



HiCommand Dynamic Link Manager (HDLM) for HP-UX® Systems

User's Guide

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Preface

The *HiCommand Dynamic Link Manager (HDLM) User's Guide* describes and provides instructions for installing and using the HDLM for HP-UX software for the Hitachi TagmaStore Universal Storage Platform (USP) and Network Storage Controller (NSC) storage subsystems. This document is intended for system administrators who use HDLM to operate and manage storage.

This document assumes that:

- the user has a background in data processing and understands storage subsystems and their basic functions,
- the user is familiar with the Hitachi Freedom Storage subsystem(s): TagmaStore Universal Storage Platform, Lightning 9900 V Series, Hitachi Lightning 9900, Thunder 9500 V Series, Thunder 9200, array subsystems, Freedom Storage 5800, Freedom Storage 5700E, and
- the user is familiar with the HP-UX operating system, file system, system commands, and utilities.

For further information on the Hitachi storage subsystems, refer to the user's guide for the subsystem (e.g., *Hitachi Lightning 9900 User and Reference Guide*, MK-90RD008). For further information on Hitachi Data Systems products and services, contact your Hitachi Data Systems account team, or visit Hitachi Data Systems online at <http://www.hds.com>.

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Software Version

This document revision applies to HDLM for HP-UX version 5.9.

Convention for Storage Capacity Values

Storage capacity values displayed by HDLM are calculated based on the following values:

- 1 KB (kilobyte) = 1,024 bytes
- 1 MB (megabyte) = 1,024² bytes
- 1 GB (gigabyte) = 1,024³ bytes
- 1 TB (terabyte) = 1,024⁴ bytes

Referenced Documents

- *Hitachi TagmaStore Universal Storage Platform User and Reference Guide* (MK-94RD231)
- *Hitachi TagmaStore Network Storage Controller User and Reference Guide* (MK-95RD279)
- *Hitachi TagmaStore Adaptable Modular Storage 200 User and Reference Guide* (MK-95DF713)

- *Hitachi TagmaStore Adaptable Modular Storage 500 User and Reference Guide (MK-95DF714)*
- *HiCommand Device Manager Agent Installation Guide (MK-92HC019)*
- *HiCommand Device Manager Web Client User's Guide (MK-91HC001)*
- *HiCommand Device Manager Server Installation and Configuration Guide (MK-91HC002)*
- *Hitachi Universal Storage Platform V User and Reference Guide, (MK-96RD635)*
- *Hitachi Cross-OS File Exchange User's Guide, (MK-96RD647)*

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Chapter 1 Overview of HDLM

HDLM manages paths between a host and storage subsystem. HDLM distributes the load across paths and switches to another path if there is a failure in a path being used, thus improving system reliability.

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

- 1.1 What is HDLM?
- 1.2 HDLM features

1.1 What is HDLM?

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

The HDLM software manages access paths to storage subsystems. HDLM provides functionality for distributing the load across paths and switching to another path if there is a failure in a path being used, thus improving system availability and reliability.

Figure 1.1 illustrates the connections between hosts and storage subsystems. A server on which HDLM is installed is called a *host*.

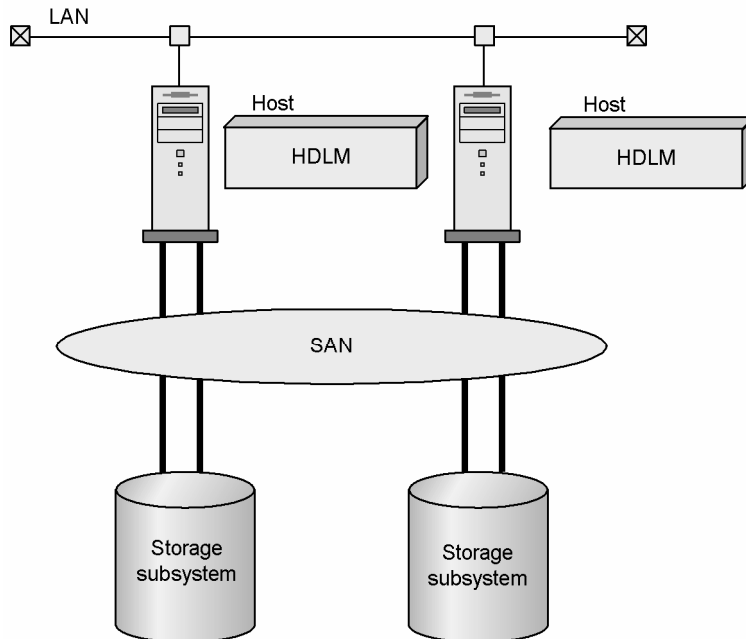


Figure 1.1 Connections between hosts and storage subsystems

HDLM supports the following storage subsystems.

- Freedom Storage 5700E
- Freedom Storage 5800
- Thunder 9200
- Lightning 9900 Series
- Thunder 9500V Series
- Lightning 9900V Series
- TagmaStore AMS/WMS series
- TagmaStore USP
- Universal Storage Platform V

1.2 HDLM features

HDLM has the following features.

Distributes the load across paths (*load balancing*)

When multiple paths connect a host and storage subsystem, HDLM distributes the load across the paths. This prevents a heavily loaded path from affecting processing speed.

For details on load balancing, see 2.7.

Allows processing to continue if there is a failure (*failover*)

When multiple paths connect a host and storage subsystem, HDLM automatically switches to another path if there is a failure in a path being used. This allows processing to continue without being affected by the failure.

For details on failover, see 2.8.

Allows you to place online a path recovered from an error (*failback*)

When a path recovers from an error, HDLM can place the path online. This enables the maximum number of paths to be online, which in turn enables HDLM to distribute the load for each path.

Route failbacks can be performed manually or automatically. In an automatic failback, HDLM automatically restores the route to the active state after the user has corrected the problem in the physical route.

For details on failback, see 2.8.

Automatically checks the path status at regular intervals (*path health checking*)

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

For details on path health checking, see 2.10.

Chapter 2 HDLM Functions

This chapter describes the HDLM functionality. Initially, the HDLM management targets, system configuration, and basic terms are described. The rest of this chapter describes the functionality including load distribution across paths and path switching.

- 2.1 Devices Managed by HDLM
- 2.2 System Configuration
- 2.3 LU Configuration
- 2.4 Program Configuration
- 2.5 Position of the HDLM Driver and HDLM Device
- 2.6 Device Files for HDLM Devices
- 2.7 Load Distribution Using Load Balancing
- 2.8 Failover and Failback Using Path Switching
- 2.9 Monitoring Intermittent Errors (Functionality When Automatic Failback Is Used)
- 2.10 Detecting Errors by Using Path Health Checking
- 2.11 Error Management
- 2.12 Cluster Support

2.1 Devices Managed by HDLM

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

Devices that HDLM can manage:

HDLM can manage SCSI devices in Hitachi storage subsystems.

Devices that HDLM cannot manage:

- SCSI devices other than those for Hitachi storage subsystems
- Hitachi storage subsystem command devices, such as Hitachi RAID Manager command devices
- Built-in disks in a host
- Devices other than disks (tape devices, etc.)
- MC/ServiceGuard lock disks(Except the Serviceguard A.11.16)[#]
- Boot disks[#]
- Dump devices[#]
- Swap devices[#]
- Devices that include a root file system[#]

#

To use SCSI devices in Hitachi storage subsystems as devices that include MC/ServiceGuard lock disks(Except the Serviceguard A.11.16 and A.11.17), boot disks, dump devices, swap devices, or devices that include a root file system, settings must be made to remove the SCSI devices from HDLM management. Other devices that cannot be managed by HDLM are automatically set not to be targets for HDLM management.

2.2 System Configuration

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

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

HDLM assigns an ID to the management-target path. This ID is called an *AutoPATH_ID*. The path might also be called a *management target*.

Figure 2.1 shows the HDLM system configuration.

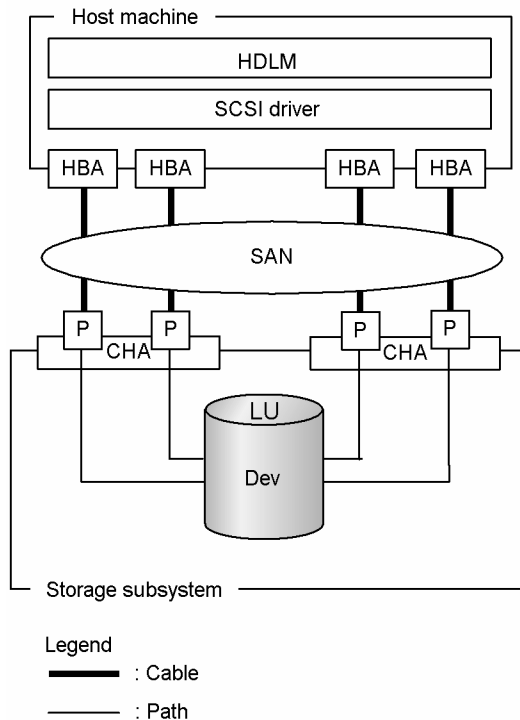


Figure 2.1 HDLM System Configuration

Table 2.1 lists the HDLM system components.

Table 2.1 HDLM System Components

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

2.3 LU Configuration

When you install HDLM, the LU configuration recognized by the host changes as follows:

Before installing HDLM:

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

Thus, a single LU in the storage subsystem is recognized as the same number of LUs as that of paths.

After installing HDLM:

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

Thus, from the host, LUs in the storage subsystem are also recognized as one LU regardless the number of paths.

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

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.

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

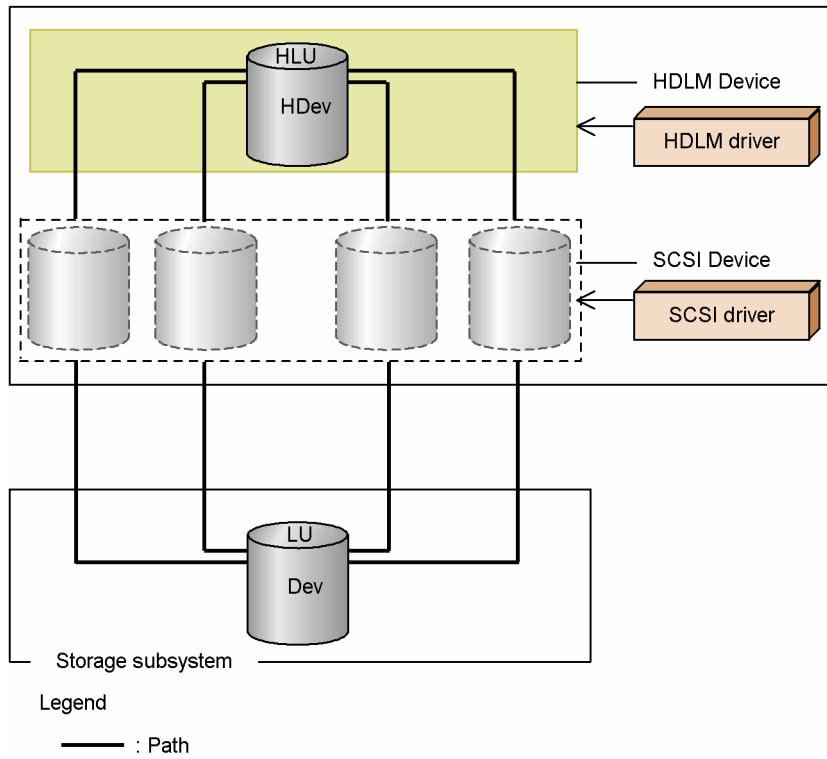


Figure 2.2 LU Configuration Recognized by the Host After HDLM Installation

Table 2.2 lists the components recognized by the host.

Table 2.2 Components recognized by the host

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

2.4 Program Configuration

HDLM runs as a combination of programs. Because these programs correspond to the HDLM operations, you need to understand the name, position, and role of each program.

Figure 2.3 shows the HDLM program configuration.

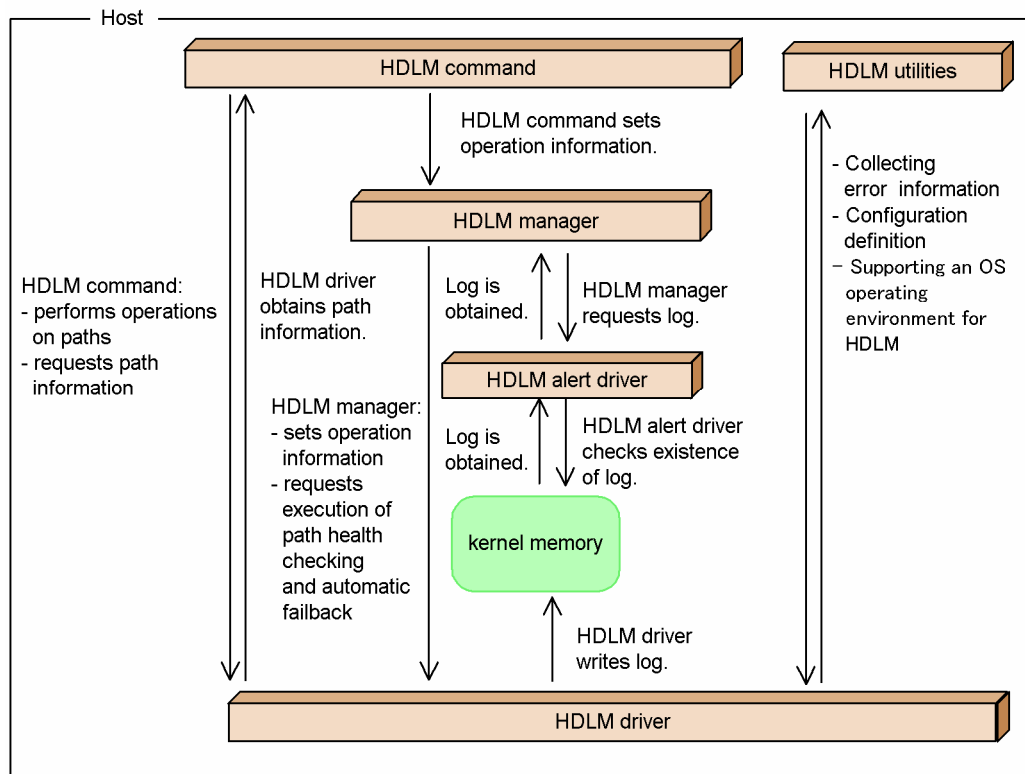


Figure 2.3 HDLM Program Configuration

Table 2.3 lists and describes the functionality of these programs.

Table 2.3 Functionality of HDLM Programs

Program name	Functionality
--------------	---------------

HDLM command	Provides the <code>dlnkmgx</code> command to enable 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 to enable you to: <ul style="list-style-type: none"> ▪ Collect error information ▪ Define configuration information ▪ Set up HDLM depending on the OS operating environment
HDLM manager	Provides the HDLM manager to enable you to: <ul style="list-style-type: none"> ▪ Configures the HDLM operating environment ▪ Requests the execution of path health checks and automatic failback ▪ Collects error log data
HDLM alert driver	Reports the log information collected by the HDLM driver to the HDLM manager. The driver name is <code>dlnmadv</code> .
HDLM driver	Controls HDLM functionality, manages paths, and detects errors. The HDLM driver consists of the following: <ul style="list-style-type: none"> ▪ Core logic component Controls the basic functionality of HDLM. ▪ Filter component Sends and receives I/O. The driver name is <code>dlnmfdrv</code> (In the HP-UX 11i v2.0, the driver name is <code>zdlnmfdrv</code>).

2.5 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 (device file) created by HDLM, to access LUs in the storage subsystem.

Figure 2.4 shows the position of the HDLM driver and HDLM device.

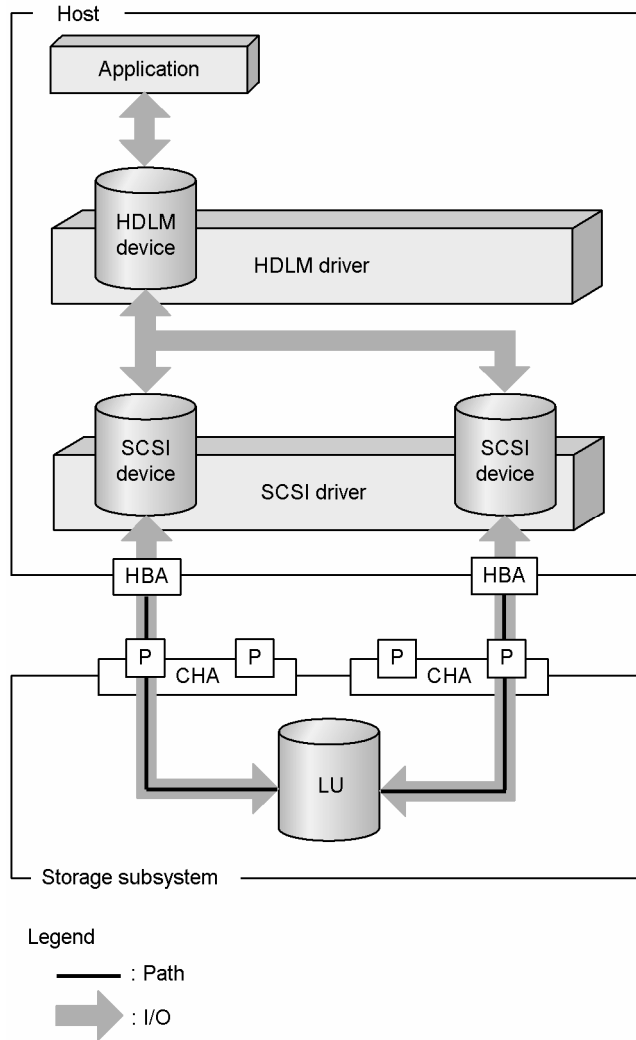


Figure 2.4 Position of the HDLM Driver and HDLM Devices

2.6 Device Files for HDLM Devices

This subsection describes the following items for device files for HDLM devices:

- Device file names of HDLM devices
- Locations of device files for HDLM devices

Device file names of HDLM devices

The logical device file name of an HDLM device is different from the logical device file name of a SCSI device.

The device file names of HDLM devices have the `chXtYdZ` format. This format has an additional `h`, compared with the `cXtYdZ` format for the device file names of SCSI devices. If more than one SCSI device indicates the same LU, `h` is added to the SCSI device file name of the SCSI device whose card instance number (`X`) is the smallest to produce the HDLM device file name. For example, when the SCSI devices `c4t1d0` and `c6t1d0` indicate the same LU, `ch4t1d0` is the HDLM device file name that corresponds to them.

However, if HP-UX is activated when the path to the device file for the SCSI device with the smallest card instance number has an error, the device file name of the HDLM device generated during configuration definition is inherited. Therefore, the actual device file names may not follow the above naming rule.

You can verify the correspondence between device file names of HDLM devices and those of SCSI devices by executing the `view -drv` operation.

Note: To use an LU managed by HDLM in an application, specify the device file name of the HDLM device. If a SCSI device file is specified, HDLM functionality cannot be used.

Locations of device files for HDLM devices

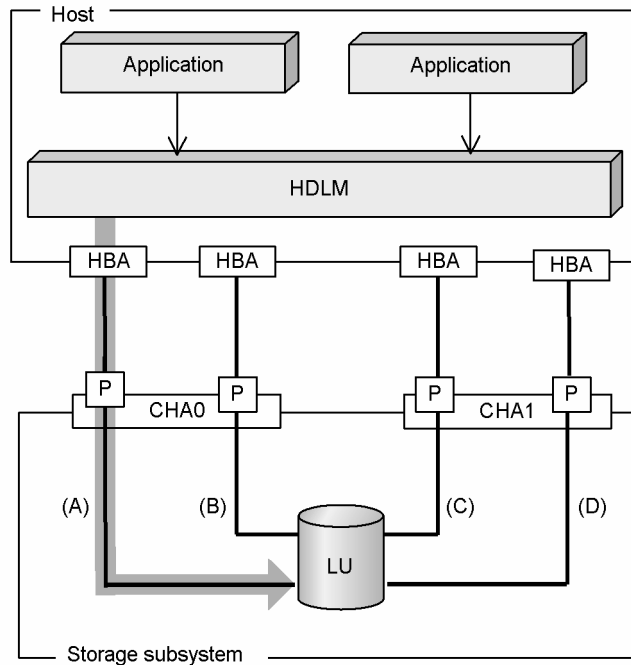
Block device files for HDLM devices are created in `/dev/dsk`. Character device files for HDLM devices are created in `/dev/rdsk`.

2.7 Load Distribution Using Load Balancing

When the system contains multiple paths to an LU, HDLM can distribute the load across the paths by using multiple paths for I/O. This functionality is called *load balancing*, and it prevents a 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 may not be equally allocated to each path.

