Online (D)</code> to <code>Online</code>, re-execute the HDLM command using the <code>-hapath</code> parameter.</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>
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 processing will be aborted because an invalid license key was entered three times in a row.</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 and is registered as a permanent license.</p>

Message ID	Message Text	Explanation
		Action None.
KAPL01072-I	The emergency license was installed. The license expires on <i>aa...aa</i> .	Details A license was renewed and is registered as an emergency license. <i>aa...aa</i> : Year (4 digits)/month (01-12)/day (01-31) Action Install a permanent license by the expiration day.
KAPL01073-E	The temporary license expired.	Details The temporary license has expired. Register a permanent license. Action Register a permanent license.
KAPL01074-E	The emergency license expired.	Details The emergency license has expired. Register a permanent license. Action Register a permanent license.
KAPL01075-E	A fatal error occurred in HDLM. The system environment is invalid.	Details The license information file is missing. Action Re-install HDLM.
KAPL01076-I	The permanent license has been installed.	Details You need not install a license because a permanent license has already been installed. Action None.
KAPL01079-W	The intermittent error monitoring function cannot be set up because automatic failback is disabled.	Details The intermittent error monitoring function cannot be set up because automatic failbacks are disabled. Action Enable automatic failbacks, and then re-execute.
KAPL01080-W	The error monitoring interval and the number of times that the error is to occur conflict with	Details An intermittent error cannot be detected by using the values specified for the following: the

Message ID	Message Text	Explanation
	the automatic failback checking interval.	<p>checking interval for automatic failbacks, the error-monitoring interval, and the number of times the error needs to occur.</p> <p>Action</p> <p>Set the intermittent error-monitoring interval to a value that is equal to or greater than (<i>automatic-failback-checking-interval</i> x <i>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 useable license key for HDLM 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>
KAPL01083-I	There is no license key file. File name = <i>aa...aa</i>	<p>Details</p> <p>There is no license key file in the designated directory:</p> <p><i>aa...aa</i>: /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>
KAPL01084-W	An attempt to delete the license key file has failed. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /var/tmp/hdlm_license</p> <p>Action</p>

Message ID	Message Text	Explanation
		If the following license key file exists, delete it: <code>/var/tmp/hdlm_license</code> .
KAPL01088-W	The specified parameter values cannot be specified at the same time. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter values = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Parameter values that 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 which parameter can be specified, and then retry. For details on the <code>help</code> operation, see help (displays the operation format) on page 6-4.</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. If necessary, re-execute the HDLM command's <code>set -lic</code> operation. If the same error message is output again, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>Do not perform the following operations:</p> <ul style="list-style-type: none"> Simultaneously execute the HDLM command's <code>set -lic</code> operation with the <code>view -sys -lic</code> operation. Execution of the HDLM command's <code>set -lic</code> operation simultaneously with an update of the license for an upgrade or re-installation.
KAPL01095-E	An attempt to acquire the HDLM version information has failed. details = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Code showing the reason for the error</p> <p>Action</p> <p>Re-execute the command. 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>

Message ID	Message Text	Explanation
KAPL01096-E	An attempt to acquire the Service Pack version information has failed. details = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Code showing the reason for the error</p> <p>Action</p> <p>Re-execute the command. If the same error occurs again, execute the <i>DLMgetras</i> 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 that is less than the current value of the trace file size or number of trace files, all the current trace files will be deleted. To continue the operation, enter <i>y</i>. To cancel the operation, enter <i>n</i>.</p> <p>Action</p> <p>If you want to execute the operation of the HDLM command, enter <i>y</i>. If you want to terminate processing, enter <i>n</i>.</p>
KAPL01100-I	<i>aa...aa</i>	<p>Details</p> <p>This message indicates the executed command line.</p> <p><i>aa...aa</i>: Name of the executed command.</p> <p>Action</p> <p>None.</p>
KAPL01107-I	The load balancing type specified for individual LUs will become invalid when this operation is executed. Do you want to execute the operation anyway? Operation name = set [y/n]:	<p>Action</p> <p>If you want to change the load balancing algorithm for the system, enter <i>y</i>. If you want to terminate processing, enter <i>n</i>.</p>
KAPL01111-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Install HDLM that adjusts to the kernel that is running now.
KAPL01112-E	An attempt to connect to the HDLM driver has failed. Operation name = <i>aa...aa</i>	<p>Details</p> <p>HDLM driver information must be collected to execute the given HDLM command, but the HDLM driver cannot be accessed.</p> <p><i>aa...aa</i>: Specified operation name</p> <p>Action</p> <p>If you did not perform HDLM configuration, Perform HDLM configuration.</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 utility for collecting HDLM error information (<i>DLMgetras</i>) 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 <i>DLMgetras</i> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL01113-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL01114-W	The audit log configuration file does not exist. Restart the HDLM Manager, and execute the "dlnkmgr view -sys -audlog" command and check the setting.	<p>Details</p> <p>The audit log configuration file does not exist.</p> <p>Action</p> <p>Restart the HDLM Manager, and execute the <code>dlnkmgr view -sys -audlog</code> command, and then specify the desired setting by using the <code>dlnkmgr set -audlog</code> command or the <code>dlnkmgr set -audfac</code> command as necessary.</p>
KAPL01115-W	The audit log configuration file cannot be opened. Execute the "dlnkmgr view -sys -audlog"	<p>Details</p> <p>The audit log configuration file cannot be opened.</p>

Message ID	Message Text	Explanation
	command and check whether a normal result is displayed.	<p>Action</p> <p>If the <code>dlmkmgr view -sys -audlog</code> command does not display a normal result, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.</p>
KAPL01116-W	The audit log configuration file is invalid. Restart the HDLM Manager, and execute the " <code>dlmkmgr view -sys -audlog</code> " command and check the setting.	<p>Details</p> <p>The audit log configuration file is invalid.</p> <p>Action</p> <p>Restart the HDLM Manager, and execute the <code>dlmkmgr view -sys -audlog</code> command, and then specify the desired setting by using the <code>dlmkmgr set -audlog</code> command or the <code>dlmkmgr set -audfac</code> command as necessary.</p>
KAPL01117-W	An error occurred during processing to read the audit log configuration file.	<p>Details</p> <p>An internal error occurred while reading the audit log configuration file.</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.</p>
KAPL01118-W	An error occurred during processing to output the audit log configuration file.	<p>Details</p> <p>An internal parameter error when the audit-log data was output.</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.</p>
KAPL01119-W	An error occurred during processing to output the audit log configuration file.	<p>Details</p> <p>An internal parameter error when the audit-log data was output.</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.</p>
KAPL01120-W	A storage system model ID could not be displayed. Details = <i>aa...aa, bb...bb</i>	<p>Details</p> <p>A storage system model ID could not be displayed.</p> <p><i>aa...aa</i>: Storage recognition information</p> <p><i>bb...bb</i>: Error code</p> <p>Action</p>

Message ID	Message Text	Explanation
		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, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL01122-W	The file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL01123-W	You do not have read permission for the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL01124-W	The file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL01125-E	The directory does not exist. Directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation path, /HDLM installation path/lib</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL01126-E	The execution file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation path/bin/.dlnkmgr_exe</p> <p>Action</p> <p>Reinstall HDLM.</p>

Message ID	Message Text	Explanation
KAPL01127-E	You do not have execute permission for the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDL installation path/bin/.dlnmgr_exe</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, see clear (returns the path statistics to the initial value) on page 6-3.</p>
KAPL01128-W	HNTRLib2 initialization failed. Trace per process information cannot be collected.	<p>Details</p> <p>HNTRLib2 initialization failed. Integrated trace information cannot be collected.</p> <p>Action</p> <p>Execute the HDLM command as a user who has root permissions.</p> <p>If neither of above are the source of the problem, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL01133-I	<i>aa...aa</i> path(s) were successfully placed <i>bb...bb</i> ; <i>cc...cc</i> path(s) were successfully placed <i>dd...dd</i> ; <i>ee...ee</i> path(s) were not. Operation name = <i>ff...ff</i>	<p>Details</p> <p>The number of paths processed by an online operation is shown.</p> <p><i>aa...aa</i>: The number of paths which changed to the Online status</p> <p><i>bb...bb</i>: Online or Online(S)</p> <p><i>cc...cc</i>: The number of paths which changed to the Online(S) or Online(D) status</p> <p><i>dd...dd</i>: Online(S), Online(D) or Online(S)/Online(D)</p> <p><i>ee...ee</i>: The number of paths which failed to change to either the Online, Online(S) or Online(D) status</p> <p><i>ff...ff</i>: online</p> <p>Action</p>

Message ID	Message Text	Explanation
		None.
KAPL01134-I	The target paths are already Online or Online(S).	<p>Details</p> <p>The specified paths are already in the Online or Online(S) status as a result of an online operation.</p> <p>Action</p> <p>Check path status by using the view operation. For details on the view operation, see view (displays information) on page 6-31.</p> <p>For Online(S) paths:</p> <p>To change the status of a path from Online(S) to Online, re-execute the HDLM command using the -hapath parameter.</p>
KAPL01154-W	The dynamic I/O path control function is already set to aa...aa for the system.	<p>Details</p> <p>aa...aa: on or off</p> <p>Action</p> <p>Use the view operation of the HDLM command (dlnkmgr) to check the setting for the host, storage, and LUs. For details on the view operation, see view (displays information) on page 6-31.</p>
KAPL01155-W	The dynamic I/O path control function is already set to aa...aa for storage.	<p>Details</p> <p>aa...aa: on or off</p> <p>Action</p> <p>Use the view operation of the HDLM command (dlnkmgr) to check the setting for storage. For details on the view operation, see view (displays information) on page 6-31.</p>
KAPL01156-I	The dynamic I/O path control function was set to aa...aa for storage.	<p>Details</p> <p>aa...aa: on or off</p> <p>Action</p> <p>Use the view operation of the HDLM command (dlnkmgr) to check the setting for storage and LUs. For details on the view operation, see view (displays information) on page 6-31.</p>
KAPL01157-I	The dynamic I/O path control function was set to aa...aa for the system.	<p>Details</p> <p>aa...aa: on or off</p> <p>Action</p>

Message ID	Message Text	Explanation
		Use the view operation of the HDLM command (<code>dlnkmgr</code>) to check the setting for the host, storage, and LUs. For details on the <code>view</code> operation, see view (displays information) on page 6-31 .
KAPL01158-E	Dynamic I/O path control cannot be applied to the specified storage.	<p>Details</p> <p><code>aa...aa</code>: on or off</p> <p>Action</p> <p>Use the view operation of the HDLM command (<code>dlnkmgr</code>) to check the path ID. For details on the <code>view</code> operation, see view (displays information) on page 6-31.</p>
KAPL01159-I	Paths were added. (number of paths added = <code>aa...aa</code> , completion time = <code>bb...bb</code>)	<p>Details</p> <p>This message indicates that an <code>add</code> operation succeeded.</p> <p><code>aa...aa</code>: number of paths added</p> <p><code>bb...bb</code>: year (4 digits)/month/date hour:minute:second</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to verify information about the added paths.</p>
KAPL01160-W	The path configuration was not changed.	<p>Details</p> <p>If an <code>add</code> operation was executed</p> <p>This message indicates that no paths were added.</p> <p>If a <code>delete</code> operation was executed</p> <p>This message indicates that no paths were deleted.</p> <p>Action</p> <p>If an <code>add</code> operation was executed</p> <ul style="list-style-type: none"> - Execute an OS command, and check whether the addition of paths is recognized by the OS. - Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check whether the paths have already been added to HDLM. <p>If a <code>delete</code> operation was executed</p>

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> - Check whether the paths to be deleted have been disconnected from the system. - Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check whether the paths have already been deleted from HDLM.
KAPL01161-I	This operation will change the path configuration. Do you want to continue? [y/n]:	<p>Details</p> <p>This message confirms whether to perform a path configuration change by using an <code>add</code> operation or <code>delete</code> operation.</p> <p>Action</p> <p>Enter <code>y</code> to change the path configuration, or enter <code>n</code> to cancel the operation.</p>
KAPL01162-I	A path was added. (path ID = <i>aa...aa</i> , storage = <i>bb...bb</i> , iLU = <i>cc...cc</i>)	<p>Details</p> <p>This message displays information about a path added as the result of an <code>add</code> operation.</p> <p><i>aa...aa</i>: path ID of the added path</p> <p><i>bb...bb</i>: storage (vendor ID.product ID.serial number) to which the added path is connected</p> <p><i>cc...cc</i>: LU number to which the added path is connected</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to verify information about the added paths.</p>
KAPL01163-E	The path configuration change failed. (details = <i>aa...aa</i>)	<p>Details</p> <p>This message indicates that an <code>add</code> operation or <code>delete</code> operation failed.</p> <p><i>aa...aa</i>: code indicating the content of the error</p> <p>Action</p> <p>Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or, if you have a maintenance contract for HDLM, the maintenance company.</p>
KAPL01164-I	Paths were deleted. (number of paths deleted = <i>aa...aa</i> , completion time = <i>bb...bb</i>)	<p>Details</p> <p>This message indicates that a <code>delete</code> operation succeeded.</p>

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: number of paths deleted</p> <p><i>bb...bb</i>: year (4 digits)/month/date hour:minute:second</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to verify that the paths were deleted.</p>
KAPL01165-I	A path was deleted. (path ID = <i>aa...aa</i> , storage = <i>bb...bb</i> , iLU = <i>cc...cc</i>)	<p>Details</p> <p>This message displays information about a path deleted as the result of a delete operation.</p> <p><i>aa...aa</i>: path ID of the deleted path</p> <p><i>bb...bb</i>: storage (vendor ID.product ID.serial number) to which the deleted path was connected</p> <p><i>cc...cc</i>: LU number to which the deleted path was connected</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to verify that the paths were deleted.</p>
KAPL01166-I	If you execute this operation, the specified number of times that the same path can be used for individual LUs will become invalid. Do you want to execute the operation anyway? Operation name = set [y/n]:	<p>Details</p> <p>The specified number of times that the same path can be used for individual LUs will become invalid. To continue the operation, enter <i>y</i>. To cancel the operation, enter <i>n</i>.</p> <p>Action</p> <p>If you want to change the number of times that the same path can be used for the system, enter <i>y</i>. To cancel the operation, enter <i>n</i>.</p>
KAPL01167-I	All paths will be set to <code>Online</code> or <code>Online (D)</code> . Is this OK? [y/n]:	<p>Details</p> <p>All paths will be set to <code>Online</code> or <code>Online (D)</code> because no path is specified. To continue, enter <i>y</i>. To cancel the operation, enter <i>n</i>.</p> <p>Action</p> <p>To set all paths to <code>Online</code> or <code>Online (D)</code>, enter <i>y</i>. To cancel the operation, enter <i>n</i>. Before you execute the processing, you must check the path status by executing the <code>view</code> operation of the HDLM command <code>dlnkmgr</code>.</p>

Message ID	Message Text	Explanation
KAPL01168-I	All P-VOL paths that are connected to the LU that has the specified path ID will be set to <code>Online(D)</code> . Is this OK? [y/n]:	<p>Details</p> <p>All paths for each specified LU will be set to <code>Online</code> or <code>Online(D)</code>. To continue, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Note: All paths of the LU, including non-P-VOL paths, will be set to <code>Online</code> or <code>Online(D)</code>.</p> <p>Action</p> <p>To set to <code>Online</code> or <code>Online(D)</code> all paths that are connected to the LU that has the specified path ID, enter <code>y</code>. To cancel the process, enter <code>n</code>.</p>
KAPL01169-I	All <code>Online(S)</code> or <code>Online(D)</code> paths will be set to <code>Online</code> . Is this OK? [y/n]:	<p>Details</p> <p>All paths in the <code>Online(S)</code> or <code>Online(D)</code> status will be set to <code>Online</code> because no path is specified. To continue, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>To execute online processing, enter <code>y</code>. To cancel the operation, enter <code>n</code>. Before you execute the processing, you must check the path status by executing the view operation of the HDLM command <code>dlnkmgr</code>.</p>
KAPL01170-I	All <code>Online(S)</code> or <code>Online(D)</code> paths that are connected to the LU that has the specified path ID will be set to <code>Online</code> . Is this OK? [y/n]:	<p>Details</p> <p>All paths in the <code>Online(S)</code> or <code>Online(D)</code> status for each specified LU will be set to <code>Online</code>. To continue, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>To set to online the all <code>Online(S)</code> or <code>Online(D)</code> paths that are connected to the specified LU with path ID, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p>
KAPL01171-I	The target paths are already <code>aa...aa</code> or <code>bb...bb</code> .	<p>Details</p> <p>The specified paths are already in the <code>Online</code>, <code>Online(S)</code>, or <code>Online(D)</code> status as a result of an online operation.</p> <p><code>aa...aa</code>: <code>Online</code> or <code>Online(S)</code></p> <p><code>bb...bb</code>: <code>Online(D)</code> or <code>Online(S)/Online(D)</code></p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>Check path status by using the view operation. For <code>Online(S)</code> or <code>Online(D)</code> paths: To change the status of a path from <code>Online(S)</code> or <code>Online(D)</code> to <code>Online</code>, re-execute the HDLM command with the <code>-hapath</code> parameter specified.</p>
KAPL01172-I	There are no <code>Online(S)/Online(D)</code> paths among the target paths.	<p>Details</p> <p>An online operation was executed using the <code>-hapath</code> parameter, but there are no paths with the <code>Online(S)/Online(D)</code> status among the specified paths.</p> <p>Action</p> <p>Use the view operation of the HDLM command (<code>dlnkmgr</code>) to check the status of the path.</p>
KAPL01173-W	The target CHA port was constructed from multiple physical CHA ports. Operation name = <code>aa...aa</code> . Specify a physical CHA port by using the <code>"-cha -pathid"</code> parameter.	<p>Details</p> <p>In an environment where storage systems are virtualized, when you specify a CHA port by using the <code>-chaid</code> parameter of the offline or online operation, the CHA port might be constructed from multiple CHA ports of the physical storage system. In such a case, you cannot execute the offline or online operation with the <code>-chaid</code> parameter specified.</p> <p><code>aa...aa</code>: offline or Online</p> <p>Action</p> <p>Specify a physical CHA port by using the <code>-cha -pathid</code> parameter, and then re-execute the offline or online operation.</p>
KAPL01174-W	If the Physical Storage View is disabled, the parameter value <code>aa...aa</code> cannot be specified for the <code>-item</code> parameter.	<p>Details</p> <p>If the Physical Storage View is disabled, the parameter value shown cannot be specified.</p> <p><code>aa...aa</code>: virt</p> <p>Action</p> <p>When specifying virtual storage information as a display item, enable the Physical Storage View.</p>
KAPL01175-W	If the Physical Storage View is enabled, the parameter value <code>aa...aa</code> cannot be specified for the <code>-item</code> parameter.	<p>Details</p> <p>If the Physical Storage View is enabled, the parameter value shown cannot be specified.</p>

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: phys, vid, ha, or hastat</p> <p>Action</p> <p>When specifying physical storage information as a display item, disable the Physical Storage View.</p>
KAPL01176-I	Some of the target paths are in the offline status. Storage system settings are not refreshed for offline paths.	<p>Details</p> <p>HDLM cannot refresh storage system settings for offline paths, because HDLM cannot acquire the settings.</p> <p>Action</p> <p>Place online the paths for which HDLM will refresh storage system settings, and execute the refresh operation.</p>
KAPL01177-W	HDLM failed to acquire storage system settings for some paths.	<p>Details</p> <p>HDLM failed to acquire storage system settings for some paths.</p> <p>Action</p> <p>If this message is output when path errors occur during a refresh operation, recover from the path errors, place the paths online, and then re-execute the refresh operation. If this message is output when there are no offline paths, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.</p>
KAPL01178-E	HDLM failed to refresh the storage system settings. Details = <i>aa...aa</i> , <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Detailed information 1</p> <p><i>bb...bb</i>: Detailed information 2</p> <p>Action</p> <p>Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.</p>

KAPL03001 to KAPL04000

Message ID	Message Text	Explanation
KAPL03001-I	HDLM API information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: Trace information</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>None.</p>
KAPL03003-E	HDLM API Error information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL03004-C	A critical error occurred in the HDLM API. (<i>aa...aa</i>)	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL03006-E	An access to the HDLM driver causes an error. (<i>aa...aa</i>)	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
KAPL03007-E	An error occurred during communication with the HDLM manager. (aa...aa)	<p>Details</p> <p>This information is required for resolving problems.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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 resolving problems.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL03999-E	An unexpected error occurred.	<p>Details</p> <p>Conflicting versions of HDLM modules are being used.</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>

KAPL04001 to KAPL05000

Message ID	Message Text	Explanation
KAPL04001-I	HDLM manager started.	Action None.
KAPL04002-E	Could not start the HDLM manager.	Details The HDLM manager failed to start because the current environment is unsuitable for the HDLM manager to run in. Action Execute the <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, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL04003-E	The startup parameter is invalid.	Details The HDLM manager internal parameter is invalid. 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL04004-I	HDLM manager will now terminate.	Action None.
KAPL04008-E	Cannot open the option definition file (<i>aa...aa</i>).	Details HDLM manager could not start normally because it was unable to open the option definition file. <i>aa...aa</i> : Option definition file name Action Check whether another program is currently using this file (for example, the file is being opened in a text editor), or whether the file has been inadvertently deleted.

Message ID	Message Text	Explanation
KAPL04009-E	The option definition is invalid.	<p>Details</p> <p>HDLM manager could not start normally because some of the definitions in the option definition file were invalid.</p> <p>Action</p> <p>If the KAPL04033-W message is output after this message, execute the <code>dlmkmgr view -sys -sfunc</code> command, and then check the option settings.</p> <p>Use the <code>dlmkmgr set</code> operation to return options settings back to where you had them.</p> <p>If the KAPL04033-W message is not output, restart HDLM manager.</p> <p>If the same error occurs, re-install HDLM. For details on the <code>view</code> operation, see view (displays information) on page 6-31. For details on the <code>set</code> operation, see set (sets up the operating environment) on page 6-15.</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/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code>).</p> <p>Action</p> <p>Check whether another program is using the file (for example, the file is being opened in a text editor), or whether the error log file has been inadvertently deleted.</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/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code>.</p> <p>Action</p> <p>Make sure that the disk has enough unused capacity.</p>
KAPL04012-E	Could not create a communication pipe. RC = <i>aa...aa</i>	<p>Details</p> <p>HDLM manager could not start normally because it was unable to create a pipe file, which is used in</p>

Message ID	Message Text	Explanation
		<p>communication with HDLM commands.</p> <p><i>aa...aa</i>: OS error code(decimal (base-10) 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04013-E	Input is impossible via the communication pipe. RC = <i>aa...aa</i>	<p>Details</p> <p>Data could not be read from the pipe file while communicating with an HDLM command.</p> <p><i>aa...aa</i>: OS error code (decimal (base-10) 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04014-E	Output is impossible via the communication pipe. RC = <i>aa...aa</i>	<p>Details</p> <p>Data could not be written to the pipe file while communicating with an HDLM command.</p> <p><i>aa...aa</i>: OS error code (decimal (base-10) 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04019-E	Could not collect the error information. RC = <i>aa...aa</i>	<p>Details</p>

Message ID	Message Text	Explanation
		<p>An attempt to read the log information from the alert driver failed.</p> <p><i>aa...aa</i>: API return code (decimal (base-10) 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04021-I	HDLM manager information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: HDLM manager trace information</p> <p>Action</p> <p>None.</p>
KAPL04022-W	HDLM manager warning information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04023-E	HDLM manager error information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: HDLM manager trace error information</p> <p>Action</p> <p>After updating the <code>initscripts</code> package and restarting the OS, if the HDLM information does not exist in the <code>/etc/rc.d/rc.sysinit</code> file, execute the</p>

Message ID	Message Text	Explanation
		<p>utility for updating system scripts (dlmupdatesysinit). In cases other than the above,</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04024-C	A critical error occurred in the HDLM manager. (<i>aa...aa</i>)	<p>Details</p> <p>This information is required for resolving problems.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04025-C	A memory shortage occurred in the HDLM manager.	<p>Details</p> <p>There was not enough memory to run the HDLM manager processes.</p> <p>Action</p> <p>To increase the amount of free memory, terminate unnecessary applications or restart the host.</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><i>aa...aa</i>: Expiration day</p> <p><i>bb...bb</i>: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install a permanent license by the expiration day.</p>
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><i>aa...aa</i>: Expiration day</p> <p><i>bb...bb</i>: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p>

Message ID	Message Text	Explanation
		Action Install a permanent license by the expiration day.
KAPL04028-E	The temporary license expired.	Action Install a permanent license.
KAPL04029-E	The emergency license expired.	Action Install a permanent license.
KAPL04030-E	The temporary license has already expired.	Action Install a permanent license.
KAPL04031-E	The emergency license has already expired.	Action Install a permanent license.
KAPL04032-C	A fatal error occurred in HDLM. The system environment is invalid	Details A part of the HDLM configuration file is missing. Action Re-install HDLM.
KAPL04033-W	The option definition file was re-created.	Details When an existing option definition file cannot be read, a new option definition file will be re-created by using the default values. If some of the options can be read, those values can be used. As for any remaining values, the default values will be used. Action For any non-default options, use the <code>dlmkmgr set</code> operation to set the options again. For details on the <code>set</code> operation, see set (sets up the operating environment) on page 6-15 .
KAPL04034-E	An attempt to create the option definition file has failed.	Details An attempt to re-create an option definition file (<code>/etc/opt/DynamicLinkManager/dlmmgr.xml</code>) using the default values has failed. Action Remove unnecessary files to secure unused capacity on the file system, or check the write permissions for the directory and file.

Message ID	Message Text	Explanation
KAPL04035-I	The path health check will now start. Total number of paths = <i>aa...aa</i>	<p>Details</p> <p><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><i>aa...aa</i>: Number of paths targeted for path health checking.</p> <p><i>bb...bb</i>: Number of paths determined to have an error by path health checking.</p> <p>Action</p> <p>None.</p>
KAPL04042-I	HDLM SNMP TRAP information - <i>aa...aa</i>	<p>Details</p> <p>All the paths that path health checking examined are fine.</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</p> <p><i>bb...bb</i>: Destination IP address of the trap</p> <p><i>cc...cc</i>: Destination port number of the trap</p> <p><i>dd...dd</i>: Community name given to the trap</p> <p><i>ee...ee</i>: Transmission data</p> <p>Action</p> <p>None.</p>
KAPL04047-W	The file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL04048-W	You do not have read permission for the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</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</p>

Message ID	Message Text	Explanation
		contract for HDLM. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL04049-W	The file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL04050-E	The directory does not exist. Directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation path, /HDLM installation path/lib</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL04051-E	The execution file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation path/bin/.dlnkmgr_exe</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL04052-E	You do not have execute permission for the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation path/bin/.dlnkmgr_exe</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL04053-W	The option definition file was recovered from a work file.	<p>Action</p> <p>Execute the <code>dlnkmgr view -sys</code> command to check whether the settings are recovered. If the settings are not recovered, execute the <code>dlnkmgr set</code> operation to recover the settings. For details on the <code>view</code> operation, see view (displays information) on page 6-31. For details on the <code>set</code> operation, see set (sets up the</p>

Message ID	Message Text	Explanation
		operating environment) on page 6-15.
KAPL04054-I	The owner controller will now be revised. (number of LUs = <i>aa...aa</i>)	Details <i>aa...aa</i> : number of targeted LUs Action None.
KAPL04055-I	The owner controller was revised. (number of changed LUs = <i>aa...aa</i>)	Details <i>aa...aa</i> : number of changed LUs Action None.
KAPL04056-W	The owner controller cannot be revised because no paths are in the Online status. (LU = <i>aa...aa</i>)	Details <i>aa...aa</i> : ID (serial number + iLUN) of the LU that was not revised Action Recover the paths from the failure, and then place them in the Online status, or exclude the LU from dynamic I/O path control.

KAPL05001 to KAPL06000

Message ID	Message Text	Explanation
KAPL05003-I	The HDLM driver (filter component) was successfully attached to Disk (<i>aa...aa</i>), Partition (<i>bb...bb</i>).	Details The path corresponding to disk <i>aa...aa</i> and partition <i>bb...bb</i> was successfully registered in the core logic. <i>aa...aa</i> : Disk sequence number (decimal number) <i>bb...bb</i> : Fixed at 0 (decimal number) Action None.
KAPL05008-E	Could not allocate memory. (<i>aa...aa:bb...bb</i>) Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.	Details <i>aa...aa</i> : File ID, line number, (hexadecimal number) <i>bb...bb</i> : Memory capture size (hexadecimal number) Action Execute the utility for setting HDLM driver option (<code>dlnmsetopt</code>) and increase the number of retries for allocating memory. For details on the <code>dlnmsetopt</code> utility, see

Message ID	Message Text	Explanation
		<p>dlmsetopt utility for setting HDLM driver options on page 7-52.</p> <p>Increase system memory. Stop any unnecessary processes. If the problem is not solved, execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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>) Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.	<p>Details</p> <p>The path corresponding to the disk <i>aa...aa</i> and partition <i>bb...bb</i> could not be registered in the core logic.</p> <p><i>aa...aa</i>: Disk sequence number (decimal number)</p> <p><i>bb...bb</i>: Partition number (decimal number)</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>
KAPL05014-I	The device object (<i>aa...aa</i>) was registered as the path (<i>bb...bb</i>).	<p>Details</p> <p>The HDLM filter driver was successfully attached and registered as a path.</p> <p><i>aa...aa</i>: Address of table for managing the HDLM filter driver (hexadecimal number)</p> <p><i>bb...bb</i>: Path ID (hexadecimal number)</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>) Check the connection status of	<p>Details</p> <p>An attempt at FO processing for path <i>aa...aa</i> has failed.</p>

Message ID	Message Text	Explanation
	the path <i>aa...aa</i> . If there is no problem with the connection status, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.	<p><i>aa...aa</i>: Core logic path identifier for the failed FO (hexadecimal number)</p> <p><i>bb...bb</i>: Error code (hexadecimal number)</p> <p><i>cc...cc</i>: 0 (fixed)</p> <p>Action</p> <p>The I/O being processed is discarded. Check the status of the device path and resolve the problem accordingly. If there is no problem with the connection status of the path, execute the DLMgetras utility for collecting error information, and then contact the HDLM vendor or the maintenance company if you have a maintenance contract for HDLM.</p>
KAPL05019-I	The FO processing in the path (<i>aa...aa</i>) finished. The I/O request was processed in the path (<i>bb...bb</i>).	<p>Details</p> <p>A failure was detected from a lower layer of HDLM during an I/O request. As a result, processing to fail over the path was performed, and the I/O request to the alternative path was successful. I/O requests was processed in the path <i>bb...bb</i>.</p> <p><i>aa...aa</i>: Path ID (hexadecimal number)</p> <p><i>bb...bb</i>: Path ID (hexadecimal number)</p> <p>Action</p> <p>None.</p>
KAPL05020-I	Processing of IOCTL(<i>aa...aa</i>) will now start.	<p>Details</p> <p>An IOCTL request was received.</p> <p><i>aa...aa</i>: IOCTL code (hexadecimal number)</p> <p>Action</p> <p>None.</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>) Check the message of the HDLM	<p>Details</p>

Message ID	Message Text	Explanation
	command or the HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company. Refer to the HDLM User's Guide for instructions how to execute the DLMgetras utility.	<p>An attempt to process the requested IOCTL call has failed.</p> <p><i>aa...aa</i>: IOCTL code (hexadecimal number)</p> <p><i>bb...bb</i>: Error code (hexadecimal number)</p> <p><i>cc...cc</i>: Thread ID of the process that issued the I/O</p> <p>Action</p> <p>Check the following. After the check, if the problem is not solved, 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 then report the error and detail code. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p> <ol style="list-style-type: none"> Make sure that the command is executed by a user with root permission. The memory size is insufficient. Stop the unnecessary process. Make sure that the IOCTL is not issued to the device management file (<code>/dev/dlm/sddlmfdrv0</code>). <p>To check whether the error will have any effect on the application, check the application that sent the IOCTL system call.</p>
KAPL05701-I	HDLM version <i>aa...aa</i> Build <i>bb...bb cc...cc dd...dd ee...ee</i>	<p>Details</p> <p>The version of HDLM is shown.</p> <p><i>aa...aa</i>: HDLM version (character string)</p> <p><i>bb...bb</i>: HDLM build number (decimal number)</p> <p><i>cc...cc</i>: Days-and-months A.D (character string)</p> <p><i>dd...dd</i>: Time in seconds (character string)</p> <p><i>ee...ee</i>: Internal code (hexadecimal number) (This is information required for the investigation at the time the problem was generated.)</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>None.</p>
KAPL05704-E	<p>The LDEV information for an HDLM device has changed. HCTL value = <i>aa...aa bb...bb cc...cc dd...dd</i></p>	<p>Details</p> <p>The LDEV information for the HCTL value corresponding to an HDLM device has changed.</p> <p>LDEV information (storage system model name, serial number, and LU number, separated by period)</p> <p><i>aa...aa</i>: Host ID (host port number) (decimal number)</p> <p><i>bb...bb</i>: Channel number (bus number) (decimal number)</p> <p><i>cc...cc</i>: Target ID (target ID) (decimal number)</p> <p><i>dd...dd</i>: LUN (host LU number) (decimal number)</p> <p>Action</p> <p>Please perform the following steps.</p> <ol style="list-style-type: none"> Note down the HCTL values of the SCSI device as shown in the error messages. Obtain the corresponding HDLM device name for the HCTL value noted in step a by using the following command: # <code>dlnmcfmgmr -v</code> Unregister the HDLM devices by using the following command: # <code>dlnmcfmgmr -u logical-device-file-name-of-the-HDLM-device</code> Reconfigure the HDLM by using the following command: # <code>dlnmcfmgmr -r</code>
KAPL05708-E	<p>The system retried to allocate memory <i>aa...aa</i> times, but the retries failed. (<i>bb...bb:cc...cc</i>)</p>	<p>Details</p> <p><i>aa...aa</i>: Memory allocation retry count (decimal number)</p> <p><i>bb...bb</i>: File ID, line number (hexadecimal number)</p> <p><i>cc...cc</i>: Memory allocation size (hexadecimal number)</p> <p>Action</p> <p>Execute the utility for setting HDLM driver option (<code>dlnmsetopt</code>)</p>

Message ID	Message Text	Explanation
		<p>and increase the number of retries for allocating memory. For details on the <code>d1msetopt</code> utility, see d1msetopt utility for setting HDLM driver options on page 7-52.</p> <p>Increase system memory. Stop any unnecessary processes. If the problem is not solved, 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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL05709-I	The system will retry to allocate memory <i>aa...aa</i> times.	<p>Details</p> <p><i>aa...aa</i>: Memory allocation retry count (decimal number)</p> <p>Action</p> <p>None.</p>
KAPL05711-I	The timeout value and retry count of SCSI INQUIRY has been set. (timeout value = <i>aa...aa</i> , retry count = <i>bb...bb</i>)	<p>Details</p> <p><i>aa...aa</i>: SCSI INQUIRY timeout value</p> <p><i>bb...bb</i>: SCSI INQUIRY retry count</p> <p>Action</p> <p>None.</p>
KAPL05713-I	The registration status of the reservation key will now be checked.	<p>Details</p> <p>The registration status of the reservation key will now be checked.</p> <p>Action</p> <p>None.</p>
KAPL05714-I	The registration status of the reservation key was checked.	<p>Details</p> <p>The registration status of the reservation key was checked.</p> <p>Action</p> <p>None.</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>: Maintenance information (hexadecimal number)</p> <p><i>bb...bb</i>: Maintenance information (hexadecimal number)</p>

Message ID	Message Text	Explanation
		<p>cc...cc: Maintenance information (hexadecimal number)</p> <p>dd...dd: Maintenance information (hexadecimal number)</p> <p>Action</p> <p>None.</p>

KAPL06001 to KAPL07000

Message ID	Message Text	Explanation
KAPL06004-E	Could not allocate memory. (aa...aa:bb...bb)	<p>Details</p> <p>An attempt to reserve memory to save alert information has failed.</p> <p>aa...aa: Program line (hexadecimal number)</p> <p>bb...bb: 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL06007-I	IOCTL processing (aa...aa) will now start.	<p>Details</p> <p>The IOCTL request aa...aa was accepted.</p> <p>aa...aa: IOCTL code (hexadecimal number)</p> <p>Action</p> <p>None.</p>
KAPL06008-I	IOCTL processing (aa...aa) completed normally.	<p>Details</p> <p>The IOCTL request aa...aa was processed normally.</p> <p>aa...aa: IOCTL code (hexadecimal number)</p> <p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
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> was issued to the alert driver.</p> <p><i>aa...aa</i>: IOCTL code (hexadecimal number)</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>An IOCTL request was not processed normally.</p> <p><i>aa...aa</i>: IOCTL code (hexadecimal number)</p> <p><i>bb...bb</i>: Error number (hexadecimal number)</p> <p><i>cc...cc</i>: 0 (fixed)</p> <p>Action</p> <p>Check the message of the HDLM command (<code>dlnkmgr</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL06013-E	Could not write log information into the log buffer. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>Log information from the filter driver was destroyed without being written to a log buffer because the attempt to reserve memory for the log information failed.</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>

Message ID	Message Text	Explanation
		<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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL06014-E	<p>Could not write emergency information into the emergency information buffer. (<i>aa...aa:bb...bb</i>)</p>	<p>Details</p> <p>Urgent information from the filter driver was destroyed without being written to the urgent information buffer because the attempt to reserve memory for the information failed.</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 it.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL06100-E	<p>The version of the kernel supported by the installed HDLM does not match the currently booting kernel version.</p>	<p>Details</p> <p>The version of the kernel supported by the installed HDLM is different from the currently running kernel version.</p>

Message ID	Message Text	Explanation
		<p>It may be that you booted the kernel that is different from the kernel when you installed HDLM.</p> <p>Action</p> <p>Install an HDLM that supports the currently running kernel.</p>
KAPL06101-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found or the content of a file is invalid. Therefore, the Alert driver cannot be loaded.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>

KAPL07001 to KAPL08000

Message ID	Message Text	Explanation
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 (base-10) number)</p> <p><i>bb...bb</i>: Internal function number of the core logic (decimal (base-10) number)</p> <p><i>cc...cc</i>: Detailed information 2 (decimal (base-10) number)</p> <p><i>dd...dd</i>: Detailed information 3 (decimal (base-10) number)</p> <p>Action</p> <p>None.</p>
KAPL07824-I	The owner controller of the LU connected to the path (<i>aa...aa</i>) was changed to (<i>bb...bb</i>).	<p>Details</p> <p>The owner controller of the LU connected to the path with the ID shown in the message was changed.</p> <p><i>aa...aa</i>: Path ID of the changed LU. (same as PathID of <code>view - path</code>) (Decimal number)</p> <p><i>bb...bb</i>: Owner controller ID after the change. (Hexadecimal number)</p> <p>Action</p>

Message ID	Message Text	Explanation
		None.
KAPL07825-I	The owner core of the LU connected to the path (<i>aa...aa</i>) was changed to (<i>bb...bb</i>).	<p>Details</p> <p>The owner core of the LU connected to the path with the ID shown in the message was changed.</p> <p><i>aa...aa</i>: Path ID of the changed LU. (same as PathID of <code>view - path</code>) (Decimal number)</p> <p><i>bb...bb</i>: Owner core ID after the change. (Hexadecimal number)</p> <p>Action</p> <p>None.</p>

KAPL08001 to KAPL09000

Message ID	Message Text	Explanation
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. The error is most likely due to a disconnected cable.</p> <p><i>aa...aa</i>: Path identifier (hexadecimal number)</p> <p><i>bb...bb</i>: Error code (hexadecimal number)</p> <ul style="list-style-type: none"> When a path error is detected by a path health checking or the online operation Displays 0x000F0000 (Fixed). When a path error is detected through an I/O error Displays the OS error code. <p><i>cc...cc</i>: 0x00000000 (fixed)</p> <p>Action</p> <p>Check the path in which the error was detected.</p>
KAPL08022-E	A path error occurred. ErrorCode = <i>aa...aa</i> , PathID = <i>bb...bb</i> , PathName = <i>cc...cc.dd...dd.ee...ee.ff...ff</i> , DNum = <i>gg...gg</i> , HDevName = <i>hh...hh</i>	<p>Details</p> <p>A physical or logical error occurred in the path.</p> <p><i>aa...aa</i>: OS error code (hexadecimal number)</p> <ul style="list-style-type: none"> When a path error is detected by a path health checking or the online operation Displays 0x000F0000 (Fixed).