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

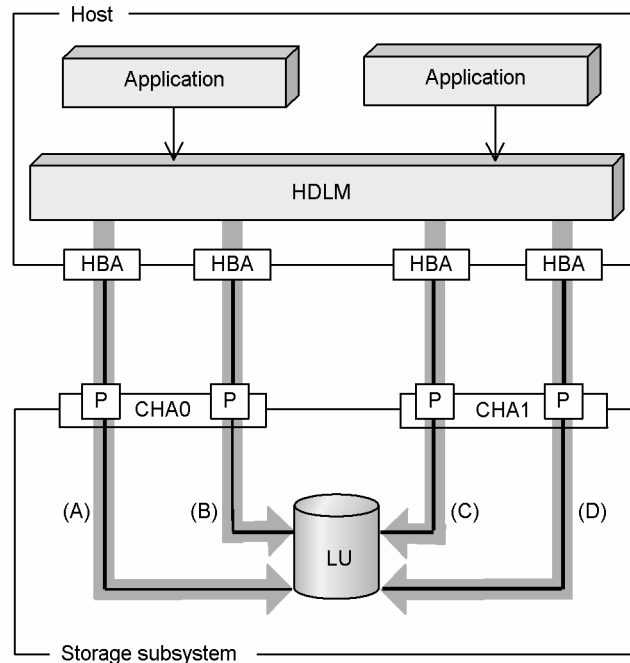


Legend

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

Figure 2.5 I/O Flow When the Load Balancing Function is Not Being Used

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



Legend

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

Figure 2.6 I/O Flow When the Load Balancing Function is Being Used

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

2.7.1 Paths to Which Load Balancing is Applied

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

2.7.1.1 When Using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200 Series, Thunder 9500V Series, or TagmaStore AMS/WMS series

HDLM performs load balancing between owner paths or between non-owner paths. An *owner path* is a path that passes through the channel adapter. This path is set on the *owner controller* of the storage subsystem LU. A *non-owner path* is a path that uses a channel adapter other than the owner controller (a *non-owner controller*). When you set an LU, you determine the owner controller and non-owner controller for the LU. Since the owner controller varies depending on the LU, the owner path also varies depending on the LU. To prevent performance in the entire system from deteriorating, HDLM does not perform load balancing between owner paths and non-owner paths. When some owner paths cannot be used due to a problem such as a failure, load balancing is performed among the remaining usable owner paths. When all owner paths cannot be used, load balancing is performed among the non-owner paths.

For the example in Figure 2.7, suppose that the owner controller of LU0 is CHA0. When the LU is accessed, the load is balanced between the paths (A) and (B) (that is, between owner paths). When the path (A) cannot be used due to a problem such as a failure, the LU can only be accessed via the path (B). When the paths (A) and (B) cannot be used, the load is balanced between the physical paths (C) and (D) (that is, between non-owner paths).

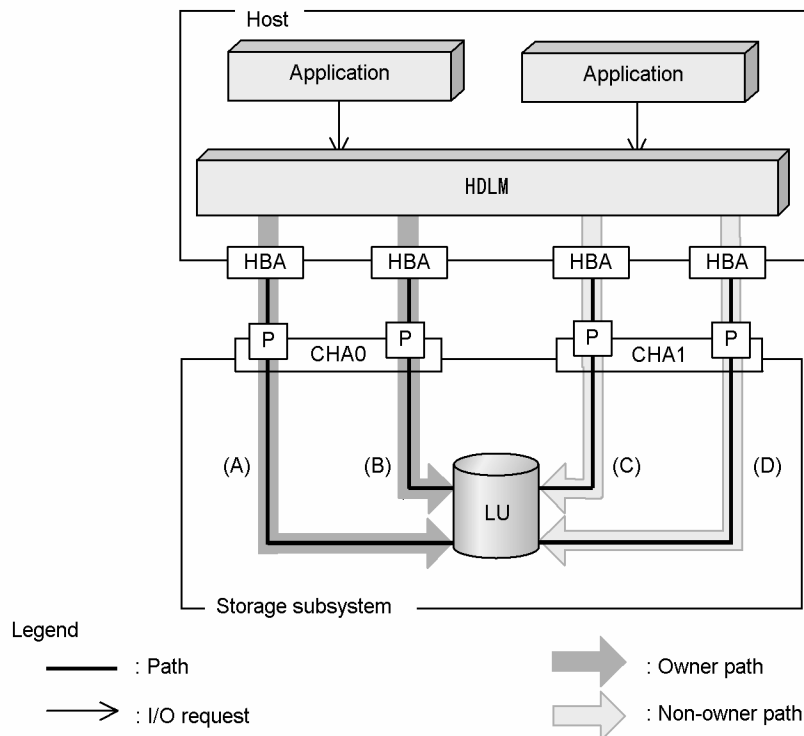


Figure 2.7 Overview of Load Balancing

2.7.1.2 When Using the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V

All the online paths are owner paths. Therefore, for the example in Figure 2.7, when the LU is accessed, the load is balanced among the paths (A), (B), (C), and (D). When one of the paths cannot be used due to a problem such as a failure, the load is balanced among the remaining paths.

2.7.2 Algorithms for Load Balancing

HDLM has the following two types of load balancing:

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

Table 2.4 describes the type of load balancing (round robin and extended round robin) for each I/O operation type.

Table 2.4 Algorithms for Load Balancing

Algorithm	For sequential access	For random access
Round robin	<ul style="list-style-type: none"> ▪ After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path. ▪ The storage subsystem cache might not be fully usable. ▪ When multiple applications that request sequential access are run concurrently, we recommend that you use the round robin algorithm in order to distribute I/Os across multiple paths.# 	After an I/O operation is issued to a path once or a certain number of times, the path is switched to the next path.
Extended round robin	<ul style="list-style-type: none"> ▪ After an I/O operation is issued to a path a certain number of times in succession, the path is switched to the next path. If sequential access is switched to random access before an I/O operation is issued to a path a certain number of times, the path is switched to the next path when sequential access is switched to random access. ▪ The storage subsystem cache can be used. ▪ When you execute only a single application that requests sequential access, such as a batch job running at night, we recommend that you use the extended round robin algorithm.# 	

#

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

You can specify the load balancing function by the `dlmcmd` command's `set` operation. For details on the `set` operation, see 6.6.

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

A path is not switched for the consecutive I/O operations from VxFS, regardless of the type of load balancing.

2.8 Failover and Failback Using Path Switching

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

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

Two types of failover and failback are available:

- Automatic path switching
- Manual path switching

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

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

For details on the `offline` operation, see 6.4.

For details on path statuses and the status transitions, see 2.8.3.

Note: When using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series make sure that you set the data share mode to **ON (Used)**.

For details on the data share mode, see the manual for Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series.

2.8.1 Automatic Path Switching

The following describes the automatic failover and automatic failback functionalities that automatically switch a path.

2.8.1.1 Automatic Failover

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

Critical

A fatal error that may stop the system.

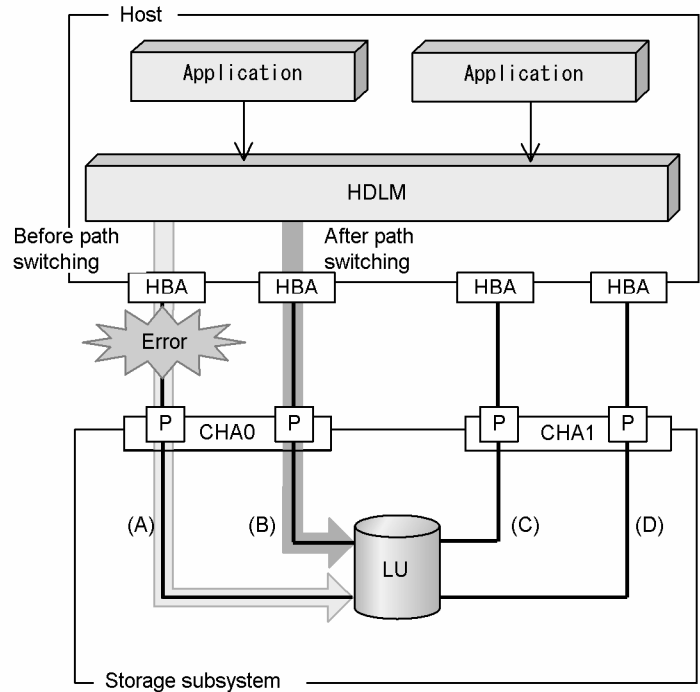
Error

A high-risk error that can be avoided by using failover or other countermeasures.

For details on error levels, see 2.11.2.

When the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series is being used, HDLM selects the switching destination from the paths that access the same LU, in the order of owner paths and non-owner paths. For example, in Figure 2.8, the owner controller of LU is CHA0, and access to the LU is made only via the path (A). After the access path is placed offline, the first candidate for the switching destination is the path (B) and the second candidate is the path (C) or (D).

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



Legend

— : Path

- - - : I/O request

→ : Path before switching

→ : Path after switching

Figure 2.8 Path Switching

2.8.1.2 Automatic Failback

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

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

When using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series, HDLM selects the path to use from online owner paths, and then from online non-owner paths. Therefore, if an owner path recovers from an error and HDLM automatically places the recovered path online while any non-owner path is in use, the path to use is switched to the owner path.

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

When intermittent errors[#] occur in paths, the path status may frequently alternate between the online and offline status if you are using automatic failback, so the I/O performance might deteriorate. In such a case, if there is a path in which an intermittent error might be occurring, we recommend that you set up intermittent error monitoring to remove that path from those subject to automatic failback.

You can specify the automatic failback function or intermittent error by the `dlncmgr` command's `set` operation. For details on the `set` operation, see 6.6.

#

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

2.8.2 Manual Path Switching

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

You can manually place a path online or offline in the following ways:

- Execute the `dlncmgr` command's `online` or `offline` operation.
For details on the `online` operation, see 6.5. For details on the `offline` operation, see 6.4.

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

HDLM selects the switching destination path the same way as for automatic path switching.

When using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series, HDLM selects the switching destination path from owner paths and then from non-owner paths. When the Lightning 9900 Series, Lightning 9900V, TagmaStore USP or Universal Storage Platform V is being used, all paths that access the same LU are candidates for the switching destination path. All other paths that run through the same path are switched.

Executing the `online` operation places the offline path online. For details on the `online` operation, see 6.5. After the path status is changed to online (by using the Path Management window or by executing the `online` operation), HDLM selects the path to use in the same way as for automatic path switching. When using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series, HDLM selects the path to use from online owner paths, and then from online non-owner paths. When the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP or Universal Storage Platform V is being used, since all the paths are owner paths, the path to use is not switched even if you change the path status to online by using the `online` operation.

2.8.3 Path Status Transition

Each of the online and offline statuses described in 2.8 is further subdivided into two statuses. The following explains the two online path statuses and the two offline statuses.

2.8.3.1 The Online Path Status

The online path statuses are as follows:

- `Online`

I/O can be issued normally.

- `Online(E)`

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

If none of the paths accessing a single LU are in the `Online` status, one of the paths is changed to the `Online(E)` status. This ensures that the LU can be accessed, by making sure that all paths are not offline.

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

2.8.3.2 The Offline Path Status

The offline path statuses are as follows:

- `Offline(C)`

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

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

- `Offline(E)`

The status in which I/O cannot be performed because an error occurred in the path.

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

2.8.3.3 Status Transitions of a Path

Figure 2.9 shows the status transitions of a path.

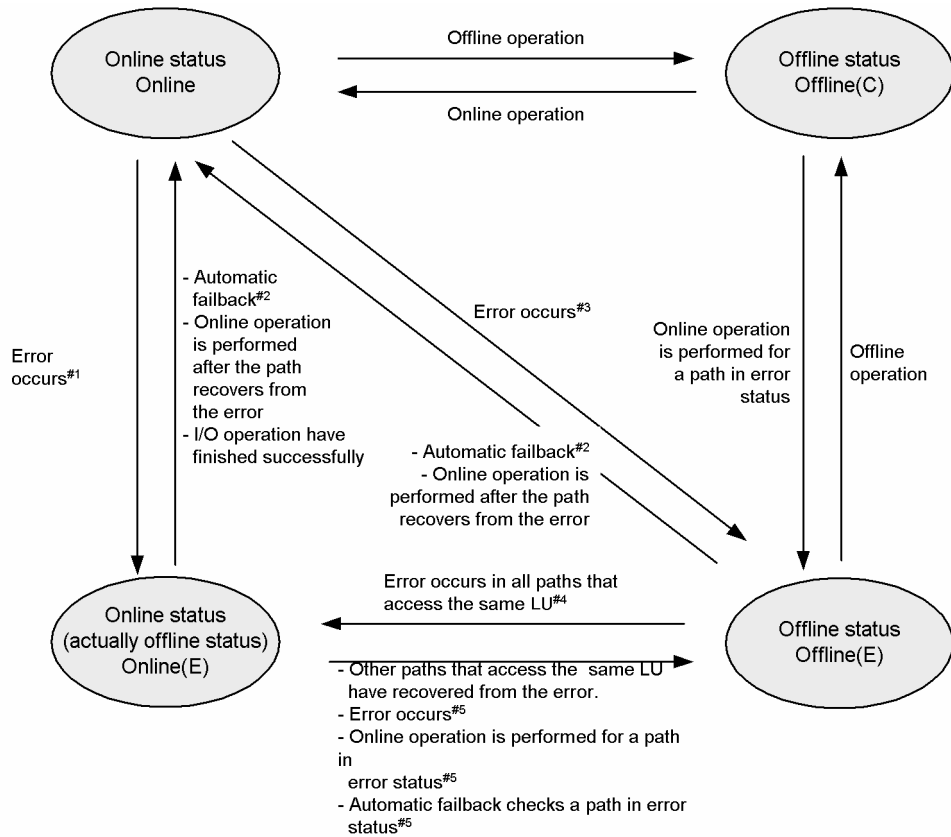


Figure 2.9 Path Status Transitions

Legend:

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

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

#1

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

#2

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

- All the paths connected to an LU are `Online(E)`, `Offline(E)`, or `Offline(C)`.
- All the paths connected to an LU have been determined to have an intermittent error.
- The processing of continuous I/O operations issued to an LU is successful.

#3

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

#4

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

#5

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

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

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

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

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

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

2.9 Monitoring Intermittent Errors (Functionality When Automatic Failback Is Used)

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

We recommend that intermittent error monitoring be used along with automatic failback.

With intermittent error monitoring, a path in which an error occurs a specified number of times within a specified interval is determined to have an intermittent error. The path where an intermittent error occurs has an error status until the user places the path online. Failback is not performed for the path. This status is called *not subject to auto failback*.

2.9.1 Checking Intermittent Errors

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

For details on the `view` operation, see 6.7.

2.9.2 Setting Up Intermittent Error Monitoring

When you use the intermittent error functionality, you can enable or disable the functionality. If you enable the functionality, specify the monitoring conditions: the error monitoring interval, and the number of times that the error is to occur. If an error occurs in a path the specified number of times within the specified error monitoring interval, the system determines that the path has an intermittent error. For example, if you specify 30 for the error monitoring interval and 3 for the number of times that the error is to occur, the path is determined to have an intermittent error if an error occurs 3 or more times in 30 minutes.

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

Intermittent error monitoring can be used only when automatic failback is enabled. The setting value depends on the setting value for automatic failback. For details on how to set up the setting values, see 6.6.

2.9.3 Actions for Intermittent Error Monitoring

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

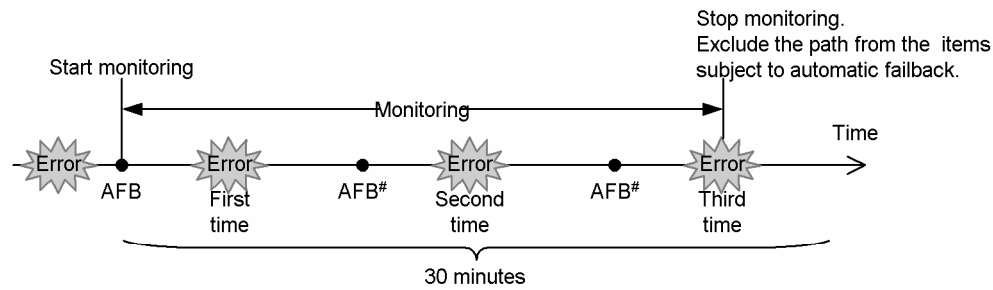
This subsection describes the following actions for intermittent error monitoring:

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

2.9.3.1 When an Intermittent Error Occurs

When an error occurs in a path the specified number of times within the specified interval, the error monitoring finishes, the path is determined to have an intermittent error, and then the path is removed from those items subject to automatic failback. The path that is removed from the paths that are subject to automatic failback has an error status until the `online` operation is performed properly. However, if the path satisfies certain conditions, it will be subject to automatic failover and change to online (`Online`). For details on the conditions, see Figure 2.9.

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



(Legend)

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

#

This includes online operation performed by a user.

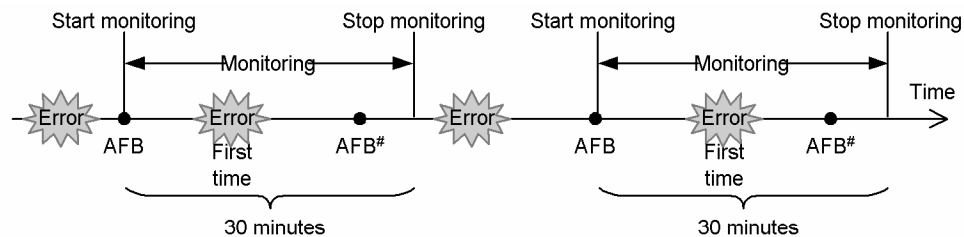
Figure 2.10 Action When an Intermittent Error Occurs in the Path

2.9.3.2 When an Intermittent Error Does Not Occur

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

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

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



(Legend)

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

#

This includes online operation performed by a user.

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

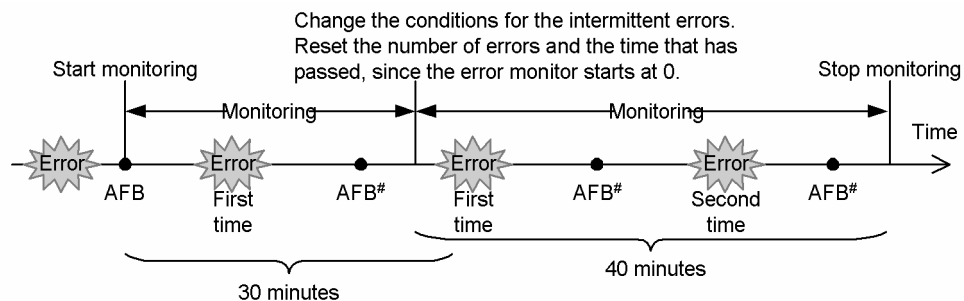
The number of times that the error is to occur is counted when an error occurs. As shown in Figure 2.11, normally the number of times that the error is to occur is counted each time an error occurs after the path is recovered online by automatic failback during intermittent error monitoring. However, if all the paths connected to the LU are in Offline(E), Online(E), or Offline(C) status due to disconnection of the paths or other reasons, the path is not recovered online by automatic failback. If I/O operations are continuously issued to such a LU, the number of times that the error is to occur might be counted even if the path is not placed online. If the number of times that the error is to occur reaches the specified value, the path is determined to have an intermittent error. In such a case, remove the cause of the error, and then manually place the path online.

2.9.3.3 When the Conditions for the Intermittent Error Are Changed During Monitoring of Intermittent Errors

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

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

Figure 2.12 shows the action for intermittent error monitoring when the conditions for an intermittent error are changed during error monitoring. In this example, the conditions have been changed from 3 or more errors in 30 minutes, to 3 or more errors in 40 minutes. The events occurring in one path are written on the time arrow.



(Legend)

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

#

This includes online operation performed by a user.

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

2.9.4 When User Operations Change the Intermittent Error Information

The following might be reset when the user changes the values set for an intermittent error or the path status: the number of errors that are counted during error monitoring, the time that has passed since error monitoring started, and the information about whether an intermittent error occurs (the path has been removed from those paths subject to automatic failback). Table 2.5 lists whether the above items are reset.

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

Table 2.5 When User Operations Change the Intermittent Error Information

User operation		Number of errors and time passed since error monitoring started	Information about paths not subject to automatic failback
Changing the setting for intermittent error monitoring	Setting <code>off</code>	Reset	Reset ^{#1}
	Changing the conditions for an intermittent error during intermittent error monitoring	Reset ^{#2}	Inherit
	Setting <code>on</code> during intermittent error monitoring by executing the <code>set</code> operation (the conditions for the intermittent error monitoring are not changed)		
	Changing the setting for intermittent error monitoring to outside the intermittent error monitoring.	(Not applicable) (Not counted.)	Inherit
Changing the automatic failback settings	Setting <code>off</code>	Reset	Reset
Changing the path status	Placing the path Offline(C)	Reset	Reset
	Placing the path Online outside the intermittent error monitoring	(Not applicable) (Not counted.)	Reset
	Placing the path Online during intermittent error monitoring	Inherit	(Not applicable)(If a path has been removed from the paths subject to automatic monitoring, that path is not monitored.)
Restarting the HDLM manager		Reset ^{#3}	Inherit
Restarting the host		Reset	Reset

#1

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

#2

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

#3

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

2.10 Detecting Errors by Using Path Health Checking

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

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

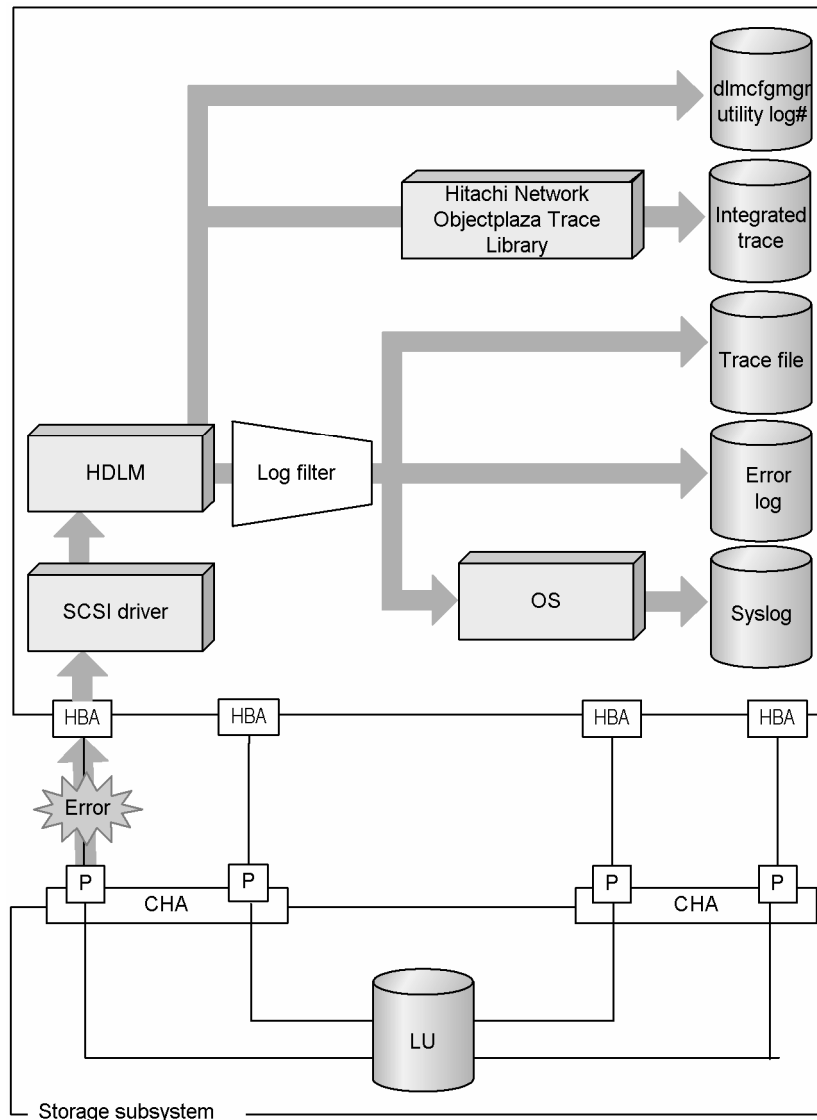
For example, in a normal state, I/O is not performed on the paths of the standby host in the cluster configuration or on the non-owner paths (that is, some of the paths that access the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, and TagmaStore AMS/WMS series storage subsystem). Because of this, for the standby host or a host connected to non-owner paths, we recommend that you use path health checking to detect errors. This enables the system to use the most recent path-status information when selecting the switching destination.

You can configure checking by executing the `dlnmgr` command's `set` operation. For details on the `set` operation, see 6.6.

2.11 Error Management

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

Figure 2.13 shows the data flow when collecting error information.



#:
dlmcfmgr utility: HDLM-configuration definition utility (dlmcfmgr)

Legend
 — : Path ➔ : Flow of error information

Figure 2.13 Data Flow When Collecting Error Information

Logs might be collected in layers lower than HDLM, such as for the SCSI driver. For details on the logs, see the HP-UX documentation.

2.11.1 Types of Logs Collected

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

Table 2.6 describes the types of error information.

Table 2.6 Types of Error Information

Log name	Description	Output destination
Integrated trace file	Operation logs of the HDLM command are collected.	The default file path is <code>/var/opt/hitachi/HNTRLib2/spool/hntr2[1-16].log</code> . To specify the output destination directory and the file prefix for the integrated trace file, use a utility of Hitachi Network Objectplaza Trace Library (HNTRLib2).
Trace file	Trace information on the HDLM manager is collected for the level set by the user. If an error occurs, you might need to change the settings to collect trace information.	The trace file name is <code>/var/opt/DynamicLinkManager/log/hdlmtr[1-64].log</code>
Error log	Error information for the user-defined level is collected from detected errors. By default, HDLM collects all detected error information.	HDLM Manager logs: <code>/var/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code> HDLM remote access interface logs: <code>/var/opt/DynamicLinkManager/log/dlmwebagent[1-n].log</code> The value <i>n</i> depends on the setting in the file <code>dlmwebagent.properties</code> .
<i>HDLM-configuration definition utility (dlmcfgmgr) log</i>	Logs are collected when the <code>dlmcfgmgr</code> utility and <code>dlmdefpath</code> utility executed.	The following is the log file name. <ul style="list-style-type: none"> <code>/var/opt/DynamicLinkManager/log/dlmcfgmgr.log</code>
Syslog	The HDLM messages on or above the level set by the user with <code>syslogd</code> settings file are collected.# We recommend that you configure the system so that information at the Information level and higher is output. Syslogs can be checked using a text editor.	The default file path is <code>/var/adm/syslog/syslog.log</code> . The syslog file path is specified in the file <code>/etc/syslog.conf</code> . For details, see the HP-UX documentation.

#

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

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

For details on error levels, see 2.11.2.

2.11.2 Filtering of Error Information

Errors that HDLM detects are classified into error levels. Table 2.7 lists the error levels, in order of adverse effect on the system.

Table 2.7 Error Levels

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

Error information is filtered according to the 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 8.1.1.

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

Note that all the facilities when HDLM outputs messages in syslog are LOG_USER.

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

Collection levels for error logs

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

Collection levels for log information in trace files:

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

For details on how to set the collection level, see 3.7.2.

2.11.3 Collecting Error Information Using the Utility for Collecting HDLM Error Information (DLMgetras)

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

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

For details on the `DLMgetras` utility, see 7.2.

2.12 Cluster Support

HDLM is also available for cluster configurations.

For details on cluster software supported by HDLM, and the supported HP-UX version, see Table 3.2 in 3.1.3.2 and Table 3.3 in 3.1.3.3. You can use the load balancing function when these cluster software products are used.

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

The details of host switching depend on the application.

Note:

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
```

Chapter 3 Creating an HDLM Environment

This chapter explains the steps involved in setting up an HDLM environment and in canceling the environment settings.

You must always perform HDLM installation and function setup. For volume groups, perform setup to conform to your operating environment.

- 3.1 System Requirements
- 3.1.6 Flow for Creating an HDLM Environment
- 3.3 HDLM installation types
- 3.4 Notes on creating an HDLM environment
- 3.5 Installing HDLM
- 3.6 Checking the Path Configuration
- 3.7 Setting Up HDLM
- 3.8 Setting up Integrated traces
- 3.9 Creating a File System (When LVM Is Not Used)
- 3.10 Creating a Volume Group
- 3.11 Sharing a Volume Group
- 3.12 Migrating a Volume Group (From SCSI Devices to the HDLM Device)
- 3.13 Canceling Setup of HDLM
- 3.14 Operations on HDLM Management-Target Devices
- 3.15 Migrating a Volume Group (From the HDLM Device to SCSI Devices)
- 3.16 Uninstalling HDLM
- 3.17 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)
- 3.18 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib)

3.1 System Requirements

Check the following before installing HDLM.

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

3.1.1 Applicable Models

3.1.1.1 Applicable Hosts

You can install HDLM on a host that is running the OS described in 3.1.2.1.

3.1.1.2 Applicable Host Bus Adapters (HBAs)

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

3.1.1.3 Applicable Storage Subsystems

HDLM supports the following storage subsystems:

Freedom Storage 5700E/Freedom Storage 5800/Thunder 9200/Thunder 9500V Series/TagmaStore AMS/TagmaStore WMS, Lightning 9900 Series/Lightning 9900V Series/TagmaStore USP/Universal Storage Platform V

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

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

3.1.2 Applicable OSs

3.1.2.1 Management Target Host

You can install HDLM on the host that is running the OS listed in Table 3.1.

Table 3.1 Applicable OSs for Management Target Hosts

OS	Patch information#
HP-UX 11.0 (64-bit kernel mode only)	<ul style="list-style-type: none">▪ XSWGR1100 B.11.00.47.08 or later▪ XSWHWCR1100 B.11.00.54.6, or HWE1100 B.11.00.0112.7 or later▪ QPK1100 B.11.00.54.7 or later▪ PHCO_27672 or later▪ PHKL_27003 or later▪ PHSS_26972 or later

OS	Patch information#
HP-UX 11i V1.0 (64-bit kernel mode only)	<ul style="list-style-type: none"> ▪ BUNDLE11i B.11.11.0102.2 or later ▪ HWEnable11i B.11.11.0203.5 or later ▪ GOLDBASE11i B.11.11.0112.6 or later ▪ PHCO_27671 or later ▪ PHKL_27579 or later ▪ PHSS_22535 or later ▪ PHSS_26971 or later
HP-UX 11i V2.0, 2004-09	<ul style="list-style-type: none"> ▪ PHCO_33135 or later (for PA-RISC)
HP-UX 11i V2.0, 2005-05	
HP-UX 11i V2.0, 2005-12	
HP-UX 11i V2.0, 2006-03	
HP-UX 11i V2.0, 2006-06	
HP-UX 11i V2.0, 2006-09	

#

When you installed an OS or patches, make sure the information of the installed patches inherits the information of the patches below, because the components of these patches might have changed:

- For HP-UX11.0
 - XSWG1100 B.11.00.47.08 (11.00 Core OS, 2001-09)
 - XSWHWCR1100 B.11.00.54.6 (HP-UX 11.0 Support Plus, 2001-09)
 - HWE1100 B.11.00.0112.7 (HP-UX 11.0 Support Plus, 2001-12)
 - QPK1100 B.11.00.54.7 (HP-UX 11.0 Support Plus, 2001-09)
- For HP-UX11i V1.0
 - BUNDLE11i B.11.11.0102.2 (HP-UX 11i operating environment, 2001-09)
 - HWEnable11i B.11.11.0203.5 (HP-UX 11i Support Plus, 2001-09)
 - GOLDBASE11i B.11.11.0112.6 (HP-UX 11i Support Plus, 2001-09)

3.1.3 Related Programs

This subsection lists and describes HDLM-related programs.

3.1.3.1 When You Use a Volume Manager

HDLM supports the HP-UX standard logical volume manager (LVM). VERITAS Volume Manager (VxVM) is not supported.

3.1.3.2 When You Configure a Cluster

Table 3.2 lists the related programs used when configuring a cluster.

Table 3.2 Related Programs Used When Configuring a Cluster

OS	Related programs
HP-UX 11.0	MC/ServiceGuard A.11.13 or A.11.14 #
HP-UX 11i V1.0	MC/ServiceGuard A.11.13, A.11.14, or A.11.15#
	Serviceguard A.11.16
HP-UX 11i V2.0(IPF)	Serviceguard A.11.16 or A.11.17
HP-UX 11i V2.0 (PA-RISC)	Serviceguard A.11.16 or A.11.17

#

Lock disks for MC/ServiceGuard A.11.13, A.11.14, and A.11.15 are not supported.

3.1.3.3 When You Configure Oracle RAC

Table 3.3 lists the related programs used when configuring Oracle RAC.

Table 3.3 Related Programs Used When Configuring Oracle RAC

OS	Related programs
HP-UX 11.0	MC/ServiceGuard A.11.13#1 ServiceGuard OPS Edition A.11.13 Oracle9i RAC 9.0.1
HP-UX 11i V1.0	MC/ServiceGuard A.11.13#1 ServiceGuard OPS Edition A.11.13 Oracle9i RAC 9.0.1
	MC/ServiceGuard A.11.15#1 ServiceGuard Extension for RAC A.11.15 Oracle9i RAC 9.2.0.1.0
	Serviceguard A.11.16 Serviceguard Extension for RAC A.11.16 Oracle9i RAC 9.2.0.1.0 or 9.2.0.5.0
	Serviceguard A.11.16 Serviceguard Extension for RAC A.11.16 Oracle RAC 10g 10.1.0.3.0#2
HP-UX 11i V2.0 (IPF)	Serviceguard A.11.16 Serviceguard Extension for RAC A.11.16 Oracle9i RAC 9.2.0.6.0

OS	Related programs
	Serviceguard A.11.16 Serviceguard Extension for RAC A.11.16 Oracle Clusterware 10.2.0.1.0 Oracle Database 10g Release 2 for HP-UX Itanium 10.2.0.1.0#2
	Serviceguard A.11.17.00 Serviceguard Extension for RAC A.11.17.00 Oracle Clusterware 10.2.0.1.0 Oracle Database 10g Release 2 for HP-UX Itanium 10.2.0.1.0 Oracle Patch Set Release for HP-UX Itanium 10.2.0.2.0
	Oracle Clusterware 10.2.0.1.0 Oracle Database 10g Release 2 for HP-UX Itanium 10.2.0.1.0 Oracle Patch Set Release for HP-UX Itanium 10.2.0.2.0
HP-UX 11i V2.0 (PA-RISC)	Serviceguard A.11.16 Serviceguard Extension for RAC A.11.16 Oracle Clusterware 10.2.0.1.0 Oracle Database 10g Release 2 for HP-UX PA-RISC(64bit) 10.2.0.1.0#2

#1

Lock disks for MC/ServiceGuard A.11.13, A.11.14, and A.11.15 are not supported.

#2

Configurations using Automatic Storage Management (ASM) and Oracle Cluster Ready Services (CRS) are not supported.

3.1.3.4 When You Exchange Data by Using Intermediate Volumes Managed by Hitachi

RapidXchange

Table 3.4 lists the related programs used when exchanging data by intermediate volumes managed by Hitachi RapidXchange^{#1#2}.

#1

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

#2

Connected storage subsystems: Lightning 9900 Series, Lightning 9900V Series, or TagmaStore USP

Table 3.4 Related Programs Used When Exchanging Data Managed by Hitachi RapidXchange

OS	Connected storage subsystems	Related program
----	------------------------------	-----------------

HP-UX 11i V1.0	Lightning 9900 Series	File Access Library and File Conversion Utility (FAL/FCU) 01-02-56/20 or later
	Lightning 9900V Series	File Access Library and File Conversion Utility (FAL/FCU) 01-03-56/20 or later
	TagmaStore USP	File Access Library and File Conversion Utility (FAL/FCU) 01-04-61/21 or later
HP-UX 11i V2.0 [#]	Lightning 9900 Series	File Access Library and File Conversion Utility (FAL/FCU) 01-02-64/22 or later
	Lightning 9900V Series	File Access Library and File Conversion Utility (FAL/FCU) 01-03-64/22 or later
	TagmaStore USP	File Access Library and File Conversion Utility (FAL/FCU) 01-04-64/22 or later

#

Only the IPF version is available.

3.1.4 Memory Requirements and Disk Space Requirements

This subsection explains the memory and disk space requirements.

3.1.4.1 Memory Requirements

You can calculate the memory requirements for the host by using the following formula:

$$8 \text{ MB} + (\text{number-of-paths} \times 4 / 1,024) \text{ MB} + (\text{system-buffer-cache-size} / 4) \text{ MB}$$

Note:

HDLM uses about 1 KB of memory whenever an I/O is issued, but this memory is freed after the I/O finishes.

In addition, if memory is insufficient, the I/O stops until sufficient memory is made available.

3.1.4.2 Disk Space Requirements

This subsection explains the disk space requirements for a host.

- Management Target Host

Table 3.5 lists the disk space requirements for a host.

Table 3.5 Disk Space Requirements for a Host

Directory	Disk space requirements
/etc	7MB
/opt	200 MB
/sbin	500 KB

/stand	Approximately twice the disk space of the kernel file (/stand/vmunix) size is temporarily required when executing the dlmdefpath utility.
/usr	2 MB
/var	$p \text{ MB}^{\#1} + q \text{ MB}^{\#2} + 13\text{MB}$ Besides the disk space listed above, 200 MB of disk space is temporarily required during HDLM installation.

#1

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

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

where:

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

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

#2

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

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

where:

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

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

3.1.5 Number of Paths Guaranteed by HDLM

Table 3.6 lists the number of LUs, the number of paths for an individual LU, and the total number of paths, guaranteed by HDLM.

Table 3.6 Number of paths guaranteed by HDLM

Item	Maximum value
Number of LUs	1024
Number of paths for an individual LU	64
Total number of paths	4096

3.1.6 Values to Be Set for the Prerequisite Kernel Parameters

You need to set values for the kernel parameters maxssiz and maxdsiz according to the following Table 3-7:

Table 3.7 Default values and setting values

Parameter name	Default value	Setting value
----------------	---------------	---------------

maxssiz	8 MB	5 MB or more
maxdsiz	<ul style="list-style-type: none"> ▪ HP-UX 11.0: 64 MB ▪ HP-UX 11i V1.0: 256 MB ▪ HP-UX 11i V2.0: 1 GB 	128 MB or more

3.2 Flow for Creating an HDLM Environment

Set up the environment to use HDLM as follows.

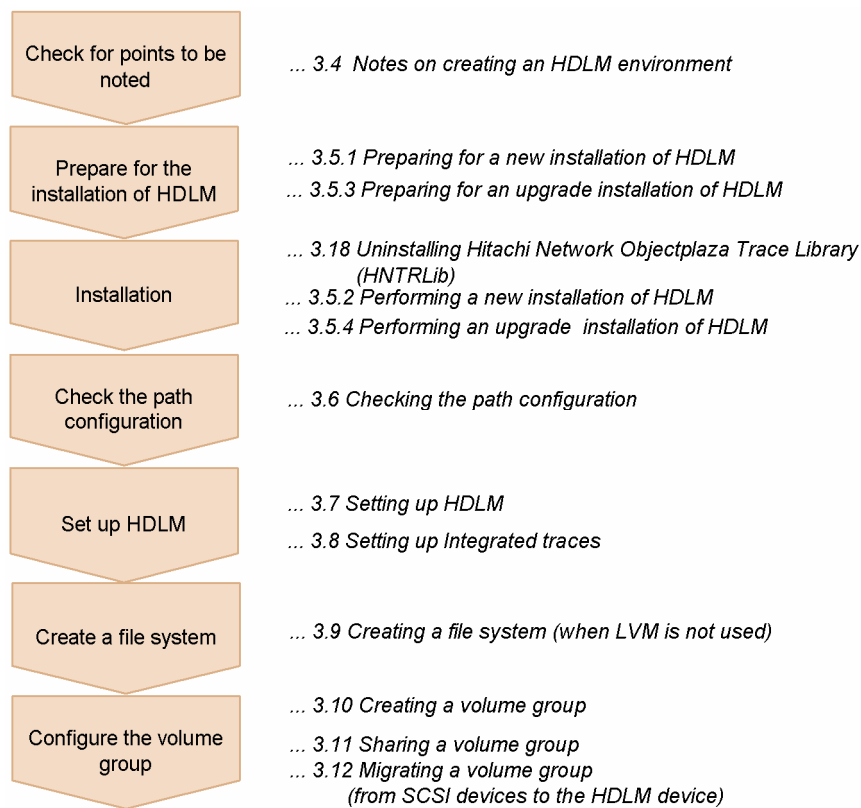


Figure 3.1 Flow of HDLM Environment Setup

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

Upgrade installation of HDLM:

Installing a newer version than the existing version without uninstalling the existing 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 uninstalling that version is called a *re-installation of HDLM*.

3.4 Notes on creating an HDLM environment

Be sure to note the following when installing HDLM.

For points to be noted during operation, see 4.1.

- Install HDLM in a boot disk.
- Make sure that the following directories exist in the same file system of the machine where HDLM is to be installed: `/etc/opt`, `/etc/opt/DynamicLinkManager`, `/` (root directory)
- To install HDLM, use commands described in the manual. HDLM does not support installation the `sam` command and the installation using the GUI.
- When installing HDLM on a host where a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during installation. Also, do not install HDLM while executing any of the following Device Manager Agent commands:

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

For details about Device Manager Agent commands, see the manual *HiCommand Device Manager Agent Installation Guide*.

- You can perform an upgrade installation of HDLM 5.9 onto HDLM 04-00 to 5.9.
- Entering a license key or license key file is necessary in the following cases:
 - When performing a new installation of HDLM
 - When performing an upgrade installation from version of HDLM earlier than 05-40 to HDLM 5.9
 - When the license has expired

When you use a license key, do not cancel the installation after you enter the license key. When you use a license key file, do not cancel installation. If the license key has expired, you can also use the HDLM command's `set -lic` operation to update the license. The license key specified in the license key file or the type of input license key determines the expiration of the license key. For details on license key types and the `set` operation, see 6.6 in Chapter 6.

- When an upgrade installation of HDLM is performed, the new installation inherits the existing configuration definitions, non-HDLM-managed device definitions, HDLM executing environment information, license information, and log files. These are stored in the `/etc/opt/DynamicLinkManager` and `/var/opt/DynamicLinkManager` directories.

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

When you perform an upgrade installation from HDLM 04-00

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

Integrated trace files after upgrade:

`/var/opt/hitachi/HNTRLlib2/spool/hntr2n.log` (*n* indicates a file number)

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

When you perform an upgrade installation form HDLM version 05-02 or later (but earlier than version 5.6).

Trace files before upgrade: `/var/opt/hitachi/HNTRLlib2/spool/hntr2n.log` (*n* indicates a file number)

Integrated trace files after upgrade:

`/var/opt/hitachi/HNTRLlib2/spool/hntr2n.log` (*n* indicates a file number)

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

- When an upgrade installation of HDLM 5.9 is performed on a host that contains HDLM 04-00, Hitachi Network Objectplaza Trace Library (HNTRLlib) that was installed with HDLM 04-00 remains. You cannot uninstall HNTRLlib if programs other than HDLM are using it. Before you uninstall HNTRLlib, see the documentations for the programs installed in the host to check whether the programs use HNTRLlib. For details about how to uninstall HNTRLlib, see 3.18.
- If the installation is canceled before it finishes, check whether the `/var/opt/DynamicLinkManager` directory exists. If the `/var/opt/DynamicLinkManager` directory exists, execute the following command to delete it.