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> When a path error is detected through an I/O error Displays 0x00000000 (Fixed). <p><i>bb...bb</i>: Path ID (same as PathID of <code>view -path</code>) (decimal (base-10) number)</p> <p><i>cc...cc</i>: Host port number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>dd...dd</i>: Bus number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>ee...ee</i>: Target ID (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>ff...ff</i>: HLU number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>gg...gg</i>: Dev number (same as DNum of <code>view -path</code>) (decimal (base-10) number)</p> <p><i>hh...hh</i>: Host device name (same as HDevName of <code>view -path</code>)</p> <p>Action</p> <p>There could be an error in the path. See What to do for a path error on page 5-3 and restore the path displayed in the message to running status.</p> <p>If the Offline (E) path has a PathName target ID value that is 000000000000100 or more, it cannot be brought online by the <code>online</code> command or auto fallback. To bring the path online, execute the <code>dlnmcfgmgr</code> utility (<code>dlnmcfgmgr -r</code>).</p>
KAPL08023-I	A path was recovered. PathID = <i>aa...aa</i> , PathName = <i>bb...bb.cc...cc.dd...dd.ee...ee</i> , DNum = <i>ff...ff</i> , HDevName = <i>gg...gg</i>	<p>Details</p> <p><i>aa...aa</i>: Path ID (same as PathID of <code>view -path</code>) (decimal (base-10) number)</p> <p><i>bb...bb</i>: Host port number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>cc...cc</i>: Bus number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p><i>dd...dd</i>: Target ID (same as PathName of <code>view -path</code>) (hexadecimal number)</p>

Message ID	Message Text	Explanation
		<p>ee...ee: HLU number (same as PathName of <code>view -path</code>) (hexadecimal number)</p> <p>ff...ff: Device number (same as DNum of <code>view -path</code>) (decimal (base-10) number)</p> <p>gg...gg: Host Dev name (same as HDevName of <code>view -path</code>)</p> <p>Action</p> <p>None.</p>
KAPL08026-E	An error occurred on all the paths of the LU. PathID = <i>aa...aa</i>	<p>Details</p> <p>An error occurred in the last, remaining path of an LU. (This is most likely as a result of a disconnection.)</p> <p><i>aa...aa</i>: Path ID (same as PathID of <code>view -path</code>) (decimal (base-10) number)</p> <p>Action</p> <p>Errors are detected in all the paths connected to the LUs. See What to do for a path error on page 5-3 to 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 = <i>aa...aa</i>	<p>Details</p> <p>A path was excluded from being subject to automatic failbacks because the system judged that an intermittent error was occurring in that path.</p> <p><i>aa...aa</i>: Path ID (same as PathID of <code>view -path</code>) (decimal (base-10) number)</p> <p>Action</p> <p>An intermittent error has occurred. Check the path for any possible problems. For details on what to do, see What to do for a path error on page 5-3 and switch the path shown in the message into Online.</p>
KAPL08032-I	A path was recovered. (PathID = <i>aa...aa</i>)	<p>Details</p> <p>The path has changed to an online status.</p> <p><i>aa...aa</i>: Path ID (same as PathID of <code>view -path</code>) (decimal (base-10) number)</p> <p>Action</p>

Message ID	Message Text	Explanation
		None.
KAPL08033-E	No path connected to the LU that connects to Path ID (<i>aa...aa</i>) is in the <i>Online (D)</i> status.	<p>Details</p> <p>Due to path failure, path deletion, or offline operation, no path connected to the LU that connects to Path ID (<i>aa...aa</i>) is in the <i>Online (D)</i> status.</p> <p><i>aa...aa</i>: Path ID (same as PathID of view <i>-path</i>) (decimal (base-10) number)</p> <p>Action</p> <p>To return a path to the <i>Online (D)</i> status, resolve the path failure, and then execute the "dlmkmgr online -dfha" command.</p>
KAPL08036-W	Failed to get Inquiry Page.E2h(00h) in path (<i>aa...aa</i>).	<p>Details</p> <p>Failed to obtain the Inquiry data of the path to show in a message.</p> <p><i>aa...aa</i>: Path ID (same as PathID of view <i>-path</i>) (decimal (base-10) number)</p> <p>Action</p> <p>Confirm the state of the path. After having removed an obstacle, and then execute the "dlmkmgr refresh" command.</p>
KAPL08037-W	Failed to get Inquiry Page.E2h(01h) in path (<i>aa...aa</i>).	<p>Details</p> <p>Failed to obtain the Inquiry data of the path to show in a message.</p> <p><i>aa...aa</i>: Path ID (same as PathID of view <i>-path</i>) (decimal (base-10) number)</p> <p>Action</p> <p>Confirm the state of the path. After having removed an obstacle, and then execute the "dlmkmgr refresh" command.</p>
KAPL08038-W	Failed to get Inquiry Page.E2h(02h) in path (<i>aa...aa</i>).	<p>Details</p> <p>Failed to obtain the Inquiry data of the path to show in a message.</p> <p><i>aa...aa</i>: Path ID (same as PathID of view <i>-path</i>) (decimal (base-10) number)</p> <p>Action</p> <p>Confirm the state of the path. After having removed an obstacle, and then execute the "dlmkmgr refresh" command.</p>

KAPL09001 to KAPL10000

Message ID	Message Text	Explanation
KAPL09001-E	There is no system management permission. Login with root permission and re-install HDLM.	<p>Details</p> <p>The current user does not have the necessary administrator permission to install HDLM.</p> <p>Action</p> <p>Login with root permission and re-install HDLM.</p>
KAPL09003-E	Cannot install in this system. Install HDLM on a supported OS.	<p>Details</p> <p>HDLM cannot be installed on this system.</p> <p>Action</p> <p>See Hosts and OSs supported by HDLM on page 3-3 and install HDLM in a supported OS system.</p>
KAPL09005-E	Could not stop the HDLM manager. Stop it manually, and then try the installation program or the remove program again.	<p>Details</p> <p>An attempt to stop the HDLM manager service failed.</p> <p>Action</p> <p>Stop the HDLM manager manually, and then re-execute the installation program or the remove program.</p>
KAPL09011-E	Cannot find a license key file /etc/opt/DynamicLinkManager/dlm.lic_key.	<p>Details</p> <p>The license key file, /etc/opt/DynamicLinkManager/dlm.lic_key, cannot be found in the specified directory.</p> <p>Action</p> <p>Create a license key file, and re-execute the installation program.</p>
KAPL09013-E	Some HDLM drivers could not be removed.	<p>Details</p> <p>Deleting several HDLM drivers failed because these HDLM drivers were being used for HDLM upgrade installation, re-installation, or remove.</p> <p>Action</p> <p>Check whether an HDLM device is mounted. If an HDLM device has been mounted, unmount the device, and then remove the HDLM drivers again. For details on the <code>dlmcfmgr</code> utility, see dlmcfmgr utility for managing the HDLM configuration on page 7-26.</p>

Message ID	Message Text	Explanation
KAPL09023-E	A file or directory related to HDLM could not be found. Re-install HDLM.	<p>Details</p> <p>A target file to copy to the directory of Hitachi Command Suite products other than HDLM could not be found among the files related to HDLM.</p> <p>Action</p> <p>Re-install HDLM.</p> <p>If you are using SUSE LINUX Enterprise Server 11, make sure that the nfs-client package is installed. If it is not installed, install it, and then re-install HDLM.</p>
KAPL09024-E	An attempt to copy a file or directory related to HDLM has failed. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>An attempt to copy a file related to HDLM to the directory of Hitachi Command Suite products other than HDLM has failed.</p> <p>Action</p> <p>Re-execute the HDLM installation program.</p>
KAPL09035-E	The HDLM driver could not be loaded. Execute the dlmstart utility. For details on the dlmstart utility, refer to the HDLM User's Guide section "dlmstart (Utility for Starting HDLM)".	<p>Details</p> <p>The HDLM driver could not be loaded.</p> <p>Action</p> <p>Execute the <code>dlmstart</code> utility. For details on the <code>dlmstart</code> utility, refer to dlmstart utility for starting HDLM on page 7-57.</p>
KAPL09036-E	The HDLM manager could not be started. Execute the <code>aa...aa</code> command with the start parameter to start the HDLM manager.	<p>Details</p> <p>The HDLM manager could not be started.</p> <ul style="list-style-type: none"> In other than Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: <code>aa...aa: /etc/init.d/DLMManager</code> In Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: <code>aa...aa: /opt/DynamicLinkManager/bin/dlmmanger</code>

Message ID	Message Text	Explanation
		<p>Action</p> <ul style="list-style-type: none"> In other than Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: Execute the <code>/etc/init.d/DLManager</code> command with the start parameter to start the HDLM manager. In Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: Execute the <code>/opt/DynamicLinkManager/bin/dlmmanager</code> command with the start parameter to start the HDLM manager.
KAPL09037-E	The status of the HDLM manager could not be checked. If the HDLM manager does not start, execute the <code>aa...aa</code> command with the start parameter to start the HDLM manager.	<p>Details</p> <p>An attempt to acquire the status of the HDLM manager has failed.</p> <ul style="list-style-type: none"> In other than Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: <code>aa...aa: /etc/init.d/DLManager</code> In Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: <code>aa...aa: /opt/DynamicLinkManager/bin/dlmmanager</code> <p>Action</p> <ul style="list-style-type: none"> In other than Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: If the HDLM manager does not start, execute the <code>/etc/init.d/DLManager</code> command with the start

Message ID	Message Text	Explanation
		<p>parameter to start the HDLM manager.</p> <ul style="list-style-type: none"> In other than Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, SUSE LINUX Enterprise Server 12 or SUSE LINUX Enterprise Server 15: <p>If the HDLM manager does not start, execute the <code>/opt/DynamicLinkManager/bin/dlmmanger</code> command with the <code>start</code> parameter to start the HDLM manager.</p>
KAPL09038-E	The HDLM configuration could not be deleted.	<p>Details</p> <p>Deleting the HDLM configuration failed because a managed HDLM device was being used.</p> <p>Action</p> <p>Stop applications that are using the managed HDLM device, unmount the managed HDLM device, and then retry remove.</p>
KAPL09039-E	The HDLM devices could not be configured. Execute the HDLM-configuration definition utility (dlmcfmgr) with the -r parameter specified. For details on the dlmcfmgr utility, refer to the HDLM User's Guide section "dlmcfmgr (HDLM-Configuration Definition Utility)".	<p>Details</p> <p>The HDLM devices could not be configured.</p> <p>Action</p> <p>Execute the HDLM-configuration definition utility (<code>dlmcfmgr</code>) with the <code>-r</code> parameter specified. For details on the <code>dlmcfmgr</code> utility, see dlmcfmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL09040-E	The file could not be edited. File name = <i>aa...aa</i>	<p>Details</p> <p>An attempt to edit a file has failed.</p> <p><i>aa...aa</i>: File name</p> <p>Action</p> <p>Make sure you can edit the file <i>aa...aa</i>.</p>
KAPL09043-I	The installation of <i>aa...aa</i> completed successfully.	<p>Details</p> <p>HDLM was installed.</p> <p><i>aa...aa</i>: Name of installed file</p> <p>Action</p> <p>None.</p>
KAPL09044-I	The remove of <i>aa...aa</i> completed successfully.	<p>Details</p> <p>HDLM was removed.</p>

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: Name of removed file.</p> <p>Action</p> <p>None.</p>
KAPL09045-E	An attempt to create a file or directory related to HDLM has failed. Make sure that sufficient disk space exists, and then re-install HDLM.	<p>Details</p> <p>Installation could not be executed because an attempt to create an HDLM-related file or directory failed.</p> <p>Action</p> <p>Make sure that sufficient disk capacity exists, and then re-install HDLM.</p>
KAPL09046-E	The RPM file is not in the correct path. Confirm that the installation medium is correct, and then re-install HDLM.	<p>Details</p> <p>Installation could not be executed because there was no RPM file in a suitable path.</p> <p>Action</p> <p>Confirm that the installation medium is correct, and then re-install HDLM.</p>
KAPL09047-E	Downgrading from <i>aa...aa</i> to <i>bb...bb</i> is not supported.	<p>Details</p> <p>Downgrade installation is not supported.</p> <p><i>aa...aa</i>: The version of HDLM.</p> <p><i>bb...bb</i>: The version of HDLM.</p> <p>Action</p> <p>Remove HDLM, and then re-execute the installation program.</p>
KAPL09049-W	An attempt to delete a file or directory related to HDLM has failed. Name = <i>aa...aa</i>	<p>Details</p> <p>An attempt to delete an HDLM-related file or directory has failed.</p> <p><i>aa...aa</i>: File name or a directory name</p> <p>Action</p> <p>Delete the file or directory shown in <i>aa...aa</i>.</p>
KAPL09050-E	The driver module dependencies could not be updated. Contact your HDLM vendor or the maintenance company if there is a maintenance contract of HDLM.	<p>Details</p> <p>Installation or remove failed because the dependency information for a driver module could not be updated.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>

Message ID	Message Text	Explanation
KAPL09051-E	You do not have permission to execute the file. File name = <i>aa...aa</i>	<p>Details</p> <p>Installation or remove failed because there was no execution permission for a file.</p> <p><i>aa...aa</i>: File name</p> <p>Action</p> <p>Make sure you can execute the file shown in <i>aa...aa</i>.</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 <i>aa...aa</i> .	<p>Details</p> <p>A temporary license was installed.</p> <p><i>aa...aa</i>: Year (4 digits)/month (01-12)/day (01-31)</p> <p>Action</p> <p>Install a permanent license by the expiration day.</p>
KAPL09078-I	The emergency license was installed. The license expires on <i>aa...aa</i> .	<p>Details</p> <p>An emergency license was installed.</p> <p><i>aa...aa</i>: Year (4 digits)/month (01-12)/day (01-31)</p> <p>Action</p> <p>Install a 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 <i>aa...aa</i> .	<p>Details</p> <p>The temporary license has been installed.</p> <p><i>aa...aa</i>: Year (4 digits)/month (01-12)/day (01-31)</p> <p>Action</p> <p>Install a permanent license by the expiration day.</p>
KAPL09081-I	The emergency license has been installed. The license expires on <i>aa...aa</i> .	<p>Details</p> <p>The emergency license has been installed.</p> <p><i>aa...aa</i>: Year (4 digits)/month (01-12)/day (01-31)</p> <p>Action</p>

Message ID	Message Text	Explanation
		Install a permanent license by the expiration day.
KAPL09082-W	The temporary license expired.	Action Enter a permanent license key.
KAPL09083-W	The emergency license expired.	Action Install a permanent license.
KAPL09087-E	The entered license key is invalid. Renewal of the license key will now stop. Obtain a valid license key, and then re-install HDLM.	Details License renewal will now stop because an invalid license key was entered. Action Obtain a valid license key, and then re-install HDLM.
KAPL09088-E	The entered license key is invalid. The HDLM installation will now terminate. Obtain a valid license key, and then re-install HDLM.	Action Obtain a valid license key, and then re-install HDLM.
KAPL09090-W	This operation will now be continued without updating the license.	Details This operation will continue without updating the license. Action Install a permanent license at a later time.
KAPL09091-E	A fatal error occurred in HDLM. The system environment is invalid. Contact your HDLM vendor or the maintenance company if there is a maintenance contract of HDLM.	Details A part of the HDLM configuration file is missing. Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract of HDLM.
KAPL09092-I	The installation was stopped because a stop request was received.	Details The installation was aborted, because a stop request was received. Action Installation was terminated before all processing could be completed. If the HDLM RPM has been installed, then use the rpm command to perform remove.
KAPL09093-I	<i>aa...aa</i> will be installed. Is this OK? [y/n]:	Details The message checks whether you want to install <i>aa...aa</i> .

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: The version of HDLM to be installed, or the version of the HDLM SP to be installed</p> <p>Action</p> <p>Please enter "y" to install, and "n" to abort the installation.</p>
KAPL09094-W	The entered value is invalid. Re-enter [y/n]:	<p>Details</p> <p>The message checks whether you want to correct an invalid value.</p> <p>Action</p> <p>Please enter "y" or "n".</p>
KAPL09095-E	The entered value is invalid. The installation has been stopped.	<p>Details</p> <p>The entered value is invalid. The installation has been stopped.</p> <p>Action</p> <p>To install HDLM, please re-execute the HDLM installation program.</p>
KAPL09096-I	The user stopped the installation.	<p>Details</p> <p>Installation was aborted by the user.</p> <p>Action</p> <p>None.</p>
KAPL09097-E	A package installable on this system was not found. Please check whether HDLM is supported for this system. For details about installing the package on a supported OS, refer to the HDLM User's Guide section "Hosts and OSs Supported by HDLM".	<p>Details</p> <p>A suitable package for installation on this system could not be found.</p> <p>Action</p> <p>Please check whether HDLM is supported for this system. For details about installing the package on a supported OS, see Hosts and OSs supported by HDLM on page 3-3.</p>
KAPL09098-E	An attempt to install <i>aa...aa</i> has failed. Code = <i>bb...bb</i>	<p>Details</p> <p>An attempt to install <i>aa...aa</i> has failed.</p> <p><i>aa...aa</i>: Program name</p> <p><i>bb...bb</i>: Code (decimal number).</p> <p>Action</p> <p>Please re-install HDLM after checking the error information and resolving the problems.</p>
KAPL09106-E	An invalid parameter has been specified.	<p>Details</p> <p>An invalid parameter has been specified for the <code>installhdlm</code> utility.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Specify the correct options, and then re-execute the <code>installhdlm</code> utility.
KAPL09113-E	There is no installable license key in the license key file. File name = <i>aa...aa</i> Make sure that the license key file is correct, and then re-install HDLM.	<p>Details</p> <p>There is no HDLM-installable license key in the license key file. <i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>Make sure that the license key file is correct, and then re-install HDLM. <code>/var/tmp/hdlm_license</code></p>
KAPL09114-I	There is no license key file. File name = <i>aa...aa</i>	<p>Details</p> <p>There is no license key file in the designated directory. <i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>Save the correct license key file in the designated directory, and then re-execute installation. <code>/var/tmp/hdlm_license</code></p>
KAPL09115-W	An attempt to delete the license key file has failed. File name = <i>aa...aa</i>	<p>Details</p> <p>An attempt to delete the license key file has failed. <i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>If a license key file exists, delete it. <code>/var/tmp/hdlm_license</code></p>
KAPL09116-W	The command could not be installed. (command = <i>aa...aa</i>)	<p>Details</p> <p>The output HDLM command cannot be used. <i>aa...aa</i>: 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>
KAPL09121-E	<i>aa...aa</i> is not present at <i>bb...bb</i> .	<p>Details</p> <p><i>aa...aa</i>: Installer name <i>bb...bb</i>: Installer path</p> <p>Action</p> <p>Install HDLM from the DVD-ROM.</p>

Message ID	Message Text	Explanation
		When you are attempting to install HDLM from the directory to which the DVD-ROM was copied, make sure that all the contents of the DVD-ROM have been copied to that directory, and then retry the installation.
KAPL09135-E	One of the following was executed at the same time as an HDLM command set -lic operation: another set -lic operation, or an update of the license for an update installation.	<p>Action</p> <p>Check the license by using the HDLM command's <code>view -sys -lic</code> operation. If necessary, update the license by using the <code>set -lic</code> operation during or after the 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</p>
KAPL09142-E	HDLM <i>aa...aa</i> cannot be performed. Wait a while, and then perform <i>aa...aa</i> again. Error Code = <i>bb...bb</i>	<p>Details</p> <p>HDLM cannot be installed or removed.</p> <p><i>aa...aa</i> : "installation" or "remove"</p> <p><i>bb...bb</i> : Internal code (decimal (base-10) number)</p> <p>Action</p> <p>Wait a while, and then reperform the installation or remove.</p>
KAPL09143-E	HDLM <i>aa...aa</i> cannot be performed. Error Code = <i>bb...bb</i>	<p>Details</p> <p>HDLM cannot be installed or removed.</p> <p><i>aa...aa</i>: "installation" or "remove"</p> <p><i>bb...bb</i>: 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>
KAPL09146-E	A directory required by HDLM not found. Directory = <i>aa...aa</i> . Create the directory displayed in this message, then re-install HDLM.	<p>Details</p> <p><i>aa...aa</i>: Referenced directory name</p> <p>Action</p> <p>Check the directory displayed in the message. Re-install HDLM</p>

Message ID	Message Text	Explanation
		after creating the directory displayed in the message.
KAPL09147-E	An attempt to create a file related to HDLM has failed. File name = <i>aa...aa</i> . Remove unnecessary files and secure free space on the file system. Check the write permissions for the directory. Re-install HDLM.	<p>Details</p> <p><i>aa...aa</i>: File that an attempt was made to create</p> <p>Action</p> <p>Remove unnecessary files and secure unused capacity on the file system. Check the write permissions for the directory. Re-install HDLM.</p>
KAPL09160-E	HDLM does not support this kernel. Install HDLM on a supported OS.	<p>Details</p> <p>HDLM does not support the current kernel, or it does not support the combination of the current CPU and the kernel.</p> <p>Action</p> <p>Make sure the current kernel and the running server's CPU are of the correct type.</p>
KAPL09163-E	An HDLM package installable on this kernel was not found in the mount point. Mount point = <i>aa...aa</i> . Check the HDLM installation media, or check the current kernel.	<p>Details</p> <p>The HDLM for the current kernel has not been stored in the HDLM installation media being mounted in the mount point that is specified in the message.</p> <p><i>aa...aa</i>: mount point</p> <ul style="list-style-type: none"> Red Hat Enterprise Linux 6 server: <i>/media/cdrom</i> SUSE LINUX Enterprise Server 11: <i>/media/media-volume-ID</i> <p>Action</p> <p>Check the HDLM installation media, or check the current kernel.</p>
KAPL09177-I	HDLM version: <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The version of HDLM to be installed.</p> <p>Action</p> <p>None.</p>
KAPL09191-W	The installation information settings file does not exist.	<p>Details</p> <p>The installation information settings file specified for the second parameter does not exist.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Make sure that the path name of the installation-information settings file is appropriate, and then try again.
KAPL09199-E	HDLM does not support this operating system.	<p>Details</p> <p>HDLM does not support the currently running OS.</p> <p>For details about the OSs supported by HDLM, see Table 3-2 Red Hat Enterprise Linux 6 kernels supported by HDLM on page 3-5, Table 3-3 Red Hat Enterprise Linux 7 kernels supported by HDLM on page 3-7, Table 3-4 Red Hat Enterprise Linux 8 kernels supported by HDLM on page 3-7, Table 3-5 SUSE LINUX Enterprise Server 11 kernels supported by HDLM on page 3-8, Table 3-6 SUSE LINUX Enterprise Server 12 kernels supported by HDLM on page 3-9, Table 3-7 SUSE LINUX Enterprise Server 15 kernels supported by HDLM on page 3-9, Table 3-8 Oracle Linux 6 kernels supported by HDLM on page 3-10, Table 3-9 Oracle Unbreakable Enterprise Kernel 6 kernels supported by HDLM on page 3-11, Table 3-10 Oracle Linux 7 kernels supported by HDLM on page 3-12, Table 3-11 Oracle Unbreakable Enterprise Kernel 7 kernels supported by HDLM on page 3-13, Table 3-12 Oracle Linux 8 kernels supported by HDLM on page 3-13 or Table 3-13 Oracle Unbreakable Enterprise Kernel 8 kernels supported by HDLM on page 3-14.</p> <p>Action</p> <p>Make sure that the currently running OS is supported.</p>
KAPL09210-I	<i>aa...aa</i> will now start.	<p>Details</p> <p><i>aa...aa</i> has just started.</p> <p><i>aa...aa</i>: installhdlm, installhdlm_analysis, ENVIRONMENT_SETTINGS, driver_config_settings, or dlmcfgmgr</p> <p>Action</p> <p>None.</p>
KAPL09211-I	<i>aa...aa</i> completed successfully.	Details

Message ID	Message Text	Explanation
		<p><i>aa...aa</i> completed successfully.</p> <p><i>aa...aa</i>: installhdlm, installhdlm_analysis, ENVIRONMENT_SETTINGS, driver_config_settings, or dlmcfmgr</p> <p>Action</p> <p>None.</p>
KAPL09212-E	<i>aa...aa</i> ended abnormally.	<p>Details</p> <p><i>aa...aa</i> ended abnormally.</p> <p><i>aa...aa</i>: installhdlm, or installhdlm_analysis</p> <p>Action</p> <p>Check the error message that was output just before this message, and then perform the action indicated in that error message.</p>
KAPL09213-W	An error occurred during <i>aa...aa</i> processing.	<p>Details</p> <p>Although the <i>aa...aa</i> processing has ended, an error occurred during the processing.</p> <p><i>aa...aa</i>: ENVIRONMENT_SETTINGS, driver_config_settings, or installhdlm</p> <p>Action</p> <p>Review the contents of installation information settings file when KAPL01008-W or KAPL01009-W is outputted before this message. For details, see Editing an installation-information settings file on page 7-60.</p> <p>When a message except for the above was outputted, perform the action indicated in that error message.</p>
KAPL09215-E	The system environment is invalid. Error Code = <i>aa...aa</i>	<p>Details</p> <p>The system environment is not valid as an environment for executing the installhdlm utility.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p>Action</p> <p>If the error code is 4:</p> <p>The /var/tmp directory does not have enough unused capacity, or the user does not have write permission for it.</p>

Message ID	Message Text	Explanation
		<p>Make sure there is enough unused capacity and that the user has write permission for this directory, and then try again.</p> <p>If the error code is 6:</p> <p>The <code>/etc/opt</code> directory does not have enough unused capacity, or the user does not have write permission for it. Make sure there is enough unused capacity and that the user has write permission for this directory, and then try again.</p> <p>other error code:</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09216-E	An error occurred during I/O of a file that <code>installhdlm</code> uses. Error Code = <i>aa...aa,bb...bb</i>	<p>Details</p> <p>An error occurred during I/O of a file that <code>installhdlm</code> uses.</p> <p><i>aa...aa</i>: Error number that indicates the executed processing (decimal (base-10) number)</p> <p><i>bb...bb</i>: Return value of the executed processing (decimal (base-10) number)</p> <p>Action</p> <p>Make sure that sufficient unused capacity exists for the <code>/tmp</code> directory. If the capacity is insufficient, allocate the required amount of capacity, and then retry the operation. For details about the required unused capacity. For details about the required unused capacity, see Disk requirements on page 3-72.</p>
KAPL09217-E	An error occurred during reading of the installation information settings file. Error Code = <i>aa...aa,bb...bb</i>	<p>Details</p> <p>An error occurred while reading the installation information settings file.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p>Action</p>

Message ID	Message Text	Explanation
		<p>If the error code is 9001,-1:</p> <p>You do not have read permissions for the installation information settings file. Make sure that you have access permissions.</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>
KAPL09218-E	<i>aa...aa</i> cannot be executed.	<p>Details</p> <p>A utility or command that <code>installhdlm</code> uses was not in the correct location, or you do not have a required permission.</p> <p><i>aa...aa</i>: <code>installhdlm_analysis</code>, <code>dlmcfgmgr</code>, or <code>dlnmgr</code></p> <p>Action</p> <p>If <i>aa...aa</i> is <code>dlnmgr</code> :</p> <p>The correct location of <code>dlnmgr</code> is <code>/opt/DynamicLinkManager/bin</code>. If <code>dlnmgr</code> was not in the correct location, or you did not have a required permission, re-execute <code>installhdlm</code>.</p> <p>If <i>aa...aa</i> is <code>installhdlm_analysis</code>:</p> <p>The correct location of <code>installhdlm_analysis</code> is <code>/DVD-ROM/HDLM_Linux/bin</code>. Make sure that the utility you want to execute is in the correct location and that you have the required permissions. If a utility is not in the correct location, copy the required files to the correct location, and then retry the operation. If you do not have a required permission, grant required permissions to yourself, and then retry the operation.</p> <p>If <i>aa...aa</i> is <code>dlmcfgmgr</code>:</p> <p>The correct location of <code>dlmcfgmgr</code> is <code>/sbin</code>. If <code>dlnmgr</code> was not in the</p>

Message ID	Message Text	Explanation
		correct location, or you did not have a required permission, re-execute <code>installhdlm</code> .
KAPL09219-E	An internal error occurred in the <code>installhdlm_analysis</code> . Error Code = <i>aa...aa,bb...bb</i>	<p>Details</p> <p>An internal error occurred in the <code>installhdlm_analysis</code>.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09220-W	The composition of the installation information settings file is invalid. Error Code = <i>aa...aa,bb...bb</i>	<p>Details</p> <p>In the installation information settings file, the length of a single line exceeds 1,023 characters, or the first non-white space, non-comment line that appears is not <code>[INSTALLATION_SETTINGS]</code>.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p>Action</p> <p>Specify the revised installation information settings file, and then retry the operation.</p>
KAPL09221-W	The definition of the installation information settings file includes an unusable character. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A character that cannot be used in a non-comment line was used.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Specify the revised installation information settings file, and then retry the operation.
KAPL09227-W	The definition of the installation information settings file includes an invalid key. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A key that does not exist is included.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09228-W	The definition of the installation information settings file includes an invalid key value. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>The format of a key value is invalid.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09229-W	The definition of the installation information settings file includes an invalid section name. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A section that does not exist is included.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Specify the revised installation information settings file and then retry the operation.
KAPL09230-W	The definition of the installation information settings file includes a duplicated section name. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A duplicated section name is included.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09231-W	The definition of the installation information settings file includes a duplicated key. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A duplicated key is included.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09232-W	The composition of the definition of the installation information settings file is invalid. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>A key, key value, or equal sign (=) is missing.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Specify the revised installation information settings file and then retry the operation.
KAPL09233-W	The definition of the installation information settings file is too long. Error Code = <i>aa...aa,bb...bb</i> , line = <i>cc...cc</i>	<p>Details</p> <p>The length of a single line of the definition exceeds 1023 characters.</p> <p><i>aa...aa</i>: Error number (decimal number) that specifies the executed processing</p> <p><i>bb...bb</i>: Return value (decimal number) of the executed processing</p> <p><i>cc...cc</i>: Line number (decimal number) of an installation information settings file.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09234-W	A folder or file specified by the installation information settings file does not exist. Name = <i>aa...aa</i>	<p>Details</p> <p>A folder or file specified by the installation information settings file does not exist.</p> <p><i>aa...aa</i>: Name of the folder or file that does not exist.</p> <p>Action</p> <p>Specify the revised installation information settings file and then retry the operation.</p>
KAPL09238-W	The specified file is not a normal one. Fail name = <i>aa...aa</i>	<p>Details</p> <p>A file other than a normal one (for example, a directory file or a special file.) is specified.</p> <p><i>aa...aa</i>: Specified file name (character string)</p> <p>Action</p> <p>Specify the correct file, and then retry the operation.</p>
KAPL09239-I	The system will now restart.	<p>Details</p> <p>The host will restart because restart was specified in the installation information settings file.</p> <p>Action</p> <p>None.</p>
KAPL09240-I	There is no license key file. File name = <i>aa...aa</i> If you want to	<p>Details</p> <p>There is no license key file.</p>

Message ID	Message Text	Explanation
	update the HDLM license, create a license key file (referring to the HDLM installation instructions in the user's guide, if necessary), and then re-execute the installation program.	<p><i>aa...aa</i>: dlm.lic_key</p> <p>Action</p> <p>None.</p>
KAPL09244-E	Could not create file supporting driver update.	<p>Details</p> <p>Could not create file supporting driver update.</p> <p>Action</p> <p>Re-execute the HDLM installation program. If it failed again Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09245-E	Could not delete file supporting driver update.	<p>Details</p> <p>Could not delete file supporting driver update.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL09267-W	The file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00, /etc/.HBaseAgent/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL09268-W	You do not have read permission for the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00, /etc/.HBaseAgent/ Path00</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL09269-W	The file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/</p>