```
# rm -rf /var/opt/DynamicLinkManager
```

If you canceled an upgrade installation before completion, do not delete this directory.

- HDLM can be used with the default kernel (`/stand/vmunix`) only. Make sure that the kernel is `/stand/vmunix`.
- Activate the storage subsystems before starting the host so that HP-UX can detect them.
- You must not change vendor ID and product ID of the storage subsystem. If you change these IDs, HDLM cannot recognize the storage subsystem.
- When you restart the host, reference the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file and check the message corresponding to the time when the host is started.
- Before mirroring a disk managed by HDLM with the boot disk, exclude that device from the HDLM management targets.

- HP-UX provides the `/etc/inittab` script file for the boot init process. In this script, entries added by the OS or HDLM# have been defined.

If you mistakenly modify or delete the entries added by HDLM, HDLM might become inoperative.

If you edited the `/etc/inittab` file, make sure that HDLM and upper-level application programs work normally. If not, return the contents of the `/etc/inittab` file to the pre-edit state.

```
#
```

The ID of all the entries added by HDLM is `hdlm`.

3.5 Installing HDLM

When you install HDLM, Hitachi Network Objectplaza Trace Library will also be installed. The file path of the integrated trace information file of Hitachi Network Objectplaza Trace Library is `/var/opt/hitachi/HNTRLlib2/spool/hntr2n.log`, where *n* is the number of the integrated trace information file.

3.5.1 Preparing for a new installation of HDLM

This subsection shows the preparation tasks for a new installation of HDLM. They include backing up the HDLM management-target devices, applying patches to HP-UX, and performing hardware setup.

3.5.1.1 Perform Operations for Devices to Be Managed by HDLM

Perform the following procedure when you have already defined SCSI devices and are using the devices to be managed by HDLM.

1. Terminate the processes of all applications that are accessing devices to be managed by HDLM.
2. Back up all HDLM management-target devices to tapes or other media, as required.
3. Unmount the devices.

If the devices to be managed by HDLM are mounted, unmount them as follows:

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

```
# mount -p
```

The current settings will be output as shown in Figure 3.2.

```

# mount -p
/dev/vg00/lvol3 / vxfs log 0 1
/dev/vg00/lvol11 /stand hfs defaults 0 0
/dev/vg00/lvol18 /var vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol15 /usr vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol14 /tmp vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol17 /opt vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol16 /home vxfs delaylog,nodatainlog 0 0
/dev/dsk/c8t0d0 /mntpt vxfs delaylog,nodatainlog 0 0
#

```

Figure 3.2 Execution Result Example of the mount -p Command (preparations for a new installation of HDLM)

The following example manages the device, which is showed in the shaded portion of Figure 3.2, by using HDLM.

- Execute the following command to unmount the device.

```
# umount /mntpt
```

Note: When you are using a device to be managed by HDLM as a volume group, install HDLM, set up HDLM functionality, check the path configuration, and then follow the procedure in 3.12 to migrate the volume group.

3.5.1.2 Apply HP-UX patches

See the *Release Notes*, and apply patches to the HP-UX OS if necessary.

3.5.1.3 Set up the hardware

For a Fibre Channel connection, check the topology (Fabric, AL, etc.) and perform setup as appropriate.

1. Set up the storage subsystem.

For details on how to set up the storage subsystem, see the *Hardware Notes* that come with HDLM and the maintenance documentation for the storage subsystem.

2. Set up the switches.

For more on how to set up a switch, see the switch manual. This setup is not necessary if no switch is being used.

3. Set up the host bus adapter (HBA).

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

Make sure that all HBAs that are on a single host and connected to HDLM-managed devices are of the same type, and have the same HBA driver version. If you are using more than one type of HBA, paths will not be able to be switched when an error occurs.

3.5.2 Performing a New Installation of HDLM

When using HDLM in a cluster configuration, install the same version of HDLM on all of the hosts that comprise the cluster.

When you enter a license key during the installation, do not cancel installation before it finishes after you enter the license key.

To perform a new installation of HDLM:

1. Directly under `/var/tmp/`, save the license key file as `hdlm_license`.

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

The license key file will be deleted when the installation finishes. If the license key file does not exist, a message prompts you to enter a license key during installation. Enter the license key at this time.

2. Log on to HP-UX as a user with root privileges.
3. Execute the following command and check whether the device to be managed by HDLM appears.

```
# iocan -fnC disk
```

4. Insert the HDLM CD-ROM into the CD-ROM drive, and execute the following command:

```
# mount /dev/dsk/CD-ROM-device-name CD-ROM-mount-point
```

5. Execute the following command to start installing HDLM:

```
# swinstall -x ask=true -s CD-ROM-mount-point/DLManager DLManager
```

For details about using the `swinstall` command, see the HP-UX documentation.

6. Continue by following the instructions displayed on the screen.

If the license key file does not exist, a message prompts you to enter a license key during installation. Enter the license key at this time.

- When a correct license key is entered, the installation program displays a message that indicates the license was installed.
- Take care that if you enter an incorrect license key three times, installation stops.

If the installation is canceled before it finishes, check whether the `/var/opt/DynamicLinkManager` directory exists. If the directory exists, execute the following command to delete the directory.

```
# rm -rf /var/opt/DynamicLinkManager
```

7. After the HDLM installation, execute the following command to check whether the installation was successful:

```
# swlist -l product DLManager
```

When the execution result of the above command is like the following, the installation was successful. The `host1` portion may change depending on the environment.

```
# Initializing...
# Contacting target "host1"...
#
# Target: host1:/
```

```
#
DLManager      xx.xx      Dynamic Link Manager
```

8. Create a file that defines non-HDLM-managed devices.

Execute the utility for defining the HDLM configuration (`dlnmcfgmgr`) in the command line below, to automatically determine the devices that are not to be managed by HDLM and create a file that defines non-HDLM-managed disks. For details about the judge conditions, see 7.3 in Chapter 7.

```
# /sbin/dlnmcfgmgr -e > /etc/opt/DynamicLinkManager/dlmdrv.unconf
```

The definitions in this file are applied when the host is started next time. Note that a CD-ROM is a device for which automatic judgment takes time. We recommend that you explicitly specify such a device after the `-e` argument. This speeds up automatic judgment. For details about the arguments that can be specified in this command, see 7.3 in Chapter 7.

9. In a SAN boot environment, execute the commands below and check the device files specified as physical volumes in `/dev/vg00`.

The device files specified as physical volumes in `/dev/vg00` are device files corresponding to the boot disk.

```
# vdisplay -v /dev/vg00
--- Volume groups ---
VG Name                /dev/vg00
...
--- Logical volumes ---
LV Name                /dev/vg00/lvol1
...
--- Physical volumes ---
PV Name                /dev/dsk/c4t0d0
PV Name                /dev/dsk/c6t0d0      Alternate Link
PV Status              available
...
#
```

In HP-UX 11i v2.0(IPF), PV Name is displayed in the `cXtXdXsX` format.

```
PV Name                /dev/dsk/c4t0d0s2
PV Name                /dev/dsk/c6t0d0s2      Alternate Link
```

Note: In a SAN boot environment, you need to enter the names of all device files (which include the names of device files to be mirrored) that correspond to the boot disk into the file that defines non-HDLM-managed disks. If you execute the HDLM path-configuration definition utility (`dlnmdefpath`) without coding the names of the device files corresponding to the boot disk into the file that defines non-HDLM-managed disks, the system will not start.

10. If any of the following devices exist, enter them into the file that defines non-HDLM-managed disks:
 - Boot disk
 - Dump devices
 - Swap devices

- Devices containing the root file system
- MC/ServiceGuard lock devices (Except the Serviceguard A.11.16 and A.11.17.)
- Devices that need to be removed from HDLM management

Executing the `dlnmcfmgmr` utility described in step 8 does not add the above devices automatically. Therefore, you need to manually enter these devices as devices to be excluded.

The following is an example of excluding `/dev/dsk/c4t0d0` and `/dev/dsk/c6t0d0`:

```
# /sbin/dlnmcfmgmr -l /dev/dsk/c4t0d0 /dev/dsk/c6t0d0 >>
/etc/opt/DynamicLinkManager/dlnmfdrv.unconf
#
```

In a SAN boot environment, add all device files corresponding to the boot disk to the file that defines non-HDLM-managed disks. In HP-UX 11i v2.0(IPF), `PV Name` is displayed in the `cXtXdXsX` format, but in the file that defines non-HDLM-managed disks, add the device files by using the `cXtXdX` format (without `sX`).

11. Check the name of the file that defines non-HDML-managed disks.

The following is a coding example in the SAN boot environment:

```
# cat /etc/opt/DynamicLinkManager/dlnmfdrv.unconf
...
/dev/dsk/c4t0d0
/dev/dsk/c6t0d0
#
```

12. Execute the following command to restart the host so that the HDLM driver is loaded and HDLM devices are recognized:

```
# cd /
# shutdown -r
```

13. After the host is restarted, log on to HP-UX as a user with root privileges.

14. Execute the following command and check whether `S/W State` of the path managed by HDLM shows `CLAIMED`.

```
# ioscan -fnC disk
```

15. Execute the HDLM path-configuration definition utility (`dlnmdefpath`).

Respond to the utility with `y`. The host is restarted and the current path configuration definitions are applied.

The following is an example of executing the utility for HP-UX 11i v1.0:

```
# /opt/DynamicLinkManager/bin/dlnmdefpath -a
KAPL10407-I A kernel will be built. Is this OK? [y/n] : y
KAPL10411-I The current kernel will be replaced. Is this OK? [y/n] : y

KAPL10414-I The computer must be restarted to make the path configuration effective.
Would you like to restart the computer now? [y/n] :y
```

16. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart of the `dlmcfgmgr` utility displayed in the **KAPL10301-I** message:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed devices has been modified. If this message is displayed, see step 13 and execute the `dlmdefpath` utility again.

If the **KAPL10317-E** message still appears, contact your HDLM vendor or maintenance company, if you have a maintenance contract for HDLM.

17. Executes the `dlnmgr` command's `view` operation to display the status of each program.

The following shows a sample execution of this command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 9900
Number Of Elog Files   : 2
Trace Level           : 0
Trace File Size (KB)  : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback         : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive      xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver WakeupTime      ElogMem Size
Alive      xx-xx    yyyy/mm/dd hh:mm:ss 4096
HDLM Driver Ver      WakeupTime
Alive      xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
#
```

Even when cluster software is used, `Support Cluster` is blank. However, the cluster support function is operating normally.

18. From the execution result by the `view` operation, check whether the correct version of HDLM is installed.
If `HDLM Version` is `xx-xx`, the installed version of HDLM is correct. `xx-xx` is the installed version of HDLM.
19. From the execution result by the `view` operation, check whether the programs are running properly.
If `HDLM Manager`, `HDLM Alert Driver`, and `HDLM Driver` are all `Alive`, all programs are running correctly.
20. Set an environment variable that specifies the command path.

When the Bourne shell, `ksh`, or `posix-sh` is used:

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

When csh is used:

```
# setenv PATH ${PATH}:/opt/DynamicLinkManager/bin
```

When you finish installation, check the path configuration according to the procedure in 3.7.

3.5.3 Preparing for an upgrade installation of HDLM

Preparations for an upgrade installation of HDLM include the backup of devices that HDLM manages and the backup of devices to be managed by HDLM.

3.5.3.1 Perform operations for devices to be managed by HDLM

To prepare for an update installation of HDLM:

1. End the processes of all applications that are accessing HDLM-managed devices and devices to be managed by HDLM.
2. If necessary, back up the contents of the HDLM-managed devices and the devices to be managed by HDLM in tapes or other media.
3. Unmount the devices.

If the HDLM-managed devices and the devices to be managed by HDLM are mounted, unmount them as follows:

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

```
# mount -p
```

The current settings will be output as shown in Figure 3.3.

```
# mount -p
/dev/vg00/lvol13 / vxfs log 0 1
/dev/vg00/lvol11 /stand hfs defaults 0 0
/dev/vg00/lvol18 /var vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol15 /usr vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol14 /tmp vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol17 /opt vxfs delaylog,nodatainlog 0 0
/dev/vg00/lvol16 /home vxfs delaylog,nodatainlog 0 0
/dev/dsk/c8t0d0 /mntpt vxfs delaylog,nodatainlog 0 0
#
```

Figure 3.3 Execution result example of the mount -p command (preparations for an upgrade installation of HDLM)

The shaded portion shows the device to be managed by HDLM.

- Execute the following command to unmount the device.

```
# umount /mntpt
```

Note: When you are using a device to be managed by HDLM as a volume group, install HDLM, set up HDLM functionality, check the path configuration, and then follow the procedure in 3.12 to migrate the volume group.

3.5.3.2 Stopping applications

HDLM manager stops during an upgrade installation, so stop any applications that require HDLM manager operations, such as a log output operation.

3.5.4 Performing an upgrade Installation of HDLM

This subsection describes an upgrade installation of HDLM. Adding parameters to the command to be executed during the upgrade installation procedure described below enables a re-installation of HDLM.

When you perform an upgrade installation of HDLM 5.9 on a host on which HDLM 04-00 is already installed, HNTRLlib that was installed with HDLM 04-00 will remain. If no other programs are using HNTRLlib, uninstall this HNTRLlib according to the procedure described in 3.18.

When an upgrade installation or re-installation is performed, the information about the definition of non-HDML-managed devices is inherited. You do not need to re-create the file that defines non-HDLM-managed devices.

When using HDLM in a cluster configuration, install the same version of HDLM on all of the hosts that comprise the cluster.

When you upgrade HDLM before version 05-40 to version 5.9, or the license is expired, you need to enter a proper license key file or license key. When you use a license key file, do not cancel installation before it finishes. When you use a license key, do not cancel the installation before it finishes after you enter the license key.

Note:

- During an upgrade installation, no error logs are output because HDLM manager stops. Also, you can no longer set up HDLM functions. After upgrade installation finishes successfully, immediately restart the host.
- Before upgrading the OS, uninstall HDLM. After upgrading the OS, perform a new installation of HDLM. (When installing HDML, use the version of HDLM corresponding to the upgraded OS.) If you uninstall HDLM after upgrading the OS, added LUs might not be recognized even after installing HDLM. In such a case, you might have to perform a new installation of the OS.
- You can perform a re-installation of HDLM instead of an upgrade installation by using the command described in step 4.

If you uninstall HDLM after upgrading the OS, added LUs might not be recognized after re-installing HDLM. In such a case, you might have to perform a new installation of the OS.

To perform an upgrade installation or re-installation of HDLM:

1. Directly under `/var/tmp/`, save the license key file as `hdlm_license`.

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

If the license key file does not exist, a message prompts you to enter a license key during installation. Enter the license key at this time.

2. Log on to HP-UX as a user with root privileges.
3. Insert the HDLM CD-ROM into the CD-ROM drive, and execute the following command:

```
# mount /dev/dsk/CD-ROM-device-name CD-ROM-mount-point
```

4. Execute the `swinstall` command to perform an upgrade installation or re-installation of HDLM.

– When performing an upgrade installation of HDLM:

```
# swinstall -x ask=true -s CD-ROM-mount-point/DLManager DLManager
```

– When performing a re-installation of HDLM:

```
# swinstall -x ask=true -x reinstall=true -s CD-ROM-mount-point/DLManager DLManager
```

For details about the points you must note when executing the `swinstall` command, see the HP-UX documentation.

5. If the license key file is not found, follow the message about a license key displayed during installation.

The displayed message differs depending on the version of existing HDLM or license status (expired or not). The following shows the messages that may be displayed:

– When installing on a host that contains a version of HDLM earlier than 5.4:

After the KAPL09114-I message appears that indicates the license information file was not found, you will be prompted to enter a license key. Enter a license key correctly. If you enter an incorrect license key three times, the installation will be canceled. When a correct license key is entered, a message appears that indicates a license was installed.

– When installing on a host that contains HDLM version 5.4 or later (when the license is valid):

A message that indicates a license has been installed appears. You will not be prompted to enter a license key.

– When installing on a host that contains HDLM version 5.4 or later (when the license has expired):

A message that indicates that the license has expired appears. You will be prompted to enter a license key. Enter a license key correctly. If you enter an incorrect license key three times, the installation will be canceled. When a correct license key is entered, a message appears that indicates a license was installed.

6. After the HDLM installation, execute the following command to check whether the installation was successful:

```
# swlist -l product DLManager
```

When the execution result of the above command is like the following, the installation was successful. The `host1` portion may change depending on the environment.

```
# Initializing...
# Contacting target "host1"...
#
# Target: host1:/
#
DLManager      xx.xx      Dynamic Link Manager
```

7. Execute the following command to restart the host so that the HDLM driver is loaded and HDLM devices are recognized:

```
# cd /
# shutdown -r
```

8. After the host is restarted, log on to HP-UX as a user with root privileges.
9. If the HDLM version before upgrade is 04-00, execute the following command and check whether S/W State of the path managed by HDLM shows CLAIMED.

This step is not necessary if the version before the upgrade is 05-02 or later. Proceed to step 11.

```
# ioscan -fnC disk
```

10. When you perform an upgrade installation of HDLM over HDLM 04-00, execute the HDLM path-configuration definition utility (`dlnmdefpath`).

Enter `y` in response to the utility. The host is restarted and the current path configuration definitions take effect.

This step is not necessary if the version before upgrade is 05-02 or later. Proceed to step 11.

11. Open the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file with a text editor to check whether the KAPL10317-E message was not output when the host was restarted.

If the KAPL10317-E message is output, perform the operation shown in step 13 and step 14 in 3.5.2.

12. Executes the `dlnkmgr` command's `view` operation to display the status of each program.

The following shows a sample execution of this command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version      : xx-xx
Service Pack Version :
Load Balance      : on(rr)
Support Cluster   :
Elog Level        : 3
Elog File Size (KB) : 9900
Number Of Elog Files : 2
Trace Level       : 0
Trace File Size (KB) : 1000
Number Of Trace Files : 4
Path Health Checking : on(30)
Auto Failback     : off
```

```

Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive      xx-xx      yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      xx-xx      yyyy/mm/dd hh:mm:ss 4096
HDLM Driver Ver      WakeupTime
Alive      xx-xx      yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
#

```

- The new installation inherits the existing settings.

When HDLM 04-00 is upgrade to HDLM 5.9, if the HDLM 04-00 setting for the load balancing is `on`, the HDLM 5.9 setting for the load balancing is also `on` and the HDLM 5.9 setting for the load balancing algorithm is `rr` (round robin). When you upgrade HDLM 05-02 or later to HDLM 5.8, the settings and algorithm of load balancing will be inherited if the load balancing is set to `on` in the old version. The other load balancing algorithm is extended round robin.

See 3.6 and select the load balancing algorithm if necessary.

- Even when cluster software is used, `Support Cluster` is blank. However, the cluster support function is operating normally.

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

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

14. From the execution result by the `view` operation, check that the programs are running properly.

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

3.6 Checking the Path Configuration

HDLM functionality such as load balancing and failover is 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 these paths.

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

The following describes how to check path information by using the `dlmkmgr` command's `view` operation. For details about the `view` operation, see section 6.7.

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

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlmkmgr view -path > redirect-destination-file-1
```

Open *redirect-destination-file-1* and check the following:

- Make sure that an LU accessed by a path exists.

A path can be identified with `PathName`. The LU that is accessed by a path can be identified with a combination of `DskName` and `iLU`.

- Make sure that all paths are online.

Make sure that `PathStatus` is `Online`. If there is a path whose status is not online, `Reduced` will be displayed.

- Make sure that the combinations of the CHA port (`ChaPort`), through which paths access the same LU, and the HBA port (the host port number and bus number displayed in the `PathName` column) are different.

The two-digit number from the left of the numbers displayed for `PathName` indicates an 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.

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

Execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv > redirect-destination-file-2
```

Open the `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.

3.7 Setting Up HDLM

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

3.7.1.1 Checking the Current Settings

Check the current settings by executing the following command to set the HDLM functionality by using the `dlnkmgr` command's `set` operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size(KB)     : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : off
Intermittent Error Monitor : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
yyyymm/dd hh:mm:ss
#
```

3.7.2 Setting up HDLM functionality

The recommended and default values for the HDLM functionalities are shown below in Table 3.8.

Table 3.8 The Recommended and Default Values of Each Function

Functionality	Default value	Recommended value
Load-balancing	on Algorithm is round robin	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	off	off
Intermittent Error Monitor	off	off
Reservation level	(Not specifiable)	(Not specifiable)
Remove LU	(Not specifiable)	(Not specifiable)
Logging level	3: Collect all information for errors with the level "Information" or higher	3: Collect all information for errors with the level "Information" or higher
Trace level	0: Do not output a trace	0: Do not output a trace
File size (for Error log)	9900 (kilobytes)	9900 (kilobytes)
Number of files (for Error log)	2	2
File size (for Trace)	1000 (kilobytes)	1000 (kilobytes)
Number of files (for Trace)	4	4

3.7.2.1 Setting Load Balancing

You can select whether to enable load balancing.

- Setting by the Options window and the Show HDLM Environment Settings subwindow
Set it to **ON** to enable load balancing. Otherwise, set it to **OFF**. After selecting **ON**, select a desired **algorithm** to be used for load balancing from the pull-down list.
- Setting by the `set` operation

The following is an example command to set load-balancing.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -lb on -lbtype rr
```

Set it to `on` to enable load balancing. Otherwise, set it to `off`. When you set this value to `on`, specify `rr` for round robin or `exrr` for extended round robin after the `-lbtype` option. The type of algorithm specified by the `-lbtype` parameter remains stored in the system, even when you disable load balancing function by specifying `-lb off`. Therefore, when you re-enable load balancing without specifying an algorithm, load balancing will be executed according to the setting stored in the system.

3.7.2.2 Setting Path Health Checking

You can select whether to enable path health checking.

- Setting by the Options window and the Show HDLM Environment Settings subwindow
Set it to **ON** to enable path health checking. Otherwise, set it to **OFF**. When selecting **ON**, you can specify **Checking interval** for path health checking.

- Setting by the `set` operation

The following is an example command to set path health checking.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -pchk on -intvl 10
```

To enable path health checking, set it to `on`. Otherwise, set it to `off`. When you set this value to `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.

3.7.2.3 Setting automatic failback

You can select whether to enable automatic failback

When intermittent error monitoring is enabled and the number of error occurrence is 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, an error occurs and the warning message (KAPLO1080-W) is output.

In such a case, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur. When you set the number of times that the error is to occur to 1, the condition above does not need to be satisfied.

The following shows an example of executing the command to set automatic failback:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -afb on -intvl 10
```

To enable automatic failback, set it to `on`. Otherwise, set it to `off`. 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.

3.7.2.4 Settings for Intermittent Error Monitoring

Intermittent error monitoring is specifiable only when automatic failback 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 conditions used by the system to determine whether an intermittent error is occurring). 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 is occurring if the specified number of times that the error is to occur is reached during the monitoring interval (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring starts when the path is recovered from the error by using automatic failback. Monitoring is performed on individual paths.

When a value of 2 or more is specified in number of times, make sure that the condition shown in 3.7.2.3 is satisfied.

To determine whether a path is ineligible for automatic failback, you can use the results of the `dlnkmgr` command's `view` operation.

The following shows an example of executing the command to set the error log collection level.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -iem on -intvl 20 -iemnum 2
```

`on` specifies that intermittent error monitoring is to be used. To disable intermittent error monitoring, specify `off`. When you set this parameter to `on`, you can specify intermittent error conditions (the conditions used by the system to determine whether an intermittent error is occurring) by using the `-intvl` and `-iemnum` parameters. Specify the monitoring interval for an intermittent error in the `-intvl` parameter, and the number of times that the error is to occur in the `-iemnum` parameter. When these parameters are omitted and 3 or more errors occur within 30 minutes, the system assumes that an intermittent error is occurring.

3.7.2.5 Setting the Error Log Collection Level

The error log (the HDLM manager log (`dldmgnrn.log` (*n* indicates a file number from 1 to 16)) collection level can be set.

Table 3.9 lists and describes values for the error log collection level setting.

Table 3.9 Values for the Error Log Collection Level Setting

Value#	Description
0	No error logs are collected.
1	All information for errors with the level "Error" or higher is collected.
2	All information for errors with the level "Warning" or higher is collected.
3	All information for errors with the level "Information" or higher is collected.
4	All information for errors with the level "Information" or higher (including maintenance information) is collected.

If an error occurs, you may have to set the collection level to 1 or higher to collect the log information. The higher this value is set, the more log information will be output. When the output log is large, it takes less time to overwrite the old error log information with the new information.

The following shows an example of executing the command to set the error log collection level.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -elvlv 2
```

Specify the error log collection level in a number.

3.7.2.6 Setting the Trace Level

The trace output level can be set.

A trace file in which a trace level can be set is `hdlmtrn.log` (*n* indicates a file number from 1 to 64).

Table 3.10 lists and describes values for the trace level setting.

Table 3.10 Values for the Trace Level Setting

Value#	Description
0	No trace is output.
1	Only error information is output.
2	Program operation summaries are output.
3	Program operation details are output.

4	All information is output.
---	----------------------------

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

The higher this value is set, the more log information will be output. When the output log is large, it takes less time to overwrite the old error log information with the new information.

The following is an example command to set the trace level.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systflv 1
```

Specify the trace level in a number.

3.7.2.7 Setting the Error Log File Size

The error log file size (the HDLM manager log (`dlnmgn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value (in kilobytes) from 100 to 2000000 for the error log file size. The specified value is applied for HDLM manager logs.

When an error log file reaches the specified size, the information in the old error log file is replaced with new information, beginning with the oldest file. By specifying both the log file size and the number of log files, you can collect up to 32000000 kilobytes (approximately 30 GB) of error logs in total.

The following shows an example of executing the command to set the error log file size.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -elfs 1000
```

Specify the size of the error log file in kilobytes.

3.7.2.8 Setting for the Number of Error Log Files

The number of the error log files (the HDLM manager log (`dlnmgn.log` (n indicates a file number from 1 to 16))) can be set.

You can specify a value from 2 to 16 for the number of error log files (log files for the HDLM manager).

By specifying both the log file size and the number of log files, you can collect up to 32000000 kilobytes (approximately 30GB) of error logs in total.

The following shows an example of setting the number of error log files.

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -elfn 5
```

Specify the number of error log files in numbers.

3.7.2.9 Setting the Trace File Size

The trace file size can be set.

Trace files for which a trace file size can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64). The length of a trace file is fixed. Thus, 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.

For the trace file size, you can specify a value (in kilobytes) from 100 to 16000. If you specify a value smaller than the setting value, the message (KAPL01097-W) is displayed to confirm execution, and the trace file is temporarily deleted.

Once trace data has been written to all of the trace files, the oldest file is overwritten with new trace data.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000 kilobytes of trace data in total.

The following shows an example of setting the trace file size:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systfs 2000
```

Specify the size of the trace file in kilobytes.

3.7.2.10 Setting the Number of Trace Files

You can set the number of the trace files.

Trace files for which the number of files can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64).

For the number of the trace files, you can specify a value from 2 to 64. If you specify a value smaller than the setting value, the message (KAPL01097-W) is displayed to confirm execution, and the trace file is temporarily deleted.

By specifying both the trace file size and the number of trace files, you can collect up to 1024000 kilobytes of trace data in total.

The following shows an example of setting the number of trace files:

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -systfn 10
```

Specify the number of trace files in numbers.

3.7.3 Checking the new 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 change these settings, you can display information about all HDLM function settings. The following is an example of executing the command:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys -sfunc
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 2
Elog File Size(KB)    : 1000
Number Of Elog Files   : 5
Trace Level            : 1
Trace File Size(KB)   : 2000
Number Of Trace Files  : 10
Path Health Checking   : on(10)
Auto Failback          : on(10)
Intermittent Error Monitor : on(2/20)
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
yyyy/mm/dd hh:mm:ss
#
```

3.8 Setting up Integrated traces

When HDLM is used, `dlnmgr` commands logs are output to the following *integrated trace information files* of Hitachi Network Objectplaza Trace Library (HNTRLib2):

`/var /opt/hitachi/HNTRLib2/spool/hntr2n.log` (*n* indicates a file number).

If there is a significant amount of integrated trace information output, information might end up deleted in a short time. Also, if a large amount of integrated trace information is output at once, the integrated trace information that overflowed the buffer might not be saved in integrated trace files. To save as much information as possible, change the settings for Hitachi Network Objectplaza Trace Library, increasing the integrated trace file size and buffer size. Note that specifying the values too large places a heavy load on the system. When determining these values, consider these operational tradeoffs.

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

Table 3.11 Default and Recommended Values for the Integrated Trace File Settings

Setting		Default value	Recommended value
Integrated trace file size		256 (kilobytes)	4096 (kilobytes)
Number of integrated trace files		4	8
Buffer size per monitoring interval	Monitoring cycle	10 (seconds)	5 (seconds)
	Buffer size per monitoring interval	64 (kilobytes)	256 (kilobytes)
Number of messages	Monitoring cycle	0 (seconds)	0 (seconds)

to be output per monitoring interval	Number of messages to be output	0	0
--------------------------------------	---------------------------------	---	---

If Hitachi Network Objectplaza Trace Library (HNTRLib2) is already installed, the existing settings will be inherited. If you change these settings, keep in mind that they are used by programs other than HDLM.

3.8.1 Notes on Using the Hitachi Network Objectplaza Trace Library

Note the following when using Hitachi Network Objectplaza trace library:

- If HNTRLib has already been installed when you install HDLM, the settings in the trace library will not be inherited by HNTRLib2. HDLM uses the HNTRLib2 default settings.
- If HNTRLib2 has already been installed on a host when you install HDLM, the settings in the trace library will be inherited.
- If a different Hitachi product is using HNTRLib2 when you attempt to uninstall HDLM, HNTRLib2 will not be uninstalled

3.8.2 Displaying the Hitachi Network Objectplaza Trace Library Setup Menu

To display the Hitachi Network Objectplaza Trace Library setup menu:

1. Log on as a root user.
2. Execute the following command:

```
# /opt/hitachi/HNTRLib2/bin/hntr2utl2
```

The Hitachi Network Objectplaza Trace Library setup menu appears.

```

Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Select the item you want to change.  (Type 1-7 or e)

      [Log Files]
1: Size of a log file.           256 KB
2: Number of log files.         4
3: Name of log files.           /var/opt/hitachi/HNTRLib2/spool/hntr2*.log

      [Monitor]
4: Size of buffer.              64 KB
5: Interval timer.              10 Sec

      [Logging Restriction]
6: Lookout span.                0 Sec
7: Max messages per span.       0

e: Exit

Enter the number>

```

If you do not want to change the settings, type `e` and then press the **Enter** key to quit the menu.

The following explains how to modify each setting.

3.8.3 Changing the Size of Integrated Trace Files

The following procedure shows how to change the size of integrated trace files.

To change the size of integrated trace files:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type `1` and then press the **Enter** key.

A screen to set the size of the integrated trace file will appear. The current value is displayed in **Current Size (KB)**.

```

Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type new file size [8-8192]           (Type '!' to return)

Current Size(KB): 256
New Size(KB):

```

2. Enter the desired size in **New Size (KB)**.

The specifiable range is between 8 KB and 8192 KB, with a default of 256. Set this to a value larger than that set in step 2 of 3.8.5. We recommend setting a value of 4096 when collecting an integrated trace.

If you do not want to change the integrated trace file size, leave **New Size (KB)** blank, type `!`, and then press the **Enter** key to return to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.4 Changing the Number of Integrated trace Files

The following procedure shows how to change the number of integrated trace files.

To change the number of integrated trace files:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 2 and then press the **Enter** key.

A screen to set the number of integrated trace files will appear. The current value is displayed in **Current Number (KB)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of files [1-16]           (Type '!' to return)

Current Number(KB):  4
New Number(KB):
```

2. Enter the desired number in **New Number (KB)**.

You can specify a value from 1 to 16. The default is 4. The value set here becomes the maximum of n in `/var/opt/hitachi/HNTRLlib2/spool/hntr2n.log`. The recommended value for integrated trace collection is 8.

If you do not want to change the number of integrated trace files, leave **New Number (KB)** blank, type !, and then press the **Enter** key to return to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.5 Changing the Buffer Size Per Monitoring Interval Duration

The following procedure shows how to change the buffer size per monitoring interval.

To change the buffer size per monitoring interval:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 4 and then press the **Enter** key.

A screen to set the buffer size will appear. The current value is displayed in **Current Size (KB)**.

```

Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type new buffer size [8-2048]      (Type '!' to return)

Current Size(KB):  64
New Size(KB):

```

2. Enter the desired size in **New Size (KB)**.

Set a new buffer size to fit the monitoring interval set in **5: Interval Timer**. The specifiable range is between 8 KB and 2048 KB, with a default of 64. Set this to a value smaller than that set in step 2 of 3.8.3. We recommend setting a value of 256 when collecting an integrated trace.

To leave the buffer size as is, leave **New Size (KB)** blank, type ! and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

4. In the Hitachi Network Objectplaza Trace Library setup menu, type 5 and then press the **Enter** key.

A screen to set the monitoring interval will appear. The current value is displayed in **Current Span (sec)**.

```

Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the value of interval timer for the monitor [1-300](Type '!' to return)

Current Span(sec): 10
New Span(sec):

```

5. Enter the desired interval in **New Span (sec)**.

The specifiable range is between 1 second and 300 seconds, with a default of 10. We recommend setting a value of 5 when collecting an integrated trace.

To leave the monitoring interval as is, leave **New Span (sec)** blank, enter ! and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

6. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.6 Adjusting the Number of Messages to Be Output Per Monitoring Interval

This section explains how to adjust the number of messages output to fit a particular monitoring interval.

To adjust the number of messages to be output per monitoring interval:

1. In the Hitachi Network Objectplaza Trace Library setup menu, type 6 and then press the **Enter** key.

A screen to set the monitoring interval for the amount of messages output to the integrated trace file will appear. The current value is displayed in **Current Span (sec)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of lookout span [1-3600 or 0]      (Type '!' to return)

Current Span(sec):  0
New Span(sec):
```

2. Enter a desired interval in **New Span (sec)**.

The specifiable range is between 0 and 3600 seconds, with a default of 0. We recommend setting a value of 0.

To leave the monitoring interval as is, leave **New Span (sec)** blank, type ! and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

Note that when you specify a monitoring interval of 0, even if you specify the maximum number of messages in **7: Max messages per span**, the amount of integrated trace information to be output will not be adjusted.

3. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

4. In the Hitachi Network Objectplaza Trace Library setup menu, type 7 and press the **Enter** key.

A screen to set the maximum number of messages output to the integrated trace file based on the monitoring interval specified in **6: Lookout span** will appear. The current value is displayed in **Current Max (sec)**.

```
Hitachi Network Objectplaza Trace Library 2 - Configuration Utility  Rel 2.0

Type the number of max messages [0-500]      (Type '!' to return)

Current Max:  0
New Max:
```

5. Adjust the maximum number of messages output to the integrated trace files in **New Max (sec)**.

The specifiable range is between 0 messages and 500 messages, with a default of 0. If you want to increase the number of messages which are output to the integrated trace file as much as possible, we recommend setting a value of 0.

When you specify a monitoring interval of 0 in **6: Lookout span**, the value set in **New Max (sec)** will be disregarded.

Also, when you specify a value of 0 for **New Max (sec)**, even if you specify the monitoring interval in **6: Lookout span**, the maximum number of messages output will not be adjusted.

To leave the maximum number of messages output as is, leave **New Max (sec)** blank, enter **!** and press the **Enter** key. You will be returned to the Hitachi Network Objectplaza Trace Library setup menu.

6. Press the **Enter** key.

The new setting is applied and the Hitachi Network Objectplaza Trace Library setup menu appears again.

3.8.7 Finishing the Hitachi Network Objectplaza Trace Library Settings

This section explains how to close the Hitachi Network Objectplaza Trace Library setup menu when you are finished.

1. In the Hitachi Network Objectplaza Trace Library setup menu, type **e** and press the **Enter** key.

You will be asked to if you wish to save the new settings.

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

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

3.8.8 Applying the Hitachi Network Objectplaza Trace Library Settings

To apply the settings, after you change the amount of integrated trace information by using Hitachi Network Objectplaza Trace Library :

1. Log in as a user with root privileges.
2. Execute the following command to check the programs using HNTRLib2.

In the following example, only HDLM uses HNTRLib2.

```
# /opt/hitachi/HNTRLib2/etc/hntr2dgetname  
Hitachi Dynamic Link Manager  
#
```

3. Stop the programs that are using HNTRLib2.

If programs other than HDLM are displayed in step 2, stop the programs, and then go to step 4. You do not need to stop the HDLM manager.

If you do not know how to stop and start programs other than HDLM, do not perform the following steps, and restart the host.

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

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

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

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

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

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

7. Start the programs stopped in step 3.

If you stopped programs other than HDLM in step 3, start them.

3.9 Creating a File System (When LVM Is Not Used)

When LVM is not used, directly use an HDLM device file as the destination of input and output. To use an HDLM device file as block devices, use `/dev/dsk/chXtYdZ`. To use them as character devices, use `/dev/rdisk/chXtYdZ`.

This section explains how to specify the name of an HDLM device file and mount the device managed by HDLM as a file system.

To mount an HDLM device as a file system:

1. Check for the HDLM device for the SCSI device.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV H/W Path
000000 ch9t0d0 c9t0d0 9970/9980.15001.0540 0/2/0/0.8.0.4.0.0.0
000001 ch9t0d1 c9t0d1 9970/9980.15001.0541 0/2/0/0.8.0.4.0.0.1
000002 ch9t0d2 c9t0d2 9970/9980.15001.0542 0/2/0/0.8.0.4.0.0.2
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

2. If a file system has not been created, create it.

In the following example, the command creates VxFS in the HDLM device `ch9t0d0`.

```
# newfs -F vxfs /dev/rdsk/ch9t0d0
version 4 layout
1024 sectors, 1024 blocks of size 1024, log size 256 blocks
unlimited inodes, largefiles not supported
1024 data blocks, 696 free data blocks
1 allocation units of 32768 blocks, 32768 data blocks
```

```
last allocation unit has 1024 data blocks
#
```

3. Specify a block-type HDLM device file name to mount the device managed by HDLM.

In the following example, the command mounts `/dev/dsk/ch9t0d0` to `/mntpt`:

```
# mkdir /mntpt
# mount /dev/dsk/ch9t0d0 /mntpt
```

4. To automatically mount the device managed by HDLM at the start of the host, edit the `/etc/fstab` file.

Figure 3.4 shows an example of editing the `/etc/fstab` file to automatically mount a device. This example of editing is for mounting the VxFS `/dev/dsk/ch9t0d0` (whose bus number specified in the `fsck` command is 2) to the mount point `/mntpt` with the default mount options. In this example, shaded lines have been added.

```
/dev/vg00/lvol3 / vxfs delaylog 0 1
/dev/vg00/lvol1 /stand hfs defaults 0 1
/dev/vg00/lvol4 /tmp vxfs delaylog 0 2
/dev/vg00/lvol5 /usr vxfs delaylog 0 2
/dev/vg00/lvol6 /home vxfs delaylog 0 2
/dev/vg00/lvol7 /opt vxfs delaylog 0 2
/dev/vg00/lvol8 /var vxfs delaylog 0 2
/dev/dsk/ch9t0d0 /mntpt vxfs delaylog 0 2
```

Figure 3.4 Example of editing the `/etc/fstab` file to automatically mount a device

3.10 Creating a Volume Group

When you use LVM to create a volume group using the devices managed by HDLM, specify the HDLM device files (`/dev/dsk/chXtYdZ`). If you create a volume group by specifying SCSI device files (`cXtYdZ`), you cannot use the HDLM functionality for the volume group.

If you have already created a volume group using SCSI devices that correspond to HDLM devices, you need to migrate the device files of the HDLM devices to the specified volume group. For details about this migration, see 3.12.

Note: When creating a volume group, enter commands (such as `pvcreate` and `vgcreate`) from the command line. You cannot use the `sam` command. For details about creating a volume group by using the command line, see the HP-UX documentation.

The following example procedure shows how to create a volume group using an HDLM device. In this example, you use `ch8t0d0` to create the volume group `vgdlm` that has one 100-MB logical volume. When you specify the number of logical volumes, extent size, and other arguments to be specified in the `pvcreate`, `vgcreate`, or `lvcreate` command, consider the device size and other settings on the storage subsystem side. Then, determine the values by referring to the documentation of each command. In this example, you use defaults.

To create a volume group using an HDLM device:

1. Check for the major number and minor number of the current volume group.

```
# ls -l /dev/*/group
crw-r----- 1 root      sys          64 0x000000 date/time /dev/vg00/group
```

2. Create a directory for the new volume group.