Message ID	Message Text	Explanation
		Path00, /etc/.HBaseAgent/ Path00 Action Reinstall HDLM.
KAPL09270-E	The directory does not exist. Directory name = <i>aa...aa</i>	Details <i>aa...aa</i> : /HDLM installation directory, /HBsA installation directory Action Reinstall HDLM.
KAPL09295-W	Restart the host to complete installation.	Details HDLM was installed successfully. Restart the host to complete installation. Action The manual includes the same content. Restart the host to complete installation. Supplement: The -update option should only be used in an HDLM-SAN boot environment. However, if the option is used in a different environment, one of the following must be done: <ol style="list-style-type: none"> If you are using the option in an environment from which migration to an HDLM-SAN boot environment is not possible: Restart the host, and then start the operation. If you are using the option in an environment from which migration to an HDLM-SAN boot environment is possible: Restart the host, and then migrate to an HDLM-SAN boot environment by following the procedure in the manual.
KAPL09296-E	The upgrade of the device management files failed.	Details The upgrade of the device management files failed. Action <ol style="list-style-type: none"> To continue HDLM installation: Delete the device management files (/dev/dlm/

Message ID	Message Text	Explanation
		<p>sddl[m[af]drv0), and then install HDLM.</p> <p>b. To terminate HDLM installation:</p> <p>Restart the host to reconfigure HDLM, and then start the application.</p>
KAPL09297-W	Create an initial RAM disk image, and then update the boot loader configuration file. Then restart the host to complete installation.	<p>Details</p> <p>HDLM was installed successfully. Create an initial RAM disk image, and then update the boot loader configuration file. Then restart the host to complete installation.</p> <p>Action</p> <p>Follow the procedure to create an initial RAM disk image. Specify the created initial RAM disk image in the boot loader configuration file, and then restart the host.</p>
KAPL09299-W	The creation of the initial RAM disk image failed.	<p>Details</p> <p>The creation of the initial RAM disk image failed.</p> <p>Action</p> <p>Follow the procedure to create an initial RAM disk image. Specify the created initial RAM disk image in the boot loader configuration file, and then restart the host.</p>
KAPL09300-I	An initial RAM disk image was created. (file name = <i>aa...aa</i>)	<p>Details</p> <p>An initial RAM disk image was created.</p> <p><i>aa...aa</i>: Name of the created file (full path)</p> <p>Action</p> <p>None.</p>
KAPL09301-W	Update the boot loader configuration file, and then restart the host to complete installation.	<p>Details</p> <p>HDLM was installed successfully. Update the boot loader configuration file, and then restart the host to complete installation.</p> <p>Action</p> <p>Specify the created initial RAM disk image in the boot loader configuration file, and then restart the host.</p>
KAPL09306-W	Create an initial RAM disk image. Then restart the host to complete installation.	<p>Details</p>

Message ID	Message Text	Explanation
		<p>HDLM was installed successfully. Create an initial RAM disk image. Then restart the host to complete installation.</p> <p>Action</p> <p>Follow the procedure to create an initial RAM disk image, and then restart the host.</p>
KAPL09320-E	A command required to install HDLM could not be found. Command name = <i>aa...aa</i>	<p>Details</p> <p>A command required to install HDLM could not be found. <i>aa...aa</i>: Command name</p> <p>Action</p> <p>Make sure that the OS you are using meets the prerequisite conditions, and install all required packages. Then, re-install HDLM.</p>
KAPL09321-E	The specified option is invalid.	<p>Details</p> <p>An invalid option was specified.</p> <p>Action</p> <p>Revise the specified option in accordance with the following syntax, and then re-execute the utility.</p> <p>Usage: <code>removehdlm [-h]</code></p>
KAPL09322-W	The removal of HDLM was not performed by using the <code>removehdlm</code> utility.	<p>Details</p> <p>The removal of HDLM was not performed by using the <code>removehdlm</code> utility.</p> <p>Action</p> <p>The removal of HDLM was not performed by using the <code>removehdlm</code> utility. Do not use <code>rpm -e</code> to remove HDLM. Be sure to use the <code>removehdlm</code> utility.</p> <p>Check whether the execution results of the command for which this message was output include the KAPL09044-I message. Depending on the execution results, take action as follows:</p> <p>If the execution results include KAPL09044-I:</p> <p>HDLM was successfully removed.</p> <p>If the following messages are output after this message, perform the actions described in those messages.</p>

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> • KAPL09049-W • KAPL09323-W <p>If the execution results do not include KAPL09044-I:</p> <p>The removal of HDLM failed.</p> <p>Resolve the problem, and then remove HDLM by using the <code>removehdlm</code> utility. (Do not use <code>rpm -e</code>.)</p> <p>If the removal of HDLM was canceled, manually restart the <code>hbsasrv</code> service.</p>
KAPL09323-W	The <code>hbsasrv</code> service could not start.	<p>Details</p> <p>The <code>hbsasrv</code> service could not start because the removal of HDLM was not performed by using the <code>removehdlm</code> utility.</p> <p>Action</p> <p>HDLM was removed, but the <code>hbsasrv</code> service could not start. Manually start the <code>hbsasrv</code> service.</p>
KAPL09501-E	HDLM is not installed on this system.	<p>Details</p> <p>An SP cannot be applied because HDLM is not installed on the system.</p> <p>Action</p> <p>Check whether HDLM has been correctly installed.</p>
KAPL09505-E	<i>aa...aa</i> cannot be applied to the installed <i>bb...bb</i> .	<p>Details</p> <p>This HDLM or SP (<i>aa...aa</i>) cannot be used for an upgrade installation or re-installation on the already installed HDLM or installed SP (<i>bb...bb</i>).</p> <p><i>aa...aa</i>: the version of HDLM or SP currently being installed</p> <p><i>bb...bb</i>: the version of HDLM or SP already installed</p> <p>Action</p> <p>An upgrade installation or re-installation cannot be performed on an already installed HDLM or SP.</p> <p>When installing HDLM: First remove the installed HDLM or SP, and then perform a new installation.</p>

Message ID	Message Text	Explanation
		When installing a SP: Obtain, and then install an SP or corrected version that can be applied to the installed version of HDLM.
KAPL09509-E	Service Pack <i>aa...aa</i> cannot be installed. The same version has already been installed.	<p>Details</p> <p>The version of the SP being installed is the same as the already installed SP. Installation of the SP has stopped.</p> <p><i>aa...aa</i>: Version of the SP being installed</p> <p>Action</p> <p>You do not have to install the SP. Keep using HDLM as is.</p>
KAPL09510-E	Service Pack <i>aa...aa</i> cannot be installed. A newer version has already been installed.	<p>Details</p> <p>A newer version is already installed. Installation of SP (<i>aa...aa</i>) is stopped.</p> <p><i>aa...aa</i>: Version of SP to be installed</p> <p>Action</p> <p>You do not have to install the SP. Keep using the already installed HDLM.</p>
KAPL09511-E	The RPM file for the service pack was not found.(directory = <i>aa...aa</i>)	<p>Details</p> <p>The RPM file for the SP corresponding to the installed HDLM does not exist in the directory indicated by the message.</p> <p><i>aa...aa</i>: Directory name</p> <p>Action</p> <p>Download the installation file for the SP version again. Then, retry the installation.</p>
KAPL09601-E	Cannot install in this system. Install HDLM on a supported OS.	<p>Details</p> <p>HDLM cannot be installed on this system.</p> <p>Action</p> <p>Execute the following command in place of <code>installux.sh</code>:</p> <p><code>DVD-mount-point/HDLM_Linux/installhdlm</code></p>
KAPL09602-E	The installation will now stop because a file or directory is missing. Confirm that the file or directory (<i>aa...aa</i>) exists.	<p>Details</p> <p><i>aa...aa</i>: Name of the missing file or directory</p> <p>Action</p>

Message ID	Message Text	Explanation
		<p>If an installation is performed from the DVD-ROM, confirm that the DVD-ROM is not damaged.</p> <p>If an installation is performed by using files copied from the DVD-ROM, re-copy all of the DVD-ROM files.</p>
KAPL09603-E	The installation will now stop because a command or utility cannot be executed. Confirm that the command or utility (<i>aa...aa</i>) exists, and that you have the proper permission.	<p>Details</p> <p><i>aa...aa</i>: Name of the command or utility that cannot be executed.</p> <p>Action</p> <ul style="list-style-type: none"> When the output information is an HDLM utility: <p>If an installation is performed from the DVD-ROM, confirm that the DVD-ROM is not damaged.</p> <p>If an installation is performed by using files copied from the DVD-ROM, re-copy all of the DVD-ROM files. After that, confirm the permission of the HDLM utility that caused the error.</p> When the output information is an OS command: <p>Confirm that the OS command exists, and that you have the proper permission.</p>
KAPL09604-E	A system error occurred. The installation will now stop. (command = <i>aa...aa</i> , error code = <i>bb...bb</i>)	<p>Details</p> <p><i>aa...aa</i>: Command that failed</p> <p><i>bb...bb</i>: Return value</p> <p>Action</p> <p>Acquire the log <code>/var/tmp/hdlm_installux_sh.log</code>, and then contact your HDLM vendor or, if you have a maintenance contract, contact the maintenance company.</p>

KAPL10001 to KAPL11000

Message ID	Message Text	Explanation
KAPL10001-W	No parameter has been specified.	<p>Details</p> <p>No directory to which the collected information will be output has been specified.</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10003-W	The first parameter has not been set to a directory. Value = <i>aa...aa</i>	<p>Details</p> <p>A value which is not a directory name is set for the first parameter. The first parameter must be a directory to which collected information will be output.</p> <p><i>aa...aa</i>: First parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10004-W	The parameter contains an incorrect value. Value = <i>aa...aa</i>	<p>Details</p> <p>The first parameter must be a directory. The second parameter must be <code>-f</code>.</p> <p><i>aa...aa</i>: Invalid parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
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. The number of parameters is insufficient.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10006-W	The file for defining the information to be collected does not exist, or cannot be read. Value = <i>aa...aa</i>	<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><i>aa...aa</i>: 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 = <i>aa...aa</i>	<p>Details</p> <p>A directory is specified for the <code>-f</code> parameter.</p> <p><i>aa...aa</i>: Third parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10008-W	You lack write permission for the specified directory. Value = <i>aa...aa</i>	<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><i>aa...aa</i>: first parameter</p> <p>Action</p> <p>Check the following.</p>

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> a. Check whether you have access permission for the specified directory. b. Check whether the specified directory name is correct. c. Check that the disk has sufficient unused capacity.
KAPL10009-W	The specified directory already exists. Do you want to overwrite it? [y/n]:	<p>Details</p> <p>The specified directory already exists. To overwrite the directory, enter <i>y</i>. To cancel this operation, enter <i>n</i>.</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. For details on the <i>DLMgetras</i> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10010-W	A root directory has been specified. Line = <i>aa...aa</i>	<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><i>aa...aa</i>: 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. For details on the <i>DLMgetras</i> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
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>

Message ID	Message Text	Explanation
		<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> utility will ignore the specified file or directory and continue processing. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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 where information is to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining which information to be collected (decimal (base-10) number)</p> <p><i>bb...bb</i>: Indicated contents of 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> utility will ignore the specified file or directory and continue processing. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
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>

Message ID	Message Text	Explanation
		<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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10015-W	The file format is invalid. Value = <i>aa...aa</i>	<p>Details</p> <p>The file format is invalid. The file format in the file for defining information to be collected is not a text file.</p>

Message ID	Message Text	Explanation
		<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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10016-W	The root directory has been specified in the first parameter.	<p>Details</p> <p>The root directory has been specified in the first parameter. 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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 permissions.</p> <p>Action</p> <p>Re-execute as a user with root permissions. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10020-I	The file has been obtained successfully. File = <i>aa...aa</i> , Collection time = <i>bb...bb</i> (GMT: <i>bb...bb</i>)	<p>Details</p> <p>The file to be collected has been obtained.</p> <p><i>aa...aa</i>: Collected file name <i>bb...bb</i>: 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 <code>Ctrl + c</code>.</p> <p>Action</p>

Message ID	Message Text	Explanation
		<p>The utility for collecting HDLM error information terminated before completion.</p> <p>If the directory is unnecessary, delete directory. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10030-I	A user terminated the utility for collecting HDLM error information.	<p>Details</p> <p>Processing of the <code>DLMgetras</code> utility for collecting HDLM error information has been terminated because the user replied to the confirmation with an n response.</p> <p>Action</p> <p>None. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10031-W	The entered value is invalid. Continue operation? [y/n]:	<p>Details</p> <p>A value other than y or n has been entered for a [y/n] request. Enter y or n.</p> <p>Action</p> <p>Enter y or n.</p>
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 in a row to a request.</p> <p>Action</p> <p>Re-execute the <code>DLMgetras</code> utility. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</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>: Name of file to collect</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>None.</p>
KAPL10034-E	The file could not be copied. Filename = <i>aa...aa</i> , Details = <i>bb...bb</i>	<p>Details</p> <p>Execution of the <code>cp</code> command failed.</p> <p><i>aa...aa</i>: Name of the file you tried to copy</p> <p><i>bb...bb</i>: <code>cp</code> command output message</p> <p>Action</p> <p>An error occurred while the collected files were being copied. The environment, in which a user executed the command, might be wrong. Check the system configuration.</p>
KAPL10035-E	An attempt to archive the error information failed. Details = <i>aa...aa</i>	<p>Details</p> <p>Execution of the <code>tar</code> command failed.</p> <p><i>aa...aa</i>: <code>tar</code> command 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 = <i>aa...aa</i>	<p>Details</p> <p>Execution of the <code>gzip</code> command failed.</p> <p><i>aa...aa</i>: <code>gzip</code> command 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>
KAPL10037-W	The file does not exist or does not have executable permissions. Filename = <i>aa...aa</i>	<p>Details</p>

Message ID	Message Text	Explanation
		<p>There is no output file, or the user does not have execution permission.</p> <p><i>aa...aa</i>: file name</p> <p>Action</p> <p>Make sure the specified file exists and the user has execution permission.</p>
KAPL10049-I	Error information collection command = <i>aa...aa</i> , Return value = <i>bb...bb</i> , Execution time = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: Executed command</p> <p><i>bb...bb</i>: Return value of the executed command</p> <p><i>cc...cc</i>: Year (4 digits)/month/day hour:minute:second</p> <p>Action</p> <p>None.</p>
KAPL10050-I	The utility for collecting HDLM error information started. Start time = <i>aa...aa</i> (GMT <i>aa...aa</i>)	<p>Details</p> <p><i>aa...aa</i>: Year (4 digits)/month/day hour:minute:second</p> <p>Action</p> <p>None.</p>
KAPL10301-I	/sbin/dlmcfgmgr started: <i>aa...aa</i>	<p>Details</p> <p>The HDLM-configuration definition utility (dlmcfgmgr) has started.</p> <p><i>aa...aa</i>: date and time (for example, Fri Aug 23 19 : 12 : 50 2004)</p> <p>Action</p> <p>None. For details on the dlmcfgmgr utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10302-I	/sbin/dlmcfgmgr completed normally.	<p>Details</p> <p>The HDLM-configuration definition utility (dlmcfgmgr) has completed successfully.</p> <p>Action</p> <p>None. For details on the dlmcfgmgr utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10305-E	A special file could not be created. Filename = <i>aa...aa</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>A logical device file for an HDLM device cannot be created.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p>

Message ID	Message Text	Explanation
		<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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10306-W	The configuration definition file is invalid. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>The configuration definition file (<code>/etc/opt/DynamicLinkManager/.dlmfdrv.conf</code>) is invalid.</p> <p>Action</p> <p><code>/etc/opt/DynamicLinkManager/.dlmfdrv.conf</code> to an alias name and restart the host. The logical device file name of the HDLM device might be changed, so that after the host restarts, check the logical device file name. If the logical device file name was changed, modify the path to the upper-level program.</p>
KAPL10308-W	The configuration definition file could not be created. Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>The configuration definition file (<code>/etc/opt/DynamicLinkManager/.dlmfdrv.conf</code>) could not be created.</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10309-W	The HDLM management-target disk does not exist. Check the system configuration.	<p>Details</p> <p>The HDLM management-target device does not exist.</p> <p>Action</p> <p>Check the system configuration.</p>

Message ID	Message Text	Explanation
KAPL10312-I	HDLM has created an HDLM device special file. Device = <i>aa...aa</i>	<p>Details</p> <p>A logical device file for an HDLM device has been created.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None.</p>
KAPL10313-I	HDLM has deleted an HDLM device special file. Device = <i>aa...aa</i>	<p>Details</p> <p>A logical device file for an HDLM device has been deleted.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None.</p>
KAPL10314-I	HDLM has updated an HDLM device special file. Device = <i>aa...aa</i>	<p>Details</p> <p>A logical device file for an HDLM device has been updated.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None.</p>
KAPL10316-E	Could not allocate memory. Size = <i>aa...aa</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>Securing of memory failed.</p> <p><i>aa...aa</i>: Target memory size (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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10318-E	An internal error occurred in the HDLM-configuration definition utility (<code>dlnmcfmgr</code>). Code = <i>aa...aa</i> Errno = <i>bb...bb cc...cc</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An internal error occurred in the HDLM-configuration definition utility (<code>dlnmcfmgr</code>).</p> <p><i>aa...aa</i>: Line number in which the error occurred (decimal number)</p> <p><i>bb...bb</i>: Error number (errno) (decimal number)</p> <p><i>cc...cc</i>: Detailed information (optional)</p> <p>Action</p>

Message ID	Message Text	Explanation
		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, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL10319-W	usage: /sbin/dlmcfgmgr [-s] <div> {-r -o {special-file-name ... all} -i {special-file-name ... all} -v [-u udev] -u {special-file-name ... all} - extenddev {hdlm-special- file... all} - logfs [log-file-size]} </div>	<p>Details</p> <p>Since the parameter of the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) was inaccurate, execution of the <code>dlmcfgmgr</code> utility failed. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p> <p>Action</p> <p>Specify the correct options, and then re-execute the <code>dlmcfgmgr</code> utility.</p>
KAPL10320-E	The file format is invalid. File name = <code>aa...aa</code> . Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>The file format is invalid. <code>aa...aa</code>: file name</p> <p>Action</p> <p>Re-execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>). If the same message is output, 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.</p> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10321-W	The specified HDLM device is invalid. Device = <code>aa...aa</code> . Specify a valid logical device file name of an HDLM device, and then execute the <code>dlmcfgmgr</code> utility.	<p>Details</p> <p>Executing the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) failed because the logical device file name of the HDLM device was incorrect. <code>aa...aa</code>: Logical device file name of HDLM device</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>Specify a correct logical device file name of an HDLM device, and then re-execute the <code>dlnmcfmgmgr</code> utility. For details on the <code>dlnmcfmgmgr</code> utility, see dlnmcfmgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10322-E	A file that defines HDLM-unmanaged disks could not be created. File name = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>Execution of the HDLM-configuration definition utility (<code>dlnmcfmgmgr</code>) failed because an exclusion disk definition file (<i>aa...aa</i>) could not be created.</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Error number (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10323-E	The registration of the block device driver for HDLM failed. All dynamic major numbers are exhausted. Unload (remove from the kernel) an unnecessary driver, and then execute the <code>dlnmcfmgmgr</code> utility again.	<p>Details</p> <p>Registration of the block device driver of HDLM failed because all dynamic major numbers were used.</p> <p>Action</p> <p>Unload (remove from the kernel) any unnecessary driver, and then re-execute the HDLM-configuration definition utility (<code>dlnmcfmgmgr</code>). For details on the <code>dlnmcfmgmgr</code> utility, see dlnmcfmgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10324-I	The device configuration of the system has changed. Device = <i>aa...aa</i>	<p>Details</p> <p>The device composition of a system to a device (<i>aa...aa</i>) was changed.</p> <p><i>aa...aa</i>: HDLM device name</p> <p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL10325-E	A regular expression cannot be established. The files will not be deleted. Errno = <i>aa...aa</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An HDLM device could not be deleted because the device could not be found by using a regular expression.</p> <p><i>aa...aa</i>: Error number (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10326-E	You lack permission for executing the HDLM-configuration definition utility. Execute the <code>dlnmcfmgmr</code> utility as a user with root permission.	<p>Details</p> <p>The current user does not have authority to execute the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>).</p> <p>Action</p> <p>Re-execute the <code>dlnmcfmgmr</code> utility as a user with root permission. For details on the <code>dlnmcfmgmr</code> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10327-W	The entered value is invalid.	<p>Details</p> <p>The value input into the execution check message of the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>) is invalid.</p> <p>Action</p> <p>Enter the correct y/n value after the KAPL10339-I message is output. For details on the <code>dlnmcfmgmr</code> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10328-E	The entered value is invalid. The HDLM-configuration definition utility processing will now stop. Execute the HDLM-configuration definition utility again.	<p>Details</p> <p>An invalid value was entered 3 or more times for the message confirming the execution of the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>). Processing is interrupted.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Re-execute the <code>dlnmcfgmgr</code> utility. For details on the <code>dlnmcfgmgr</code> utility, see dlnmcfgmgr utility for managing the HDLM configuration on page 7-26 .
KAPL10329-E	A file could not be opened. File name = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>The file could not be opened.</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Error number (decimal number)</p> <p>Action</p> <p>Confirm the existence of the file. If there is no problem, and then 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10330-E	A symbolic link cannot be created. File name = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An attempt to create a symbolic link has failed.</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Error number (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10331-E	The registering of the block device driver for HDLM failed. Errno = <i>aa...aa</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An attempt to register the block device driver of HDLM has failed.</p> <p><i>aa...aa</i>: Error number (decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM</p>

Message ID	Message Text	Explanation
		<p>vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10332-E	The registering of the partition information for HDLM device(s) failed. Errno = <i>aa...aa</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An attempt to register the partition information on HDLM has failed.</p> <p><i>aa...aa</i>: Error number (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10333-E	An internal error occurred in the file operation. File name = <i>aa...aa</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An internal error occurred during file operation.</p> <p><i>aa...aa</i>: File name</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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10334-E	<code>Ioctl aa...aa</code> failed with errno = <i>bb...bb</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An attempt to issue an IOCTL call has failed.</p> <p><i>aa...aa</i>: IOCTL name</p> <p><i>bb...bb</i>: Error number (decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information,</p>

Message ID	Message Text	Explanation
		<p>and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10335-E	A directory cannot be created. Directory = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An attempt to create a directory has failed.</p> <p><i>aa...aa</i>: Directory name</p> <p><i>bb...bb</i>: Error number (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10336-W	A file cannot be deleted. File name = <i>aa...aa</i> . Manually delete the file <i>aa...aa</i>	<p>Details</p> <p>An attempt to delete a file has failed.</p> <p><i>aa...aa</i>: File name</p> <p>Action</p> <p>Delete the file shown in File name.</p>
KAPL10337-W	A special device exists with a different major number. The device will now be unlinked. Device = <i>aa...aa</i>	<p>Details</p> <p>The HDLM device indicated by <i>aa...aa</i> was deleted because the major number for its logical device file is invalid.</p> <p><i>aa...aa</i>: Logical device file name of the HDLM device</p> <p>Action</p> <p>None.</p>
KAPL10338-W	A directory cannot be deleted. Directory = <i>aa...aa</i> . Manually delete the directory <i>aa...aa</i>	<p>Details</p> <p>An attempt to delete a directory has failed.</p> <p><i>aa...aa</i>: Directory name</p> <p>Action</p> <p>Delete the directory shown in Directory.</p>

Message ID	Message Text	Explanation
KAPL10339-I	This operation will change the configuration of HDLM devices. Do you want to continue? [y/n]:	<p>Details</p> <p>This message checks whether you want to change the configuration definition of an HDLM device.</p> <p>Action</p> <p>Enter <i>y</i> to continue. Enter <i>n</i> to cancel.</p>
KAPL10340-E	Several processes failed. See the <i>aa...aa</i> file. Check the message output before this message.	<p>Details</p> <p>Some processes in the execution of the HDLM-configuration definition utility (<i>dlmcfgmgr</i>) have failed. Check the file <i>aa...aa</i>. <i>aa...aa</i>: File name</p> <p>Action</p> <p>See the <i>/var/opt/DynamicLinkManager/log/dlmcfgmgr1.log</i> file and check the message output before this message. For details on the <i>dlmcfgmgr</i> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10341-I	The HDLM device configurations have been changed.	<p>Details</p> <p>The configuration of an HDLM device was changed by execution of the HDLM-configuration definition utility (<i>dlmcfgmgr</i>).</p> <p>Action</p> <p>None. For details on the <i>dlmcfgmgr</i> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10343-I	HDLM has detected and registered a new HDLM device. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlmcfgmgr</i>), a new HDLM device has been detected and registered into the HDLM device configuration definition. <i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None. For details on the <i>dlmcfgmgr</i> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10344-I	HDLM has detected and registered a new path to an already registered HDLM device.	<p>Details</p>

Message ID	Message Text	Explanation
	HDLM device = <i>aa...aa</i> , Device = <i>bb...bb</i> (Host: <i>cc...cc</i> Channel: 0 ID: <i>dd...dd</i> Lun: <i>ee...ee</i>)	<p>By executing the HDLM-configuration definition utility (<i>dlnmcfmgmr</i>), a newly detected path has been added to the registered HDLM device.</p> <p><i>aa...aa</i>: HDLM device name <i>bb...bb</i>: SCSI device name <i>cc...cc</i>: Host ID (decimal number) Channel: Channel ID (fixed value: 0) (decimal number) <i>dd...dd</i>: Target ID (decimal number) <i>ee...ee</i>: LUN (decimal number)</p> <p>Action</p> <p>None. For details on the <i>dlnmcfmgmr</i> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10345-I	HDLM has unregistered the existing path to an HDLM device. HDLM device = <i>aa...aa</i> , Device = <i>bb...bb</i> (Host: <i>cc...cc</i> Channel: 0 ID: <i>dd...dd</i> Lun: <i>ee...ee</i>)	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlnmcfmgmr</i>), the existing path has been unregistered from the registered HDLM device.</p> <p><i>aa...aa</i>: HDLM device name <i>bb...bb</i>: SCSI device name <i>cc...cc</i>: Host ID (decimal number) Channel: Channel ID (fixed value: 0) (decimal number) <i>dd...dd</i>: Target ID (decimal number) <i>ee...ee</i>: LUN (decimal number)</p> <p>Action</p> <p>None. For details on the <i>dlnmcfmgmr</i> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10346-I	HDLM has unregistered an existing HDLM device. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlnmcfmgmr</i>), the registered HDLM device has been unregistered.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None. For details on the <i>dlnmcfmgmr</i> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>

Message ID	Message Text	Explanation
		<i>utility for managing the HDLM configuration on page 7-26.</i>
KAPL10347-I	The HDLM device is no longer under management. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlnmcfgmgr</i>), the HDLM device has been removed from HDLM management.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None. For details on the <i>dlnmcfgmgr</i> utility, see <i>dlnmcfgmgr utility for managing the HDLM configuration on page 7-26.</i></p>
KAPL10348-I	The HDLM device is now under management. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlnmcfgmgr</i>), the HDLM device has been placed under HDLM management.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None. For details on the <i>dlnmcfgmgr</i> utility, see <i>dlnmcfgmgr utility for managing the HDLM configuration on page 7-26.</i></p>
KAPL10349-I	HDLM will remove unavailable paths or devices. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>By executing the HDLM-configuration definition utility (<i>dlnmcfgmgr</i>), a path and a logical device file of an HDLM device has been deleted.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None. For details on the <i>dlnmcfgmgr</i> utility, see <i>dlnmcfgmgr utility for managing the HDLM configuration on page 7-26.</i></p>
KAPL10350-E	The HDLM driver(s) is not loaded. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<i>dlnmcfgmgr</i>) failed because the HDLM driver was not loaded.</p> <p>Action</p> <p>Carry out the following process:</p>

Message ID	Message Text	Explanation
		<p>a. Execute the following command to load the HDLM driver</p> <pre># /opt/ DynamicLinkManager/bin/ dlminsadv</pre> <p># modprobe sddlmfdrv</p> <p>b. Re-execute the <code>dlmcfgmgr</code> utility.</p> <p>For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10351-E	The specified HDLM-configuration definition utility is invalid. Operation name = <i>aa...aa</i> , Parameter = <i>bb...bb</i>	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) failed because the specified operation name (<i>aa...aa</i>) or parameter (<i>bb...bb</i>) was invalid.</p> <p><i>aa...aa</i>: Operation name <i>bb...bb</i>: Parameter</p> <p>Action</p> <p>Confirm that the operation name and parameter are correct, and then re-execute the <code>dlmcfgmgr</code> utility. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10352-W	The HDLM device is in use. HDLM device = <i>aa...aa</i> . Stop the application using the HDLM device, unmount the HDLM device being mounted, and then execute the <code>dlmcfgmgr</code> utility again.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) failed because the specified HDLM device (<i>aa...aa</i>) was using it.</p> <p><i>aa...aa</i>: HDLM device name</p> <p>Action</p> <p>Stop the application using the HDLM device, unmount the HDLM device being mounted, and then re-execute the <code>dlmcfgmgr</code> utility. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10353-W	An error occurred while a backup of the HDLM files was being acquired. File name = <i>aa...aa</i> . Execute the <code>DLMgetras</code>	<p>Details</p> <p>An error occurred during acquisition of the HDLM file (<i>aa...aa</i>) backup.</p>

Message ID	Message Text	Explanation
	utility to collect error information, and then contact your vendor or maintenance company.	<p><i>aa...aa</i>: File name</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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10354-E	An attempt to unregister a block device driver for HDLM failed. Stop the application using the HDLM device, and unmount the mounting HDLM device, and then execute the <code>dlmcfgmgr</code> utility again.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) failed because registration of an HDLM block device driver could not be released.</p> <p>Action</p> <p>Stop the application for using HDLM device, and unmount the mounting HDLM device, and re-execute the <code>dlmcfgmgr</code> utility. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10355-E	An attempt to unregister partition information for the HDLM device(s) failed. Stop the application using the HDLM device, and unmount the mounting HDLM device, and then execute the <code>dlmcfgmgr</code> utility again.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) failed because registration of the partition information on an HDLM device could not be released.</p> <p>Action</p> <p>Stop the application for using HDLM device, and unmount the mounting HDLM device, and re-execute the <code>dlmcfgmgr</code> utility. For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10356-E	An unused major number could not be released. Major number = <i>aa...aa</i> . Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>An attempt to release an intact major number (<i>aa...aa</i>) has failed.</p> <p><i>aa...aa</i>: Major number (decimal number)</p> <p>Action</p>

Message ID	Message Text	Explanation
		<p>Restart the host. If the host does not recover, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10357-E	The maximum number of HDLM device files has been reached. Maximum number = <code>aa...aa</code> . Modify the configuration of the HDLM device to reduce the number of HDLM devices used, and then execute the <code>dlnmcfmgmr</code> utility again.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>) failed because the maximum number of logical device files has been created.</p> <p><code>aa...aa</code>: Maximum number of created logical device files of an HDLM device (decimal number)</p> <p>Action</p> <p>Revise the configuration of the HDLM device to reduce the number of HDLM devices used, and then re-execute the <code>dlnmcfmgmr</code> utility. For details on the <code>dlnmcfmgmr</code> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10358-E	The device name is too long. Maximum length = <code>aa...aa</code> . Check that the logical device file name of the HDLM device is correct, and then execute the <code>dlnmcfmgmr</code> utility again.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlnmcfmgmr</code>) failed because the name of the logical device file is too long.</p> <p><code>aa...aa</code>: Maximum length of characters for a logical device file name (decimal)</p> <p>Action</p> <p>Check that the logical device file name of the HDLM device is correct, and then re-execute the <code>dlnmcfmgmr</code> utility. For details on the <code>dlnmcfmgmr</code> utility, see dlnmcfmgmr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10359-E	Multiple instances of the HDLM-configuration definition utility cannot be executed concurrently. Wait until the	<p>Details</p> <p>An attempt to execute <code>dlnmcfmgmr</code> failed because two or more</p>

Message ID	Message Text	Explanation
	running dlmcfmgr utility ends, and then try the dlmcfmgr utility again.	<p>instances of dlmcfmgr were executed simultaneously.</p> <p>Action</p> <p>Wait until the running HDLM-configuration definition utility (dlmcfmgr) ends, and then re-execute the HDLM-configuration definition utility (dlmcfmgr). For details on the dlmcfmgr utility, see dlmcfmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10360-I	HDLM has activated a path for an HDLM device. HDLM device = <i>aa...aa</i> , Device = <i>bb...bb</i> (Host: <i>cc...cc</i> Channel: 0 ID: <i>dd...dd</i> Lun: <i>ee...ee</i>)	<p>Details</p> <p>By executing the HDLM-configuration definition utility (dlmcfmgr), the path to the HDLM device has been made active.</p> <p><i>aa...aa</i>: HDLM device name <i>bb...bb</i>: SCSI device name <i>cc...cc</i>: Host ID (decimal number) Channel: Channel ID (fixed value: 0) (decimal number) <i>dd...dd</i>: Target ID (decimal number) <i>ee...ee</i>: LUN (decimal number)</p> <p>Action</p> <p>None. For details on the dlmcfmgr utility, see dlmcfmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10361-I	HDLM has deactivated a path for the HDLM device. HDLM device = <i>aa...aa</i> , Device = <i>bb...bb</i> (Host: <i>cc...cc</i> Channel: 0 ID: <i>dd...dd</i> Lun: <i>ee...ee</i>)	<p>Details</p> <p>By executing the HDLM-configuration definition utility (dlmcfmgr), the path to the HDLM device has been made inactive.</p> <p><i>aa...aa</i>: HDLM device name <i>bb...bb</i>: SCSI device name <i>cc...cc</i>: Host ID (decimal number) Channel: Channel ID (fixed value: 0) (decimal number) <i>dd...dd</i>: Target ID (decimal number) <i>ee...ee</i>: LUN (decimal number)</p> <p>Action</p>

Message ID	Message Text	Explanation
		None. For details on the <code>dlnmcfgmgr</code> utility, see dlnmcfgmgr utility for managing the HDLM configuration on page 7-26 .
KAPL10362-W	HDLM has detected an active path that cannot be deleted. HDLM device = <i>aa...aa</i> , Device = <i>bb...bb</i> (Host: <i>cc...cc</i> Channel: 0 ID: <i>dd...dd</i> Lun: <i>ee...ee</i>). Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>An attempt to execute the HDLM-configuration definition utility (<code>dlnmcfgmgr</code>) failed because a path to the specified HDLM device was being used.</p> <p><i>aa...aa</i>: HDLM device name <i>bb...bb</i>: SCSI device name <i>cc...cc</i>: Host ID (decimal number) Channel: Channel ID (fixed value: 0) (decimal number) <i>dd...dd</i>: Target ID (decimal number) <i>ee...ee</i>: LUN (decimal number)</p> <p>Action</p> <p>Stop the application that uses the HDLM device, unmount the HDLM device being mounted, and then re-execute the <code>dlnmcfgmgr</code> utility. For details on the <code>dlnmcfgmgr</code> utility, see dlnmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10363-W	A data mismatch was found. HDLM device = <i>aa...aa</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>When HDLM configuration Definition Utility (<code>dlnmcfgmgr</code>) was executed, a mismatch of HDLM device configuration information was detected.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10364-I	The LDEV for an HDLM device has changed. HDLM will now change the configuration. HDLM device = <i>aa...aa</i>	<p>Details</p> <p>The configuration has been modified because an LDEV</p>

Message ID	Message Text	Explanation
		<p>corresponding to an HDLM device was changed.</p> <p><i>aa...aa</i>: Logical device file name of an HDLM device</p> <p>Action</p> <p>None.</p>
KAPL10365-W	The LDEV for an HDLM device has changed. The processing for that HDLM device will be cancelled. HDLM device = <i>aa...aa</i> . Execute the HDLM-configuration definition utility (dlmcfmgr) with the -v option, and then check the configuration of the HDLM device.	<p>Details</p> <p>The processing for the HDLM device was interrupted because an LDEV corresponding to an HDLM device was changed.</p> <p><i>aa...aa</i>: The logical device file name of the HDLM device</p> <p>Action</p> <p>Execute the HDLM-configuration definition utility (dlmcfmgr) with the -v option, and then check the configuration of the HDLM device. For details on the dlmcfmgr utility, see dlmcfmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10366-I	Unsupported SCSI device was found. Device = <i>aa...aa</i>	<p>Details</p> <p>The SCSI device output in this message is not supported.</p> <p><i>aa...aa</i>: Logical device file name of HDLM device</p> <p>Action</p> <p>None.</p>
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>None.</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 dlmpr utility.</p> <p>Action</p>

Message ID	Message Text	Explanation
		Execute the <code>dlmpr -h</code> utility to check the parameter, and then retry execution. For details on the <code>dlmpr</code> utility, see dlmpr utility for clearing HDLM persistent reservation on page 7-50 .
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>dlmpr</code> utility at the same time.</p> <p><i>aa...aa</i>: Specified parameter</p> <p>Action</p> <p>Execute the <code>dlmpr -h</code> utility to check the parameter, and then retry execution. For details on the <code>dlmpr</code> utility, see dlmpr utility for clearing HDLM persistent reservation on page 7-50.</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>dlmpr</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. For details on the <code>dlmpr</code> utility, see dlmpr utility for clearing HDLM persistent reservation on page 7-50.</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>dlmpr</code> utility.</p> <p><i>aa...aa</i>: Specified parameter</p> <p>Action</p> <p>Execute help of the <code>dlmpr</code> utility to check the parameters that can be specified, and then retry. For details on the <code>dlmpr</code> utility, see dlmpr utility for clearing HDLM persistent reservation on page 7-50.</p>
KAPL10648-E	An internal error occurred in the <code>dlmpr</code> utility. Error Code = <i>aa...aa</i>	<p>Details</p> <p>An error not caused by the user has occurred in the <code>dlmpr</code> utility.</p> <p><i>aa...aa</i>: Error number (character string)</p> <p>Action</p>

Message ID	Message Text	Explanation
		<p>When the error code is 1: Make sure that there is sufficient memory.</p> <p>When the error code is 2: Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>When the error code is 4 or 5: Make sure that the SCSI device file permissions permit reading and writing.</p> <p>For details on the <code>dlnpr</code> utility, see dlnpr utility for clearing HDLM persistent reservation on page 7-50.</p>
KAPL10649-E	<i>aa...aa</i> : 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><i>aa...aa</i>: HDLM device (<code>dlnfdvsn</code>)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL10650-I	<i>aa...aa</i> : NO RESERVATION	<p>Details</p> <p>A LU has not been reserved.</p> <p><i>aa...aa</i>: HDLM device (<code>dlnfdvsn</code>)</p> <p>Action</p> <p>None.</p>
KAPL10651-I	The user terminated the operation.	<p>Details</p> <p>The <code>dlnpr</code> utility has been terminated because <code>n</code> was sent to a request.</p> <p>Action</p> <p>None. For details on the <code>dlnpr</code> utility, see dlnpr utility for clearing HDLM persistent reservation on page 7-50.</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>dlnpr</code> utility. For details on the <code>dlnpr</code> utility, see dlnpr utility for clearing HDLM persistent reservation on page 7-50.</p>

Message ID	Message Text	Explanation
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>
KAPL10665-I	The dlmpr utility completed.	<p>Details</p> <p>The <code>dlmpr</code> utility completed normally.</p> <p>Action</p> <p>None. For details on the <code>dlmpr</code> utility, see dlmpr utility for clearing HDLM persistent reservation on page 7-50.</p>
KAPL10920-W	Processing for HDLM Config Manager interrupted. Execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) again.	<p>Details</p> <p>Processing of the HDLM-configuration definition utility (<code>dlmcfgmgr</code>) was interrupted.</p> <p>Action</p> <p>Please re-execute the HDLM-configuration definition utility (<code>dlmcfgmgr</code>).</p> <p>For details on the <code>dlmcfgmgr</code> utility, see dlmcfgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10922-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version. Install the HDLM software that supports this kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>
KAPL10923-E	The HDLM file is invalid. File name = <code>aa...aa</code> . Reinstall the HDLM software.	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><code>aa...aa</code>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL10934-W	A file could not be opened. File name = <code>/etc/opt/</code>	<p>Details</p>

Message ID	Message Text	Explanation
	DynamicLinkManager/hdlm_utillog.conf, Errno = aa...aa. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>An attempt to open the settings file for the HDLM utility log (/etc/opt/DynamicLinkManager/hdlm_utillog.conf) has failed. A maximum log file size of 1024 KB will be assumed, and the processing of the dlmcfgmgr utility will continue.</p> <p>aa...aa: Error number (decimal number)</p> <p>Action</p> <p>Make sure that the file exist. If the file is normal, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10935-W	An internal error occurred in the file operation. File name = /etc/opt/DynamicLinkManager/hdlm_utillog.conf. Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p>An internal error occurred during operations of the settings file for the HDLM utility log (/etc/opt/DynamicLinkManager/hdlm_utillog.conf). A maximum log file size of 1024 KB will be assumed, and the processing of the dlmcfgmgr utility will continue.</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> <p>For details on the DLMgetras utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10936-W	The file format is invalid. File name = /etc/opt/DynamicLinkManager/hdlm_utillog.conf. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>The format of the settings file for the HDLM utility log (/etc/opt/DynamicLinkManager/hdlm_utillog.conf) is invalid. A maximum log file size of 1024 KB will be assumed, and the processing of the dlmcfgmgr utility will continue.</p>

Message ID	Message Text	Explanation
		<p>Action</p> <p>Execute the <code>dlnmcfmgmgr</code> utility with the <code>-logfs</code> parameter specified. If the error occurs again, <code>/etc/opt/DynamicLinkManager/hdlm_utillog.conf</code> which is not a regular file might exist. Delete <code>/etc/opt/DynamicLinkManager/hdlm_utillog.conf</code> and then execute the <code>dlnmcfmgmgr</code> utility again. For details on the <code>dlnmcfmgmgr</code> utility, see dlnmcfmgmgr utility for managing the HDLM configuration on page 7-26.</p>
KAPL10937-W	The maximum number of paths was exceeded. Revise the configuration so that the number of paths is less than, or the same as, the maximum number. Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	<p>Details</p> <p>The number of paths in the entire system exceeded the maximum number of paths supported in HDLM. Review and, if necessary, revise the configuration.</p> <p>Action</p> <p>The maximum number of paths supported in HDLM has been exceeded. Review and, if necessary, revise the number of paths in the entire system. For details on the number of paths supported in HDLM, see Number of LUs and paths that are supported in HDLM on page 3-75.</p>
KAPL10938-I	dlnmcfmgmgr Log File Size(KB) : <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The setup value or default value of dlnmcfmgmgr Log File Size.</p> <p>Action</p> <p>None.</p>
KAPL10939-W	An error occurred during processing to read a file. File name = <i>aa...aa</i>	<p>Details</p> <p>An error occurred during processing to read a file. <i>aa...aa</i>: File name</p> <p>Action</p> <p>Follow the instructions in the message that was output before this message.</p>
KAPL10940-W	The maximum wait time has been reached. Maximum wait time = <i>aa...aa</i> , Checking interval = <i>bb...bb</i>	<p>Details</p> <p>The maximum wait time has been reached. <i>aa...aa</i>: Maximum wait time</p>

Message ID	Message Text	Explanation
		<p><i>bb...bb</i>: Checking interval</p> <p>Action</p> <p>Perform the following action if you use a boot disk environment where a SCSI device is used.</p> <p>If the path status is <code>Offline(E)</code> or <code>Online(E)</code> because recognition of the SCSI device is delayed when the OS starts, increase the value of <code>scsichckmax</code> in the <code>/etc/opt/DynamicLinkManager/hdlm.conf</code> file to a value that is appropriate for your environment.</p> <p>Perform the following action for a boot disk environment where an HDLM device is used.</p> <p>Confirm that the configuration for HDLM devices is correct.</p> <p>If it is not correct, execute the <code>DLMgetras</code> utility to collect HDLM error information, and then contact your HDLM vendor, or the maintenance company if you have a maintenance contract for HDLM.</p> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10941-W	The file could not be opened. File name = <i>aa...aa</i> , Errno = <i>bb...bb</i>	<p>Details</p> <p>The file could not be opened.</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Errno</p> <p>Action</p> <p>Confirm that the configuration for HDLM devices is correct.</p> <p>If it is not correct, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10942-W	Memory could not be allocated. Size = <i>aa...aa</i> , Errno = <i>bb...bb</i>	<p>Details</p> <p>Memory could not be allocated.</p> <p><i>aa...aa</i>: Size</p>

Message ID	Message Text	Explanation
		<p><i>bb...bb</i>: Errno</p> <p>Action</p> <p>Confirm that the configuration for HDLM devices is correct.</p> <p>If it is not correct, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10943-W	An error occurred during processing to read a file in the (<i>aa...aa</i>) function. File name = <i>bb...bb</i> , Errno = <i>cc...cc</i>	<p>Details</p> <p>An error occurred during processing to read a file in the (<i>aa...aa</i>) function.</p> <p><i>bb...bb</i>: File name</p> <p><i>cc...cc</i>: Errno</p> <p>Action</p> <p>Confirm that the configuration for HDLM devices is correct.</p> <p>If it is not correct, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL10944-I	Checking will now start. Checking interval = <i>aa...aa</i> , Check count = <i>bb...bb</i> , Maximum wait time = <i>cc...cc</i>	<p>Details</p> <p>Checking will now start.</p> <p><i>aa...aa</i>: Checking interval</p> <p><i>bb...bb</i>: Check count</p> <p><i>cc...cc</i>: Maximum wait time</p> <p>Action</p> <p>None.</p>
KAPL10948-W	An invalid entry is registered in the file. File name = <i>aa...aa</i>	<p>Details</p> <p>An invalid entry is registered in the file.</p> <p><i>aa...aa</i>: File name</p> <p>Action</p>

Message ID	Message Text	Explanation
		Edit the <code>/etc/opt/DynamicLinkManager/hdlm.conf</code> file as follows, and then restart the host. <ul style="list-style-type: none"> For FC-SAN: <code>iscsi_boot=n</code> For IP-SAN: <code>iscsi_boot=y</code>
KAPL10949-E	A necessary file was not found. File name = <i>aa...aa</i>	Details A necessary file was not found. <i>aa...aa</i> : File name Action Reinstall an HDLM.
KAPL10950-E	An error occurred during creation of an HDLM temporary file. File name = <i>aa...aa</i> . Refer to the Messages section of the HDLM User's Guide for instructions to correct this problem.	Details An error occurred during creation of an HDLM temporary file. <i>aa...aa</i> : File name Action Confirm that the root directory (/) has enough unused capacity. If it has enough unused capacity, 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, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL10959-E	The configuration definition file is invalid. Error Code = <i>aa...aa</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	Details The contents of the configuration definition file (<code>/etc/opt/DynamicLinkManager/.dlmfdrv.conf</code>) are invalid. <i>aa...aa</i> : Internal code (decimal (base-10) number) 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for

Message ID	Message Text	Explanation
		<u>collecting HDLM error information on page 7-3.</u>
KAPL10960-I	The LU capacity does not need to be updated because the LU capacity is up to date. Device = <i>aa...aa</i>	<p>Details</p> <p>The LU capacity does not need to be updated because the LU capacity is up to date.</p> <p><i>aa...aa</i>: Target device file</p> <p>Action</p> <p>None.</p>
KAPL10961-I	The LU capacity was updated. Device = <i>aa...aa</i>	<p>Details</p> <p>The LU capacity was updated.</p> <p><i>aa...aa</i>: Target device file</p> <p>Action</p> <p>None.</p>
KAPL10962-E	The LU capacity of a managed HDLM device cannot be decreased. Device = <i>aa...aa</i>	<p>Details</p> <p>The LU capacity of a managed HDLM device cannot be decreased.</p> <p><i>aa...aa</i>: Target device file</p> <p>Action</p> <p>For the HDLM device displayed in the message, remove it from HDLM management and then put it under HDLM management again.</p>
KAPL10963-E	Failed to update the LU capacity. Device = <i>aa...aa</i>	<p>Details</p> <p>Failed to update the LU capacity.</p> <p><i>aa...aa</i>: Target device file</p> <p>Action</p> <p>The following conditions apply to the HDLM device corresponding to the HDLM device file that is output to a message. Verify that all of the following conditions are met:</p> <ul style="list-style-type: none"> ◦ The HDLM device file exists. ◦ All of the paths of the HDLM device are online. ◦ All of the HDLM device paths (SCSI devices) have the same LU capacity. <p>Verify that all conditions are met, and then retry the command. If an error still occurs, even though all conditions are met, execute the <i>DLMgetras</i> utility for collecting HDLM error information, and then</p>

Message ID	Message Text	Explanation
		contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3 .

KAPL11001 to KAPL12000

Message ID	Message Text	Explanation
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> <ul style="list-style-type: none"> ◦ Get Path Information ◦ Get Option Information ◦ Set Option Information ◦ Clear Data ◦ Get HDLM Manager Status ◦ Get HDLM Driver Status ◦ Get HDLM Alert Driver Status ◦ Get SNMP Trap Information ◦ Set SNMP Trap Information ◦ Set LU Load Balance ◦ Get Path Status Log Information ◦ Get Local Time ◦ Add Path Information ◦ Delete Path Information ◦ Set Storage Identification Information <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> <ul style="list-style-type: none"> ◦ Online ◦ Offline

Message ID	Message Text	Explanation
		<i>bb...bb</i> : The Path ID of the target path (decimal number) Action None.
KAPL11903-I	<i>aa...aa</i> has completed normally.	Details The operation has completed normally on the host. <i>aa...aa</i> : Any of the following operations (character string) <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 ◦ Get Path Status Log Information ◦ Get Local Time ◦ Add Path Information ◦ Delete Path Information ◦ Set Storage Identification Information Action None.
KAPL11904-E	<i>aa...aa</i> has completed abnormally. Error status = <i>bb...bb</i>	Details The operation has completed abnormally on the host. <i>aa...aa</i> : Operation (character string) <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

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> ◦ Get HDLM Alert Driver Status ◦ Online ◦ Offline ◦ Get SNMP Trap Information ◦ Set SNMP Trap Information ◦ Set LU Load Balance ◦ Get Path Status Log Information ◦ Add Path Information ◦ Delete Path Information ◦ Set Storage Identification Information <p><i>bb...bb</i>: Error status returned from the API (character string)</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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL11905-E	An unexpected error occurred.	<p>Details</p> <p>An exception occurred during processing on the host.</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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL11906-I	GUI information - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: Trace information (character string)</p> <p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL11907-I	XML reception - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: XML information (character string)</p> <p>Action</p> <p>None.</p>
KAPL11908-I	XML transmission - <i>aa...aa</i>	<p>Details</p> <p>This information is required for resolving problems.</p> <p><i>aa...aa</i>: XML information (character string)</p> <p>Action</p> <p>None.</p>

KAPL12001 to KAPL13000

Message ID	Message Text	Explanation
KAPL12035-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>
KAPL12036-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL12301-E	This script can only be executed with the name <code>dlmmkinitrd</code> .	<p>Action</p> <p>Please rename the script to <code>dlmmkinitrd</code>.</p>
KAPL12302-E	Multiple instances of the utility for supporting the boot disk cannot be executed concurrently.	<p>Action</p> <p>Wait until the <code>dlmmkinitrd</code> utility for supporting the boot disk ends, and then re-execute the <code>dlmmkinitrd</code> utility. For details on the <code>dlmmkinitrd</code> utility, see</p>

Message ID	Message Text	Explanation
		<i>dlmmkinitrd utility for supporting a boot disk on page 7-38.</i>
KAPL12303-E	A file or directory does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the non-existent file</p> <p>Action</p> <p>For <code>dracut</code> command:</p> <p>If the file name displayed in the message is the HDLM file name shown below, HDLM may not be installed correctly. In this situation, re-install HDLM.</p> <pre>/etc/dracut.conf.d/hdlm- dracut.conf</pre> <p>If the file name displayed in the message is another file name</p> <p>The OS (kernel) or the HBA driver may not be installed correctly. Confirm sure the existence of the files.</p> <p>For <code>dlmmkinitrd</code>:</p> <p>If the file name displayed in the message is the file name specified in the <code>fstab</code> parameter of the Boot Disk Support Utility (<code>dlmmkinitrd</code>)</p> <p>Check the specified file name, specify the file name of the existing <code>fstab</code> file, and then re-execute the utility.</p> <p>If the file name displayed in the message is the HDLM file name shown below, HDLM may not be installed correctly. In this situation, re-install HDLM.</p> <p>In the list shown below, <i>kernel-version</i> indicates the value displayed by the <code>uname -r</code> command.</p> <ul style="list-style-type: none"> • <code>/etc/opt/ DynamicLinkManager/ dlmmkinitrd.conf</code> • <code>/lib/modules/kernel- version/kernel/drivers/ DynamicLinkManager/ sddlmdrv.o</code> • <code>/lib/modules/kernel- version/kernel/drivers/ DynamicLinkManager/ sddlmdrv.ko</code>

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> • <code>/lib/modules/kernel-version/kernel/drivers/DynamicLinkManager/sddlmdrv.o</code> • <code>/lib/modules/kernel-version/kernel/drivers/DynamicLinkManager/sddlmdrv.ko</code> <p>If the file name displayed in the message is another file name</p> <p>The OS (kernel) or the HBA driver may not be installed correctly. Confirm sure the existence of the files.</p>
KAPL12305-I	The utility for supporting the boot disk was stopped by the user.	Action Retry the <code>dldmmkinitrd</code> utility for supporting the boot disk.
KAPL12306-I	The list of files required in the initial ramdisk image is being created.	Action None.
KAPL12307-I	The initial ramdisk file system is being created.	Action None.
KAPL12308-I	The initial ramdisk file system is being mounted. Mount point = <code>aa...aa</code>	Details <code>aa...aa</code> : Mount point to be used Action None.
KAPL12309-I	Required files are being copied to the initial ramdisk.	Action None.
KAPL12310-I	The <code>linuxrc</code> executable is being created.	Action None.
KAPL12311-I	The <code>fstab</code> file for the initial ramdisk is being created.	Action None.
KAPL12312-I	The directories for the initial ramdisk are being created.	Action None.
KAPL12313-I	Initial ramdisk is being unmounted.	Action None.
KAPL12314-I	The compressed initial ramdisk image is being created.	Action None.
KAPL12315-I	A compressed initial ramdisk image <code>aa...aa</code> was created with the	Details <code>aa...aa</code> : The created initial ramdisk image

Message ID	Message Text	Explanation
	ramdisk size = <i>bb...bb</i> KB.	<p><i>bb...bb</i>: The ramdisk size required for the created initrd image (decimal number)</p> <p>Action</p> <p>None.</p>
KAPL12316-I	The SCSI root partition is <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The SCSI device partition on which the root is mounted</p> <p>Action</p> <p>None.</p>
KAPL12318-W	Usage: /opt/DynamicLinkManager/bin/dlmmkinitrd <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: [-i initrd-image] [-b boot-directory] [-h]</p> <p>Action</p> <p>Confirm the parameters specified when the <code>dlmmkinitrd</code> utility for supporting the boot disk was executed, and then retry. For details on the <code>dlmmkinitrd</code> utility, see dlmmkinitrd utility for supporting a boot disk on page 7-38.</p>
KAPL12319-E	The utility for supporting the boot disk has failed.	<p>Action</p> <p>This message is always preceded by some other specific error message.</p>
KAPL12320-E	A file or directory already exists. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the already existing file</p> <p>Action</p> <p>To the file name of the initial RAM disk image file specified in the parameter of the Boot Disk Support Utility (<code>dlmmkinitrd</code>), do not specify an existing file name. However, if overwriting the existing file, specify the <code>-f</code> parameter.</p> <p>Note that if you attempt to specify an existing directory name as the initial RAM disk image file, it is impossible to overwrite the file even if the <code>-f</code> parameter is specified. To overwrite the file, it is necessary to delete the directory first.</p>
KAPL12321-E	An invalid root partition is specified in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file containing the invalid root partition entry</p> <p>Action</p> <p>Change the root partition specified in the <code>/etc/fstab</code> file to a SCSI or HDLM device, or specify settings so that HDLM</p>

Message ID	Message Text	Explanation
		manages the device that is listed next to the root partition specified in the <code>/etc/fstab</code> file.
KAPL12322-I	Execution of linuxrc started.	<p>Details</p> <p>Execution of linuxrc started.</p> <p>Action</p> <p>None.</p>
KAPL12323-I	The insertion of the module was started. Module name = <i>aa...aa</i>	<p>Details</p> <p>The insertion of the module was started. <i>aa...aa</i>: The name of the module being inserted</p> <p>Action</p> <p>None.</p>
KAPL12324-E	The module could not be inserted. Module name = <i>aa...aa</i>	<p>Details</p> <p>The module could not be inserted. <i>aa...aa</i>: The name of the module whose insertion has failed</p> <p>Action</p> <p>Confirm that the system environments are not changed after creating the initial ramdisk image file.</p> <p>Check whether there is a mistake in the initial ramdisk image file specified in the config file of the boot loader.</p>
KAPL12325-I	The command started. Command name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The started command</p> <p>Action</p> <p>None.</p>
KAPL12326-E	The command could not execute. Command name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The failed command</p> <p>Action</p> <p>For <code>dracut</code> command:</p> <p>Perform the following confirmation corresponding to the output command, and then retry. Re-execute the <code>dracut</code> command after performing the next check according to the outputted command.</p> <p>And if the error message is outputted before this message, remove the cause of the error with reference to the contents of the message.</p> <p>cp:</p> <p>Confirm that there is enough unused capacity and that the</p>

Message ID	Message Text	Explanation
		<p>user has write permission in the root directory (/).</p> <p>dlnmcfmgr:</p> <ul style="list-style-type: none"> • Confirm that the version of the OS has not changed since you made the initial ramdisk image file. • Take action according to the contents output in the log of the dlnmcfmgr utility. • Confirm that the user has write permission in the root directory (/). <p>dlnkmgr:</p> <ul style="list-style-type: none"> • Confirm that HDLM has been configured. • Take action according to the contents output in the log of the dlnmcfmgr utility. • Confirm that the user has write permission in the root directory (/). <p>mkdir:</p> <p>Confirm that there is enough unused capacity and that the user has write permission in the following directory:</p> <ul style="list-style-type: none"> • /etc/opt/ DynamicLinkManager. • /opt/DynamicLinkManager. • The root directory (/) <p>mount:</p> <p>Confirm that there is unused capacity in the loop device.</p> <p>umount:</p> <p>A temporary file remains, so do the following:</p> <ol style="list-style-type: none"> 1. Unmount /etc/opt/ DynamicLinkManager/tmp/ initrdmnt.\$\$ (\$\$ is a process ID). 2. Remove the /etc/opt/ DynamicLinkManager/tmp/ initrdmnt.\$\$ (\$\$ is a process ID) file. <p>Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor</p>

Message ID	Message Text	Explanation
		<p>or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p> <p>For <code>dlmmkinitrd</code>:</p> <p>Perform the following confirmation corresponding to the output command, and then retry.</p> <p>Re-execute the <code>dlmmkinitrd</code> utility for supporting the boot disk after performing the next check according to the outputted command.</p> <p>And if the error message is outputted before this message, remove the cause of the error with reference to the contents of the message.</p> <p><code>cp</code>:</p> <p>Confirm that there is enough unused capacity and that the user has write permission in the root directory (/).</p> <p><code>cpio</code> or <code>dd</code>:</p> <p>Confirm that there is enough unused capacity and that the user has write permission in the <code>/etc/opt/</code> <code>DynamicLinkManager</code> directory.</p> <p><code>dlmcfgmgr</code>:</p> <ul style="list-style-type: none"> • Confirm that the version of the OS has not changed since you made the initial ramdisk image file. • Take action according to the contents output in the log of the <code>dlmcfgmgr</code> utility. • Confirm that the user has write permission in the root directory (/). <p><code>dlmkmgr</code>:</p> <ul style="list-style-type: none"> • Confirm that HDLM has been configured. • Take action according to the contents output in the log of the <code>dlmcfgmgr</code> utility. • Confirm that the user has write permission in the root directory (/).

Message ID	Message Text	Explanation
		<p>gzip:</p> <p>Confirm that that the unused capacity is sufficient at the creation destination of the initial ramdisk image file.</p> <p>mke2fs or touch:</p> <p>Confirm that the user has write permission in the root directory (/).</p> <p>mkdir:</p> <p>Confirm that there is enough unused capacity and that the user has write permission in the following directory:</p> <ul style="list-style-type: none"> • /etc/opt/ DynamicLinkManager. • /opt/DynamicLinkManager. • The root directory (/) <p>mount:</p> <p>Confirm that there is unused capacity in the loop device.</p> <p>umount:</p> <p>A temporary file remains, so do the following:</p> <ol style="list-style-type: none"> 1. Unmount /etc/opt/ DynamicLinkManager/tmp/ initrdmnt.\$\$ (\$\$ is a process ID). 2. Remove the /etc/opt/ DynamicLinkManager/tmp/ initrdmnt.\$\$ (\$\$ is a process ID) file. <p>vol_id:</p> <p>Confirm that the file system is created in the root directory (/) indicated by /etc/fstab file.</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, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
KAPL12327-E	An invalid entry is registered in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file containing the invalid entry</p> <p>Action</p> <p>For dracut command:</p> <p>Take the following actions depending on the file name output, and then reexecute the dracut command.</p> <p>In the case of /etc/lvm/lvm.conf file</p> <p>Edit the following lines as described in Settings for a multipath boot disk environment on page 3-131 or Upgrade installation of HDLM in a boot disk environment on page 3-133:</p> <ul style="list-style-type: none"> - filter or global_filter - write_cache_state - types - md_component_detection <p>For dlmmkinitrd:</p> <p>Take the following actions depending on the file name output, and then re-execute the dlmmkinitrd utility.</p> <p>In the case of /etc/lvm/lvm.conf file</p> <p>Edit the following lines as described in Settings for a multipath boot disk environment on page 3-131 or Upgrade installation of HDLM in a boot disk environment on page 3-133:</p> <ul style="list-style-type: none"> - filter - write_cache_state - types - md_component_detection <p>In the case of /etc/opt/DynamicLinkManager/dlmmkinitrd.conf file</p> <p>Install an HBA driver, which is supported as a boot disk by HDLM.</p> <p>Or use an HBA, which is supported as a boot disk by HDLM.</p>

Message ID	Message Text	Explanation
		<p>In the case of <code>/etc/sysconfig/kernel</code> file</p> <p>The OS environment is incorrect. Add the names of the HBA drivers that have to be included in the initial RAM disk image into the <code>INITRD_MODULES=</code> line of the <code>/etc/sysconfig/kernel</code> file.</p>
KAPL12328-I	Execution of linuxrc completed.	<p>Details</p> <p>Execution of linuxrc completed.</p> <p>Action</p> <p>None.</p>
KAPL12329-I	The utility for supporting the boot disk started.	<p>Action</p> <p>None.</p>
KAPL12330-I	The utility for supporting the boot disk completed.	<p>Action</p> <p>None.</p>
KAPL12331-E	A directory with the specified kernel version does not exist. Directory name = <code>aa...aa</code>	<p>Details</p> <p><code>aa...aa</code>: The directory where the kernel module is stored</p> <p>The name following <code>/lib/modules/</code> directory is a kernel version which the <code>dlmmkinitrd</code> utility for supporting the boot disk has recognized.</p> <p>Action</p> <p>Perform the <code>dlmmkinitrd</code> utility again after performing the following check:</p> <ol style="list-style-type: none"> Confirm that the kernel of the version displayed into the message is installed. In Red Hat Enterprise Linux, confirm the kernel version specified as a parameter. <p>For the details of the parameter, see dlmmkinitrd utility for supporting a boot disk on page 7-38.</p> <p>If the problem is not solved, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
KAPL12332-E	The root partition could not be found in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file referenced by the <code>dlmmkinitrd</code> utility for supporting the boot disk</p> <p>Action</p> <p>Confirm that the settings of the root partition are in the <code>/etc/fstab</code> file.</p> <p>Confirm that the root partition is mounted.</p>
KAPL12333-E	An HBA that HDLM can support as a boot disk was not found in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file referenced by the <code>dlmmkinitrd</code> utility for supporting the boot disk</p> <p>Action</p> <p>Make sure that an HBA driver that can be used when the boot disk is an HDLM device is in the following file:</p> <ul style="list-style-type: none"> When SUSE LINUX Enterprise Server is used: The line of <code>INITRD_MODULES=</code> of a <code>/etc/sysconfig/kernel</code> file <p>Also, make sure that the HBA driver has been installed.</p>
KAPL12334-E	Multiple root partition entries exist in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file referenced by the <code>dlmmkinitrd</code> utility for supporting the boot disk</p> <p>Action</p> <p>Modify the <code>fstab</code> file specified in the <code>fstab</code> parameter of the boot disk support utility (<code>dlmmkinitrd</code>), and then retry the operation. Alternatively, modify the root partition setting in the <code>/etc/fstab</code> file and then retry the operation.</p>
KAPL12335-E	A file system that HDLM can support as a boot disk was not found in the file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The name of the file referenced by the <code>dlmmkinitrd</code> utility for supporting the boot disk</p> <p>Action</p> <p>Modify the <code>fstab</code> file specified in the <code>fstab</code> parameter of the boot disk support utility (<code>dlmmkinitrd</code>), or the file system of the <code>/etc/fstab</code> file root partition, to a file system that can be applied when the HDLM device is used as a boot disk (<code>ext2</code> or <code>ext3</code>). Also, make sure that the kernel package has been installed correctly.</p>

Message ID	Message Text	Explanation
KAPL12336-E	The user does not have permission to execute the utility for supporting the boot disk.	Action Retry as a user with root permission.
KAPL12337-E	UUID and LABEL information on the root partition were not able to be acquired.	Action Confirm UUID or LABEL is set to the root partition. Set UUID or LABEL to the root partition when it is not set and re-execute the <code>dlmmkinitrd</code> utility for supporting the boot disk.
KAPL12338-E	The command does not exist or does not have executable permissions. Command name = <i>aa...aa</i>	Details There is no command, or the user does not have execution permission. <i>aa...aa</i> : Command name Action Make sure the specified command exists and the user has execution permission.
KAPL12339-E	The HDLM device required to start the host could not be found.	Action This message is always preceded by some other specific error message.
KAPL12340-E	A backup of the configuration definition file was used to configure the HDLM devices. Confirm that the HDLM devices are properly configured, and then make them management targets before using them again.	Details This message is output when the following conditions are met: <ul style="list-style-type: none"> When the configuration definition file becomes corrupted, because, for example, a user directly edited the file. When the configuration definition file becomes corrupted, because, for example, the system stopped while a program was creating the configuration definition file. Action Make sure that the all the HDLM device and LDEV associations are correct. If all the associations are correct, make any HDLM devices management targets that are not management targets before using them again. If one or more associations are not correct, execute the <code>DLMgetras</code> utility for collecting error information, and then contact your HDLM vendor or your maintenance company, if you have an HDLM maintenance contract.
KAPL12341-I	Execution of bootup script started.	Action None.

Message ID	Message Text	Explanation
KAPL12342-I	Execution of bootup script completed.	Action None.
KAPL12343-I	The bootup executable is being created.	Action None.
KAPL12344-I	A compressed initial ramdisk image (<i>aa...aa</i>) was created.	Details <i>aa...aa</i> : The created initial ramdisk image Action None.
KAPL12345-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	Details The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM. Action Install HDLM that adjusts to the kernel that is running now.
KAPL12346-E	The HDLM file is invalid. File name = <i>aa...aa</i>	Details A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid. <i>aa...aa</i> : Name of file where error was detected. Action Reinstall an HDLM.
KAPL12350-E	The HDLM device corresponding to root device could not be found. Root device name = <i>aa...aa</i>	Details <i>aa...aa</i> : Root device name 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. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL12351-I	The collection of files for HDLM started.	Details The collection of files for HDLM started. Action None.
KAPL12352-I	The collection of files for HDLM completed.	Details The collection of files for HDLM completed.