```
# mkdir /dev/vgdlm
```

3. Create a group file.

```
# mknod /dev/vgdlm/group c 64 0x010000
```

4. Set `ch8t0d0` as a physical volume.

```
# pvcreate -f /dev/rdisk/ch8t0d0
Physical volume "/dev/rdisk/ch8t0d0" has been successfully created.
```

5. Create a volume group.

```
# vgcreate vgdlm /dev/dsk/ch8t0d0
Volume group "/dev/vgdlm" has been successfully created.
Volume Group configuration for /dev/vgdlm has been saved in /etc/lvmconf/vgdlm.conf
```

6. Create a logical volume in the volume group.

```
# lvcreate -L 100 vgdlm
Logical volume "/dev/vgdlm/lvol1" has been successfully created with
character device "/dev/vgdlm/rlvol1".
Logical volume "/dev/vgdlm/lvol1" has been successfully extended.
Volume Group configuration for /dev/vgdlm has been saved in /etc/lvmconf/vgdlm.conf
#
```

3.11 Sharing a Volume Group

In a cluster configuration, to share a new volume group of LVM between hosts, you must perform the following tasks:

- Checking the correspondence of device file names
- Creating a volume group
- Distributing a volume group

The following subsection describe the procedure for each task. The procedures are the same when MC/ServiceGuard or Oracle RAC is used for the cluster software.

For details about the procedure for configuring the cluster system, see the documentation for the cluster software.

3.11.1 Checking the Correspondence of Device File Names

HDLM device file names may differ depending on the host. At each host, check the name of the HDLM device file for the device to be shared between hosts.

The following shows the procedure when the cluster system consists of `host1` and `host2`.

To check the correspondence of device file names between hosts:

1. Execute the `dlnkmgr view -path -item dn lu hd` command to display the storage subsystem name, LU number, and host device name.

Execution result at `host1`:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -item dn lu hd
PathID DskName          .iLU          Status      HDevName
000000 HP      .OPEN-K      .35001      0100      Online     ch16t0d0
000001 HP      .OPEN-K      .35001      0101      Online     ch16t0d1
:
```

Execution result at `host2`:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -item dn lu hd
PathID DskName          .iLU          Status      HDevName
000000 HP      .OPEN-K      .35001      0100      Online     ch24t0d0
000001 HP      .OPEN-K      .35001      0101      Online     ch24t0d1
:
```

This example indicates that `ch16t0d0` at `host1` corresponds to `ch24t0d0` at `host2`.

3.11.2 Creating a Volume Group

Create a volume group that you will distribute.

Perform the following procedure at one host only. The following is an example procedure to be performed at `host1`.

To create a volume group:

1. Execute the `pvcreeate` command with an HDLM device file specified, to create a physical volume.

```
# pvcreate -f /dev/rdisk/ch16t0d0
Physical volume "/dev/rdisk/ch16t0d0" has been successfully created.
```

2. Execute the `mkknod` command to create a volume group device file.

When executing the `mknod` command, specify `c` as the file type, and the logical volume manager's major number.

```
# mkdir /dev/vg10
# mnod /dev/vg10/group c 64 0x040000
```

The volume group name at each host must be the same.

The minor number specified in the `mknod` command must be common to each host.

In this example, the `/dev/vg10` directory and the volume group device file `/dev/vg10/group` are created.

3. Execute the `vgcreate` command with an HDLM device file specified, to create a volume group.

```
# vgcreate /dev/vg10 /dev/dsk/ch16t0d0
Volume group "/dev/vg10" has been successfully created.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf
```

4. Execute the `lvcreate` command to create a logical volume.

```
# lvcreate -L 1000 /dev/vg10
Logical volume "/dev/vg10/lvol1" has been successfully created with
character device "/dev/vg10/rlvol1".
Logical volume "/dev/vg10/lvol1" has been successfully extended.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf
```

In this example, a 1000-MB logical volume is created in the volume group `/dev/vg10`.

5. Execute the `vgdisplay -v` command to verify the created volume group.

```
# vgdisplay -v /dev/vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
LV Name                /dev/vg10/lvol1
:
--- Physical volumes ---
PV Name                /dev/dsk/ch16t0d0
PV Status              available
Total PE               446
Free PE                196
Autoswitch             On
```

6. Execute the `vgchange -a n` command to deactivate the volume group.

```
# vgchange -a n /dev/vg10
Volume group "/dev/vg10" has been successfully changed.
```

7. Execute the `vgexport -p -m` command with a map file name specified, to create the map file for the volume group.

At this time, do not specify the `-s` option.

```
# vgexport -p -m /tmp/vg10.map /dev/vg10
```

3.11.3 Distributing a Volume Group

Perform the following procedure at each host. Do not execute the `pvcreate` command at the distribution destination hosts.

The following shows an example procedure at `host2`.

To distribute a volume group:

1. Execute the `rcp` command to transfer a map file from `host1`.

```
# rcp host1:/tmp/vg10.map /tmp/vg10.map
```

You can also use `ftp`, instead of `rcp`.

2. Execute the `mknod` command to create a volume group device file.

When executing the `mknod` command, specify `c` as the file type, and the logical volume manager's major number.

```
# mkdir /dev/vg10
# mnod /dev/vg10/group c 64 0x040000
```

The volume group name at each host must be the same.

The minor number specified in the `mknod` command must be common to each host.

In this example, the `/dev/vg10` directory and the volume group device file `/dev/vg10/group` are created.

3. Execute the `vgimport` command to import the volume group.

In the `vgimport` command, specify the distribution destination host's HDLM device file name that corresponds to the distribution source host's HDLM device file name determined in step 1. At this time, do not specify the `-s` option in the `vgimport` command.

The following shows the correspondence of the device file names between hosts in this example:

Distribution source host: `/dev/dsk/ch16t0d0`

Distribution destination host: `/dev/dsk/ch24t0d0`

```
# vgimport -m /tmp/vg10.map /dev/vg10 /dev/dsk/ch24t0d0
vgimport: Warning: Volume Group belongs to different CPU ID.
Can not determine if Volume Group is in use on another system. Continuing.
Warning: A backup of this volume group may not exist on this machine.
Please remember to take a backup using the vgcfgbackup command after activating the
volume group.
```

4. Execute the `vgchange -a y` command to activate the volume group.

```
# vgchange -a y /dev/vg10
Activated volume group
Volume group "/dev/vg10" has been successfully changed.
```

5. Execute the `vgdisplay -v volume-group-name` command to verify that the importing was successful.

```

# vgsdisplay -v /dev/vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
LV Name                /dev/vg10/lvol1
:
--- Physical volumes ---
PV Name                /dev/dsk/ch24t0d0
PV Status              available
Total PE               446
Free PE                196
Autoswitch             On

```

6. Execute the `vgchange -a n` command to deactivate the volume group.

```

# vgchange -a n /dev/vg10
Volume group "/dev/vg10" has been successfully changed.

```

3.12 Migrating a Volume Group (From SCSI Devices to the HDLM Device)

If a volume group has already been created using SCSI devices that correspond to the HDLM device, migrate the device files of the HDLM device to the specified volume group.

The migration procedure in a cluster environment differs from that in a non-cluster environment. The following subsection show the procedures in a cluster environment and in a non-cluster environment.

3.12.1 Migrating a Volume Group in a non-cluster Environment

The following procedure shows how to reconfigure a volume group composed of SCSI devices into a volume group composed of the corresponding HDLM device in a non-cluster environment.

To migrate a volume group (from SCSI to HDLM) in a non-cluster environment:

1. Execute the `vgsdisplay` command with a volume group name specified, to check the information about the volume group.

The following shows a sample execution of this command:

```

# vdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
:
--- Physical volumes ---
PV Name                /dev/dsk/c16t0d0
PV Name                /dev/dsk/c19t0d0 Alternate Link
PV Status              available
Total PE              446
Free PE               196
Autoswitch            On

```

PV Name indicates a SCSI device for a volume group.

In this example, volume group /dev/vg10 consists of SCSI devices /dev/dsk/c16t0d0 and /dev/dsk/c19t0d0 (alternate link).

2. Execute the `dlmkmgr` command's `view -drv` operation to check the correspondence between SCSI and HDLM devices.

The following shows a sample execution of this command:

```

# /opt/DynamicLinkManager/bin/dlmkmgr view -drv
PathID HDevName Device LDEV H/W Path
000000 ch16t0d0 c16t0d0 9200.2334.0000 0/6/0/0.8.0.1.0.0.0
000001 ch16t0d1 c16t0d1 9200.2334.0001 0/6/0/0.8.0.1.0.0.1
000002 ch16t0d2 c16t0d2 9200.2334.0002 0/6/0/0.8.0.1.0.0.2
000003 ch16t0d3 c16t0d3 9200.2334.0003 0/6/0/0.8.0.1.0.0.3
:
:
000140 ch16t0d0 c19t0d0 9200.2334.0000 0/6/2/0.8.0.7.0.0.0
000141 ch16t0d1 c19t0d1 9200.2334.0001 0/6/2/0.8.0.7.0.0.1
000142 ch16t0d2 c19t0d2 9200.2334.0002 0/6/2/0.8.0.7.0.0.2
000143 ch16t0d3 c19t0d3 9200.2334.0003 0/6/2/0.8.0.7.0.0.3
:

```

SCSI devices `c16t0d0` and `c19t0d0` are to be replaced with HDLM device `ch16t0d0`.

3. Execute the `vgextend` command to add the HDLM device to the volume group.

Execute the `vgextend` command with the HDLM device file specified. The HDLM device is added to the volume group as a physical volume.

```

# vgextend /dev/vg10 /dev/dsk/ch16t0d0
Current path "/dev/dsk/c19t0d0" is an alternate link, skip.
Volume group "/dev/vg10" has been successfully extended.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

```

4. Execute the `vdisplay` command with the volume group name specified, to verify that the HDLM device has been added to the physical volume as an alternate link.

The following shows a sample execution of this command:

```

# vdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
:
--- Physical volumes ---
PV Name                /dev/dsk/c16t0d0
PV Name                /dev/dsk/c19t0d0  Alternate Link
PV Name                /dev/dsk/ch16t0d0  Alternate Link
PV Status              available
Total PE              446
Free PE               196
Autoswitch            On

```

In this example, HDLM device `/dev/dsk/ch16t0d0` has been added.

- Execute the `vgreduce` command to remove the SCSI devices from the volume group.
Execute the `vgreduce` command with the SCSI devices specified, to remove the SCSI devices from the volume group.

```

# vgreduce /dev/vg10 /dev/dsk/c16t0d0
Device file path "/dev/dsk/c16t0d0" is an primary link.
Removing primary link and switching to an alternate link.
Volume group "/dev/vg10" has been successfully reduced.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

# vgreduce /dev/vg10 /dev/dsk/c19t0d0
Device file path "/dev/dsk/c19t0d0" is an primary link.
Removing primary link and switching to an alternate link.
Volume group "/dev/vg10" has been successfully reduced.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

```

- Execute the `vdisplay` command with the volume group name specified, to verify that the volume group has been composed of an HDLM device, not SCSI devices.

```

# vdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
:
--- Physical volumes ---
PV Name                /dev/dsk/ch16t0d0
PV Status              available
Total PE              446
Free PE               196
Autoswitch            On

```

When SCSI devices `/dev/dsk/c16t0d0` and `/dev/dsk/c19t0d0` have been deleted, and HDLM device `/dev/dsk/ch16t0d0` remains, migration was successful.

- Execute the `lvdisplay` command to check the timeout value for the logical volume.
Perform this step only when the timeout value for the logical volume must be set.
The following shows a sample execution of this command:

```

# lvdisplay /dev/vg10/lvol1

```

```

--- Logical volumes ---
LV Name                /dev/vg10/lvol1
VG Name                /dev/vg10
LV Permission          read/write
LV Status              available/syncd
      :
Stripes                0
Stripe Size (Kbytes)  0
Bad block              on
Allocation             strict
IO Timeout (Seconds)  default

```

8. Check whether the logical volume's timeout value (the value of IO Timeout displayed by the `lvdisplay` command) satisfies the following condition:

Logical volume's timeout value \geq physical volume's timeout value x number of paths to the device managed by HDLM

You can check the number of paths to the device managed by HDLM by executing the `view -drv` operation of the HDLM command.

For example, when the physical volume's timeout value is 30 seconds and the number of paths is 2, make sure that the logical volume's timeout value is 60 or more seconds.

If this condition is satisfied, migration of the volume group is completed.

If this condition is not satisfied, go to the following step.

9. Change the logical volume's timeout value or physical volume's timeout value properly.

Change the logical volume's timeout value or physical volume's timeout value so that the following two conditions are satisfied:

- Logical volume's timeout value \geq physical volume's timeout value x number of paths to the device managed by HDLM
- System requirements

In the following example, the command sets the logical volume's timeout value to 60 seconds:

```

# lvchange -t 60 /dev/vg10/lvol1
Logical volume "/dev/vg10/lvol1" has been successfully changed.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

```

3.12.2 Migrating a Volume Group in a Cluster Environment

This subsection shows the procedure for reconfiguring a volume group consisting of SCSI devices that are shared among hosts by specifying the device files of the corresponding the HDLM device. Perform the following procedure at all hosts that make up a cluster.

3.12.2.1 For MC/ServiceGuard or Oracle RAC

A volume group can be activated with only one host concurrently. You cannot use the `vgchange -a y` command to activate a volume group shared between hosts. Thus, you must first use the `cmruncl` command to start MC/ServiceGuard or Oracle RAC. At this time, if there is a software package that is using the target volume group, use the `cmhaltpkg` command to halt the software package. Then, use the `vgchange -a e` command to activate the volume group in the exclusive mode.

To migrate a volume group (from SCSI to HDLM) in a cluster environment:

1. Execute the `cmruncl` command to activate volume group.

```
# cmruncl -v
Successfully started $SGLBIN/cmcl on host1.
Successfully started $SGLBIN/cmcl on host2.
cmruncl : Waiting for cluster to form....
cmruncl : Cluster successfully formed.
cmruncl : Check the syslog files on all nodes in the cluster
cmruncl : to verify that no warnings occurred during startup.
```

2. Execute the `cmviewcl` command to check whether there are active software packages.

```
# cmviewcl
CLUSTER      STATUS
cluster25   up
  NODE      STATUS      STATE
  host2     up          running

  PACKAGE    STATUS      STATE      AUTO_RUN  NODE
  pkg25     up          running    enabled   host2
```

In this example, package `pkg25` is running.

3. If there is an active software package, use the `cmhaltpkg` command to terminate the software package.

In the following example, the command terminates package `pkg25`:

```
# cmhaltpkg pkg25
cmhaltpkg : Completed successfully on all packages specified.
```

4. Execute the `vgchange -a e` command to activate the volume group in the exclusive mode.

```
# vgchange -a e /dev/vg10
Activated volume group in Exclusive Mode.
Volume group "/dev/vg10" has been successfully changed.
```

5. Migrate the volume group.

Follow the directions in 3.12.1 to migrate the volume group to the one that is created by specifying HDLM device files.

6. Execute the `vgchange -a n` command to deactivate the volume group.

```
# vgchange -a n /dev/vg10
Volume group "/dev/vg10" has been successfully changed.
```

Note:

When a host and an Oracle RAC 10g voting disk are connected by multiple paths, HDLM performs failover processing for those paths (in the same way as for normal paths) when an I/O timeout occurs for one of the paths.

Note that, depending on the settings of Oracle RAC 10g, Oracle RAC 10g might determine that a node error has occurred before the failover processing performed by HDLM is completed, and then re-configure the cluster.

Therefore, when HDLM manages the paths that are connected to an Oracle RAC 10g voting disk, change the following settings according to your version of Oracle RAC 10g:

When using Oracle RAC 10g version 10.1.0.3.0 or later

Change the value of `MISSCOUNT` to the following value or greater: *(number-of-paths-connected-to-the-voting-disk x 60 seconds)*.

When using Oracle RAC 10g version 10.2.0.2.0 or later

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

For details on how to change `MISSCOUNT` and `DISKTIMEOUT`, contact the company with which you have a contract for Oracle Support Services.

Note that when you uninstall HDLM from the above configuration, you must reset the values of `MISSCOUNT` and `DISKTIMEOUT` to their original values. Therefore, make a note of the original values of `MISSCOUNT` and `DISKTIMEOUT` before changing them.

3.13 Canceling Setup of HDLM

This section explains how to return the HDLM environment to the way it was before HDLM was installed, and describes each step of the process.

Return the HDLM environment to the way it was before HDLM was installed by following the flow shown below in Figure 3.5.

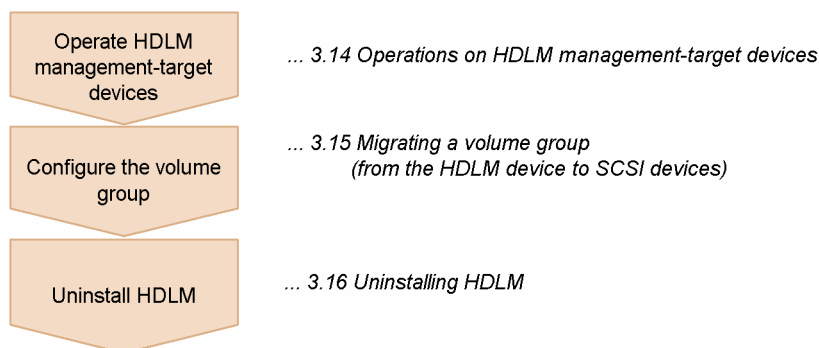


Figure 3.5 Overview of canceling setup of HDLM

3.14 Operations on HDLM Management-Target Devices

The operations you can perform on an HDLM management-target device are backing up data, checking the device file name, and canceling automatic mounting of the device managed by HDLM.

3.14.1 Backing up Data

Back up the contents of an HDLM management-target device as required.

3.14.2 Checking the Device File Name

When you uninstall HDLM and then access a device that was managed by HDLM, you need to specify the device file name of the SCSI device (cXtYdZ). Execute the `view -path` operation or `view -drv` operation to check the correspondence between the HDLM and SCSI device file names.

When LVM is used, follow the directions in 3.15 to migrate the volume group to the one that is created by specifying SCSI device files.

3.14.3 Canceling Automatic Mounting

When automatic mounting of an HDLM device is set by specifying the HDLM device file name in the `/etc/fstab` file, perform either of the following operations:

- Use a text editor to open the `/etc/fstab` file and delete the line that specifies the HDLM device file name for which you want to cancel automatic mounting.
- Use a text editor to open the `/etc/fstab` file and change the HDLM device file name for which you want to cancel automatic mounting to any of the corresponding SCSI device file names.

For example, like the shaded portion in Figure 3.6, if the `/etc/fstab` file contains a line that specifies an HDLM device file name, delete this line or change `ch9t0d0` to `c9t0d0`.

```
/dev/vg00/lvol3 / vxfs delaylog 0 1
/dev/vg00/lvol1 /stand hfs defaults 0 1
/dev/vg00/lvol4 /tmp vxfs delaylog 0 2
/dev/vg00/lvol5 /usr vxfs delaylog 0 2
/dev/vg00/lvol6 /home vxfs delaylog 0 2
/dev/vg00/lvol7 /opt vxfs delaylog 0 2
/dev/vg00/lvol8 /var vxfs delaylog 0 2
/dev/dsk/ch9t0d0 /mntpt vxfs delaylog 0 2
```

Figure 3.6 Example of editing the `/etc/fstab` file

3.15 Migrating a Volume Group (From the HDLM Device to SCSI Devices)

If a volume group is already created using HDLM devices, migrate the device files of SCSI devices to the specified volume group.

The migration procedure in a cluster environment differs from that in a non-cluster environment. The following subsection show the procedures in a cluster environment and in a non-cluster environment.

3.15.1 Migrating a Volume Group in a Non-Cluster Environment

The following procedure shows how to reconfigure a volume group composed of an HDLM device into a volume group composed of the corresponding SCSI devices in a non-cluster environment.

To migrate a volume group (from HDLM to SCSI) in a non-cluster environment:

1. Execute the `vgdisplay -v volume-group-name` command to check the information about the volume group.

```
# vgdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
   :
--- Logical volumes ---
   :
--- Physical volumes ---
PV Name                /dev/dsk/ch16t0d0
PV Status              available
Total PE              446
Free PE               196
Autoswitch            On
```

PV Name indicates the physical volume that comprises a volume group.

In this example, volume group `/dev/vg10` consists of HDLM device `/dev/dsk/ch16t0d0`.

2. Execute the `view -drv` operation to check the correspondence between HDLM and SCSI devices.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV H/W Path
000000 ch16t0d0 c16t0d0 9200.2334.0000 0/6/0/0.8.0.1.0.0.0
000001 ch16t0d1 c16t0d1 9200.2334.0001 0/6/0/0.8.0.1.0.0.1
000002 ch16t0d2 c16t0d2 9200.2334.0002 0/6/0/0.8.0.1.0.0.2
000003 ch16t0d3 c16t0d3 9200.2334.0003 0/6/0/0.8.0.1.0.0.3
   :
000140 ch16t0d0 c19t0d0 9200.2334.0000 0/6/2/0.8.0.7.0.0.0
000141 ch16t0d1 c19t0d1 9200.2334.0001 0/6/2/0.8.0.7.0.0.1
000142 ch16t0d2 c19t0d2 9200.2334.0002 0/6/2/0.8.0.7.0.0.2
000143 ch16t0d3 c19t0d3 9200.2334.0003 0/6/2/0.8.0.7.0.0.3
   :
```

HDLM device `ch16t0d0` is to be replaced with SCSI devices `c16t0d0` and `c19t0d0`.