Message ID	Message Text	Explanation
		Action None.
KAPL12355-I	The utility for creating an HDLM boot-up service started.	Details The utility for creating an HDLM boot-up service started. Action None.
KAPL12356-I	The utility for creating an HDLM boot-up service ended.	Details The utility for creating an HDLM boot-up service ended. Action None.
KAPL12357-I	A required entry could not be found in the system file.	Details A required entry could not be found in the system file. Action None.
KAPL12358-E	The utility for creating an HDLM boot-up service ended abnormally. Code = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	Details <i>aa...aa</i> : Internal code (decimal number) <i>bb...bb</i> : Error number (decimal number) Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the DLMgetras utility, see "DLMgetras utility for collecting HDLM error information" on page DLMgetras utility for collecting HDLM error information on page 7-3 .
KAPL12359-I	The entered timeout value is invalid. The utility for creating an HDLM boot-up service will execute with the default value. Parameter = <i>aa...aa</i>	Details <i>aa...aa</i> : Parameter with invalid value specified (string) Action None.
KAPL12360-I	The utility for creating an HDLM boot-up service is executing. Elapsed time = <i>aa...aa</i>	Details <i>aa...aa</i> : Elapsed time/Specified time (seconds) Action None.
KAPL12361-E	The specified parameter of the utility for changing	Details <i>aa...aa</i> : Specified parameter Action

Message ID	Message Text	Explanation
	HDLM device names is invalid. Parameter = <i>aa...aa</i>	Specify the correct parameters and then re-execute the utility for changing HDLM device names (<i>d1mchname</i>).
KAPL12362-W	Usage: <i>aa...aa</i> [-f -o]	<p>Details</p> <p><i>aa...aa</i>: <i>d1mchname</i></p> <p>Action</p> <p>Specify the correct parameters and then re-execute the utility for changing HDLM device names (<i>d1mchname</i>).</p>
KAPL12363-E	Memory could not be allocated. Size = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Target memory size (decimal number)</p> <p>Action</p> <p>If the actual memory size is insufficient, increase the actual memory size. If any running applications are not needed, stop those applications.</p> <p>If the actual memory size is sufficient, execute the <i>DLMgetras</i> 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 <i>DLMgetras</i> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12364-E	An internal error occurred in the file operation. File name = <i>aa...aa</i> , Code = <i>bb...bb</i> , Errno = <i>cc...cc</i> . Execute the <i>DLMgetras</i> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Internal code (decimal number)</p> <p><i>cc...cc</i>: Error number (errno) (decimal number)</p> <p>Action</p> <p>Execute the <i>DLMgetras</i> 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 <i>DLMgetras</i> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12365-E	Multiple instances of the utility for changing HDLM device names and the utility for managing the HDLM configuration cannot be executed concurrently. Wait until the utility for changing	<p>Action</p> <p>Do either 1 or 2, as appropriate:</p> <ol style="list-style-type: none"> 1. Wait until the utility for changing HDLM device names (<i>d1mchname</i>) ends, and then re-execute it. 2. Wait until the utility for managing the HDLM configuration (<i>d1mcfgmgr</i>) ends, and then re-execute the utility for

Message ID	Message Text	Explanation
	HDLM device names or the utility for managing the HDLM configuration ends, and then re-execute the utility for changing HDLM device names.	changing HDLM device names (dmlchname).
KAPL12366-E	The file format is invalid. File name = <i>aa...aa</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p><i>aa...aa</i>: /etc/opt/ DynamicLinkManager/.dmlfdrv.conf</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> <p>For details on the DLMgetras utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12367-E	You lack permissions required to execute the utility for changing HDLM device names. Execute the utility as a user who has root permissions.	<p>Action</p> <p>Re-execute the utility for changing HDLM device names (dmlchname) as a user who has root permissions.</p>
KAPL12368-E	An error occurred during creation of an HDLM temporary file. File name = <i>aa...aa</i> , Code = <i>bb...bb</i> , Errno = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: File name</p> <ol style="list-style-type: none"> /etc/opt/ DynamicLinkManager/.dmlfdrv.conf /etc/opt/ DynamicLinkManager/.dmlfdrv.unc onf /etc/opt/DynamicLinkManager/ dmlchname.conf <p><i>bb...bb</i>: Internal code (decimal number)</p> <p><i>cc...cc</i>: Error number (errno) (decimal number)</p> <p>Action</p> <p>Verify that the root directory (/) has enough unused capacity.</p> <p>If it has enough unused capacity, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
KAPL12369-E	The file could not be created. File name = <i>aa...aa</i> , Code = <i>bb...bb</i> , Errno = <i>cc...cc</i>	<p>Details</p> <p><i>aa...aa</i>: File name</p> <ol style="list-style-type: none"> /etc/opt/ DynamicLinkManager/.dlmfdrv.conf /etc/opt/ DynamicLinkManager/.dlmfdrv.unc onf /etc/opt/DynamicLinkManager/ dlmchname.conf <p><i>bb...bb</i>: Internal code (decimal number)</p> <p><i>cc...cc</i>: Error number (errno) (decimal number)</p> <p>Action</p> <p>Verify that the root directory (/) has enough unused capacity.</p> <p>If it has enough unused capacity, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12370-E	An internal error occurred in the utility for changing HDLM device names. Code = <i>aa...aa</i> , Errno = <i>bb...bb</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p><i>aa...aa</i>: Internal code (decimal number)</p> <p><i>bb...bb</i>: Error number (errno) (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12371-E	A file could not be opened. File name = <i>aa...aa</i> , Code = <i>bb...bb</i> , Errno = <i>cc...cc</i> . Execute the <code>DLMgetras</code> utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p><i>aa...aa</i>: File name</p> <ol style="list-style-type: none"> /etc/opt/ DynamicLinkManager/.dlmfdrv.conf /etc/opt/ DynamicLinkManager/.dlmfdrv.unc onf /etc/opt/DynamicLinkManager/ dlmchname.conf

Message ID	Message Text	Explanation
		<p><i>bb...bb</i>: Internal code (decimal number)</p> <p><i>cc...cc</i>: Error number (errno) (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12372-W	The entered value is invalid.	<p>Action</p> <p>After the KAPL12374-I message is output, enter the correct <i>y/n</i> value.</p>
KAPL12373-E	The entered value is invalid. The utility for changing HDLM device names will now stop. Re-execute the utility.	<p>Action</p> <p>Re-execute the utility for changing HDLM device names (<code>d1mchname</code>).</p>
KAPL12374-I	This operation will change the HDLM device configuration. Do you want to continue? [<i>y/n</i>]:	<p>Action</p> <p>Enter <i>y</i> to continue. Enter <i>n</i> to cancel.</p>
KAPL12375-W	Processing of the utility for changing HDLM device names was interrupted. Re-execute the utility.	<p>Action</p> <p>Re-execute the utility for changing HDLM device names (<code>d1mchname</code>).</p>
KAPL12376-E	The value entered for the storage system serial number and LU number is incorrect in the device name change definition file. Incorrect value = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Incorrect storage system serial number and LU number</p> <p>Action</p> <p>If the value entered for the storage system serial number and LU number is incorrect, the incorrect value is displayed. Correct the number, and then re-execute the utility for changing HDLM device names (<code>d1mchname</code>).</p>
KAPL12377-I	The utility for changing HDLM device names started: <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: date and time (for example, Fri Aug 23 19 : 12 : 50 2004)</p> <p>Action</p> <p>None.</p>
KAPL12378-I	Restart the machine for configuration changes to take effect.	<p>Action</p> <p>Change the name of the HDLM device in applications that use HDLM, and then restart the machine for the configuration changes to take effect.</p>

Message ID	Message Text	Explanation
KAPL12379-I	The utility for changing HDLM device names finished normally.	Action None.
KAPL12380-E	The file does not exist. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: File name</p> <ol style="list-style-type: none"> /etc/opt/ DynamicLinkManager/.dlmfdrv.conf /etc/opt/DynamicLinkManager/ dlmchname.conf <p>Action</p> <ol style="list-style-type: none"> If the configuration definition file (.dlmfdrv.conf) file does not exist, execute the dlmstart utility and configure the HDLM devices. For details on the dlmstart utility, see dlmstart utility for starting HDLM on page 7-57. If the device name change definition file (dlmchname.conf) does not exist, execute the utility for changing HDLM device names (dlmchname) with the -o option and create the device name change definition file (dlmchname.conf). For details on the dlmchname utility, see dlmchname HDLM device name replacement utility on page 7-37.
KAPL12381-E	A required system file could not be found. Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<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. For details on the DLMgetras utility, see "DLMgetras utility for collecting HDLM error information" on page DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12382-E	A required entry could not be found in the system file. Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<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. For details on the DLMgetras utility, see "DLMgetras utility for collecting HDLM error information" on page DLMgetras utility for collecting HDLM error information on page 7-3.</p>

Message ID	Message Text	Explanation
KAPL12386-E	An internal error occurred in the utility for changing HDLM device names. File name = <i>aa...aa</i> , Code = <i>bb...bb</i> , Errno = <i>cc...cc</i> . Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Details</p> <p><i>aa...aa</i>: File name</p> <p><i>bb...bb</i>: Internal code (decimal number)</p> <p><i>cc...cc</i>: Error number (errno) (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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12387-E	An internal error occurred in the utility for changing HDLM device names. Execute the DLMgetras utility to collect error information, and then contact your vendor or maintenance company.	<p>Action</p> <p>After restarting the system, perform either of the following operations:</p> <ol style="list-style-type: none"> Make sure that the HDLM device is not being used, and then re-execute the command. Execute the command with the <code>-f</code> option specified, and then restart the system. <p>If the HDLM device name cannot be changed by performing either of the above operations, 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> <p>For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL12388-E	The utility for changing HDLM device names ended abnormally.	<p>Action</p> <p>Check the error message that was output just before this message, and then perform the action indicated in that error message.</p>
KAPL12389-E	Required entries were not found in the device name change definition file.	<p>Action</p> <p>For details on the utility for changing HDLM device names (<code>d1mchname</code>), see d1mchname HDLM device name replacement utility on page 7-37</p>
KAPL12390-I	The user terminated the operation.	<p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL12391-E	The specified HDLM device name in the device name change definition file is already in use. HDLM device name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The specified HDLM device name</p> <p>Action</p> <p>Review the entries in the device name change definition file (<i>d1mchname.conf</i>) and re-execute the utility for changing HDLM device names (<i>d1mchname</i>). For details on this utility, see d1mchname HDLM device name replacement utility on page 7-37.</p>
KAPL12392-E	Duplicated entries were found in the <i>d1mchname.conf</i> file. Duplicated entry = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Duplicated entry</p> <p>Action</p> <p>Review the entries in the device name change definition file (<i>d1mchname.conf</i>) and re-execute the utility for changing HDLM device names (<i>d1mchname</i>). For details on this utility, see d1mchname HDLM device name replacement utility on page 7-37.</p>
KAPL12393-E	The file format of the device name definition file is invalid. Incorrect line = <i>aa...aa</i> Duplicated entries were found in the <i>d1mchname.conf</i> file. Duplicated entry = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The incorrect line in the device name definition file (<i>d1mchname.conf</i>)</p> <p>Action</p> <p>Review the entries in the device name change definition file (<i>d1mchname.conf</i>) and re-execute the utility for changing HDLM device names (<i>d1mchname</i>). For details on this utility, see d1mchname HDLM device name replacement utility on page 7-37.</p>
KAPL12394-E	An HDLM device specified in the device name change definition file is invalid. HDLM device name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: The specified HDLM device name</p> <p>Action</p> <p>Review the specified HDLM device name format and re-execute the utility for changing HDLM device names (<i>d1mchname</i>). For details on HDLM device names, see Logical device files for HDLM devices on page 2-11. For details on the <i>d1mchname</i> utility, see d1mchname HDLM device name replacement utility on page 7-37.</p>
KAPL12395-E	The utility for changing HDLM device names cannot be executed	<p>Action</p> <p>Execute the <i>d1mstart</i> utility and configure the HDLM devices and re-execute the utility for changing HDLM</p>

Message ID	Message Text	Explanation
	because the HDLM driver has not been loaded.	device names (<code>dmlchname</code>). For details on the <code>dmlchname</code> utility, see dmlchname HDLM device name replacement utility on page 7-37 .
KAPL12451-E	Logical volumes might not be set up in a multi-path configuration because the LVM cache file is enabled. Disable the LVM cache file.	<p>Action</p> <p>Perform the following steps:</p> <ol style="list-style-type: none"> Check whether <code>write_cache_state=0</code> is specified in the <code>/etc/lvm/lvm.conf</code> file. If <code>write_cache_state=0</code> is not specified, specify it. Execute <code>/sbin/vgscan</code>. Check whether the following files exist. If either or both of the files exist, delete them. <code>/etc/lvm/.cache</code> <code>/etc/lvm/cache/.cache</code> Create the initial RAM disk image file again. For details on the procedure, see the following: If an HDLM device is being used as a boot disk: See step 9 in Settings for a multipath boot disk environment on page C-2. If an HDLM device is not being used as a boot disk: See the description about executing a command in step 9 in Settings for a multipath boot disk environment on page C-2. For information about the format of the file name of the initial RAM disk image file that is specified in parameters, see Table 3-77 Names of initial RAM disk image files on page 3-157 in Notes on using LVM2 on page 3-154. Restart the server. <pre># shutdown -r now</pre> Check whether the LVM cache file is present by using the following commands. If the file is present, move to step g. If it is not present, the recovery procedure is complete. <pre># ls /etc/lvm/.cache</pre> <pre># ls /etc/lvm/cache/.cache</pre>

Message ID	Message Text	Explanation
		<p>g. Perform the check described in Confirming that the logical volume is in a multi-path configuration on page 3-171.</p> <ul style="list-style-type: none"> If a multi-path configuration is being used, clear the LVM cache by executing the following command. This ends the procedure. If a multi-path configuration is not being used, clear the LVM cache by executing the following command, and then go to step h. You can also restart the server instead of performing steps h and i. <pre># rm /etc/lvm/.cache # rm /etc/lvm/cache/.cache</pre> <p>h. Deactivate the volume group containing the logical volume that is not operating in a multi-path configuration.</p> <pre># vgchange -an volume-group-name</pre> <p>i. Reactivate the volume group.</p> <pre># vgchange -ay volume-group-name</pre>
KAPL12551-E	The utility for setting HDLM driver option can be executed with the name dlmsetopt only.	<p>Action</p> <p>Change the utility name back to dlmsetopt, and then execute it.</p>
KAPL12552-E	Multiple instances of the utility for setting HDLM driver option (dlmsetopt) cannot execute concurrently.	<p>Action</p> <p>Wait until the executing utility finishes, and then re-execute dlmsetopt.</p> <p>If two or more utilities are not executing simultaneously, delete the following files, and then re-execute the utility:</p> <pre>/etc/opt/ DynamicLinkManager/.dlm_modules.conf.lock</pre>
KAPL12553-W	<p>For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, or Red Hat Enterprise Linux 8:</p> <p>Usage: /opt/DynamicLinkManager/bin/dlmsetopt {-r retrycount -inqt InquiryTimeout -inqr InquiryRetry -</p>	<p>Action</p> <p>Refer to dlmsetopt utility for setting HDLM driver options on page 7-52, and then specifying the correct argument. Then, re-execute the dlmsetopt utility.</p>

Message ID	Message Text	Explanation
	<pre>prsup ReserveStatus -h}</pre> <p>For OSs other than the above:</p> <pre>Usage: /opt/ DynamicLinkManager /bin/dlmsetopt {-r retrycount -inqt InquiryTimeout - inqr InquiryRetry - h}</pre>	
KAPL12554-I	The utility for setting HDLM driver option has started.	<p>Action</p> <p>None.</p>
KAPL12555-I	The utility for setting HDLM driver option completed normally.	<p>Action</p> <p>None.</p>
KAPL12556-I	An attempt to execute the utility for setting HDLM driver option has failed.	<p>Action</p> <p>Check the action recommended in the error message output before this message, and take action accordingly.</p>
KAPL12557-I	The user stopped the utility for setting HDLM driver option.	<p>Details</p> <p>Even if the message KAPL12555-I is output before this message, the contents set by the execution of the <code>dlmsetopt</code> utility will have no effect and the settings will return to the state before the execution.</p> <p>Action</p> <p>If necessary, re-execute the <code>dlmsetopt</code> utility.</p>
KAPL12558-I	Please restart the computer so that the option settings take effect.	<p>Action</p> <p>Restart the computer.</p>
KAPL12559-E	An invalid value was specified in the parameter. Option = <i>aa...aa</i> , Parameter = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Option</p> <p><i>bb...bb</i>: Specified parameter(Maximum 10 characters. If there are more than 10 characters, only 10 characters will be output followed by . . .)</p> <p>Action</p> <p>Refer to dlmsetopt utility for setting HDLM driver options on page 7-52, and then specifying the correct argument. Then, re-execute the <code>dlmsetopt</code> utility.</p>
KAPL12560-E	An option is not specified.	<p>Action</p>

Message ID	Message Text	Explanation
		Refer to dlmsetopt utility for setting HDLM driver options on page 7-52 , specify the correct argument, and then re-execute the dlmsetopt utility.
KAPL12561-E	An invalid option was specified. Option = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Option</p> <p>Action</p> <p>Refer to dlmsetopt utility for setting HDLM driver options on page 7-52, specify the correct argument, and then re-execute the dlmsetopt utility.</p>
KAPL12562-E	A necessary file or directory was not found. File or directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Referenced directory or file name</p> <p>Action</p> <p>Make sure that the directory or file indicated in the message has not been renamed. If the directory or file has been renamed, change the name back to its original name, and then re-execute the utility for setting HDLM driver option (dlmsetopt).</p>
KAPL12563-E	An attempt to create a directory has failed. Directory = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Directory that an attempt was made to create</p> <p>Action</p> <p>Make sure there is enough free disk capacity, and then re-execute the utility for setting HDLM driver option (dlmsetopt).</p> <p>Delete any unnecessary files in the file system, and then re-execute the dlmsetopt utility.</p>
KAPL12564-E	An attempt to back up a file has failed. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Backup file name</p> <p>Action</p> <p>Make sure there is enough free disk capacity, and then re-execute the utility for setting HDLM driver option (dlmsetopt).</p>
KAPL12565-E	Could not modify file. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Name of file to be updated</p> <p>Action</p> <p>Make sure there is enough free disk capacity, and then re-execute the utility for setting HDLM driver option (dlmsetopt). If this message still appears, stop any unnecessary</p>

Message ID	Message Text	Explanation
		processes, and then re-execute the <code>dlnmsetopt</code> utility.
KAPL12566-E	The utility for setting HDLM driver option was executed and ended abnormally last time.	<p>Action</p> <p>Compare the contents of the <code>/etc/modprobe.conf</code> file and the <code>/etc/opt/DynamicLinkManager/DLMSETOPT/modprobe.conf</code> file. According to the result, perform the following procedures:</p> <p>The <code>/etc/opt/DynamicLinkManager/DLMSETOPT/modprobe.conf</code> file was copied for backup by HDLM before the utility for setting HDLM driver option (<code>dlnmsetopt</code>) is to be executed. If Red Hat Enterprise Linux 6 is being used, <code>/etc/modprobe.conf</code> must be read as <code>/etc/modprobe.d/dlnmdrvopt.conf</code>.</p> <ul style="list-style-type: none"> When the file contents match: Delete the <code>/etc/opt/DynamicLinkManager/DLMSETOPT/modprobe.conf</code> file. Then, re-execute the <code>dlnmsetopt</code> utility to make sure that an error does not occur. When the file contents do not match: Overwrite the <code>/etc/modprobe.conf</code> file with the <code>/etc/opt/DynamicLinkManager/DLMSETOPT/modprobe.conf</code> file, and then re-configure the content that was configured in the <code>/etc/modprobe.conf</code> file according to the user's environment. Then, delete the <code>/etc/opt/DynamicLinkManager/DLMSETOPT/modprobe.conf</code> file. Finally, re-execute the <code>dlnmsetopt</code> utility to make sure that an error does not occur.
KAPL12567-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>

Message ID	Message Text	Explanation
KAPL12568-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL12801-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>
KAPL12802-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL12803-E	The device management file could not be created. Restart the host before using HDLM.	<p>Details</p> <p>The device management file could not be created. Restart the host before using HDLM.</p> <p>Action</p> <p>After HDLM was installed by using the <code>-update</code> option, the host was not restarted. Restart the host before using HDLM.</p>
KAPL12851-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>
KAPL12852-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p>

Message ID	Message Text	Explanation
		<p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL12901-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	<p>Details</p> <p>The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM.</p> <p>Action</p> <p>Install HDLM that adjusts to the kernel that is running now.</p>
KAPL12902-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing HDLM cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL12903-I	The utility for creating an HDLM boot disk environment (dlmbootstart) will now start.	<p>Details</p> <p>The utility for creating an HDLM boot disk environment (dlmbootstart) will now start.</p> <p>Action</p> <p>None.</p>
KAPL12904-I	Editing of the boot loader configuration file will now start.	<p>Details</p> <p>The boot loader configuration file will now be edited.</p> <p>Action</p> <p>None.</p>
KAPL12905-I	The processing to configure the fstab file will now start.	<p>Details</p> <p>The <i>fstab</i> file will now be configured.</p> <p>Action</p> <p>None.</p>
KAPL12906-I	Editing of the <i>/etc/lvm/lvm.conf</i> file will now start.	<p>Details</p> <p>The <i>/etc/lvm/lvm.conf</i> file will now be edited.</p> <p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL12907-I	The processing to configure the initial RAM disk image file will now start.	<p>Details</p> <p>The initial RAM disk image file will now be configured.</p> <p>Action</p> <p>None.</p>
KAPL12908-I	The utility for creating an HDLM boot disk environment (dlmbootstart) finished.	<p>Details</p> <p>The utility for creating an HDLM boot disk environment (dlmbootstart) finished.</p> <p>Action</p> <p>None.</p>
KAPL12909-I	Editing of the boot loader configuration file finished.	<p>Details</p> <p>The boot loader configuration file was edited.</p> <p>Action</p> <p>None.</p>
KAPL12910-I	The processing to configure the fstab file finished.	<p>Details</p> <p>The <code>fstab</code> file was configured.</p> <p>Action</p> <p>None.</p>
KAPL12911-I	Editing of the <code>/etc/lvm/lvm.conf</code> file finished.	<p>Details</p> <p>The <code>/etc/lvm/lvm.conf</code> file was configured.</p> <p>Action</p> <p>None.</p>
KAPL12912-I	The processing to configure the initial RAM disk image file finished.	<p>Details</p> <p>The initial RAM disk image file was configured.</p> <p>Action</p> <p>None.</p>
KAPL12913-E	An attempt to execute the utility for creating an HDLM boot disk environment (dlmbootstart) failed. Take the actions described in the message that was output just before this message, and then re-execute the dlmbootstart utility.	<p>Details</p> <p>An attempt to execute the utility for creating an HDLM boot disk environment (dlmbootstart) failed.</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL12914-E	Editing of the boot loader configuration file failed. Take the actions described in the message that was output just	<p>Details</p> <p>Editing of the boot loader configuration file failed.</p> <p>Action</p>

Message ID	Message Text	Explanation
	before this message, and then re-execute the <code>dmlbootstart</code> utility.	Check the actions to take described in the message that was output just before this message.
KAPL12915-E	The processing to configure the <code>fstab</code> file failed. Take the actions described in the message that was output just before this message, and then re-execute the <code>dmlbootstart</code> utility.	<p>Details</p> <p>The processing to configure the <code>fstab</code> file failed.</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL12916-E	Editing of the <code>/etc/lvm/lvm.conf</code> file failed. Take the actions described in the message that was output just before this message, and then re-execute the <code>dmlbootstart</code> utility.	<p>Details</p> <p>Editing of the <code>/etc/lvm/lvm.conf</code> file failed.</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL12917-E	The processing to configure the initial RAM disk image file failed. Take the actions described in the message that was output just before this message, and then re-execute the <code>dmlbootstart</code> utility.	<p>Details</p> <p>The processing to configure the initial RAM disk image file failed.</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL12918-I	The utility for creating an HDLM boot disk environment (<code>dmlbootstart</code>) was terminated.	<p>Details</p> <p>The utility for crating an HDLM boot disk environment (<code>dmlbootstart</code>) was terminated.</p> <p>Action</p> <p>None.</p>
KAPL12919-I	Editing of the boot loader configuration file was terminated.	<p>Details</p> <p>Editing of the boot loader configuration file was terminated.</p> <p>Action</p> <p>None.</p>
KAPL12920-I	The processing to configure the <code>fstab</code> file was terminated.	<p>Details</p> <p>The processing to configure the <code>fstab</code> file was terminated.</p> <p>Action</p> <p>None.</p>
KAPL12921-I	Editing of the <code>/etc/lvm/lvm.conf</code> file was terminated.	<p>Details</p> <p>Editing of the <code>/etc/lvm/lvm.conf</code> file was terminated.</p> <p>Action</p>

Message ID	Message Text	Explanation
		None.
KAPL12922-I	The processing to configure the initial RAM disk image file was terminated.	<p>Details</p> <p>The initial RAM disk image file setting was terminated.</p> <p>Action</p> <p>None.</p>
KAPL12923-E	<p>The utility for creating an HDLM boot disk environment (dlmbootstart) was executed with an invalid parameter. Parameter = <i>aa...aa</i></p> <p>Specify the correct parameter, and then try again.</p>	<p>Details</p> <p><i>aa...aa</i>: The specified parameter (character string)</p> <p>Action</p> <p>Specify the correct parameters, and then re-execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>
KAPL12924-E	<p>The processing to edit the boot loader configuration file was executed with an invalid parameter.</p> <p>Parameter = <i>aa...aa</i></p> <p>Specify the correct parameter, and then execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>	<p>Details</p> <p><i>aa...aa</i>: The specified parameter (character string)</p> <p>Action</p> <p>Check the parameters of the target utility, and then execute the utility again.</p>
KAPL12925-E	<p>The processing to configure the fstab file was executed with an invalid parameter.</p> <p>Parameter = <i>aa...aa</i></p> <p>Specify the correct parameter, and then execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>	<p>Details</p> <p><i>aa...aa</i>: The specified parameter (character string)</p> <p>Action</p> <p>Check the parameters of the target utility, and then execute the utility again.</p>
KAPL12926-E	<p>The processing to edit the /etc/lvm/lvm.conf file was executed with an invalid parameter.</p> <p>Parameter = <i>aa...aa</i></p> <p>Specify the correct parameter, and then execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>	<p>Details</p> <p><i>aa...aa</i>: The specified parameter (character string)</p> <p>Action</p> <p>Check the parameters of the target utility, and then execute the utility again.</p>

Message ID	Message Text	Explanation
KAPL12927-E	<p>The processing to create the initial RAM disk image file was executed with an invalid parameter.</p> <p>Parameter = <i>aa...aa</i></p> <p>Specify the correct parameter, and then execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>	<p>Details</p> <p><i>aa...aa</i>: The specified parameter (character string)</p> <p>Action</p> <p>Check the parameters of the target utility, and then execute the utility again.</p>
KAPL12928-W	<p>Usage:</p> <pre>/opt/ DynamicLinkManager/bin/ dlmbootstart { -set hdlm [-shutdown -reboot] -set restore -h }</pre>	<p>Action</p> <p>Check for parameters, and then re-execute the dlmbootstart utility. Refer to dlmbootstart utility for creating an HDLM boot disk environment on page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12933-E	<p>The utility for creating an HDLM boot disk environment (dlmbootstart) is already being executed. Wait for the dlmbootstart utility to finish, and then execute the utility again.</p>	<p>Details</p> <p>An attempt to execute the utility for creating an HDLM boot disk environment (dlmbootstart) failed because two or more instances of the utility were executed simultaneously.</p> <p>Action</p> <p>Wait for the utility for creating an HDLM boot disk environment (dlmbootstart) to finish, and then execute the utility again.</p> <p>For details on the dlmbootstart utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p> <p>Delete the following files, and then execute the dlmbootstart utility:</p> <pre>/opt/DynamicLinkManager/ bin/.dlmbootstart.lock /opt/DynamicLinkManager/ bin/.dlmbootsetup.lock /opt/DynamicLinkManager/ bin/.dlmlvmsetup.lock</pre>
KAPL12934-E	<p>Editing of the boot loader configuration file is in progress. Wait for the dlmbootstart utility to finish, and then execute the utility again.</p>	<p>Details</p> <p>The boot loader configuration file is being edited.</p> <p>Action</p> <p>Wait for the utility for creating an HDLM boot disk environment (dlmbootstart) to finish, and then execute the utility again.</p>

Message ID	Message Text	Explanation
		For details on the dlmbootstart utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24 .
KAPL12935-E	The processing to configure the fstab file is in progress. Wait for the dlmbootstart utility to finish, and then execute the utility again.	<p>Details</p> <p>The <code>fstab</code> file is being set.</p> <p>Action</p> <p>Wait for the utility for creating an HDLM boot disk environment to finish, and then execute the utility again.</p> <p>Refer to dlmbootstart utility for creating an HDLM boot disk environment on page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12936-E	Editing of the <code>/etc/lvm/lvm.conf</code> file is in progress. Wait for the dlmbootstart utility to finish, and then execute the utility again.	<p>Details</p> <p>The <code>/etc/lvm/lvm.conf</code> file is being edited.</p> <p>Action</p> <p>Wait for the utility for creating an HDLM boot disk environment to finish, and then execute the utility again.</p> <p>Refer to dlmbootstart utility for creating an HDLM boot disk environment on page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12937-E	The processing to configure the initial RAM disk image file is in progress. Wait for the dlmbootstart utility to finish, and then execute the utility again.	<p>Details</p> <p>The initial RAM disk image file is being set.</p> <p>Action</p> <p>Wait for the utility for creating an HDLM boot disk environment to finish, and then execute the utility again.</p> <p>Refer to dlmbootstart utility for creating an HDLM boot disk environment on page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12938-E	<p>An error occurred in the internal processing of the utility for creating an HDLM boot disk environment (dlmbootstart). Details = <code>aa...aa</code>, <code>bb...bb</code></p> <p>Execute the DLMgetras utility, and then contact your HDLM vendor or the maintenance company if</p>	<p>Details</p> <p><code>aa...aa</code>: Return value (decimal number)</p> <p><code>bb...bb</code>: Maintenance information (number of lines where the error occurred) (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>

Message ID	Message Text	Explanation
	there is a maintenance contact for HDLM.	
KAPL12939-E	<p>An error occurred in the internal processing of editing the boot loader configuration file. Details = <i>aa...aa</i>, <i>bb...bb</i></p> <p>Execute the DLMgetras utility, and then contact your HDLM vendor or the maintenance company if there is a maintenance contact for HDLM.</p>	<p>Details</p> <p><i>aa...aa</i>: Return value (decimal number)</p> <p><i>bb...bb</i>: Maintenance information (number of lines where the error occurred) (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL12940-E	<p>An error occurred in the internal processing of configuring the fstab file. Error Code = <i>aa...aa</i>[<i>bb..bb</i>] <i>cc..cc</i></p> <p>Execute the DLMgetras utility, and then contact your HDLM vendor or the maintenance company if there is a maintenance contact for HDLM.</p>	<p>Details</p> <p><i>aa...aa</i>: Name of the function where the error occurred</p> <p><i>bb...bb</i>: Line number where the error occurred (decimal number)</p> <p><i>cc...cc</i>: Detailed information (character string)</p> <p>Action</p> <p>The way to resolve the problem depends on errno in the detailed information.</p> <p>12(ENOMEM)</p> <p>Make sure there is sufficient memory.</p> <p>2(ENOENT)</p> <p>13(EACCES)</p> <p>Re-install HDLM.</p> <p>28(ENOSPC)</p> <p>Make sure there is enough free disk capacity.</p> <p>If errno is not displayed in the detailed information, or an errno different from the above is displayed, contact your HDLM vendor or the maintenance company if you have a maintenance contact for HDLM.</p>
KAPL12941-E	<p>An error occurred in the internal processing of editing the /etc/lvm/lvm.conf file Details = <i>aa...aa</i>, <i>bb...bb</i></p> <p>Execute the DLMgetras utility, and then contact your HDLM vendor or the maintenance company if there is a maintenance contact for HDLM.</p>	<p>Details</p> <p><i>aa...aa</i>: Return value (decimal number)</p> <p><i>bb...bb</i>: Maintenance information (number of lines where the error occurred) (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>

Message ID	Message Text	Explanation
KAPL12942-E	<p>An error occurred in the internal processing of creating the initial RAM disk image file.</p> <p>Error Code = <i>aa..aa[bb..bb] cc..cc</i></p> <p>Execute the DLMgetras utility, and then contact your HDLM vendor or the maintenance company if there is a maintenance contact for HDLM.</p>	<p>Details</p> <p><i>aa...aa</i>: Name of the function where the error occurred</p> <p><i>bb...bb</i>: Line number where the error occurred (decimal number)</p> <p><i>cc...cc</i>: Detailed information (character string)</p> <p>Action</p> <p>The way to solve the problem depends on the detailed information of errno.</p> <p>12(ENOMEM)</p> <p>Make sure that there is sufficient memory.</p> <p>2(ENOENT)</p> <p>13(EACCES)</p> <p>Re-install HDLM.</p> <p>28(ENOSPC)</p> <p>Make sure there is enough free disk capacity.</p> <p>If errno is not displayed in the detailed information, or error that is not applicable for the above is displayed, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL12943-E	<p>A specified file or directory, required for processing of the utility for creating an HDLM boot disk environment (dlmbootstart), does not exist. File or directory name = <i>aa...aa</i></p> <p>Check whether the specified file or directory exists by comparing with the OS in its initial state or in the state just after HDLM is installed.</p>	<p>Details</p> <p><i>aa...aa</i>: Name of the non-existent file or directory (character string)</p> <p>Action</p> <p>Check whether the specified file or directory exists by comparing with the OS in its initial state or in the state just after HDLM is installed. Then, execute the dlmbootstart utility.</p> <p>For details on the dlmbootstart utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12944-I	<p>The restoration processing of the utility for creating an HDLM boot disk environment (dlmbootstart) will now start.</p>	<p>Details</p> <p>The restoration processing of the utility for creating an HDLM boot disk environment (dlmbootstart) will now start.</p> <p>Action</p> <p>None.</p>
KAPL12945-E	<p>The log information could not be output to a log file</p>	<p>Details</p>

Message ID	Message Text	Explanation
	during execution of the utility for creating an HDLM boot disk environment (dlmbootstart). Make sure that the disk has enough unused capacity and that the user has write permission for this directory.	<p>The log information could not be output to the error log file <code>/var/opt/DynamicLinkManager/log/dlmbootstart*.log</code>.</p> <p>Action</p> <p>Make sure that the disk has enough unused capacity and that the user has write permission for the log file directory.</p>
KAPL12946-I	After one minute, the system will stop or restart.	<p>Details</p> <p>After one minute, the system will stop or restart.</p> <p>Action</p> <p>None.</p>
KAPL12947-I	The processing to edit the boot loader configuration file was skipped.	<p>Details</p> <p>The processing to edit the boot loader configuration file was skipped.</p> <p>Action</p> <p>None.</p>
KAPL12948-E	<p>A specified file or directory, required for the processing to edit the boot loader configuration file, does not exist. File or directory name = <code>aa...aa</code></p> <p>Check whether the specified file or directory exists by comparing with the OS in its initial state or in the state just after HDLM is installed.</p>	<p>Details</p> <p><code>aa...aa</code>: Name of the non-existent file or directory (character string)</p> <p>Action</p> <p>Check whether the specified file or directory exists by comparing with the OS in its initial state or in the state just after HDLM is installed. Then, execute the <code>dlmbootstart</code> utility.</p> <p>For details on the <code>dlmbootstart</code> utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12949-I	This OS is not supported.	<p>Details</p> <p>This OS is not supported.</p> <p>Action</p> <p>None.</p>
KAPL12950-E	The log information could not be output to a log file during editing of the boot loader configuration file. Make sure that the disk has enough unused capacity and that the user has write permission for this directory.	<p>Details</p> <p>The log information could not be output to the error log file <code>/var/opt/DynamicLinkManager/log/dlmbootstart*.log</code>.</p> <p>Action</p> <p>Make sure that the disk has enough unused capacity and that the user has write permission for the log file directory.</p>

Message ID	Message Text	Explanation
KAPL12951-E	Both of the following RPM packages exist: grub and grub2. Leave the package that was installed in the OS in its initial state, and remove the other package.	<p>Details</p> <p>Both of the following RPM packages exist: grub and grub2.</p> <p>Action</p> <p>Make sure the environment is one where only one of the grub or grub2 RPM packages is installed. Then, re-execute the utility for creating an HDLM boot disk environment (<code>dlmbootstart</code>).</p>
KAPL12952-E	Neither of the following RPM packages exist: grub and grub2. Re-install the package that was installed in the OS in its initial state.	<p>Details</p> <p>Neither of the following RPM packages exists: grub and grub2.</p> <p>Action</p> <p>Make sure the environment is one where only one of the grub or grub2 RPM packages is installed. Then, re-execute the utility for creating an HDLM boot disk environment (<code>dlmbootstart</code>).</p>
KAPL12953-I	The restoration processing of the utility for creating an HDLM boot disk environment (<code>dlmbootstart</code>) finished.	<p>Details</p> <p>The restoration processing of the utility for creating an HDLM boot disk environment (<code>dlmbootstart</code>) finished.</p> <p>Action</p> <p>None.</p>
KAPL12954-I	The processing to edit the <code>/etc/lvm/lvm.conf</code> file was skipped.	<p>Details</p> <p>The editing processing of <code>/etc/lvm/lvm.conf</code> file was skipped.</p> <p>Action</p> <p>None.</p>
KAPL12955-E	A specified file or directory does not exist in the processing to edit the file <code>lvm.conf</code> . File or directory name = <code>aa...aa</code> Check whether the specified file or directory exists by comparing whether it exists in the OS in its initial state or in the state just after HDLM is installed.	<p>Details</p> <p><code>aa...aa</code>: Name of the non-existent file or directory</p> <p>Action</p> <p>Check whether the specified file or directory exists by comparing with the OS in its initial state or in the state just after HDLM is installed. Then, execute the <code>dlmbootstart</code> utility. For details on the <code>dlmbootstart</code> utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12956-W	The <code>grub.conf</code> file or the <code>menu.lst</code> file contains multiple copy-source entries. Change the default value to the entry for the currently running OS, and then re-execute	<p>Details</p> <p>The <code>grub.conf</code> file or the <code>menu.lst</code> file contains multiple copy-source entries.</p> <p>Action</p> <p>Change the default value to the entry for the currently running OS, and then re-</p>

Message ID	Message Text	Explanation
	the utility for creating an HDLM boot disk environment (dlmbootstart).	execute the utility for creating an HDLM boot disk environment (dlmbootstart).
KAPL12957-E	The log information could not be output to a log file during editing of the /etc/lvm/lvm.conf file. Make sure that the disk has enough unused capacity and that the user has write permission for this directory.	<p>Details</p> <p>The log information could not be output to the error log file /var/opt/DynamicLinkManager/log/dlmbootstart*.log.</p> <p>Action</p> <p>Make sure that the disk has enough unused capacity and that the user has write permission for the log file directory.</p>
KAPL12958-W	The grub.conf file or the menu.lst file does not contain a copy-source entry. Compare the grub.conf file or the menu.lst file in the OS in its initial state, and make sure there is an entry of the currently running OS.	<p>Details</p> <p>The grub.conf file or the menu.lst file does not contain a copy-source entry.</p> <p>Action</p> <p>Compare the grub.conf file or the menu.lst file in the OS in its initial state, and check whether there is an entry for the currently running OS.</p>
KAPL12959-E	The lvm.conf file contains multiple definitions of the following item. Item name = aa...aa Make sure the item is defined only once, and then re-execute the utility for creating an HDLM boot disk environment (dlmbootstart).	<p>Details</p> <p>aa...aa: Name of item defined multiple times (character string)</p> <p>Action</p> <p>Make sure the item is defined only once, and then re-execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p> <p>For details on the dlmbootstart utility, see page dlmbootstart utility for creating an HDLM boot disk environment on page 7-24.</p>
KAPL12960-E	The lvm.conf file does not contain the following item. Item name = aa...aa Make sure this item exists in the lvm.conf file, and then re-execute the utility for creating an HDLM boot disk environment (dlmbootstart).	<p>Details</p> <p>aa...aa: Name of the non-existent item (character string)</p> <p>Action</p> <p>Make sure this item exists in the lvm.conf file, and then re-execute the utility for creating an HDLM boot disk environment (dlmbootstart).</p>
KAPL12961-E	The environment is not a SAN environment. Make sure the environment is one where the system boots from a system disk in a storage area	<p>Details</p> <p>The environment is not a SAN environment.</p> <p>Action</p>

Message ID	Message Text	Explanation
	network. Alternatively, make sure the system disk (/) is not excluded from the HDLM management target by executing the HDLM-configuration definition utility (dlmcfgmgr) with the -o parameter specified.	Make sure the environment is one where the system boots from a system disk in a storage area network. Alternatively, make sure the system disk (/) is not excluded from the HDLM management target by executing the HDLM-configuration definition utility (dlmcfgmgr) with the -o parameter specified.
KAPL12962-W	The utility for creating an HDLM boot disk environment (dlmbootstart) ended abnormally last time. The initial RAM disk image file or the hdlm.conf file might be invalid.	<p>Details</p> <p>The system determined that the utility for creating an HDLM boot disk environment (dlmbootstart) did not end normally because a temporary file for the processing to configure the initial RAM disk image file remains from the last time.</p> <p>Action</p> <p>Enter y in response to the KAPL12963-I message to continue the processing.</p>
KAPL12963-I	The temporary file that remains from when the utility ended abnormally last time will be deleted, and processing to configure the initial RAM disk image file will continue based on the current system information. Do you want to continue? [y/n]:	<p>Action</p> <p>You can select whether to continue the processing to configure the initial RAM disk image file or to terminate the processing.</p> <p>If you enter y, the temporary file (for the processing to configure the initial RAM disk image file) that remains from when the utility ended abnormally last time will be deleted, and the processing will continue.</p> <p>After this, if any of the following problems occur, execute the utility for collecting HDLM error information (DLMgetras) to acquire the error information and the files in the /tmp/dlminitransetup_crash directory, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM.</p> <ul style="list-style-type: none"> ◦ The HDLM device is not being used as a boot disk in this environment. ◦ An error message appears, and the OS stops. ◦ An error message appears when the OS starts. <p>If you enter n, processing to configure the initial RAM disk image file will stop.</p>

Message ID	Message Text	Explanation
KAPL12964-I	The creation of the initial RAM disk image file for HDLM will now start.	Action None.
KAPL12965-I	The creation of the initial RAM disk image file for HDLM finished.	Action None.
KAPL12966-E	The creation of the initial RAM disk image file for HDLM failed.	Action Check the following. a. Check whether there is sufficient unused disk capacity. If the unused capacity is insufficient, allocate the required amount of capacity. b. Check the read and write permissions for the following directories: <ul style="list-style-type: none"> • /etc • /tmp • /boot • /var c. Check whether there is sufficient unused memory capacity. If the unused capacity is insufficient, allocate the required amount of capacity.
KAPL12967-I	The restoration of the initial RAM disk image file will now start.	Action None.
KAPL12968-I	The restoration of the initial RAM disk image file finished.	Action None.
KAPL12969-E	The restoration of the initial RAM disk image file failed.	Action Check the following. a. Check whether there is sufficient unused disk capacity. If the unused capacity is insufficient, allocate the required amount of capacity. b. Check the read and write permissions for the following directories: <ul style="list-style-type: none"> • /etc • /tmp • /boot • /var c. Check whether there is sufficient unused memory capacity.

Message ID	Message Text	Explanation
		If the unused capacity is insufficient, allocate the required amount of capacity.
KAPL12970-I	The initial RAM disk image file was not restored because a backup of the file does not exist.	Action None.
KAPL12971-I	The creation of the fstab file for HDLM will now start.	Action None.
KAPL12972-I	The creation of the fstab file for HDLM finished.	Action None.
KAPL12973-E	The creation of the fstab file for HDLM failed.	Action Check the following. a. Check whether there is sufficient unused disk capacity. If the unused capacity is insufficient, allocate the required amount of capacity. b. Check the read and write permissions for the following directories: <ul style="list-style-type: none"> • /etc • /tmp • /var c. Check whether there is sufficient unused memory capacity. If the unused capacity is insufficient, allocate the required amount of capacity.
KAPL12974-I	The fstab file was not updated because the file is already configured for HDLM, or because there are no devices managed by HDLM.	Action None.
KAPL12975-I	The restoration of the fstab file will now start.	Action None.
KAPL12976-I	The restoration of the fstab file finished.	Action None.
KAPL12977-E	The restoration of the fstab file failed.	Action Check the following. a. Check whether there is sufficient unused disk capacity.

Message ID	Message Text	Explanation
		<p>If the unused capacity is insufficient, allocate the required amount of capacity.</p> <p>b. Check the read and write permissions for the following directories:</p> <ul style="list-style-type: none"> • /etc • /tmp • /var <p>c. Check whether there is sufficient unused memory capacity.</p> <p>If the unused capacity is insufficient, allocate the required amount of capacity.</p>
KAPL12978-I	The fstab file was not restored because a backup of the file does not exist.	<p>Action</p> <p>None.</p>
KAPL12979-W	The utility for creating an HDLM boot disk environment (dlmbootstart) ended abnormally last time. The fstab file might be invalid.	<p>Details</p> <p>The system determined that the utility for creating an HDLM boot disk environment (dlmbootstart) did not end normally because a temporary file for the processing to configure the <code>fstab</code> file remains from the last time.</p> <p>Action</p> <p>Enter <code>y</code> in response to the KAPL12980-I message to continue the processing.</p>
KAPL12980-I	The temporary file that remains from when the utility ended abnormally last time will be deleted, and processing to configure the fstab file will continue based on the current system information. Do you want to continue? [y/n]:	<p>Action</p> <p>You can select whether to continue the processing to configure the <code>fstab</code> file or to terminate the processing.</p> <p>If you enter <code>y</code>, the temporary file (for the processing to configure the <code>fstab</code> file) that remains from when the utility ended abnormally last time will be deleted, and the processing will continue.</p> <p>After this, if any of the following problems occur, execute the utility for collecting HDLM error information (DLMgetras) to acquire the error information and the files in the <code>/tmp/dlminitramsetup_crash</code> directory, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM.</p> <ul style="list-style-type: none"> ◦ The HDLM device is not being used as a boot disk in this environment.

Message ID	Message Text	Explanation
		<ul style="list-style-type: none"> An error message appears, and the OS stops. An error message appears when the OS starts. <p>If you enter <i>n</i>, processing to configure the <i>fstab</i> file will stop.</p>
KAPL12981-E	HDLM device not configured. Execute the utility for HDLM start (<i>dlmstart</i>), configure an HDLM device, and then re-execute the utility for creating an HDLM boot disk environment (<i>dlmbootstart</i>).	<p>Details</p> <p>HDLM device not configured.</p> <p>Action</p> <p>Execute the utility for HDLM start (<i>dlmstart</i>), configure an HDLM device, and then re-execute the utility for creating an HDLM boot disk environment (<i>dlmbootstart</i>).</p>
KAPL12982-E	The SCSI device is being used as a swap device. Disable the swap, and then re-execute the utility for creating an HDLM boot disk environment (<i>dlmbootstart</i>).	<p>Details</p> <p>The SCSI device is being used as a swap device.</p> <p>Action</p> <p>Disable the swap for the SCSI device that is an HDLM-management target by using the <i>swapoff</i> command, and then re-execute the utility for creating an HDLM boot disk environment (<i>dlmbootstart</i>).</p>

KAPL13001 to KAPL14000

Message ID	Message Text	Explanation
KAPL13031-I	The utility for displaying HDLM performance information (<i>dlmperfinfo</i>) will now start. Start time = <i>aa...aa</i>	<p>Details</p> <p>The utility for displaying HDLM performance information (<i>dlmperfinfo</i>) will now start.</p> <p><i>aa...aa</i>: Year (4 digits)/month/day hour:minute:second (Start time)</p> <p>Action</p> <p>None.</p>
KAPL13032-I	The utility for displaying HDLM performance information (<i>dlmperfinfo</i>) finished. End time = <i>aa...aa</i>	<p>Details</p> <p>The utility for displaying HDLM performance information (<i>dlmperfinfo</i>) finished.</p> <p><i>aa...aa</i>: Year (4 digits)/month/day hour:minute:second (End time)</p> <p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL13033-E	An attempt to execute the utility for displaying HDLM performance information (dlmperfinfo) failed.	<p>Details</p> <p>An attempt to execute the utility for displaying HDLM performance information (dlmperfinfo) failed.</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL13034-W	The utility for displaying HDLM performance information (dlmperfinfo) was terminated. End time = aa...aa	<p>Details</p> <p>The utility for displaying HDLM performance information (dlmperfinfo) was terminated.</p> <p>aa...aa: Year (4 digits)/month/day hour:minute:second (End time)</p> <p>Action</p> <p>Check the actions to take described in the message that was output just before this message.</p>
KAPL13035-W	You do not have permission to execute the utility for displaying HDLM performance information (dlmperfinfo).	<p>Details</p> <p>You do not have permission to execute the utility for displaying HDLM performance information (dlmperfinfo). Re-execute the dlmperfinfo utility as a user with root permissions.</p> <p>Action</p> <p>Re-execute the utility as a user with root permissions.</p>
KAPL13036-W	The utility for displaying HDLM performance information (dlmperfinfo) is already being executed.	<p>Details</p> <p>The utility for displaying HDLM performance information (dlmperfinfo) is already being executed.</p> <p>Action</p> <p>Wait for the dlmperfinfo utility to finish, and then execute the utility again.</p>
KAPL13037-W	A parameter value is invalid. parameter = aa...aa, parameter value = bb...bb	<p>Details</p> <p>An invalid parameter value is specified.</p> <p>aa...aa: Specified parameter (character string)</p> <p>bb...bb: Specified parameter value (character string)</p> <p>Action</p>

Message ID	Message Text	Explanation
		Check the parameters of the utility for displaying HDLM performance information (dlmperfinfo), and then execute the utility again. For details on the dlmperfinfo utility, see The utility for displaying HDLM performance information (dlmperfinfo) on page 7-40 .
KAPL13038-W	A parameter is invalid. parameter = aa...aa	<p>Details</p> <p>An invalid parameter is specified.</p> <p>aa...aa: Specified parameter (character string)</p> <p>Action</p> <p>Check the parameters of the utility for displaying HDLM performance information (dlmperfinfo), and then execute the utility again. For details on the dlmperfinfo utility, see The utility for displaying HDLM performance information (dlmperfinfo) on page 7-40.</p>
KAPL13039-W	A parameter is duplicated. parameter = aa...aa	<p>Details</p> <p>A duplicate parameter is specified.</p> <p>aa...aa: Duplicated parameter (character string)</p> <p>Action</p> <p>Delete the duplicate parameter, and then execute the utility again.</p>
KAPL13040-W	The specified file already exists.	<p>Details</p> <p>The specified file already exists.</p> <p>Action</p> <p>Do not specify an existing file name in the parameter of the utility for displaying HDLM performance information (dlmperfinfo). If you want to overwrite an existing file, use the -o parameter.</p>
KAPL13041-E	An attempt to output the file failed. File name = aa...aa, Error code = bb...bb	<p>Details</p> <p>An attempt to output the file failed.</p> <p>aa...aa: File name (character string)</p> <p>bb...bb: Error code (decimal number)</p> <p>Action</p>

Message ID	Message Text	Explanation
		For a description of how to check whether there is sufficient space on your disk, see The utility for displaying HDLM performance information (dlmperfinfo) on page 7-40 in the manual. If there is sufficient space, contact your HDLM vendor or your maintenance company, if you have a maintenance contract for HDLM.
KAPL13042-E	The utility cannot be executed due to insufficient memory. Details = <i>aa...aa</i>	<p>Details</p> <p>The memory required for processing the utility for displaying the HDLM performance information (dlmperfinfo) could not be allocated.</p> <p><i>aa...aa</i>: Detailed information (character string)</p> <p>Action</p> <p>Close any applications that are not immediately necessary to increase the amount of free memory, or restart the host.</p>
KAPL13043-E	An error occurred in the internal processing of the utility. Details = <i>aa...aa</i>	<p>Details</p> <p>An error occurred in the internal processing of the utility for displaying HDLM performance information (dlmperfinfo).</p> <p><i>aa...aa</i>: Detailed information (character string)</p> <p>Action</p> <p>Collect detailed information, and then contact your HDLM vendor or your maintenance company, if you have a maintenance contract for HDLM.</p>
KAPL13044-W	The path configuration was changed during the execution of the utility.	<p>Details</p> <p>The path configuration was changed during the execution of the utility for displaying HDLM performance information (dlmperfinfo).</p> <p>Action</p> <p>Do not change the path configuration during the execution of the dlmperfinfo utility.</p>
KAPL13045-W	The user terminated the utility.	<p>Details</p> <p>The process was terminated during the execution of the utility</p>

Message ID	Message Text	Explanation
		<p>for displaying HDLM performance information (<code>dlnperfinfo</code>) because an operation, such as Ctrl +C, was performed.</p> <p>Action</p> <p>None.</p>
KAPL13046-W	No path is managed by HDLM.	<p>Details</p> <p>There is no path managed by HDLM.</p> <p>Action</p> <p>Check the system configuration.</p>
KAPL13047-I	Performance information is now being measured. (<i>aa...aa</i> / <i>bb...bb</i>)	<p>Details</p> <p>Performance information is now being measured</p> <p><i>aa...aa</i>: Execution count (decimal number)</p> <p><i>bb...bb</i>: Count specified by the <code>-c</code> parameter (decimal number)</p> <p>Action</p> <p>None.</p>
KAPL13060-W	A file output as a CSV file that is to be deleted by rotation could not be deleted. file name = <i>aa...aa</i>	<p>Details</p> <p>A file output as a CSV file that is to be deleted by rotation could not be deleted.</p> <p><i>aa...aa</i>: File name of the output CSV file (character string)</p> <p>Action</p> <p>If you are accessing the file to be deleted, release the file.</p>
KAPL13061-W	A parameter that cannot be specified when a value other than 0 is specified for the <code>-c</code> parameter was specified. parameter = <i>aa...aa</i>	<p>Details</p> <p>A parameter that cannot be specified when a value other than 0 is specified for the <code>-c</code> parameter was specified.</p> <p><i>aa...aa</i>: Parameter name</p> <p>Action</p> <p>Execute the utility for displaying HDLM performance information (<code>dlnperfinfo</code>) with the <code>-h</code> parameter specified, check the parameters, and then execute the utility again.</p>
KAPL13062-I	Performance information is now being measured. (<i>aa...aa</i> / <i>bb...bb</i> / <i>cc...cc</i>)	<p>Details</p> <p>Performance information is now being measured.</p> <p><i>aa...aa</i>: File name of the output CSV file (character string)</p>

Message ID	Message Text	Explanation
		<i>bb...bb</i> : Number of measurements per file (decimal number) <i>cc...cc</i> : Total number of measurements per file (decimal number) Action None.
KAPL13081-I	Parameters = <i>aa...aa</i>	Details <i>aa...aa</i> : The parameters specified with the dlmperfinfo utility Action None.
KAPL13082-I	Data for maintenance: <i>aa...aa</i>	Details <i>aa...aa</i> : Maintenance information Action None.
KAPL13091-W	The initialization of HNTRLib2 failed. The trace information is not output. Details = <i>aa...aa</i>	Details The Hitachi Network Objectplaza Trace Library (HNTRLib2) failed to be initialized. The trace information of the dlmperfinfo utility is not output to the file dlmperfinfo[1-2].log. <i>aa...aa</i> : Detailed information (character string) Action Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.
KAPL13204-W	The file does not exist. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : / etc/.DynamicLinkManager/ Path00, /etc/.HBaseAgent/ Path00 Action Reinstall HDLM.
KAPL13205-W	You do not have read permission for the file. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : / etc/.DynamicLinkManager/ Path00, /etc/.HBaseAgent/ Path00 Action Execute the DLMgetras utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company, if you have a

Message ID	Message Text	Explanation
		<p>maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3.</p>
KAPL13206-W	The file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: / etc/.DynamicLinkManager/ Path00, /etc/.HBaseAgent/ Path00</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL13207-E	The directory does not exist. Directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: /HDLM installation directory, /HBsA installation directory</p> <p>Action</p> <p>Reinstall HDLM.</p>
KAPL13401-E	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 utility for collecting HDLM install error information, and then retry.</p>
KAPL13402-E	The first parameter has not been set to a directory. Value= <i>aa...aa</i>	<p>Details</p> <p>The first directory must be set to a directory to which collected information is output.</p> <p><i>aa...aa</i>: first parameter</p> <p>Action</p> <p>Check the parameters of the utility for collecting HDLM install error information, and then retry.</p>
KAPL13403-E	You lack write permission for the specified directory. Value= <i>aa...aa</i>	<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><i>aa...aa</i>: first parameter</p> <p>Action</p> <p>Check the following.</p> <ol style="list-style-type: none"> Check whether you have access permission for the specified directory.

Message ID	Message Text	Explanation
		<p>b. Check whether the specified directory name is correct.</p> <p>c. Check that the disk has sufficient unused capacity.</p>
KAPL13404-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 utility for collecting HDLM install error information without executing it.</p>
KAPL13405-E	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 utility for collecting HDLM install error information, and then retry.</p>
KAPL13406-E	You lack privileges for executing the utility for collecting HDLM install error information.	<p>Details</p> <p>The utility for collecting HDLM install error information must be executed by a root user.</p> <p>Action</p> <p>Retry as a user with root permissions.</p>
KAPL13407-I	The file has been obtained successfully. File = <i>aa...aa</i> , Collection time = <i>bb...bb</i> (GMT: <i>cc...cc</i>)	<p>Details</p> <p>The file to be collected has been obtained.</p> <p><i>aa...aa</i>: Collected file name</p> <p><i>bb...bb</i>: the year of grace/ month/day hour:minute:second</p> <p><i>cc...cc</i>: the year of grace/ month/day hour:minute:second(GMT)</p> <p>Action</p> <p>None.</p>
KAPL13408-E	Processing terminated before completion because a signal was received.	<p>Details</p> <p>The process has been terminated by an operation such as <i>Ctrl + c</i>.</p> <p>Action</p>

Message ID	Message Text	Explanation
		The utility for collecting HDLM install error information terminated before completion. If the directory is unnecessary, delete directory.
KAPL13409-I	The utility for collecting HDLM install error information completed normally.	Details The processing of the utility for collecting HDLM install error information has been terminated as <i>n</i> was sent to a confirmation. Action None.
KAPL13410-I	A user terminated the utility for collecting HDLM install error information.	Details The processing of the utility for collecting HDLM install error information has been terminated as <i>n</i> was sent to a confirmation. Action None.
KAPL13411-W	The entered value is invalid. Continue operation? [y/n]:	Details A value other than <i>y</i> or <i>n</i> has been entered for a [y/n] request. Enter <i>y</i> or <i>n</i> . Action Enter <i>y</i> or <i>n</i> .
KAPL13412-E	The entered value is invalid. The utility for collecting HDLM install error information stops.	Details The processing of the utility for collecting HDLM install error information has been terminated as an invalid response was sent three times consecutively to a request. Action Re-execute the utility for collecting HDLM install error information.
KAPL13413-W	The file does not exist. File = <i>aa...aa</i>	Details The file subject to collecting does not exist. <i>aa...aa</i> : Name of file to collect Action None.
KAPL13414-E	The file could not be copied. File = <i>aa...aa</i> , Details = <i>bb...bb</i>	Details Execution of the <code>cp</code> command failed.

Message ID	Message Text	Explanation
		<p><i>aa...aa</i>: file name you tried to copy</p> <p><i>bb...bb</i>: <code>cp</code> output message</p> <p>Action</p> <p>Check the system configuration.</p>
KAPL13415-E	An attempt to archive the install error information failed. Details = <i>aa...aa</i>	<p>Details</p> <p>Execution of the <code>tar</code> command failed.</p> <p><i>aa...aa</i>: <code>tar</code> command 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>
KAPL13416-E	An attempt to compress the install error information failed. Details = <i>aa...aa</i>	<p>Details</p> <p>Execution of the <code>gzip</code> command failed.</p> <p><i>aa...aa</i>: <code>gzip</code> command 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>
KAPL13417-E	The install error information does not exist.	<p>Details</p> <p>The install error information does not exist.</p> <p>Action</p> <p>After installing HDLM, re-execute the <code>installgetras</code> utility.</p>
KAPL13418-E	Too many parameters have been specified.	<p>Details</p> <p>Two or more parameters have been specified.</p> <p>Action</p> <p>Check the parameters of the utility for collecting HDLM install error information, and then retry.</p>

Message ID	Message Text	Explanation
KAPL13501-I	The utility for update system scripts started.	Action None.
KAPL13502-I	The utility for update system scripts completed successfully.	Action None.
KAPL13503-I	A system script has been modified. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : File name of the modified system script Action None.
KAPL13504-I	A symbolic link has been modified. Symbolic link name = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the modified symbolic link Action None.
KAPL13505-E	A system script cannot be modified. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : File name of the system script that cannot be modified Action Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.
KAPL13506-E	Modification of a system script has failed. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : File name of the system script that could not be modified Action Resolve the problem according to the message KAPL13521-E, which was output just before this message.
KAPL13507-E	Modification of a symbolic link has failed. Symbolic link name = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the file whose symbolic link could not be modified Action Resolve the problem according to the message KAPL13521-E, which was output just before this message.
KAPL13508-E	You lack permission for executing the utility for update system scripts.	Details The current user does not have authority to execute <code>dlmupdatesysinit</code> utility. Action Re-execute <code>dlmupdatesysinit</code> utility as a user with root

Message ID	Message Text	Explanation
		permission. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13509-E	The utility for update system scripts can be executed with the name dlmupdatesysinit only.	Action Change the utility name back to dlmupdatesysinit, and then execute it. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13510-E	Multiple instances of the utility for update system scripts cannot be executed concurrently.	Action Check the execution result of the executing dlmupdatesysinit utility. Re-execute the dlmupdatesysinit utility if necessary. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13511-E	The version of the kernel supported by the installed HDLM does not match the currently running kernel version.	Details The version of the kernel to which installed HDLM has adjusted and the kernel that is running now is not corresponding. There is a possibility of installing the package of the kernel after installing HDLM. Action Install HDLM that adjusts to the kernel that is running now.
KAPL13512-E	The user stopped the utility for update system scripts.	Action Re-execute the dlmupdatesysinit utility if necessary. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13513-E	An invalid parameter was specified. Parameter = aa...aa	Details aa...aa: Specified parameter Action Check for parameters, and then re-execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13514-W	Usage: /opt/DynamicLinkManager/bin/dlmupdatesysinit	Action Check for parameters, and then re-execute the dlmupdatesysinit

Message ID	Message Text	Explanation
		utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57 .
KAPL13515-E	A command required by HDLM not found. Command = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: File name of command</p> <p>Action</p> <p>Install a package that includes the command indicated in the message. Next, execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57.</p>
KAPL13516-E	A file required by HDLM not found. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: file name</p> <p>Action</p> <p>Check for and, if necessary, restore the file indicated in the message. Next, execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57.</p>
KAPL13517-E	A directory required by HDLM not found. Directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: directory name</p> <p>Action</p> <p>Check for and, if necessary, restore the directory indicated in the message. Next, execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57.</p>
KAPL13518-E	A system file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Name of the file where an error was detected</p> <p>Action</p> <p>Check for and, if necessary, restore the system file indicated in the message. Next, execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57.</p>
KAPL13519-E	An HDLM file required for the dlmupdatesysinit utility was not found. File name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: File name</p> <p>Action</p> <p>Reinstall an HDLM.</p>

Message ID	Message Text	Explanation
KAPL13520-E	An HDLM directory required for the dlmupdatesysinit utility was not found. Directory name = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Directory name</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL13521-E	A command has failed. Command = <i>aa...aa</i> , Details = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Command that failed</p> <p><i>bb...bb</i>: Message that the command output</p> <p>Action</p> <p>Remove the error cause described in the message output by the command indicated in the message KAPL134521-E. Next, re-execute the dlmupdatesysinit utility. Refer to dlmupdatesysinit utility for updating system scripts on page 7-57.</p>
KAPL13522-E	The HDLM file is invalid. File name = <i>aa...aa</i>	<p>Details</p> <p>A file necessary for processing dlmupdatesysinit utility cannot be found. Alternatively, the content of a file is invalid.</p> <p><i>aa...aa</i>: Name of file where error was detected.</p> <p>Action</p> <p>Reinstall an HDLM.</p>
KAPL13601-W	The audit log configuration file does not exist. Restart the HDLM Manager, and execute the "dlnmgr view -sys -audlog" command and check the setting.	<p>Details</p> <p>The audit log configuration file does not exist.</p> <p>Action</p> <p>Restart the HDLM manager, execute the "dlnmgr view -sys -audlog" command, and then specify any desired settings by using the "dlnmgr set -audlog" command or the "dlnmgr set -audfac" command as necessary.</p>
KAPL13602-W	The audit log configuration file cannot be opened. Execute the "dlnmgr view -sys -audlog" command and check whether a normal result is displayed.	<p>Details</p> <p>The audit log configuration file cannot be opened.</p> <p>Action</p> <p>If the "dlnmgr view -sys -audlog" command does not display a normal result, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.</p>

Message ID	Message Text	Explanation
KAPL13603-W	The audit log configuration file is invalid. Restart the HDLM Manager, and execute the "dlnkmgr view -sys -audlog" command and check the setting.	<p>Details</p> <p>The audit log configuration file is invalid.</p> <p>Action</p> <p>Restart the HDLM manager, and execute the "dlnkmgr view -sys -audlog" command, and then specify any desired settings by using the "dlnkmgr set -audlog" or the "dlnkmgr set -audfac" command as necessary.</p>
KAPL13604-W	An error occurred during processing to read the audit log configuration file.	<p>Details</p> <p>An internal error occurred during processing to read the audit log configuration file.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL13605-W	An error occurred during processing to output the audit log configuration file.	<p>Details</p> <p>An internal parameter error occurred during output of the audit log data.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL13606-W	An error occurred during processing to output the audit log configuration file.	<p>Details</p> <p>An internal error occurred during output of the audit log data.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL13901-I	The utility for HDLM start completed successfully.	<p>Action</p> <p>None.</p>
KAPL13902-I	Alert driver had been loaded. Alert driver's loading was skipped.	<p>Action</p> <p>None.</p>
KAPL13903-I	The process related to Alert driver had been completed. The process related to Alert driver was skipped.	<p>Action</p> <p>None.</p>
KAPL13904-I	Filter driver had been loaded. Filter driver's loading was skipped.	<p>Action</p> <p>None.</p>

Message ID	Message Text	Explanation
KAPL13905-I	HDLM manager had started. HDLM manager's start processing was skipped.	Action None.
KAPL13906-I	<i>aa...aa</i> will now start.	Details <i>aa...aa</i> : Alert driver's loading, The process related to Alert driver, Filter driver's loading, dlmcfgmgr, or DLManager Action None.
KAPL13907-I	<i>aa...aa</i> completed successfully.	Details <i>aa...aa</i> : Alert driver's loading, The process related to Alert driver, Filter driver's loading, dlmcfgmgr, or DLManager Action None.
KAPL13908-W	An error occurred in processing of module. Module = <i>aa...aa</i>	Details In processing of the utility for HDLM start, an error occurred at Module <i>aa...aa</i> . <i>aa...aa</i> : Module name at which the error occurred. Action If <i>aa...aa</i> is dlmcfgmgr: Check the message output before this message. If <i>aa...aa</i> is DLManager: /opt/ DynamicLinkManager/bin/ dlmmgr file does not exist or does not have executable permissions. Reinstall an HDLM.
KAPL13909-W	Usage: /opt/ DynamicLinkManager/bin/ dlmstart	Action Re-execute the utility for HDLM start if necessary. Refer to dlmstart utility for starting HDLM on page 7-57 .
KAPL13910-W	The error occurred while processing the utility for HDLM start.	Action Resolve the problem according to the message KAPL13908-W, which was output before this message.

Message ID	Message Text	Explanation
KAPL13911-E	The utility for HDLM start ended abnormally. Error Code = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Error number that identifies the executed processing (decimal number)</p> <p>Action</p> <p>When the error code is 1:</p> <p>When <code>/dev/dlm/sddlmadr0</code> file or a file other than character device file, delete it manually and then retry the execution.</p> <p>When the error code is 2:</p> <p><code>/sbin/dlmcfgmgr</code> file does not exist or does not have executable permissions. Reinstall an HDLM.</p> <p>When the error code is 3:</p> <p><code>/etc/init.d/DLMManager</code> file does not exist or does not have executable permissions. Reinstall an HDLM.</p>
KAPL13912-E	An invalid parameter was specified. Parameter = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Specified parameter</p> <p>Action</p> <p>Re-execute the utility for HDLM start if necessary. Refer to dlmstart utility for starting HDLM on page 7-57.</p>
KAPL13913-E	A command has failed. Command = <i>aa...aa</i> , details = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: Command that failed</p> <p><i>bb...bb</i>: Message that the command output</p> <p>Action</p> <p>When the command is <code>/sbin/modprobe</code>:</p> <p>Reinstall an HDLM</p> <p>When the command is <code>/bin/mknod</code>:</p> <p>Remove the error cause described in the message output by the command indicated in the message KAPL13913-E. Next, re-execute the utility for HDLM start if necessary. Refer to dlmstart utility for starting HDLM on page 7-57.</p>

Message ID	Message Text	Explanation
KAPL13914-E	A file required by HDLM not found. File name = <i>aa...aa</i>	Details <i>aa...aa</i> : file name Action Reinstall an HDLM.

KAPL15001 to KAPL16000

Message ID	Message Text	Explanation
KAPL15001-I	The registered value of ReserveKey was successfully displayed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15002-E	An attempt to display the registered value of ReserveKey has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15010-W	The HDLM utility was executed by the user who does not have the authority. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15040-I	Creation of the HDLM configuration file and addition of HDLM devices succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15041-E	An attempt to create an HDLM configuration file and add HDLM devices has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15042-I	Processing to remove devices from HDLM management succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15043-E	Processing to remove devices from HDLM management has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15044-I	Processing to add devices to HDLM management succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15045-E	Processing to add devices to HDLM management has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15046-I	The management status and configuration information of HDLM devices was successfully	Details <i>aa...aa</i> : Name of the utility that the user executed

Message ID	Message Text	Explanation
	displayed. Command Line = <i>aa...aa</i>	
KAPL15047-E	An attempt to display the management status and configuration information of HDLM devices has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15048-I	The status of HDLM devices was checked, and then the unusable devices were successfully removed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15049-E	An attempt to check the status of HDLM devices, and then remove the unusable devices, has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15050-I	An initial RAM disk image file for using an HDLM device as a boot disk was successfully created. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15051-E	An attempt to create an initial RAM disk image file for using an HDLM device as a boot disk has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15052-I	The number of retries to allocate memory was successfully set. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15053-E	An attempt to set the number of retries to allocate memory has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15054-I	The timeout value for the SCSI INQUIRY command was successfully set. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15055-E	An attempt to set the timeout value for the SCSI INQUIRY command has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15056-I	The number of retries for the SCSI INQUIRY command was successfully set. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15057-E	An attempt to set the number of retries for the SCSI INQUIRY command has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed

Message ID	Message Text	Explanation
KAPL15058-I	Processing to re-register the HDLM information was successful. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15059-E	Processing to re-register the HDLM information failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15060-I	DLMgetras was invoked. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15061-I	DLMgetras successfully executed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15062-I	Processing to start HDLM was successful. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15063-E	Processing to start HDLM failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Name of the utility that the user executed
KAPL15064-I	ReserveKey was cleared successfully on <i>aa...aa</i> SCSI device(s) and failed on <i>bb...bb</i> SCSI device(s). Command Line = <i>cc...cc</i>	Details <i>aa...aa</i> : Number of SCSI devices for which ReserveKey was cleared successfully. <i>bb...bb</i> : Number of SCSI devices for which ReserveKey was not cleared. <i>cc...cc</i> : Name of the utility that the user executed
KAPL15065-E	An attempt to clear ReserveKey has failed on <i>aa...aa</i> SCSI device(s). Command Line = <i>bb...bb</i>	Details <i>aa...aa</i> : Number of SCSI devices for which ReserveKey was not cleared. <i>bb...bb</i> : Name of the utility that the user executed
KAPL15101-I	Clear operation was completed successfully. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15102-E	Clear operation has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15103-I	<i>aa...aa</i> path(s) were successfully placed <i>bb...bb</i> . <i>cc...cc</i> path(s) were not. Command Line = <i>bb...bb</i>	Details <i>aa...aa</i> : Number of paths where online/offline is successful <i>bb...bb</i> : Online , Online(S) , Online(D) or Offline(C)

Message ID	Message Text	Explanation
		<i>cc...cc</i> : Number of paths where online/offline is unsuccessful
KAPL15104-W	<i>aa...aa</i> path(s) were failed to place <i>bb...bb</i> . Command Line = <i>cc...cc</i>	Details <i>aa...aa</i> : Number of paths where online/offline is successful <i>bb...bb</i> : Online or Offline(C) <i>cc...cc</i> : Command that the user executed
KAPL15105-I	Setting up the operating environment succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15106-E	Setting up the operating environment failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15107-I	Program information was successfully displayed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15108-E	An attempt to display program information has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15109-I	Information about HDLM-management targets was successfully displayed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15110-E	An attempt to display information about HDLM-management targets has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15111-W	The HDLM command was started or stopped by the user who does not have the authority. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15116-I	<i>bb...bb</i> path(s) were successfully placed <i>aa...aa</i> . <i>dd...dd</i> path(s) were successfully placed <i>cc...cc</i> . <i>ee...ee</i> path(s) were not. Command Line = online	Details <i>aa...aa</i> : Online or Online(S) <i>bb...bb</i> : The number of paths which changed to the Online or Online(S) status <i>cc...cc</i> : Online(S), Online(D) or Online(S)/Online(D) <i>dd...dd</i> : The number of paths which changed to the Online(S) or Online(D) status <i>ee...ee</i> : The number of paths which failed to change to either

Message ID	Message Text	Explanation
		the Online, Online (S) or Online (D) status
KAPL15117-I	Addition of path(s) succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15118-W	Addition of path(s) failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15119-I	Deletion of path(s) succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15120-W	Deletion of path(s) failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15121-I	The storage system settings were successfully refreshed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15122-W	The refresh of the storage system settings failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15301-I	Creation of the device name change definition file succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15302-E	Creation of the device name change definition file failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15303-I	Processing to change the HDLM device name succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15304-E	Processing to change the HDLM device name failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15305-I	Processing to forcefully change the HDLM device name succeeded. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15306-E	Processing to forcefully change the HDLM device name failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15307-I	The persistent reserve support was successfully set. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed

Message ID	Message Text	Explanation
KAPL15308-E	An attempt to set the persistent reserve support has failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15320-I	The dlmperfinfo utility successfully started. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15321-E	Could not start the dlmperfinfo utility. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15322-I	The dlmperfinfo utility successfully stopped. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15323-W	The dlmperfinfo utility terminated. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15330-I	Processing to expand the LU capacity finished successfully. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15331-E	Processing to expand the LU capacity failed. Command Line = <i>aa...aa</i>	Details <i>aa...aa</i> : Command that the user executed
KAPL15401-I	HDLM Manager successfully started.	-
KAPL15402-E	Could not start the HDLM manager.	-
KAPL15403-I	HDLM Manager successfully stopped.	-
KAPL15404-W	The HDLM Manager was executed by the user who does not have the authority.	-

Return codes for Hitachi Command Suite Common Agent Component

When an operation requested of HDLM from Global Link Manager terminates abnormally, or terminates normally with a warning, HDLM outputs one of the return codes described below.