3. Execute the `vgextend` command with SCSI device files specified, to add them as physical volumes to the volume group.

```
# vgextend /dev/vg10 /dev/dsk/c16t0d0
Volume group "/dev/vg10" has been successfully extended.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

# vgextend /dev/vg10 /dev/dsk/c19t0d0
Current path "/dev/dsk/c16t0d0" is an alternate link, skip.
Volume group "/dev/vg10" has been successfully extended.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf
```

4. Execute the `vgdisplay -v` command to verify that the SCSI devices have been added as alternate links among physical volumes.

```
# vgdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access         read/write
VG Status               available
      :
      :
--- Logical volumes ---
LV Name                 /dev/vg10/lvol1
      :
      :
--- Physical volumes ---
PV Name                 /dev/dsk/ch16t0d0
PV Name                 /dev/dsk/c16t0d0 Alternate Link
PV Name                 /dev/dsk/c19t0d0 Alternate Link
PV Status               available
Total PE                446
Free PE                 196
Autoswitch              On
```

In this example, SCSI devices `/dev/dsk/c16t0d0` and `/dev/dsk/c19t0d0` have been added.

5. Execute the `vgreduce` command with the HDLM device file specified, to remove it from the volume group.

```
# vgreduce /dev/vg10 /dev/dsk/ch16t0d0
Device file path "/dev/dsk/ch16t0d0" is a primary link.
Removing primary link and switching to an alternate link.
Volume group "/dev/vg10" has been successfully reduced.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf
```

6. Execute the `vgdisplay -v` command to verify that the volume group is now composed of SCSI devices, not an HDLM device.

```

# vdisplay -v vg10
--- Volume groups ---
VG Name                /dev/vg10
VG Write Access        read/write
VG Status              available
:
--- Logical volumes ---
:
--- Physical volumes ---
PV Name                /dev/dsk/c16t0d0
PV Name                /dev/dsk/c19t0d0 Alternate Link
PV Status              available
Total PE              446
Free PE               196
Autoswitch            On

```

When HDLM device `/dev/dsk/ch16t0d0` has been deleted, and SCSI devices `/dev/dsk/c16t0d0` and `/dev/dsk/c19t0d0` remain, migration was successful.

7. Check whether the path to the SCSI device for the primary link is an owner path.

If the SCSI device for the main link is not an owner path, execute the `pvchange -s` command to set the primary link as an owner path. In the following example, the command sets an alternate link `/dev/dsk/c19t0d0` as the primary link:

```

# pvchange -s /dev/dsk/c19t0d0
Physical volume "/dev/dsk/c19t0d0" has been successfully changed.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf

```

3.15.2 Migrating a Volume Group in a Cluster Environment

This subsection shows the procedure for reconfiguring a volume group consisting of HDLM devices that are shared among hosts to the one that consists of corresponding SCSI devices by specifying the SCSI device files. Perform the following procedure at all hosts that make up a cluster.

3.15.2.1 For MC/ServiceGuard or Oracle RAC

A volume group can be activated with only one host concurrently. You cannot use the `vgchange -a y` command to activate a volume group shared between hosts. Thus, you must first use the `cmruncl` command to start MC/ServiceGuard or Oracle RAC. At this time, if there is a software package that is using the target volume group, use the `cmhaltpkg` command to halt the software package. Then, use the `vgchange -a e` command to activate the volume group in the exclusive mode.

To migrate a volume group (from HDLM to SCSI) in a cluster environment:

1. Execute the `cmruncl` command to activate volume group.

```

# cmruncl -v
Successfully started $SGLBIN/cmcl on haneda.
Successfully started $SGLBIN/cmcl on kanku.
cmruncl : Waiting for cluster to form....
cmruncl : Cluster successfully formed.
cmruncl : Check the syslog files on all nodes in the cluster
cmruncl : to verify that no warnings occurred during startup.

```

2. Execute the `cmviewcl` command to check whether there are active software packages.

```
# cmviewcl
CLUSTER      STATUS
cluster25    up
  NODE        STATUS      STATE
  kanku       up          running
    PACKAGE   STATUS      STATE      AUTO_RUN  NODE
    pkg25     up          running    enabled   kanku
```

In this example, package `pkg25` is running.

3. If there is an active software package, use the `cmhaltpkg` command to terminate the software package.

In the following example, the command terminates package `pkg25`:

```
# cmhaltpkg pkg25
cmhaltpkg : Completed successfully on all packages specified.
```

4. Execute the `vgchange -a e` command to activate the volume group in the exclusive mode.

```
# vgchange -a e /dev/vg10
Activated volume group in Exclusive Mode.
Volume group "/dev/vg10" has been successfully changed.
```

5. Migrate the volume group.

Follow the directions in 3.12.1 to migrate the device files of SCSI devices to the specified volume group.

6. Execute the `vgchange -a n` command to deactivate the volume group.

```
# vgchange -a n /dev/vg10
Volume group "/dev/vg10" has been successfully changed.
```

3.16 Uninstalling HDLM

When you uninstall HDLM, if the `KAPL09019-E` or `KAPL09020-E` message is output in the `swagent` log file (`/var/adm/sw/swagent.log`), follow the directions in 3.17 to uninstall `HNTRLlib2`. However, if the `KAPL09026-I` message is output in the `swagent` log file, since a program other than HDLM is using Hitachi Network Objectplaza Trace Library (`HNTRLlib2`), only HDLM will be uninstalled.

Once you start uninstallation, do not cancel it.

Note:

- When uninstalling HDLM on a host where a Device Manager Agent 5.0 or later is installed, do not execute any of the following commands of Device Manager Agent during uninstallation. Also, do not uninstall HDLM while executing any of the following Device Manager Agent commands:

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

For details about Device Manager Agent commands, see the manual *HiCommand Device Manager Agent Installation Guide*.

- When you uninstall HDLM, the file defining the non-HDLM-managed disks (`/etc/opt/DynamicLinkManager/dlmfdrv.unconf`) is deleted. If you need the file defining the non-HDLM-managed disks, store the file in a directory other than the following directories:

```
/opt/DynamicLinkManager, /etc/opt/DynamicLinkManager,  
/var/opt/DynamicLinkManager
```

- If you want to uninstall a specific HDLM SP, first remove the whole of HDLM using the following procedure, and then re-install HDLM. Then, install the needed HDLM SP.

To uninstall HDLM:

1. Log on to HP-UX as a user with root privileges.
2. Stop all the processes and services that use the HDLM management-target paths.
Stop any process or service of an application, such as a DBMS, that is using the HDLM management-target path.

3. Use the following command to cancel all the mount points that use HDLM.

```
# umount mount-point
```

4. Execute the following command to uninstall HDLM.

```
# swremove DLManager
```

5. Execute the following commands to restart the host.

```
# cd /  
# shutdown -r
```

3.17 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib2)

When you uninstall HDLM, if the KAPL09019-E or KAPL09020-E message is output in the `swagent log` file (`/var/adm/sw/swagent.log`), follow the directions below to uninstall HNTRLib2.

If the KAPL09020-E message is output, skip 2 and 3.

To uninstall HNTRLib2:

1. Log on to HP-UX as a user with root privileges.
2. Execute the following command to verify that HDLM has not been registered in HNTRLib2.

```
# /opt/hitachi/HNTRLib2/etc/hntr2getname  
:  
#
```

If HDLM has been registered, go to step 3. If not, go to step 4.

3. Execute the following commands to verify that it was unregistered.

```
# /opt/hitachi/HNTRLib2/etc/hntr2cancel "Hitachi Dynamic Link Manager"
# echo $?
0
#
```

If the result is not 0, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

When the program other than HDLM was not displayed in step 2, go to step 4. When the program other than HDLM was displayed in step 2, finish the procedure.

4. Execute the following command to display the HNTRLib2 setup menu.

```
# /opt/hitachi/HNTRLib2/etc/hntr2setup
```

5. From the setup menu, select 9.

HNTRLib2 will uninstall, and the following message will appear.

```
Unsetup is complete.
```

If the message other than the above message appears, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM.

6. Delete the shared library files for HNTRLib2 and the directory that contains the files.

Uninstallation of HNTRLib2 deletes the `/opt/hitachi/HNTRLib2` directory including the subdirectories but does not delete the library in the `/opt/hitachi/common/lib` directory.

When you uninstall HNTRLib2, delete the following files and directory also:

- Shared library files (symbolic link)
`/opt/hitachi/common/lib/libhntr2*`
- Directory that contains the shared library files
`/opt/hitachi/common/lib/D002`

When the `/opt/hitachi` directory contains only the above files and directory, delete the `/opt/hitachi` directory including the subdirectories.

Note: If the log output directory set in HNTRLib2 was not the default directory, the log files will not be deleted during uninstallation. In this case, delete these files after uninstallation.

3.18 Uninstalling Hitachi Network Objectplaza Trace Library (HNTRLib)

When you perform an upgrade installation of HDLM 5.9 onto a host that contains HDLM 04-00, the Hitachi Network Objectplaza Trace Library (HNTRLib) that was installed together with HDLM 04-00 remains. If no applications other than HDLM are using HNTRLib, uninstall HNTRLib as follows.

To uninstall HNTRLib:

1. Check that no applications other than HDLM are using HNTRLib.
See the manuals and documentation for each program to check whether the program is using Hitachi Network Objectplaza Trace Library.
2. Log on to HP-UX as a user with root privileges.
3. Execute the following command to display the HNTRLib setup menu.

```
# /opt/hitachi/HNTRLib/etc/hntrsetup
```

4. From the setup menu, select **9**.
HNTRLib will be uninstalled.
5. Delete the HNTRLib common library files and the directory in which they are stored.

When you uninstall HNTRLib, all directories within the `/opt/hitachi/HNTRLib` directory will be deleted, but the libraries within the `/opt/hitachi/common/lib` directory will not.

To delete HNTRLib, delete the following files and directory.

- Shared library files (symbolic links)
`/opt/hitachi/common/lib/libhntr*`
- Directory that contains shared library files
`/opt/hitachi/common/lib/D001`

If the `/opt/hitachi` directory only contains the files and directories shown above, delete the `/opt/hitachi` directory.

Note:

- If the log output directory set in HNTRLib was not the default directory, the log files will not be deleted during uninstallation. In this case delete these files after uninstallation.
- Even if you attempt to uninstall HNTRLib2 when HNTRLib is installed, HNTRLib will not be uninstalled. If no other programs are using HNTRLib, delete it manually.

Chapter 4 HDLM Operation

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

- 4.1 Cautions on Using HDLM
- 4.2 HDLM Operations Using Commands
- 4.3 Starting and Stopping the HDLM Manager
- 4.4 Reconfiguring the HDLM Operating Environment

4.1 Cautions on Using HDLM

This section explains points to bear in mind when working in an environment in which HDLM is installed or used. Be sure to read these notes.

4.1.1 About the kernel

The following notes relate to the kernel.

4.1.1.1 Supported kernel

HDLM supports only the default kernel (`/stand/vmunix`). Use this kernel as standard.

4.1.1.2 Required operations after reconfiguring kernel and restarting the host

The kernel may be reconfigured and the host may be restarted when you perform any of the following operations using the `sam`, `swinstall`, `kmtune`, or `kconfig` commands:

- Add, uninstall, or upgrade software or patches by the `swinstall`, `swremove`, or other command
- Add, remove, or change a swap device or dump device
- Change a reconfigurable kernel parameter
- Perform an upgrade installation and re-installation of HDLM

If you perform one of the above operations and then restart the host, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed devices has been modified. Run the HDLM path-configuration definition utility (`dlmdefpath`) again and make sure the above message does not appear this time after restarting the host.

For details about the `d1mdefpath` utility, see 7.4 in Chapter 7.

4.1.2 Device Files Used in HDLM

The following notes relate to device files used in HDLM.

- To use an HDLM-managed device in an application, specify the device file name of the HDLM device (`chXtYdZ`). If the device file name of a SCSI device (`cXtYdZ`) is specified, HDLM functionality cannot be used.
- A system-specific device file is created in the `/dev/d1m` directory when you install HDLM. Do not use this device file.

4.1.3 Storage Subsystems

The following notes relate to storage subsystems.

- You must not change vendor ID and product ID of the storage subsystem. If you change these IDs, HDLM cannot recognize the storage subsystem.
- Start the storage subsystems before you start the host. This enables HP-UX to detect the storage subsystems.

4.1.4 Reconfiguring a system based on HDLM

4.1.4.1 Running the HDLM path-configuration definition utility (`d1mdefpath`)

Execute the HDLM path-configuration definition utility (`d1mdefpath`) in the situations listed below. If the host is restarted without executing the `d1mdefpath` utility, commands for the HDLM-managed device will not execute properly.

- After a hardware reconfiguration, such as a changing a logical unit or path
- After modifying the file that defines non-HDLM-managed devices in HDLM

The host restarts when you run the `d1mdefpath` utility. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/d1mcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed devices has been modified. Run the `d1mdefpath` utility again and make sure the above message does not appear this time after restarting the host.

For details about the `d1mdefpath` utility, see 7.4 in Chapter 7.

4.1.4.2 Backing up configuration definition files

After you reconfigure an HDLM-based system, first make sure that the environment has been rebuilt correctly, then back up the HDLM configuration definition files. These files are located in the directory `/etc/opt/DynamicLinkManager`. Back up the entire directory.

4.1.5 Restoring a Disconnected Path

If a cable is disconnected or broken when you start the system, HDLM will not recognize that path. To restore a disconnected path, follow these steps:

Execute the `dlmkmgr` command's `view -drv` operation. Verify that all the paths set as HDLM management targets are listed in the execution result.

Any path that was disconnected at host startup will not appear in the execution result.

Connect the cable if disconnected, or replace it if broken.

Execute the `ioscan -f` command and verify that the path you connected has been restored.

The path has been restored if `CLAIMED` appears as the `S/W State` of the `H/W Path` in question.

Restart the host on which HDLM is installed.

At HDLM startup, the path to the HDLM-managed device that was disconnected at step 1 is automatically restored and placed in the active state.

Execute the `dlmkmgr` command's `view -path` operation and verify that the path to the HDLM-managed device has been restored.

The path has been restored if its `Status` appears as `Online`.

4.1.6 I/O Timeout Values

This section describes the timeout that occurs when an error occurs in all the paths connected to the HDLM-managed device. For details about timeout values for logical and physical volumes when Oracle 10g is used, also see 3.12.2.

4.1.6.1 When LVM is used

To set the timeout value for a physical volume, use the `pvchange -t` command of LVM to specify the device file name of the HDLM device for the physical volume. The timeout value set here will be set for all the paths (SCSI devices) to physical volumes corresponding to the HDLM device.

If errors occur on all the paths connected to physical volumes, HDLM sends a response to LVM after the requests sent to all the physical volumes have timed out. As a result, HDLM then sends a response informing LVM of the I/O error, after the time calculated as follows has passed since the I/O request was issued by LVM:

$physical-volume-timeout-value \text{ (seconds)} \times number-of-paths-to-the-HDLM-managed-device$

Figure 4.1 shows the flow of processing that starts when an application issues an I/O request and ends when the application receives a response. In the example in Figure 4.1, a timeout value of 30 seconds is set for an HDLM-managed device and the corresponding physical volume, and there are 2 paths connected to that volume. If an I/O request sent to the HDLM-managed device fails, HDLM will send a response to LVM about 60 seconds later, which is calculated as follows: 30 seconds ($physical-volume-timeout-value$) \times 2 ($number-of-paths-to-the-HDLM-managed-device$) = 60 seconds.

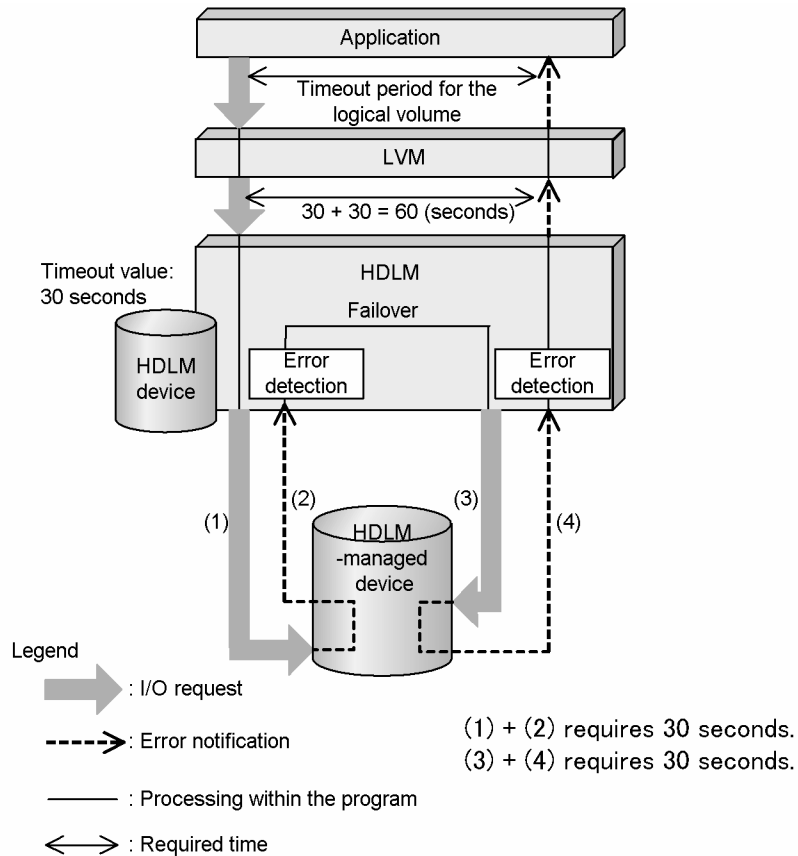


Figure 4.1 Flow from an I/O request to a response

Therefore, if the timeout value for the logical volume, set by the `lvchange -t` command of LVM, exceeds the value given by the equation above ($physical-volume-timeout-value \text{ (seconds)} \times number-of-paths-to-the-HDLM-managed-device$), HDLM sends a response to LVM before the timeout value set for the logical volume elapses, and then the application receives a response. The error number (`errno`) in this case is `EPOWERF`.

Message KAPL08019-E or KAPL08022-E is output to syslog each time the timeout for a physical volume occurs.

Considering all of the above, we recommend that the following conditions be satisfied for the logical volume's timeout or physical volume's timeout:

- Logical volume timeout value \geq *physical-volume-timeout-value* \times *number-of-paths-to-the-HDLM-managed-device*
- System requirements such as the application's timer monitoring interval

In the following example, the command sets the logical volume's timeout value to 60 seconds:

```
# lvchange -t 60 /dev/vg10/lvol1
Logical volume "/dev/vg10/lvol1" has been successfully changed.
Volume Group configuration for /dev/vg10 has been saved in /etc/lvmconf/vg10.conf
```

4.1.6.2 When LVM is not used

When the following time passes, the character I/O request to the device file for the HDLM device fails and a response to that effect is returned to the application. The `errno` at this time is EIO.

$30 \times$ *number-of-paths-to-the-HDLM-managed-device* (seconds)

4.1.7 HP-UX Commands and Ignite-UX

Restrictions apply to the operation of some HP-UX commands when a SCSI device is set as an HDLM management target. For details, see *A. Cautions on Using HP-UX Commands*.

There are also some precautions to note when using the `make_net_recovery` command or `make_tape_recovery` command provided by Ignite-UX. For details, see *B. Cautions on Using Ignite-UX*.

4.1.8 Collecting Operating Statistics

This section describes points you should note when collecting operating statistics using any of the following software:

- HP OpenView GlancePlus
- HP OpenView MeasureWare
- HP OpenView performance agent

Note: When you use any of these applications, `Logl Rd/Wr Rt` is reflected in the information about the hardware paths associated with the HDLM device file name, which you can view by executing the `ioscan -fn` command. `Phys Rd/Wr Rt` is reflected in the information about the hardware paths actually used in data transmission. Depending on the time difference when each of these values is read, the `Logl Rd/Wr Rt` total and the `Phys Rd/Wr Rt` total may not coincide.

```

Logfile: /var/opt/perf/datafiles/logglob SCOPE/UX C.03.70.00 host1
      Sec      Device
Date  Time  /Intvl  Name  File System  Disk %  Dsk Avg  Req  Logl  Logl  Phys  Phys  Phys ...
yy/mm/dd hh:mm 3600 0/6/2/0.8.0.5.0.7.0  Unknown  1.78  0.34  0.00  455  0  113.9  0.0  279.2
yy/mm/dd hh:mm 3600 0/4/0/0.8.0.5.0.7.0  Unknown  2.58  0.78  0.00  0  0  113.9  0.0  279.2
yy/mm/dd hh:mm 3600 0/6/0/0.8.0.4.0.7.0  Unknown  2.67  0.85  0.00  0  0  113.9  0.0  279.2
yy/mm/dd hh:mm 3600 0/2/0/0.8.0.4.0.7.0  Unknown  1.82  0.26  0.00  0  0  113.9  0.0  279.2

```

In this output example, HP OpenView MeasureWare was used to collect operating statistics after raw I/O was issued on an HDLM device (/dev/rdisk/ch16t7d0). You can use the `dlnmgr` command's `view -drv` operation to check the correspondence between the HDLM device and the information that was output.