Return Code	Explanation
1002	Details There is no path on which the operation can be performed. Action

Return Code	Explanation
	Refresh the host information, check the path status, and then perform the operation again.
1003	<p>Details</p> <p>No path was detected.</p> <p>Action</p> <p>Check whether a path between the host and the storage system 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>
1006	<p>Details</p> <p>An <code>Offline</code> path cannot be placed <code>Online</code>.</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, remaining path connected to the device and therefore, 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 <code>Offline</code> path cannot be placed <code>Online</code>.</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p> <p>If you perform the <code>view</code> operation (specifying <code>-path</code> or <code>-lu</code>) of the HDLM command and the offline path (E) has a <code>PathName</code> target ID (in hexadecimal) that is 0000000000000100 or more, the <code>Offline(E)</code> path cannot be brought online by the <code>online</code> command or auto failback. To bring the path online, execute the <code>dlnmcfgmgr</code> utility (<code>dlnmcfgmgr -r</code>).</p>
1016	<p>Details</p> <p>The target path(s) are already <code>Online</code>.</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 <code>Offline(C)</code>.</p> <p>Action</p>

Return Code	Explanation
	Update the host information, and then check the path status.
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 DLMgetras utility for collecting HDLM error information on page 7-3.</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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
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 again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
1026	<p>Details</p> <p>The acquisition of path information has been aborted, because the path configuration was changed while the system was attempting to acquire the 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 error monitoring interval and the number of times that the error needs to occur are conflicting with the automatic failback-checking interval.</p> <p>Action</p> <p>Set the intermittent error-monitoring interval to a value that is equal to or greater than (<i>automatic-failback-checking-interval x number-of-times-error-is-to-occur-for-intermittent-error-monitoring</i>).</p>

Return Code	Explanation
1033	<p>Details</p> <p>An attempt to acquire the HDLM version information failed.</p> <p>Action</p> <p>Re-execute the command. If the same error occurs again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
1034	<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 the command. If the same error occurs again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
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 the command. If the same error occurs again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</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 the command. If the same error occurs again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
1037	<p>Details</p> <p>A parameter is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs again, 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</p>

Return Code	Explanation
	the <code>DLMgetras</code> utility, see DLMgetras utility for collecting HDLM error information on page 7-3 .
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>
1045	<p>Details</p> <p>A parameter is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
1046	<p>Details</p> <p>A parameter is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs again, 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 DLMgetras utility for collecting HDLM error information on page 7-3.</p>
1063	<p>Details</p> <p>An attempt to update <code>global-active device non-preferred path option</code> failed.</p> <p>Action</p> <p>If a path error occurs during an update operation and this message is output, perform recovery for the path error to return the path to the online status, and then try the operation again. If this message is output when there are no offline paths, 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.</p>

Notes on Linux commands and files

This section provides notes on Linux commands and files.

- ☐ [Notes on the /proc/partitions file](#)
- ☐ [Notes on Linux commands](#)
- ☐ [Notes on the iostat command](#)
- ☐ [Notes on the mkfs command](#)
- ☐ [Notes on the fdisk command](#)
- ☐ [Notes on the sar command](#)
- ☐ [Notes on the fdisk and parted commands](#)
- ☐ [Notes on the parted command](#)
- ☐ [Notes on the vgrename and lvrename commands](#)

Notes on the /proc/partitions file

The HDLM device and each partition of the HDLM device that is recognized by Linux and can be used are recorded in the /proc/partitions file. The /proc/partitions file records the I/O statistics per device; however, it does not record the I/O statistics of the HDLM device. The I/O statistics are always 0.

If you are going to obtain statistics about an HDLM device, perform calculations by using the value recorded for the SCSI device that corresponds to the HDLM device. The following is an example of output statistics.

```
# cat /proc/partitions
major minor #blocks name          rio rmerge rsect ruse wio wmerge wsect wuse running use
aveq

253    0      2403360 sddlmaa 0 0 0 0 0 0 0 0 0 0 0 0
253    1      2401686 sddlmaa1 0 0 0 0 0 0 0 0 0 0 0 0
253   16      2403360 sddlmaab 0 0 0 0 0 0 0 0 0 0 0 0
253   17       803218 sddlmaab1 0 0 0 0 0 0 0 0 0 0 0 0
253   18       803250 sddlmaab2 0 0 0 0 0 0 0 0 0 0 0 0
253   19       795217 sddlmaab3 0 0 0 0 0 0 0 0 0 0 0 0
      ⋮
      ⋮

 8     0      2403360 sda 6 0 12 60 0 0 0 0 0 60 80
 8     1      2401686 sda1 4 0 8 0 0 0 0 0 0 0 0 0
 8    16      2403360 sdb 12 6 36 100 1 0 2 0 0 100 100
 8    17       803218 sdb1 0 0 0 0 0 0 0 0 0 0 0 0
 8    18       803250 sdb2 0 0 0 0 0 0 0 0 0 0 0 0
 8    19       795217 sdb3 0 0 0 0 0 0 0 0 0 0 0 0
```

Figure A-1 Example of a displayed /proc/partitions file

Notes on Linux commands

When a host and storage system are connected by multiple paths, HDLM uses all of these paths as HDLM devices. Consequently, with `Open()` and `Close()` system calls to the HDLM device, open or close processing occurs on each of the multiple paths. Linux commands that issue successive `Open()` or `Close()` system calls to multiple HDLM devices, such as the `lvmdiskscan` or `pvscan` commands, will take longer to execute after HDLM is installed.

[*Table A-1 Examples of Linux command execution times on page A-3*](#)

describes examples of how long the execution of these Linux commands can be expected to take before and after HDLM installation. The execution times shown in [*Table A-1 Examples of Linux command execution times on page A-3*](#) were measured by using LVM1 commands. LVM2 commands show little difference before and after HDLM installation.

Table A-1 Examples of Linux command execution times

Linux commands	Time			
	Example 1 ^{#1}		Example 2 ^{#2}	
	Before HDLM installation	After HDLM installation	Before HDLM installation	After HDLM installation
lvmdiskscan	6.1 sec	19.6 sec	3.8 sec	10.6 sec
pvscan	2.6 sec	12.6 sec	1.5 sec	5.2 sec

1

CPU: Pentium III 1.4 GHz x 2

Memory: 1 GB

Connection between host and storage systems: 64 LU x 2 paths (total 128 paths)

2

CPU: Xeon 2.0GHz x 2

Memory: 2 GB

Connection between host and storage systems: 64 LU x 2 paths (total 128 paths)

Notes on the iostat command

If an HDLM device is not specified for the `iostat` command, the HDLM device will not be displayed. Information about an HDLM device is displayed only when the HDLM device is specified for the `iostat` command (in such case as `iostat -x /dev/sddlmaa`). The information (CPU or I/O statistics) displayed for the HDLM device is always 0, and the actual value is displayed for each SCSI device that conforms to the HDLM device.

If you are going to obtain information about an HDLM device, perform calculations by using the value of a SCSI device that conforms to the HDLM device. The following is an example of executing the `iostat` command.

```
# iostat -x /dev/sddlmaa /dev/sda /dev/sdq
Linux 2.6.18-194.el5 (localhost)      mm/dd/yy

avg-cpu:  %user   %nice    %sys %iowait    %idle
           0.09    0.00    0.10    0.02   99.78

Device: rrqm/s wrqm/s r/s   w/s  rsec/s wsec/s rkB/s kB/s avgrq-sz avgqu-sz await
svctm %util
sddlmaa  0.00    0.00 0.00 0.00   0.00   0.00  0.00  0.00    0.00    0.00 0.00 0.00
0.00
sdq      0.00    0.00 0.00 0.00   0.00   0.00  0.00  0.00    8.00    0.00 2.86 2.86
0.00
sda      0.16    1.37 0.09 0.20   2.03  12.65  1.01  6.32   50.61    0.02 55.41 1.11
0.03
```

Figure A-2 Example of executing the iostat command

Notes on the mkfs command

If you are going to create a file system for an HDLM device, specify the name of a logical device file of the HDLM device for the `mkfs` command. However, if a file system is created for a SCSI device that is already in use, the applicable HDLM device will be created with a file system even without creating a new file system by using the `mkfs` command.

Furthermore, if the `mkfs` command is executed for a SCSI device, a message confirming whether to execute the command will appear; however, when an HDLM device is specified, the message will not appear.

Notes on the fdisk command

You can perform operations on a partition of an HDLM device by executing the `fdisk` command with the name of a logical device file of the HDLM device specified. In addition, by setting up partitions in an HDLM device, partitions can be set up in a corresponding SCSI device at the same time.

However, partitions for a device managed by HDLM will not be automatically created at the same time even when partitions are created for a corresponding SCSI device that HDLM manages. In this case, restart the host to make the partitions the same as those for the corresponding SCSI device.

If HDLM is installed for the first time, an HDLM device that inherits the partitions of the corresponding SCSI device will be created automatically.

Notes on the sar command

Executing the `sar` command with the `-d` or `-A` option does not display HDLM devices. To obtain statistics about an HDLM device, perform calculations by using the value of the SCSI device that conforms to the HDLM device. The following is an example of executing the `sar` command.

```
# sar -d
Linux 2.6.18-194.el5 (localhost)      mm/dd/yy

00:00:00      DEV      tps  rd_sec/s  wr_sec/s
00:10:00      dev65-0      0.00      0.00      0.00
00:10:00      dev65-16     0.00      0.00      0.00
00:10:00      dev65-32     0.00      0.00      0.00
      ⋮
Average:      dev65-0      0.00      0.00      0.00
Average:      dev65-16     0.00      0.00      0.00
Average:      dev65-32     0.00      0.00      0.00
      ⋮
```

Figure A-3 Example of executing the sar command

Notes on the fdisk and parted commands

When creating partitions on an HDLM device, only use the `fdisk` command or the `parted` command.

If partitions have been created on an HDLM device using the `fdisk` or `parted` command, some of the partitions created by the `fdisk` command might not be visible to the `parted` command. Likewise, some of the partitions created by the `parted` command might not be visible to the `fdisk` command. For this reason, if partitions that are created using the `fdisk` command are modified using the `parted` command, the partition information might be corrupt.

Notes on the parted command

If the `parted` command is used to create partitions on an HDLM device, after issuing the `parted` command, execute the following command:

```
# blockdev --rereadpt HDLM device SCSI device 1 ... SCSI device n
```

Where:

HDLM device: The HDLM device name on which the partition was created (for example, `/dev/sddlmd`)

SCSI device 1..n: The SCSI device names which are being managed by the above HDLM device (for example, `/dev/sda`)

The following messages are displayed when the `parted -l` command is executed. However, you can ignore these messages, because there is no actual problem.

```
Error: /dev/sddlmfdrv0: unrecognised disk label
```

```
Warning: Error fsyncing/closing /dev/sddlmfdrv0: No such device or address
```

```
Retry/Ignore?
```

Notes on the vgrename and lvrename commands

If a logical volume is created on an md device, you can rename a volume group or a logical volume by using the `vgrename` or `lvrename` command. After renaming, if the `vgdisplay -v -D` command, `vgscan`, or `lvscan` command is executed, the information from the previous volume group or logical volume might be displayed. To display information from after the change, deactivate the volume group, and then activate the volume group after restarting the md device.

How to set up the kdump function

This appendix describes how to specify the necessary settings for using the kdump function in an environment where an HDLM device is used as a boot disk.

Note that, if the settings are incorrect, the OS might not start. If you cannot start the OS from the HDLM device, see [Countermeasures for unsuccessful startup of the OS from an HDLM device on page 3-139](#) and take the appropriate action.

- ☐ [Prerequisites](#)
- ☐ [Setup procedure](#)
- ☐ [Notes](#)

Prerequisites

To use the kdump function, the following conditions must be met:

- The OS of the host is Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6, Oracle Linux 7 or Oracle Linux 8.
- FC-SAN is used for connection between the host and the storage system.
- An HDLM device or a logical volume on an HDLM device (LVM2) is used as a boot disk.

Setup procedure

This section describes how to specify the settings for using the kdump function in the following sequence:

1. Add a disk for the kernel dump output.
2. Specify the kernel dump output destination.
3. Edit the boot loader configuration file.
4. Create an initial RAM disk image file for the kdump function.
5. Verify that the kernel dump is collected correctly.

Add a disk for the kernel dump output

Add the disk to which kernel dumps are to be output.

We recommend that, for the kernel dump output disk, you specify a disk that is separate from the system disk. This ensures that kernel dumps can be collected even if an error occurs in a file system on the system disk (`/var` directory).

If the following condition is met, you do not need to add a disk:

- You want to specify a directory on the built-in disk as the kernel dump output destination:
Go to [Specify the kernel dump output destination on page B-31](#).

The following example show how to create a disk for kernel dump output:

1. Create a kernel dump output disk on a volume in the storage system, and then connect the disk to the host by using a single path.
2. Execute the HDLM configuration definition utility (`dlmcfgmgr -r`) to make HDLM recognize the kernel dump output disk.

When the KAPL10339-I message appears, enter `y`.

```
# /sbin/dlmcfgmgr -r
KAPL10339-I This operation will change the configuration of HDLM
devices. Do you want to continue? [y/n]: y
KAPL10341-I The HDLM device configurations have been changed.
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

3. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to verify that HDLM recognizes the kernel dump output disk.

```
# /sbin/dlmcfgmgr -v
HDevName      Management  Device      Host  Channel  Target  Lun
/dev/sddlmaa   configured  /dev/sda    0     0        0      0
                /dev/sdc    1     0        0      0
/dev/sddlmaab  configured  /dev/sdb    0     0        0      1
                /dev/sdd    1     0        0      1
/dev/sddlmac  configured  /dev/sde    0     0        0      2
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

The underlined entry indicates the disk that has been added.

4. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -o`) to remove the kernel dump output disk from the management target of HDLM.

When the KAPL10339-I message appears, enter `y`.

```
# /sbin/dlmcfgmgr -o /dev/sddlmac
KAPL10339-I This operation will change the configuration of HDLM
devices. Do you want to continue? [y/n]: y
KAPL10341-I The HDLM device configurations have been changed.
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

5. Execute the `dlmcfgmgr` utility (`dlmcfgmgr -v`) to verify that the kernel dump output disk is no longer managed by HDLM.

```
# /sbin/dlmcfgmgr -v
HDevName      Management  Device      Host  Channel  Target  Lun
/dev/sddlmaa   configured  /dev/sda    0     0        0      0
                /dev/sdc    1     0        0      0
/dev/sddlmaab  configured  /dev/sdb    0     0        0      1
                /dev/sdd    1     0        0      1
/dev/sddlmac  unconfigured /dev/sde    0     0        0      2
KAPL10302-I /sbin/dlmcfgmgr completed normally.
```

Verify that `unconfigured` appears in the Management column.

#

This is a SCSI disk (the disk for kernel dump output) that is not managed by HDLM. You can use multiple paths if the OS supports multiple paths.

Specify the kernel dump output destination

To specify the kernel dump output destination, perform the following steps:

- Create a partition.
 - Create a file system.
 - Edit the `/etc/fstab` file.
 - Edit the `kdump` function configuration file (`/etc/kdump.conf`).
1. Execute the `fdisk` command to create a partition on the kernel dump output disk.

Enter the values for the `fdisk` command as indicated by the underlined parts below.

```
# fdisk /dev/sde
```

```
The number of cylinders for this disk is set to 10240.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)
```

```
Command (m for help): p
```

```
Disk /dev/sde: 10.7 GB, 10737418240 bytes
64 heads, 32 sectors/track, 10240 cylinders
Units = cylinders of 2048 * 512 = 1048576 bytes
```

Device	Boot	Start	End	Blocks	Id	System
--------	------	-------	-----	--------	----	--------

```
Command (m for help): n
```

```
Command action
```

```
  e   extended
```

```
  p   primary partition (1-4)
```

```
p
```

```
Partition number (1-4): 1
```

```
First cylinder (1-10240, default 1): _
```

```
Using default value 1
```

```
Last cylinder or +size or +sizeM or +sizeK (1-10240, default
10240):
```

```
Using default value 10240
```

```
Command (m for help): p
```

```
Disk /dev/sde: 10.7 GB, 10737418240 bytes
64 heads, 32 sectors/track, 10240 cylinders
Units = cylinders of 2048 * 512 = 1048576 bytes
```

Device	Boot	Start	End	Blocks	Id	System
/dev/sde1		1	10240	10485744	83	Linux

```
Command (m for help): w
```

```
The partition table has been altered!
```

```
Calling ioctl() to re-read partition table.
Syncing disks.
```

2. Execute the `mkfs` command to create a file system in the partition you created.

If LABEL is used:

Specify a volume label for the `-L` parameter. We recommend specifying a label name that indicates the label is used by the `kdump` function. If you specify a volume label for the kernel dump output destination, you will not need to correct any configuration file when the device configuration changes.

In the following example, the volume label is set to `kdump_disk`:

```

# mkfs -t ext3 -L kdump_disk /dev/sde1
mke2fs 1.39 (29-May-2006)
Filesystem label=kdump_disk
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
1310720 inodes, 2621436 blocks
131071 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=2684354560
80 block groups
32768 blocks per group, 32768 fragments per group
16384 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912, 819200, 884736,
1605632

Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information:
done

This filesystem will be automatically checked every 24 mounts
or
180 days, whichever comes first. Use tune2fs -c or -i to
override.

```

If UUID is used:

After creating the file system, check the UUID that was set.

```

# mkfs -t ext4 /dev/sde1
mke2fs 1.41.12 (17-May-2010)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
65536 inodes, 262094 blocks
13104 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=268435456
8 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376

Writing inode tables: done
Creating journal (4096 blocks): done
Writing superblocks and filesystem accounting information:
done

This filesystem will be automatically checked every 30 mounts
or
180 days, whichever comes first. Use tune2fs -c or -i to
override.

```

Execute the `blkid` command to check the UUID that was set.

```
UUID="bf5d6d8d-d18b-45f8-8187-86837d895488" TYPE="ext4"
```

3. Add the kernel dump output destination to the `/etc/fstab` file.

If LABEL is used:

For LABEL, specify the volume label you set in step 2.

```
LABEL=kdump_disk /var/crash ext3 defaults 1 2
```

If UUID is used:

Specify the UUID you checked in step 2.

```
UUID=bf5d6d8d-d18b-45f8-8187-86837d895488 /var/crash ext4  
defaults 1 2
```

4. Add the kernel dump output destination to the `kdump` function configuration file (`/etc/kdump.conf`).

If LABEL is used:

For LABEL, specify the volume label you set in step 2.

```
path hdlm  
ext3 LABEL=kdump_disk
```

If UUID is used:

Specify the UUID you checked in step 2.

```
path hdlm  
ext4 UUID=bf5d6d8d-d18b-45f8-8187-86837d895488
```

5. Add the timeout setting to the `kdump` function configuration file (`/etc/kdump.conf`).

Timeout settings are not required for Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8.

```
disk_timeout 1
```

Edit the boot loader configuration file

Add an option of the `kdump` function to the boot loader configuration file. However, editing is not required for Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8.

The following shows an example of editing the `grub.conf` file. Edit the underlined parts.

```
default=0  
:  
:  
:
```

```

timeout=5
splashimage=(hd0,0)/grub/splash.xpm.gz
hiddenmenu

#title HDLM-Red Hat Enterprise Linux 6 (2.6.32-754.el6.x86_64)
#       root (hd0,0)
#       kernel /vmlinuz-2.6.32-754.el6.x86_64 ro root=UUID=0d5f28ce-
f4ac-44f4-bf10-2d1ac785fbac rd_NO_LUKS rd_NO_MD rd_NO_LVM rd_NO_DM
rhgb quiet
#       initrd /initramfs-hdlm-2.6.32-754.el6.x86_64.img
title HDLM-kdump-Red Hat Enterprise Linux 6 (2.6.32-754.el6.x86_64)
       root (hd0,0)
       kernel /vmlinuz-2.6.32-754.el6.x86_64 ro root=UUID=0d5f28ce-
f4ac-44f4-bf10-2d1ac785fbac rd_NO_LUKS rd_NO_MD rd_NO_LVM rd_NO_DM
rhgb quiet crashkernel=128M
       initrd /initramfs-hdlm-2.6.32-754.el6.x86_64.img
       :
       :

```

1. Copy the existing settings that specify startup from the HDLM device.
2. Add a hash mark (#) to the beginning of each line of the copy-source existing settings to comment them out.
3. In the line that starts with `title`, specify a setting name. We recommend specifying a setting name that indicates the setting is used by the `kdump` function.
4. Add the option (`crashkernel=128M#`) for the `kdump` function.

#

The value to be specified for the `crashkernel` option depends on your OS.

`crashkernel=128M` is an example of the value specified when the OS is Red Hat Enterprise Linux 6.

Create an initial RAM disk image file for the `kdump` function

Create an initial RAM disk image file for the `kdump` function. This file will be used by the second kernel when a kernel dump is collected.

1. Restart the host.

```
# shutdown -r now
```

2. After the host restarts, log in as a user with root privileges.
3. If the `/var/crash/hdlm` directory does not exist, use the `mkdir` command to create the directory.

```
# mkdir /var/crash/hdlm
```

4. For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8, check the definition of `hdlm_dracut` in `/etc/opt/DynamicLinkManager/hdlm.conf`.

If `hdlm_dracut=n` is defined, change it to `hdlm_dracut=y`. If `hdlm_dracut` is not defined, add `hdlm_dracut=y`.

5. Restart the kdump service, and then create an initial RAM disk image file for the kdump function.
 - For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8:

```
# touch /etc/kdump.conf
# systemctl restart kdump.service
#
```

- For OSs other than the above:

```
# touch /etc/kdump.conf
# /sbin/service kdump restart
Stopping kdump:
[ OK ]
Detected change(s) the following file(s):

/etc/kdump.conf
Rebuilding /boot/initrd-2.6.32-754.el6.x86_64kdump.img
Starting kdump:
[ OK ]
```

Note

For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8, do not change the definition of `hdlm_dracut (hdlm_dracut=y)` in `/etc/opt/DynamicLinkManager/hdlm.conf`.

6. Verify that the initial RAM disk image file was created.

```
# ls -l /boot/initrd-`uname -r`kdump.img
-rw-----. 1 root root 6499431 mmm dd hh:mm /boot/
initrd-2.6.32-754.el6.x86_64kdump.img
```

Check the displayed update time of the file.

7. Restart the host.

```
# shutdown -r now
```

Verify that the kernel dump is collected correctly

Generate a kernel panic and then verify that the kernel dump is collected correctly.

1. Execute the following command to generate a kernel panic:

```
# echo c > /proc/sysrq-trigger
```

When a kernel panic occurs, a kernel dump is collected, and then the host restarts.

2. After the host restarts, verify that a kernel dump (`vmcore` file) was created in the `/var/crash/hdlm` directory.

- For Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8:

```
# ls -lR /var/crash/
/var/crash/:
total 0
drwxr-xr-x 2 root root 4096 mmm dd hh:mm 127.0.0.1-yyyy-mm-dd-
hh:mm:ss

/var/crash/hdlm/127.0.0.1-yyyy-mm-dd-hh:mm:ss:
total 58732
-r----- 1 root root 60074832 mmm dd hh:mm vmcore
-rw-r--r-- 1 root root 63270 mmm dd hh:mm vmcore-dmesg.txt
#
```

- For OSs other than the above:

```
# ls -lR /var/crash/
/var/crash/:
total 24
drwxr-xr-x 3 root root 4096 mmm dd hh:mm hdlm
drwx----- 2 root root 16384 mmm dd hh:mm lost+found

/var/crash/hdlm:
total 4
drwxr-xr-x 2 root root 4096 mmm dd hh:mm 127.0.0.1-yyyy-mm-dd-
hh:mm:ss

/var/crash/hdlm/127.0.0.1-yyyy-mm-dd-hh:mm:ss:
total 1971852
-r----- 1 root root 2017199848 mmm dd hh:mm vmcore

/var/crash/lost+found:
total 0
```

Specification of the necessary settings for using the kdump function is now finished.

Notes

- Regardless of whether HDLM is used in a non-boot disk environment or in a boot disk environment, you cannot specify an HDLM device for the kernel dump output destination.
- In Red Hat Enterprise Linux 6 or in Oracle Unbreakable Enterprise Kernel 6, regardless of whether HDLM is used in a non-boot disk environment or in a boot disk environment, the output of the kernel dump will fail if both of the following conditions are met: 1) a permanent name of a SCSI device is specified for the `filter` setting in `/etc/lvm/lvm.conf`[#], and 2) a logical volume created on a SCSI device is specified as the output destination for the kernel dump (kdump). If this happens, perform the procedure described in [Add a disk for the kernel dump output on page B-2](#).

#

For details, see [*Notes on using LVM2 on page 3-154*](#).

- If you specify a directory in the file system created on the HDLM device for the kernel dump output destination, HDLM will not operate when a kernel dump is collected. In this case, the kernel dump will not be output because the HDLM device cannot be accessed.

Manually setting a boot disk environment

This section describes how to configure a multipath boot disk environment without using the utility for creating an HDLM boot disk environment (`d1mbootstart`).

- [Settings for a multipath boot disk environment](#)

Settings for a multipath boot disk environment

This subsection describes how to perform a new installation of HDLM in a single-path boot disk environment that uses a SCSI device and how to configure a multipath boot disk environment.

Note that if the settings are incorrect, the OS might not start. For details about what action to take if the OS cannot be started from an HDLM device, see [Countermeasures for unsuccessful startup of the OS from an HDLM device on page 3-139](#).

The name of the boot loader configuration file used in these procedures differs depending on the boot loader and OS. The following table lists the names of the boot loader configuration files.

Table C-1 Names of boot loader configuration files

Boot loader			Configuration file name
GRUB	BIOS	Red Hat Enterprise Linux Oracle Unbreakable Enterprise Kernel 6	/boot/grub/grub.conf
		SUSE LINUX Enterprise Server 11	/boot/grub/menu.lst
	UEFI	Red Hat Enterprise Linux 6	/boot/efi/EFI/redhat/ grub.conf
GRUB2	BIOS	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	/boot/grub2/grub.cfg
	UEFI	Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8	/boot/efi/EFI/redhat/ grub.cfg

To install HDLM in a boot disk environment that uses a SCSI device, and set up the environment:

1. Log in to Linux as a user with root permissions.
2. Install HDLM.
See [Performing a new installation of HDLM on page 3-99](#), and then create an HDLM device by performing step 2 to 12.
3. Check whether LVM is used in the boot disk environment.
Execute the `mount` command to check the name of the devices mounted on the root partition (/). If LVM is used, device names that contain the VG name and LV name appear. The following shows an example of executing the command.

- If LVM is used:

```
# mount  
/dev/mapper/vg00-lv00 on / type ext3 (rw)  
:
```

```
#
```

- o If LVM is not used:

```
# mount
/dev/sda9 on / type ext3 (rw)
:
#
```

4. If LVM is used in the boot disk environment, edit the `/etc/lvm/lvm.conf` file so that the LVM2 recognizes the HDLM device, not the SCSI device. The following shows examples of editing the `/etc/lvm/lvm.conf` file.

- o For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later:

Before:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
    :
    global_filter = [ "a/*/" ]
    :
    # types = [ "fd", 16 ]
    :
    md_component_detection = 1
    :
    allow_changes_with_duplicate_pvs = 0
    :
}
```

After:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
    :
    #_global_filter = [ "a/*/" ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|" ]
    :
    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
    :
    #_md_component_detection = 1
    md_component_detection=0
    :
    #_allow_changes_with_duplicate_pvs = 0
    allow_changes_with_duplicate_pvs = 1
    :
}
```

Comment out the existing `global_filter`, `types` and `md_component_detection` lines, and then add the underlined parts. Record the original values, because they are necessary when removing HDLM.

- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Linux 7: Specify 1 for `allow_changes_with_duplicate_pvs`. For details, see [Notes on using LVM2 on page 3-154](#).

If you want to use `use_lvmetad=0` for operation, specify `filter`, not `global_filter`.

Before:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
```

```
                                :

    filter = [ "a/*/" ]
                                :

    write_cache_state = 1
                                :

    # types = [ "fd", 16 ]
                                :

    md_component_detection = 1
                                :

}
```

After:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
devices {
```

```
                                :

    #_filter = [ "a/*/" ]
    filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/sd|" ]
                                :

    #_write_cache_state = 1
    write_cache_state = 0
                                :

    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
                                :

    #_md_component_detection = 1
    md_component_detection=0
                                :

}
```

Comment out the existing `filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts.

Record the original values, because they are necessary when removing HDLM.

- For OSs other than the above:

If you want to use `use_lvmetad=1` for operation in an LVM2 version that can use `global_filter`, specify `global_filter`, not `filter`.

Before:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
```

```
devices {
    :

    # filter = [ "a./.*/" ]
    :

    global_filter = [ "a./.*/" ]
    :

    write_cache_state = 1
    :

    # types = [ "fd", 16 ]
    :

    md_component_detection = 1
    :
}
```

After:

```
# This section allows you to configure which block devices
should
# be used by the LVM system.
```

```
devices {
    :

    # filter = [ "a./.*/" ]
    :

    #_global_filter = [ "a./.*/" ]
    global_filter = [ "a|sddlm[a-p][a-p].*|", "r|/dev/
sd|"_ ]
    :

    #_write_cache_state = 1
    write_cache_state = 0
    :

    # types = [ "fd", 16 ]
    types = [ "sddlmfdrv", 16 ]
    :

    #_md_component_detection = 1
    md_component_detection=0
    :
}
```

Comment out the existing `global_filter`, `write_cache_state`, `types` and `md_component_detection` lines, and then add the underlined parts.

Record the original values, because they are necessary when removing HDLM.

After editing the file, execute the following command.

```
# /sbin/vgscan
```

If the following files exist, delete them:

- o /etc/lvm/.cache
- o /etc/lvm/cache/.cache

5. Back up the /etc/fstab file.
6. In the next step, you will edit the /etc/fstab file so that an HDLM device is mounted on each mount point. To do this, follow the procedure below to check the HDLM device name that corresponds to each item.
 - a. Check the HDLM device name from the SCSI device name.
Execute the HDLM configuration definition utility (dlmcfmgmgr) and specify the -v parameter to check the HDLM devices that corresponds to the SCSI devices.

```
# /sbin/dlmcfmgmgr -v
HDevName      Management  Device      Host      Channel Target
Lun
/dev/sddlmaa  configured  /dev/sda    0          0        0
0
KAPL10302-I /sbin/dlmcfmgmgr completed normally.
```

The HDLM device name is displayed in the `HDevName` column and the SCSI device name is displayed in the `Device` column.

- b. From the LABEL specification, check the HDLM device name from LABEL.
Execute the OS command `findfs LABEL={LABEL-value}`, and check the device name that corresponds to LABEL. If a SCSI device name is displayed, change it to the corresponding HDLM device name based on the results of a.. If a logical volume name (`/dev/{VG}/{LV}`, `/dev/mapper/{VG}-{LV}`) is displayed, change LABEL to the logical volume name. (Note that, if a logical volume name is displayed for SUSE Linux Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, or Oracle Linux 8, you do not need to change LABEL.)

```
# /sbin/findfs LABEL=/
/dev/sddlmaa2
#
```

Note

Depending on the environment you are using, you might not be able to obtain information even if you specify the LABEL of a swap in the findfs command. In such a case, execute `/bin/cat /proc/swaps` and check which device is used by the swap. In addition, if you know the LABEL of the swap, record it, because it is necessary when uninstalling HDLM.

- c. From the UUID specification, check the HDLM device name from UUID.

Execute the OS command `findfs UUID={UUID-value}` to check the device name that corresponds to UUID. If a SCSI device name is displayed, change it to the corresponding HDLM device name based on the result of a.. If a logical volume name (`/dev/{VG}/{LV}`, `/dev/mapper/{VG}-{LV}`) is displayed, change UUID to the logical volume name. (Note that, if a logical volume name is displayed for SUSE Linux Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, or Oracle Linux 8, you do not need to change UUID.)

```
# /sbin/findfs UUID=b74637c2-59bb-4bca-94f0-94a96325b73f
/dev/sddlmaa2
#
```

- d. From the specification of a device name (udev name) that starts with `/dev/disk`, check the HDLM device name that corresponds to the device name (udev name) that starts with the `/dev/disk` directory.

Execute the OS command `readlink -f {udev-name}` to check the device name that corresponds to the udev name. If a SCSI device name is displayed, change it to the corresponding HDLM device name based on the result of a..

```
# /usr/bin/readlink -f /dev/disk/by-id/
scsi-360060e801025333005112b6300000036-part2
/dev/sddlmaa2
#
```

- e. For logical volumes, the names of the devices to be mounted (`/dev/{VG}/{LV}` and `/dev/mapper/{VG}-{LV}`) are not within the scope of this change.

7. Edit the `/etc/fstab` file.

Change the mount points for the HDLM management-target devices from the SCSI device to the HDLM device:

Comment out the existing SCSI device specification by placing a hash mark (#) at the beginning of each line, and then add the HDLM device specification as shown below, based on the correspondence between the SCSI device and the HDLM device as checked in a. of step 6.

```
# vi /etc/fstab
/dev/VolGroup00/LogVol100 / ext3 defaults 1 1
#LABEL=/boot /boot ext3 defaults 1 2
/dev/sddlmaa1 /boot ext3 defaults 1 2
none /dev/pts devpts gid=5,mode=620 0 0
:
:
```

Note that, in the HDLM boot disk environment, the following format restrictions, depending on the OS, apply to the device names that can be specified for the mount point of the root partition (/).

Table C-2 Device name format that can be specified for the root partition (/) in the /etc/fstab file

OS	HDLM boot disk environment	
	Without LVM	With LVM
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	/dev/{HDLM device}	/dev/mapper/{VG}-{LV}
SUSE LINUX Enterprise Server 11		/dev/{VG}/{LV}
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15		UUID={UUID-value} or /dev/{VG}/{LV}

8. Execute the `swapoff` command to disable a swap device.

An example of executing the command to disable all swap devices is as follows:

```
# /sbin/swapoff -a
```

In an environment where all of the following conditions are met, if you perform the step while a swap device is enabled, the host might take a while to stop.

Make sure to disable the swap, and then perform the step.

- o Either of the following OSs is used:
 - Red Hat Enterprise Linux 7
 - Red Hat Enterprise Linux 8
 - Oracle Linux 7
 - Oracle Linux 8
 - SUSE LINUX Enterprise Server 12
 - SUSE LINUX Enterprise Server 15
 - o The HDLM management-target device is enabled as a swap device.
9. Create an initial RAM disk image file for HDLM.
- The format of the initial RAM disk image file name to be specified in the parameter is shown below. If a file having the same name as the initial RAM disk image file to be created already exists, back up the existing file under a different name.

Table C-3 Names of initial RAM disk image files for HDLM

OS	File name
Red Hat Enterprise Linux 6	initramfs-hdlm-{kernel-version#}.img

OS	File name
Oracle Linux 6	
SUSE LINUX Enterprise Server 11	initrd- <i>{kernel-version#}</i> .hdln
Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 7 Oracle Linux 8	initramfs- <i>{kernel-version#}</i> .img
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	initrd- <i>{kernel-version#}</i>

#

This is the output result of the `uname -r` command.

From the following, perform the procedure that corresponds to the host OS.

- o For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8:

- a. Change `hdlm_dracut=n` defined in the `/etc/opt/DynamicLinkManager/hdlm.conf` file to `hdlm_dracut=y`.
- b. Execute the `dracut` command.

The following shows an example of executing the command:

```
# /usr/bin/dracut /boot/initrd-3.12.28-4-default `uname -r`
```

- o For Red Hat Enterprise Linux 6 or Oracle Linux 6:

- a. Change `hdlm_dracut=n` defined in the `/etc/opt/DynamicLinkManager/hdlm.conf` file to `hdlm_dracut=y`.
- b. Execute the `dracut` command.

The following shows an example of executing the command:

```
# /sbin/dracut /boot/initramfs-hdlm-2.6.32-71.el6.i686.img
`uname -r`
```

- o For OSs other than the above:

Execute the utility for supporting a boot disk (`dlmmkinitrd`).

For details on the `dlmmkinitrd` utility, see [dlmmkinitrd utility for supporting a boot disk on page 7-38](#).

10. Back up the boot loader configuration file.

- o SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7 or Oracle Linux 8:

Check that `resume` is not specified for the kernel parameter for the OS start process.

- a. Check the kernel parameter for the OS start process.

```
# /usr/bin/cat /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-3.12.28-4-default \
root=UUID=c12fce35-4de5-4674-8b3b-2a2e45007b61 \
resume=/dev/system/swap splash=silent quiet
crashkernel=214M-:107M showopts
#
```

If `resume` is specified, re-create the boot loader configuration file for which `resume` is not specified by performing the steps below. If `resume` is not specified, then this procedure is unnecessary, and you can go to step 16.

- b. Delete `resume` from the `/etc/default/grub` file.

Before:

```
GRUB_CMDLINE_LINUX_DEFAULT="resume=/dev/system/swap
splash=silent quiet crashkernel=214M-:107M showopts"
```

After:

```
GRUB_CMDLINE_LINUX_DEFAULT="splash=silent quiet
crashkernel=214M-:107M showopts"
```

If `resume` is specified for the `GRUB_CMDLINE_LINUX` key, delete `resume` in the same way.

- c. Re-create `grub.cfg` by using the `grub2-mkconfig` command, and then proceed to step 16.

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

- o For OSs other than the above:

Perform the steps below depending on the host OS you are using.

11. Copy the configuration contained in the boot loader configuration file, which is used during startup.

12. Change the name of the configuration contained in the boot loader configuration file.

Change the name of the configuration copied in step 11. Choose a name that indicates use for an HDLM device specification.

Change the underlined text as follows:

Before:

```
title RHEL4.5 (2.6.9-55.EL)
```

After:

```
title RHEL4.5 (2.6.9-55.EL-hdlm)
```

13. Edit the `root` specification written in the boot loader configuration file.

From the following, perform the procedure that corresponds to the host OS.

- o For Red Hat Enterprise Linux 6 or Oracle Linux 6:

Specify the UUID of the root device for `root` by the following procedure:

- a. Execute the `mount` command to check the name of the device mounted on the root partition (/).

The following shows an example of executing the command.

```
# mount
/dev/sda2 on / type ext4 (rw)
proc on /proc type proc (rw)
:
```

Check the underlined device name.

- b. Execute the `blkid` command to check the UUID of the device that you checked above.

The following shows an example of executing the command.

```
# blkid /dev/sda2
/dev/sda2: UUID="19597725-5d20-4d1d-9906-f9f891b7711a"
TYPE="ext4"
#
```

- c. Change the `root` specification in the configuration that you copied in step 11 to the UUID checked above.

```
root=UUID=19597725-5d20-4d1d-9906-f9f891b7711a
```

- o For OSs other than the above:
Perform the following procedure to specify the device name for root.

- a. Execute the `mount` command to check the name of the device mounted on the root partition (/).

The following shows an example of executing the command.

```
# mount
/dev/sda2 on / type ext4 (rw)
proc on /proc type proc (rw)
:
```

Check the underlined device name.

- b. Change the root specification of the configuration copied in step 11, to the device name checked in a..

```
root=/dev/sddlmaa2 on / type ext4 (rw)
```

Note that, in the HDLM boot disk environment, the following format restrictions apply to the values that can be specified for the kernel parameter `root=`.

Table C-4 Format of values that can be specified for the kernel parameter "root="

OS	HDLM boot disk environment	
	Without LVM	With LVM
Red Hat Enterprise Linux 6 Red Hat Enterprise Linux 7 Red Hat Enterprise Linux 8 Oracle Linux 6 Oracle Linux 7 Oracle Linux 8	root=UUID={ <i>UUID-value</i> }	root=UUID={ <i>UUID-value</i> } or root=/dev/mapper/ { <i>VG</i> }- <i>{LV}</i> }
SUSE LINUX Enterprise Server 11	root=/dev/{ <i>HDLM device</i> }	root=/dev/{ <i>VG</i> }/ { <i>LV</i> }
SUSE LINUX Enterprise Server 12 SUSE LINUX Enterprise Server 15	root=UUID={ <i>UUID-value</i> }	root=UUID={ <i>UUID-value</i> } or root=/dev/{ <i>VG</i> }/ { <i>LV</i> }

14. Specify the initial RAM disk image file created in step 9 for `initrd` contained in the boot loader configuration file.
Change the `initrd` specification in the configuration that you copied in step 11.
Keep in mind that the specification method for `initrd` differs depending on the boot loader.
If any options have been specified to suit the user environment, take care not to delete those options.
 - o SUSE LINUX Enterprise Server 11:
If you are using a Xen kernel, change the `initrd` file name specified in `module` to the initial RAM disk image file you created in step 9. For details on Xen kernels, see [Table 3-67 Xen hypervisor operating environments supported by HDLM on page 3-77](#).
Delete the `resume` specification contained in the configuration that you copied in step 11. If `resume` is set for the `kernel` parameter, delete the `resume` setting, because it is not supported by HDLM.
15. In the boot loader configuration file, edit the settings to be used during a boot.
Change the `default` number so that a boot can be performed using the configuration copied in step 11.
This number is the number of the first valid `title` when counted from 0.
The following is an example of the edited settings when the first `title` is valid:
`default= 0`
16. Shut down the host.
Execute the following command to shut down the host:

```
# shutdown -h now
```

17. Add a path to the LU (system disk) and then change the configuration from a single-path configuration to a multi-path configuration.
18. Start the host.
19. Check that the HDLM boot disk environment is configured.
See `/proc/mounts` to check the devices mounted on the root (/). Then execute the following command to output the root information and check the devices that are output.

```
# /bin/cat /proc/mounts | /bin/grep -w / | /bin/grep -v rootfs
```

Check as follows, depending on the devices that are output.

- o If `/dev/{HDLM-device}` is output:
The HDLM boot disk environment is used.
- o If another device is output:
 - a. Execute the `/usr/bin/readlink -f {output-device}` command.
The full path of the file is output.
 - b. Execute the `/bin/ls -l {output-device}` command.
In a general file, the `major` and `minor` values are displayed where the file size is displayed.
 - c. Execute the following command with the `major` value specified for the argument:

```
# /bin/cat /proc/devices | /bin/grep -w {major}
```

 - If `sddlmfdrv` is output, the HDLM boot disk environment is used.
 - If `device-mapper` is output:
Execute `/sbin/dmsetup ls --tree` to check the `major` and `minor` values of the device associated with the `major` and `minor` values displayed in `b..`.

Display example:

```
# /sbin/dmsetup ls --tree
system-usr (252:3)
|- (251:2)
system-var (252:4)
|- (251:2)
system-swap (252:1)
|- (251:2)
system-root (252:0)
|- (251:2)
system-tmp (252:2)
|- (251:2)
#
```

If the `major` and `minor` values in `b.` are 252 and 0 respectively, then, in the example above, the corresponding device is (251:2), which has `major` and `minor` values of 251 and 2 respectively.

Execute the following command with the `major` value specified for the argument:

```
/bin/cat /proc/devices | /bin/grep -w {major}
```

If `sddlmfdrv` is output, the HDLM boot disk environment is used.

If `sddlmfdrv` is not output, the HDLM boot disk environment is not used.

- If another device is output:
The HDLM boot disk environment is not used.



HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method

The following describes the HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method.

- [List of the HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method](#)

List of the HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method

The following table lists the HDLM-supported kernels that handle CPU vulnerabilities by the Retpoline method.

Table D-1 Kernels that handle CPU vulnerabilities in Red Hat Enterprise Linux 6 by the Retpoline method

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
Red Hat Enterprise Linux 6.0	IA32	2.6.32-71.el6.i686	--
	EM64T/AMD64	2.6.32-71.el6.x86_64	--
Red Hat Enterprise Linux 6.1	IA32	2.6.32-131.0.15.el6.i686	--
	EM64T/AMD64	2.6.32-131.0.15.el6.x86_64	--
Red Hat Enterprise Linux 6.2	IA32	2.6.32-220.el6.i686	--
	EM64T/AMD64	2.6.32-220.el6.x86_64	--
Red Hat Enterprise Linux 6.3	IA32	2.6.32-279.el6.i686	--
	EM64T/AMD64	2.6.32-279.el6.x86_64	--
Red Hat Enterprise Linux 6.4	IA32	2.6.32-358.el6.i686	--
	EM64T/AMD64	2.6.32-358.el6.x86_64	2.6.32-358.87.1.el6.x86_64
Red Hat Enterprise Linux 6.5	IA32	2.6.32-431.el6.i686	--
	EM64T/AMD64	2.6.32-431.el6.x86_64	2.6.32-431.87.1.el6.x86_64
Red Hat Enterprise Linux 6.6	IA32	2.6.32-504.el6.i686	--
	EM64T/AMD64	2.6.32-504.el6.x86_64	2.6.32-504.66.1.el6.x86_64
Red Hat Enterprise Linux 6.7	IA32	2.6.32-573.el6.i686	2.6.32-573.53.1.el6.i686
	EM64T/AMD64	2.6.32-573.el6.x86_64	2.6.32-573.53.1.el6.x86_64
Red Hat Enterprise Linux 6.8	IA32	2.6.32-642.el6.i686	--
	EM64T/AMD64	2.6.32-642.el6.x86_64	--
Red Hat Enterprise Linux 6.9	IA32	2.6.32-696.el6.i686	2.6.32-696.23.1.el6.i686
	EM64T/AMD64	2.6.32-696.el6.x86_64	2.6.32-696.23.1.el6.x86_64

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
Red Hat Enterprise Linux 6.10	IA32	2.6.32-754.el6.i686	Same as the column to the left [#]
	EM64T/AMD64	2.6.32-754.el6.x86_64	Same as the column to the left [#]

Legend:

--: Not applicable.

#

All kernels handle CPU vulnerabilities by the Retpoline method.

Table D-2 Kernels that handle CPU vulnerabilities in Red Hat Enterprise Linux 7 by the Retpoline method

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
Red Hat Enterprise Linux 7.0	EM64T/AMD64	3.10.0-123.el7.x86_64	N
Red Hat Enterprise Linux 7.1	EM64T/AMD64	3.10.0-229.el7.x86_64	N
Red Hat Enterprise Linux 7.2	EM64T/AMD64	3.10.0-327.el7.x86_64	3.10.0-327.64.1.el7.x86_64
Red Hat Enterprise Linux 7.3	EM64T/AMD64	3.10.0-514.el7.x86_64	3.10.0-514.44.1.el7.x86_64
Red Hat Enterprise Linux 7.4	EM64T/AMD64	3.10.0-693.el7.x86_64	3.10.0-693.21.1.el7.x86_64
Red Hat Enterprise Linux 7.5	EM64T/AMD64	3.10.0-862.el7.x86_64	Same as the column to the left [#]
Red Hat Enterprise Linux 7.6	EM64T/AMD64	3.10.0-957.el7.x86_64	Same as the column to the left [#]
Red Hat Enterprise Linux 7.7	EM64T/AMD64	3.10.0-1062.el7.x86_64	Same as the column to the left [#]
Red Hat Enterprise Linux 7.8	EM64T/AMD64	3.10.0-1127.el7.x86_64	Same as the column to the left [#]

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
Red Hat Enterprise Linux 7.9	EM64T/AMD64	3.10.0-1160.el7.x86_64	Same as the column to the left [#]

Legend:

N: HDLM does not handle CPUs with vulnerabilities fixed by the Retpoline method.

#

All kernels handle CPU vulnerabilities by the Retpoline method.

Table D-3 Kernels that handle CPU vulnerabilities in Red Hat Enterprise Linux 8 by the Retpoline method

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
Red Hat Enterprise Linux 8.1	EM64T/AMD64	4.18.0-147.el8.x86_64	Same as the column to the left [#]
Red Hat Enterprise Linux 8.2	EM64T/AMD64	4.18.0-193.el8.x86_64	Same as the column to the left [#]

#

All kernels handle CPU vulnerabilities by the Retpoline method.

Table D-4 Kernels that handle CPU vulnerabilities in SUSE LINUX Enterprise Server 11 by the Retpoline method

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
SUSE LINUX Enterprise Server 11 SP4	IA32	3.0.101-63.1-default	3.0.101-108.68-default
		3.0.101-63.1-pae	3.0.101-108.68-pae
	EM64T/AMD64	3.0.101-63.1-default	3.0.101-108.68-default
		3.0.101-63.1-xen	3.0.101-108.68-xen

Legend:

--: Not applicable.

**Table D-5 Kernels that handle CPU vulnerabilities in SUSE LINUX
Enterprise Server 12 by the Retpoline method**

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
SUSE LINUX Enterprise Server 12	EM64T/AMD64	3.12.28-4-default	N
		3.12.28-4-xen	N
SUSE LINUX Enterprise Server 12 SP1	EM64T/AMD64	3.12.59-60.45-default	N
		3.12.59-60.45-xen	N
SUSE LINUX Enterprise Server 12 SP2	EM64T/AMD64	4.4.21-69-default	N
SUSE LINUX Enterprise Server 12 SP3	EM64T/AMD64	4.4.82-6.9-default	4.4.114-94.14-default
SUSE LINUX Enterprise Server 12 SP4	EM64T/AMD64	4.12.14-94.41-default	Same as the column to the left [#]
SUSE LINUX Enterprise Server 12 SP5	EM64T/AMD64	4.12.14-120-default	Same as the column to the left [#]

Legend:

N: HDLM does not handle CPUs with vulnerabilities fixed by the Retpoline method.

#

All kernels handle CPU vulnerabilities by the Retpoline method.

**Table D-6 Kernels that handle CPU vulnerabilities in SUSE LINUX
Enterprise Server 15 by the Retpoline method**

OS	Kernel architecture	Kernel provided on the installation media	Kernel that handles CPU vulnerabilities by the Retpoline method
SUSE LINUX Enterprise Server 15	EM64T/AMD64	4.12.14-23-default	Same as the column to the left [#]
SUSE LINUX Enterprise Server 15 SP1	EM64T/AMD64	4.12.14-195-default	Same as the column to the left [#]
SUSE LINUX Enterprise Server 15 SP2	EM64T/AMD64	5.3.18-22-default	Same as the column to the left [#]

#

All kernels handle CPU vulnerabilities by the Retpoline method.



Functional differences between versions of HDLM

This section explains the functional differences between newer and older versions of HDLM.

- ☐ [Functional differences between version 8.7.8 and versions earlier than 8.7.8](#)
- ☐ [Functional differences between version 8.7.3 and versions earlier than 8.7.3](#)
- ☐ [Functional differences between version 8.7 and versions earlier than 8.7](#)
- ☐ [Functional differences between version 8.6.4 and versions earlier than 8.6.4](#)
- ☐ [Functional differences between version 8.6.2 and versions earlier than 8.6.2](#)
- ☐ [Functional differences between version 8.5.3 and versions earlier than 8.5.3](#)
- ☐ [Functional differences between version 8.0 and versions earlier than 8.0](#)
- ☐ [Functional differences between version 7.6 and versions earlier than 7.6](#)
- ☐ [Functional differences between version 7.2 and versions earlier than 7.2](#)
- ☐ [Functional differences between version 6.2.1 and versions earlier than 6.2.1](#)

- ☐ [Functional differences between version 6.1 and versions earlier than 6.1](#)
- ☐ [Functional differences between version 6.0 or later and versions earlier than 6.0](#)
- ☐ [Functional differences between version 5.9.4 or later and versions earlier than 5.9.4](#)
- ☐ [Functional differences between version 5.9.1 or later and versions earlier than 5.9.1](#)
- ☐ [Functional differences between version 5.9 or later and versions earlier than 5.9](#)
- ☐ [Functional differences between version 5.8 or later and versions earlier than 5.8](#)
- ☐ [Functional differences between version 5.7.1 or later and versions earlier than 5.7.1](#)
- ☐ [Functional differences between version 5.7.0-01 or later and versions earlier than 5.7.0-01](#)
- ☐ [Functional differences between version 5.7 or later and versions earlier than 5.7](#)
- ☐ [Functional differences between version 5.6.3 or later and versions earlier than 5.6.3](#)
- ☐ [Functional differences between version 5.4 or later and versions earlier than 5.4](#)

Functional differences between version 8.7.8 and versions earlier than 8.7.8

The following OSs are no longer supported:

- Red Hat Enterprise Linux 5
- Oracle Enterprise Linux 5
- Oracle Unbreakable Enterprise Kernel 5

Functional differences between version 8.7.3 and versions earlier than 8.7.3

- The procedure for removing HDLM was changed so that the utility for removing HDLM (`removehdlm`) is used, instead of the `rpm` command.
- The following OS is no longer supported:
 - SUSE LINUX Enterprise Server 11 SP3

Functional differences between version 8.7 and versions earlier than 8.7

A function that, during the installation of HDLM, checks whether the use of LVM cache files is enabled was added.

If the use of LVM cache files is enabled, the KAPL12451-E message is output and the installation is terminated.

Functional differences between version 8.6.4 and versions earlier than 8.6.4

The following OSs are no longer supported:

- SUSE LINUX Enterprise Server 10 SP4
- SUSE LINUX Enterprise Server 11
- SUSE LINUX Enterprise Server 11 SP1
- SUSE LINUX Enterprise Server 11 SP2

Functional differences between version 8.6.2 and versions earlier than 8.6.2

The procedure described in [Settings for a multipath boot disk environment on page 3-131](#) has been changed so that the utility for creating an HDLM boot disk environment (`dlmbootstart`) is used. You can also perform the

procedures for version 8.6.1 and earlier versions. For details, see [Appendix C, Manually setting a boot disk environment on page C-1](#).

Functional differences between version 8.5.3 and versions earlier than 8.5.3

The IPF architecture of the following OSs is no longer supported:

- Red Hat Enterprise Linux 5
- SUSE LINUX Enterprise Server 10
- SUSE LINUX Enterprise Server 11

Functional differences between version 8.0 and versions earlier than 8.0

Procedures in [Settings for a multipath boot disk environment on page 3-131](#), [Upgrade installation of HDLM in a boot disk environment on page 3-133](#), and [3-250 Migration to a single-path boot disk environment on page 3-219](#) were changed. You can also perform operations by using the procedures for version 7.6 and earlier versions. (For details, see Hitachi Dynamic Link Manager Software User Guide for Linux® (MK-92DLM113-25) or an earlier version of this manual.

Functional differences between version 7.6 and versions earlier than 7.6

For FC-SAN environments, the number of paths in the `Offline(E)` status no longer increases if the server is restarted when no system (path) configuration has been changed and no path error has occurred. For IP-SAN environments, there are no functional differences.

Functional differences between version 7.2 and versions earlier than 7.2

When creating an initial RAM disk image file in Red Hat Enterprise Linux 6, the `dracut` command is now used, instead of the `dmmkinitrd` boot disk support utility.

Due to this change, the `dmmkinitrd` utility is no longer installed in a Red Hat Enterprise Linux 6 environment.

Functional differences between version 6.2.1 and versions earlier than 6.2.1

The output destination of the HDLM command operation log data has been changed from Hitachi Network Objectplaza Trace Library (HNTRLib2) integrated trace information files (`/var/opt/hitachi/HNTRLib2/spool/hntr2n.log#`) to process-specific-trace (traces for multiple processes) information files (`/var/opt/DynamicLinkManager/log/dlnkmgrn.log#`).

n indicates a file number.

Functional differences between version 6.1 and versions earlier than 6.1

In a new installation of HDLM, the default load balancing algorithm has been changed from the Round Robin algorithm to the Extended Least I/Os algorithm.

Functional differences between version 6.0 or later and versions earlier than 6.0

- The description of the HDLM version displayed as a result of executing HDLM commands or utilities has been changed.
- In versions earlier than 6.0, the messages KAPL09210-I, KAPL09211-I, and KAPL09212-E will *not* be output when you install HDLM. In versions 6.0 or later, one of the above messages will be output when you install HDLM.
- In a new installation of HDLM, the default value for the automatic fallback function has been changed from `off` to `on`.

Functional differences between version 5.9.4 or later and versions earlier than 5.9.4

- The maximum number of LUs for one port for one storage that was guaranteed in HDLM for each storage system is now guaranteed for each OS.
- The maximum number of LUs guaranteed in HDLM has been changed to 512. Therefore, the naming rules for HDLM logical device files have also been changed.
- The maximum size of a log file that is obtained during execution of the HDLM-configuration definition utility (`dlnmcfgmgr`) can now be specified by using the `dlnmcfgmgr` utility.

Functional differences between version 5.9.1 or later and versions earlier than 5.9.1

- In versions earlier than 5.9.1, the timeout value of `SCSI INQUIRY` is fixed. Therefore, depending on the connected storage system, a timeout occurs when the response for `SCSI INQUIRY` is delayed.

In versions 5.9.1 or later, you can use the `d1msetopt` utility to customize the timeout value according to the storage system in use.

- In versions earlier than 5.9.1, the message below will *not* be output when you install HDLM. In versions 5.9.1 or later, the following message will be output when you install HDLM.

- Preparing packages for installation...
- HDLM-x.xx.x.xxx.-xx

The following shows an execution example in Red Hat Enterprise Linux AS4:

```
# /media/cdrom/installhdlm
KAPL09093-I HDLM xx-xx will be installed. Is this OK ? [y/n]: y
Preparing packages for installation...
KAPL09076-I The permanent license was installed.
HDLM-x.xx.x.xxx-xx
KAPL09043-I The installation of HDLM-x.xx.x.xxx-xx completed
successfully.
#
```

Functional differences between version 5.9 or later and versions earlier than 5.9

The function for operating HDLM from the HDLM GUI or HDLM Web GUI is no longer supported.

Functional differences between version 5.8 or later and versions earlier than 5.8

The following table describes the version of the JRE or JDK required to use the HDLM GUI on a host.

Table E-1 JRE/JDK version required for HDLM GUI

OS	Required version of JRE or JDK	
	Earlier than HDLM 5.7.1	HDLM 5.8 or later
Red Hat Enterprise Linux AS3/ES3 (IA32)	JRE v1.4.2_08	JRE v1.4.2_09
Red Hat Enterprise Linux AS4/ES4 (IA32)		

OS	Required version of JRE or JDK	
	Earlier than HDLM 5.7.1	HDLM 5.8 or later
SUSE LINUX Enterprise Server 9 (IA32)		
Red Hat Enterprise Linux AS3/ES3 (IPF) Red Hat Enterprise Linux AS4/ES4 (IPF)	JDK v1.4.2_08	JDK v1.4.2_09
Red Hat Enterprise Linux AS3/ES3 (EM64T/AMD64) Red Hat Enterprise Linux AS4/ES4 (EM64T/AMD64) SUSE LINUX Enterprise Server 9 (EM64T/AMD64)	JRE v1.5.0_03 (JRE 64 bit version is supported)	JRE v1.5.0_05 (JRE 32 bit version is supported)

Functional differences between version 5.7.1 or later and versions earlier than 5.7.1

In versions earlier than 5.7.1, if the HDLM driver fails to allocate memory for an I/O operation when reading or writing from the HDLM device, it returns an error instead of retrying.

In version 5.7.1 or later, the system tries to allocate the memory again and the I/O operation is executed successfully. The number of retries can be set by the user. By default, the system retries the operation until memory is allocated.

Functional differences between version 5.7.0-01 or later and versions earlier than 5.7.0-01

In versions earlier than 5.7.0-01, when an I/O request is sent to a path in the `Online(E)` status despite all paths being disconnected, the status of the path is changed to `Offline(E)` and another path is placed in the `Online(E)` status. In version 5.7.0-01 or later, even if an I/O request is sent to a path in the `Online(E)` status, the status of the path does not change.

In the event of path recovery after all paths have failed, the paths must be placed online by automatic failback or by using a command before you can access the data.

Functional differences between version 5.7 or later and versions earlier than 5.7

In version 5.7 or later, if there are no files under the `/etc/opt/DynamicLinkManager` directory when HDLM is removed, the directory is deleted.

Functional differences between version 5.6.3 or later and versions earlier than 5.6.3

The following table describes the version of the JRE or JDK required to use the HDLM GUI on a host.

Table E-2 JRE/JDK version required for HDLM GUI

OS	Required version of JRE or JDK		
	Earlier than HDLM 5.4.2	HDLM 5.6 - 5.6.2	HDLM 5.6.3
Red Hat Enterprise Linux AS2.1 (IA32) SUSE LINUX Enterprise Server 8 (IA32)	JRE v1.3.1_08	JRE v1.3.1_15	JRE v1.4.2_08
Red Hat Enterprise Linux AS3/ES3 (IA32)	JRE v1.4.2_03	JRE v1.4.2_07	JRE v1.4.2_08
Red Hat Enterprise Linux AS2.1 (IPF) Red Hat Enterprise Linux AS3/ES3 (IPF) SUSE LINUX Enterprise Server 8 (IPF)	JRE v1.4.2_03	JRE v1.4.2_07	JRE v1.4.2_08

Functional differences between version 5.4 or later and versions earlier than 5.4

- The permission for the error log file `/var/DynamicLinkManager/log/dlmmgrX.log` has been changed to 600.
- The permission for the trace log directory `/var/opt/hitachi/HNTRLib2/spool` has been changed to 755, and the permission for the log file `/var/opt/hitachi/HNTRLib2/spool/hntr2X.log` has been changed to 644.
- License keys that worked with versions 04-00, 05-02, and 05-03 are no longer valid with version 5.4.



Acronyms and abbreviations

The following acronyms and abbreviations might be used in this guide.

A

AMD64

Advanced Micro Devices 64

API

Application Programming Interface

ASM

Automatic Storage Management

B

BIOS

Basic Input / Output System

C

CHA

Channel Adapter

CLPR

Cache Logical Partition

CPU

Central Processing Unit

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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CSV

Comma Separated Value

CU

Control Unit

D**DBMS**

Database Management System

Dev

Device

DHCP

Dynamic Host Configuration Protocol

DNS

Domain Name System

DRBD

Distributed Replicated Block Device

E**EM64T**

Extended Memory 64 Technology

EVMS

Enterprise Volume Management System

ext

Extended File System

F**FC**

Fibre Channel

FCoE

Fibre Channel over Ethernet

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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FC-SP

Fibre Channel Security Protocol

FO

Failover

FQDN

Fully Qualified Domain Name

G**GMT**

Greenwich Mean Time

GRUB

GRand Unified Bootloader

GUI

Graphical User Interface

H**HBA**

Host Bus Adapter

HDev

Host Device

HLU

Host Logical Unit

HTTP

Hypertext Transfer Protocol

I**I/O**

Input/Output

IA32

Intel Architecture 32

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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IDE

Integrated Drive Electronics

IP

Internet Protocol

IPC

Inter Process Communication

IPF

Itanium[®] Processor Family

IRQ

Interrupt ReQuest

iSCSI

Internet Small Computer System Interface

K**KVM**

Kernel-based Virtual Machine

L**LAN**

Local Area Network

LDAP

Lightweight Directory Access Protocol

LDEV

Logical Device

LILO

Linux Loader

LU

Logical Unit

LUN

Logical Unit Number

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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LVM

Logical Volume Manager

M

md

Multiple Devices

N

NAS

Network Attached Storage

NIC

Network Interface Card

NTP

Network Time Protocol

O

OS

Operating System

P

P

Port

PCI

Peripheral Component Interconnect

R

RADIUS

Remote Authentication Dial In User Service

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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S

SAN

Storage Area Network

SCSI

Small Computer System Interface

SLPR

Storage Logical Partition

SNMP

Simple Network Management Protocol

SP

Service Pack

SSL

Secure Sockets Layer

SVP

Service Processor

U

UUID

Universally Unique Identifier

V

VG

Volume Group

W

WWN

World Wide Name

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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X

XML

Extensible Markup Language

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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Glossary

This glossary explains the terms used in this manual.

A

automatic failback

A function for checking the status of paths at regular intervals, and automatically placing the status of a path recovered from an error into the Online status.

If a path with an `Offline(E)` or `Online(E)` status recovers from an error, an automatic failback will place the path `Online`.

Automatic failbacks check the status of paths that were placed in the `Offline(E)` or `Online(E)` status because of an error, but do not check the status of paths that were placed in the `Offline(C)` status by executing an offline operation. For details on offline operations, see 6.4 *offline (Places a Path or Paths Offline)*.

AutoPATH_ID

An ID that HDLM assigns to a path during the system startup. Every path has a unique AutoPATH_ID.

(See also: *path*)

B

boot disk environment

An environment in which the startup disk is in a storage system instead of in the host.

C

CHA (Channel Adapter)

An adapter for controlling the channels of a storage system.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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CLPR(Cache Logical Partition)

A function supported for logically splitting up a cache. This function can split up a cache into parity groups in the storage system, so that other parity groups do not affect the cache performance.

cluster

A system of connecting multiple hosts with the same OS or platform (essentially, an environment in which the same application can run) and treating them as one system.

D

Dev (Device)

A logical division of an LU that HDLM controls and operates.

A Dev is equivalent to a *partition* in Linux.

In Linux, each LU can be divided into more than one Dev.

Each Dev has a *Dev number*.

Depending on the access method, Devs are classified into two types: block devices and character devices.

(See also: *Dev number*)

Dev number

A Dev number (the DNum column) in the configuration list in HDLM.

This number is assigned to each Dev within an LU. In Linux, a Dev number is called a *partition number*.

The Dev number is set to 0 because HDLM manages Devs in units of LUs.

(See also: *Dev*)

domain

An environment in which Xen is used to manage OSs.

The domain that has management privileges for Xen is called *domain0*. The other domains are called *domainU*.

E

emulation type

An LU type that is accessible from a host. Since an HDLM host is an open-system host such as a PC or a UNIX computer, the HDLM host can access only the LUs that have open-system emulation types.

For details on emulation types supported by a storage system, see the maintenance manual for that particular storage system.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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F

failback

A function for placing the status of a path recovered from an error into the `Online` status, and then switching the access path to the path that was just recovered.

failover

A function for switching to another normal path if there is an error in the current access path, thereby enabling the system to continue to operate.

FC-SAN (Fibre Channel - Storage Area Network)

A SAN using Fibre Channel.

H

HAM environment

An environment in which volume pairs that are synchronized between two storage systems are created by HAM (High Availability Manager), and hosts are configured to recognize these volumes as one volume. An HAM environment consists of the primary volume (P-VOL) in the primary site and the secondary volume (S-VOL) in the secondary site. When an error occurs on one of the volumes, the path can be switched to the other volume by using HDLM.

HBA (Host Bus Adapter)

Device that functions as an interface connecting a host with external devices. In this manual, the term *HBA* refers to an interface card installed in a host, in configurations where the host and storage units are connected via a FC connection.

HDLM alert driver

A program that receives information about an error detected by the HDLM driver, and then reports the error information to the HDLM manager.

HDLM driver

A program that controls all the HDLM functions, manages paths, and detects errors.

HDLM manager

A program that manages error information. The HDLM manager receives error information from the HDLM alert driver and then collects error logs.

host

A generic term for both servers and clients.

host device

A logical area in a host LU.
(See also: *host LU*, *host device name*)

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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host device name

A name assigned to a host device. A name of the logical device file for an HDLM device is assigned to a host device name.

host LU

An LU that a host recognizes. The actual HDev entity is a Dev in the storage system. Each host LU has a *host LU number*.
(See also: *LU*, *host LU number*, *host device*)

host LU number

A number assigned to a host LU. The host LU number is part of a path name.
(See also: *host LU*, *path name*)

hypervisor

Software that enables host virtualization.

I**intermittent error**

An error that occurs irregularly due to, for example, a loose cable connection.

IP-SAN (Internet Protocol - Storage Area Network)

A data transfer network that connects hosts and storage systems by using the iSCSI standard.

K**KVM (Kernel-based Virtual Machine)**

A mechanism that uses the Linux kernel itself as a hypervisor. KVM uses QEMU to control guest OSs.
(See also: *QEMU*)

L**LDEV (Logical Device)**

A combination of the storage system's product name, serial number, and an internal LU. HDLM uses this value to identify a particular LU.

load balancing

Functionality for distributing the load across the paths that access each area within an LU. To distribute loads, load balancing uses multiple paths to perform I/O operations. HDLM uses the following six algorithms for load balancing:
- The Round Robin algorithm

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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- The Extended Round Robin algorithm
- The Least I/Os algorithm
- The Extended Least I/Os algorithm
- The Least Blocks algorithm
- The Extended Least Blocks algorithm

logical device file

A device file in the `/dev` directory.

Note that the term *logical device* here is different from *LDEV*.

LU (Logical Unit)

A logical unit that is a logical volume defined in the storage system, and with which the host can perform input or output operations.

(See also: *host LU*)

N

node

A server in a cluster.

non-owner controller

A controller that is not set as the controller responsible for LUs by the dynamic load balance controller function when the HUS100 series is used.

(See also: *owner controller*, *non-owner path*)

non-owner path

The following paths become non-owner paths:

- Paths that pass through a non-owner controller when the dynamic I/O path control function is enabled and the HUS100 series is used
- Paths for which the non-preferred path option is specified when the global-active device is used

(See also: *owner path*, *non-owner controller*)

O

owner controller

A controller that is set as the controller responsible for LUs by the dynamic load balance controller function when the HUS100 series is used.

(See also: *owner path*, *non-owner controller*)

owner path

All the paths other than the following paths are owner paths:

- Non-owner paths when the dynamic I/O path control function is enabled
- Non-owner paths when global-active device is used

(See also: *owner controller*, *non-owner path*)

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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P

path

An access path from a host to a storage system. Access to an area within an LU in a storage system is made via a cable connecting the HBA on the host and the CHA on the storage system. This cable is a path. Each path has an `AutoPATH_ID`.
(See also: *AutoPATH_ID*)

path health checking

A function for checking the status of paths at regular intervals.
When an error occurs on a path that was in the `Online` status, path health checking changes the status of the path to the `Offline(E)` status.
Path health checking checks only those paths that have the `Online` status.

path name

The path name consisting of the following four elements, separated by periods:
- Host port number (hexadecimal number)
- Bus number (hexadecimal number)
- Target ID (hexadecimal number)
- Host LU number (hexadecimal number)
A path name is used to identify a physical path.
(See also: *host LU number*)

persistent reservation

Similar to *reservations*, persistent reservations enable a server to declare that it has exclusive rights to use an LU, and prevents other servers from accessing that LU. Note, however, that while reservations allows a server to have exclusive use of only one path to the LU, persistent reservations allow a server to have exclusive rights to use multiple paths.
If persistent reservations are used in HDLM, a host can have exclusive use of multiple paths to an LU, so that load balancing among these paths is possible.
(See also: *reservation*)

physical path

An access path from a host to an LU. A path name is used to identify a physical path.

Q

QEMU

A virtual emulator available for the entire host system.
(See also: *KVM*)

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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R

reservation

The reservation function enables a host to declare that it has exclusive rights to use a particular LU, and prevents other hosts from accessing that LU. Access permission for an LU that has been reserved is given only to the host that issued the reservation, so the LU cannot be accessed from multiple paths (coming from multiple hosts) simultaneously. However, because of this, load balancing is not possible.
(See also: *persistent reservation*)

S

SAN (Storage Area Network)

A high-speed network connecting hosts to storage systems. This network is independent of a LAN and is dedicated to data transfers. A SAN provides faster access to storage systems, and prevents the transfer of high-volumes of data from deteriorating LAN performance.

SCSI device

A SCSI disk device.

SLPR (Storage Logical Partition)

A function supported for logically splitting up a storage system. This function splits up the resources, such as ports, CLPR, and volumes, in the storage system, so that the user can manage each resource independently.

X

Xen

Software that provides a virtual environment in Linux.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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