The following shows an example of the results of executing the `view -drv` operation.

```

PathID HDevName Device LDEV H/W Path
000006 ch16t7d0 c16t7d0 9970/9980.15001.0540 0/6/2/0.8.0.5.0.7.0
000037 ch16t7d0 c17t7d0 9970/9980.15001.0540 0/4/0/0.8.0.5.0.7.0
000040 ch16t7d0 c18t7d0 9970/9980.15001.0540 0/6/0/0.8.0.4.0.7.0
000043 ch16t7d0 c19t7d0 9970/9980.15001.0540 0/2/0/0.8.0.4.0.7.0

```

4.2 HDLM Operations Using Commands

This section explains how to use the HDLM commands to utilize HDLM functions. For details on commands, see Chapter 6.

4.2.1 Notes on Using Commands

- Execute the command as a user with root privileges.
- To specify a value containing a space in a parameter, enclose the entire value in double quotation marks (").

4.2.2 Viewing Path Information

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

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

```
# /opt/DynamicLinkManager/bin/dlnmgr view -path
```

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

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hdev ch8t0d0
Paths:000002 OnlinePaths:000002
PathStatus   IO-Count   IO-Errors
Online       0             0

PathID PathName          DskName
iLU          ChaPort Status      Type IO-Count   IO-Errors  DNum HDevName
000000 0008.0000.0000000000000000.0000 HITACHI .DF500F      .2334
0000          0A      Online      Non      0           0         0 ch8t0d0
000005 0010.0000.0000000000000000.0000 HITACHI .DF500F      .2334
0000          1A      Online      Own      0           0         0 ch8t0d0
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#

```

For details on the displayed items and their descriptions, see 6.7.

4.2.3 Changing the Status of Paths

This subsection explains how to change the status of paths.

4.2.3.1 When Changing the Status of a Path to Online

To change the status of a path to online:

1. Check the current status of the path.

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

The following example shows how to execute the command:

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

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

You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. For details on how to specify a path, see 6.5.

For example, if you want to place all paths that pass through a specific HBA port online, execute the `dlnkmgr` command's `online` operation with the `-hba` parameter specified. The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0001.0000
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) could not be placed
online. Operation name = online
#
```

3. Check the changed status of the path.

The following example shows how to execute the command:

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



4.2.3.2 When Changing the Status of a Path to Offline(C)

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

1. Check the current status of the path.

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

The following example shows how to execute the command:

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

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

You can specify the paths you want to place online by specifying an HBA port or channel adapter port to which the target paths are connected, or by specifying a single path. For details on how to specify a path, see 6.4.

For example, if you want to place all paths that pass through a specific HBA port offline, execute the `dlnkmgr` command's `offline` operation with the `-hba` parameter specified. The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0001.0000
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) could not be
placed offline(C). Operation name = offline
#
```

3. Check the changed status of the path.

The following example shows how to execute the command:

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

4.2.4 Viewing LU Information

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

To display LU information, execute the `dlnkmgr` command's `view` operation with the `-lu` parameter specified. The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : 9500V
SerialNumber : 0016
LUs          : 2

iLU  HDevName Device PathID Status
0058 ch6t0d0  c6t0d0 000000 Online
      c8t0d0 000002 Online
```

```

0059 ch6t0d1 c6t0d1 000001 Online
           c8t0d1 000003 Online
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#

```

For details on the displayed items and their descriptions, see 6.7.

4.2.5 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 `dlkmgr` command's `view` operation with the `-drv` parameter specified. For details on the `view` operation, see 6.7 The execution result of this operation is displayed on a single line for each path.

The following shows an example in which the `view` operation is executed:

```

# /opt/DynamicLinkManager/bin/dlkmgr view -drv
PathID HDevName Device LDEV H/W Path
000000 ch4t0d0 c4t0d0 9970/9980.15001.0540 0/6/0/0.8.0.0.0.0.0
000001 ch4t0d1 c4t0d1 9970/9980.15001.0541 0/6/0/0.8.0.0.0.0.1
000002 ch4t0d2 c4t0d2 9970/9980.15001.0542 0/6/0/0.8.0.0.0.0.2
:
000024 ch4t0d0 c11t0d0 9970/9980.15001.0540 0/6/2/0.8.0.0.0.0.0
000025 ch4t0d1 c11t0d1 9970/9980.15001.0541 0/6/2/0.8.0.0.0.0.1
000026 ch4t0d2 c11t0d2 9970/9980.15001.0542 0/6/2/0.8.0.0.0.0.2
:
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#

```

For details on the displayed items and their descriptions, see 6.7.

4.2.6 Initializing Statistical Information for Paths

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

This procedure is useful when you wish to check the number of I/O hits and I/O errors that have occurred since the last time the I/O counts and I/O errors were initialized to the value 0.

To initialize statistical information for paths:

1. Check the current status of the path.

The following shows how to execute the command:

```

# /opt/DynamicLinkManager/bin/dlkmgr view -path

```

2. To initialize statistical information (I/O counts and I/O errors) for all paths managed by HDLM, execute the `dlnkmgr` command's `clear` operation with the `-pdst` parameter specified.

The following shows an example in which the command is executed:

```
# /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 whether the statistical information for the paths has been initialized.

The following shows how to execute the command:

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

4.2.7 Viewing and Setting up the Operating Environment

This subsection explains how to display and set up the HDLM operating environment.

4.2.7.1 Viewing the Operating Environment

To display the operating environment, execute the `dlnkmgr` command's `view` operation with the `-sys` and `-sfunc` parameters specified.

The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size(KB)     : 9900
Number Of Elog Files   : 2
Trace Level            : 1
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : off
Intermittent Error Monitor : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7.

4.2.7.2 Setting Up the Operating Environment

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

- Load balancing
- Path health checking
- Automatic failback
- Intermittent error monitoring
- Error log collection level
- Trace level
- Error log file size
- The number of error log files
- Trace file size
- The number of trace files

For details on how to set each function, see 6.6.

For example, to set up the log level, execute the `dlnmgr` command's `set` operation with the `-ellv` parameter specified. When the confirmation message is displayed, enter `y` to execute, or `n` to cancel the command.

The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]: y
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time =
yyyy/mm/dd hh:mm:ss
#
```

To check whether the settings have been applied, see 4.2.7.1 from 4.2.7.

4.2.8 Viewing license information

This subsection explains how to display license information.

To display license information, execute the `dlnmgr` command's `view` operation with the `-sys` and `-lic` parameters specified.

The following shows an example in which the command is executed.

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys -lic
License Type Expiration
Permanent -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#
```

For details on the displayed items and their descriptions, see 6.7.

4.2.9 Updating the License

This subsection 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 might appear:

```
KAPL01075-E
```

```
A fatal error occurred in HDLM. The system environment is invalid.
```

If this message appears, execute the `dlnmgr` command's `view` operation with the `-sys -lic` parameter to make sure that the license is installed correctly.

The following shows an example in which the command is executed:

```
# /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.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time =
yyyymm/dd hh:mm:ss
#
```

4.2.10 Viewing HDLM Version Information

This subsection explains how to display HDLM version information.

To display HDLM version information, execute the `dlnmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in which the command is executed:

```
# /opt/DynamicLinkManager/bin/dlnmgr view -sys
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size (KB)    : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace File Size (KB)   : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive                 xx-xx   yyyymm/dd hh:mm:ss
HDLM Alert Driver Ver WakeupTime   ElogMem Size
Alive                 xx-xx   yyyymm/dd hh:mm:ss 4096
```

```

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

```

The value displayed in HDLM version indicates the HDLM version.

4.2.11 Viewing HDLM Component Information

This subsection explains how to display HDLM component information.

To display HDLM component information, execute the `dlnkmgr` command's `view` operation with the `-sys` parameter specified. The following shows an example in which the command is executed:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version      : xx-xx
Service Pack Version      :
Load Balance      : on(rr)
Support Cluster      :
Elog Level        : 3
Elog File Size (KB)      : 9900
Number Of Elog Files      : 2
Trace Level        : 0
Trace File Size (KB)      : 1000
Number Of Trace Files      : 4
Path Health Checking      : on(30)
Auto Failback      : off
Intermittent Error Monitor : off
HDLM Manager Ver      WakeupTime
Alive      xx-xx    yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      xx-xx    yyyy/mm/dd hh:mm:ss 4096
HDLM Driver Ver      WakeupTime
Alive      xx-xx    yyyy/mm/dd hh:mm:ss
License Type Expiration
Permanent      -
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#

```

Among the displayed items, HDLM Manager, HDLM Alert Driver, and HDLM Driver indicate the HDLM component information.

Also, you can view information for each HDLM component. Execute the `dlnkmgr` command's `view` operation with the `-sys` and subsequent parameter specified. The following shows an example in which the command is executed:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -advr
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -pdrv

```

4.3 Starting and Stopping the HDLM Manager

If an error occurs in the system, such as in an HDLM program, you may need to manually stop or start HDLM to recover from the error.

4.3.1 Starting the HDLM Manager

To start the HDLM manager, log in to HP-UX as a user with root privileges and then execute the following command.

```
# /sbin/init.d/DLMManager start
```

Lower case characters can be used for the command name (`dlmmanager`).

```
# /sbin/init.d/dlmmanager start
```

The startup script that was set up during HDLM installation runs, and starts the HDLM manager.

Note: If you execute `dlmmanager`, only use the standard POSIX shell (`/usr/bin/sh`) for the shell argument.

Use the following HDLM command's `view` operation to confirm that the HDLM manager is running:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Alive      xx-xx    yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#
```

When the HDLM Manager column shows `Alive`, the HDLM manager is active.

4.3.2 Stopping the HDLM Manager

To stop the HDLM manager, log in to HP-UX as a user with root privileges, and then execute the following command:

```
# /sbin/init.d/DLMManager stop
```

Lower case characters can be used for the command name (`dlmmanager`).

```
# /sbin/init.d/dlmmanager stop
```

The stop script that was set up during HDLM installation runs, and stops the HDLM manager.

Note: If you execute `dlmmanager`, only use the standard POSIX shell (`/usr/bin/sh`) for the shell argument.

Use one of the following procedures to confirm that the HDLM manager has stopped:

Use the following `dlnkmgr` command's `view` operation to confirm that the HDLM manager has stopped.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver      WakeupTime
Dead
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyymm/dd hh:mm:ss
#
```

When the HDLM Manager column shows Dead, the HDLM manager is inactive.

4.4 Reconfiguring the HDLM Operating Environment

This section describes how to reconfigure the environment for running HDLM. The procedures described in this section include replacing hardware (host bus adapter and fiber cable) and changing an HDLM-managed device.

4.4.1 Replacing a Host Bus Adapter

If there are multiple active paths for an LU, you can replace a desired host bus adapter while running your applications. To do this, place offline only the path that goes through the host bus adapter to be replaced, and use other paths to continue access.

Note: The following procedure is only for replacing a host bus adapter.

To replace a host bus adapter:

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

To place in Offline(C) status the path that goes through the host bus adapter with host port number 0001 and bus number 0000, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0001.0000
```

2. Replace the host bus adapter.

Because the path configuration changes when you insert the host bus adapter in a different slot, the host must be restarted. To replace the host bus adapter while the application is operating, we recommend that a new host bus adapter should be inserted into the same slot where the host bus adapter is to be replaced.

3. Execute the `ioscan -fnC disk` command to check whether the replaced host bus adapter is properly inserted, and the path configuration has not been changed.

According to the results of the `ioscan` command, confirm that S/W State of the path for the inserted HBA is CLAIMED. Also check the Driver of the path for the inserted HBA.

If Driver appears as `dlnmfdrv` (`zdlmfdrv` in the HP-UX 11i v2.0):

Proceed to step 4.

If the Driver appears as `sdisk`:

The path configuration has changed. To apply the latest path configuration definition, run the HDLM path-configuration definition utility (`dldmdefpath`). After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dldmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

After confirming that the `KAPL10317-E` message is not output, execute the `dlnkmgr` command's `view -drv` operation to verify the new path configuration.

You do not need to perform the following steps.

4. Place in Online status the path that goes through the replaced host bus adapter.

To place in Online status the path that goes through the host bus adapter with host port number `0001` and bus number `0000`, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0001.0000
```

5. Execute the `dlnkmgr` command's `view -drv` operation to check the path information.

4.4.2 Replacing a Fiber Cable

If there are multiple active paths for an LU, you can replace a desired cable while running your applications. To do this, place offline only the path that goes through the cable to be replaced, and use other paths to continue accesses.

Note: The following procedure is only for replacing a fiber cable.

To replace a fiber cable:

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

To place in Offline(C) status the path that goes through the host bus adapter with host port number `0001` and bus number `0000`, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr offline -hba 0001.0000
```

2. Replace the cable.

If you connect a cable to a switch-side port or storage subsystem-side port that is different from the port used before the replacement, you must restart the host because the path configuration has changed. We recommend that you connect the cable to the ports that were used before the replacement because this enables applications to continue running while you replace the cable.

3. Execute the `ioscan -fnC disk` command to check whether the replaced cable is properly connected, and the path configuration has not been changed.

According to the results of the `ioscan` command, confirm that `S/W State` of the path that goes through the replaced cable is `CLAIMED`. Also check the `Driver` of the path that goes through the replaced cable.

If `Driver` appears as `dlnmfdrv` (`zdlmfdrv` in the HP-UX 11i v2.0):

Proceed to step 4.

If the `Driver` appears as `sdisk`:

The path configuration has changed. To apply the latest path configuration definition, run the HDLM path-configuration definition utility (`dlnmdefpath`). After the host is restarted, access the

`/var/opt/DynamicLinkManager/log/dlnmcfmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dlnmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

After confirming that the `KAPL10317-E` message is not output, execute the `dlnkmgr` command's `view -drv` operation to verify the new path configuration.

You do not need to perform the following steps.

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

To place in Online status the path that goes through the host bus adapter with host port number `0001` and bus number `0000`, execute the following command:

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -hba 0001.0000
```

5. Execute the `dlnkmgr` command's `view -drv` operation to check the path information.

4.4.3 Changing the Configuration of HDLM Devices

This section describes the procedures for reconfiguring an HDLM-managed device.

4.4.3.1 Adding a Logical Unit

To add an HDLM device for an LU to an HDLM host:

1. Using the storage subsystem management program, set a logical-unit (LU) path by allocating a logical unit (LU) to the port of a storage subsystem that has a path to the host. The LU must not be already allocated to this host.

For details about setting a path, see your storage subsystem documentation.

2. Execute the `ioscan -fnC disk` command to make sure that S/W State of the added LU is CLAIMED.

```
# ioscan -fnC disk
```

3. On the HDLM host, execute the HDLM path-configuration definition utility (`dldmdefpath -a`).

The host is restarted and the HDLM device that you set the path for at step 1 is automatically added.

4. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dldmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

5. Execute the `dlnkmgr` command's `view -drv` operation to verify that an HDLU device corresponding to the added LU has been created.

4.4.3.2 Deleting a Logical Unit

To delete the HDLM device for an LU:

1. Stop all access to the logical unit (LU) to be deleted.
2. If the HDLM device to be deleted is specified in a setup file or other information in an upper-level program, ensure that the upper-level program is inactive.
3. If you are using a logical volume manager, delete the volume group by using the `vgexport` command or delete the LU from the volume group by using the `vgreduce` command.
4. Using the storage subsystem management program, delete all path allocations to this LU from the ports of storage subsystems that have a path to this host.

For details about deallocating (deleting) a path, see your storage subsystem documentation.

5. Execute the `ioscan -fnC disk` command to make sure that S/W State of the path to the LU whose path allocations were deleted is NO HW.

```
# ioscan -fnC disk
```

6. On the HDLM host, execute the HDLM path-configuration definition utility (`dldmdefpath -a`).

The host is restarted and the HDLM device corresponding to the LU that you defined for deletion at step 4 is automatically deleted.

7. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dldmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

8. Execute the `dlnkmgr` command's `view -drv` operation to verify that the HDLM device corresponding to the deleted LU has been deleted.

4.4.4 Adding or Deleting a Path

This section describes the procedures for adding or deleting a path.

4.4.4.1 Adding a Path to a Logical unit

To add a path to an existing logical unit (HDLM device):

1. Using the storage subsystem management program, define the addition of a path to the target LU.

For details about adding a path, see your storage subsystem documentation.

2. Execute the `ioscan -fnC disk` command to make sure that S/W State of the added path is CLAIMED.

```
# ioscan -fnC disk
```

3. On the HDLM host, execute the HDLM path-configuration definition utility (`dldmdefpath -a`).

The host is restarted and the path that you defined for addition at step 1 is automatically added as a path between the LU and the HDLM device.

4. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dldmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

5. Execute the `dlnkmgr` command's `view -drv` operation to verify that an extra path to the HDLM device has been added.

4.4.4.2 Deleting a Path to a Logical Unit

To delete a path to a logical unit (HDLM device):

1. Stop all access to the logical unit (LU) in question.
2. Using the storage subsystem management program, delete the LU path.
For details about deleting a path, see your storage subsystem documentation.
3. Execute the `ioscan -fnC disk` command to make sure that S/W State of the deleted path is `NO_HW`.

```
# ioscan -fnC disk
```

4. On the HDLM host, execute the HDLM path-configuration definition utility (`dldmdefpath -a`).

The host is restarted and the path you have deleted at step 2 is automatically deleted from the paths between the LU and the HDLM device.

5. After the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dldmdefpath` utility again, and make sure the above message does not appear this time after restarting the host.

6. Execute the `dlnkmgr` command's `view -drv` operation to verify that the information about the deleted path has been deleted from the information about the HDLM device.

Chapter 5 Troubleshooting

This chapter describes how to check HDLM error information and how to take action if an error occurs in HDLM. The actions to take are described separately for path errors, HDLM program errors, and other types of errors.

- 5.1 Information collected by the DLMgetras utility for collecting HDLM error information
- 5.2 Checking Error Information in Messages
- 5.3 Actions Taken for a Path Error
- 5.4 Actions Taken for a Program Error
- 5.5 Actions Taken for Other Errors

5.1 Information collected by the DLMgetras utility for collecting HDLM error information

Immediately after an error occurs, execute the error information collection utility `DLMgetras`, since restarting the machine may delete information collected by `DLMgetras`. For details about the `DLMgetras` utility and the error information it collects, see 7.2.

5.2 Checking Error Information in Messages

When you want to configure the system so that HDLM messages are output to `syslog`, specify `user` for the name of the system function defined in the `syslogd` settings file. In the following example, the system function name is `user`, and messages at the Information level or higher are output to the `/etc/syslog.conf` file:

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

You can check path errors by referring to the `KAPL08xxx` messages that are output to `syslog`.

To obtain detailed information about the failed path, check the execution results of the `view` operation as indicated by the error message.

For details on the `view` operation, see 6.7.

Based on the applicable message, detailed information about a path can be obtained by checking the execution results of the `view` operation.

The following is an example of a message:

```
KAPL08022-E
```

```
Error in path occurred.
```

```
ErrorCode = aa...aa, PathID = bb...bb, PathName =  
cc...cc.dd...dd.ee...ee.ff...ff, DNum = gg...gg, HDevName = hh...hh
```

The elements of the message are explained below.

ErrorCode

The error number generated when HP-UX detected the path error.

The four leftmost digits are `errno`, and the four rightmost digits are `cdb_status`.

For details on `errno`, see the man page for `errno(2)` and the `/usr/include/sys/errno.h` file.

For details on `cdb_status`, see the man page for `sioc_io(7)` and the `/usr/include/sys/scsi.h` file.

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.

The path ID is also the same as `PathID` displayed by the `dlkmgr` command's `view` operation. For details on the `view` operation, see 6.7.

PathName

The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the paths that will be affected by the change.

A path name consists of the following four elements, separated by periods:

- 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 `PathName` in 6.7.

DNum

A Dev number, which is equivalent to a section number in HP-UX.

A Dev number beginning from 0 is assigned to the Dev in the LU.

In HP-UX, this value is fixed to 0 because one LU contains one Dev.

This is the same as the `DNum` that is displayed by the `view` operation. For details on the `view` operation, see 6.7.

HDevName

The name of the host device.

In HP-UX, the HDLM device file name (`chXtYdZ`, where *X* is the card instance number, *Y* is the target ID of the iLU, and *Z* is a LUN that the host recognizes) is displayed.

This is the same as the `HDevName` that is displayed by the `view` operation. For details on the `view` operation, see 6.7.

5.3 Actions Taken for a Path Error

When a path error is detected, HDLM performs failover for the path and outputs the KAPL08022-E message. This message indicates that an error has occurred in the components that make up the path. Figure 5.1 indicates these components.

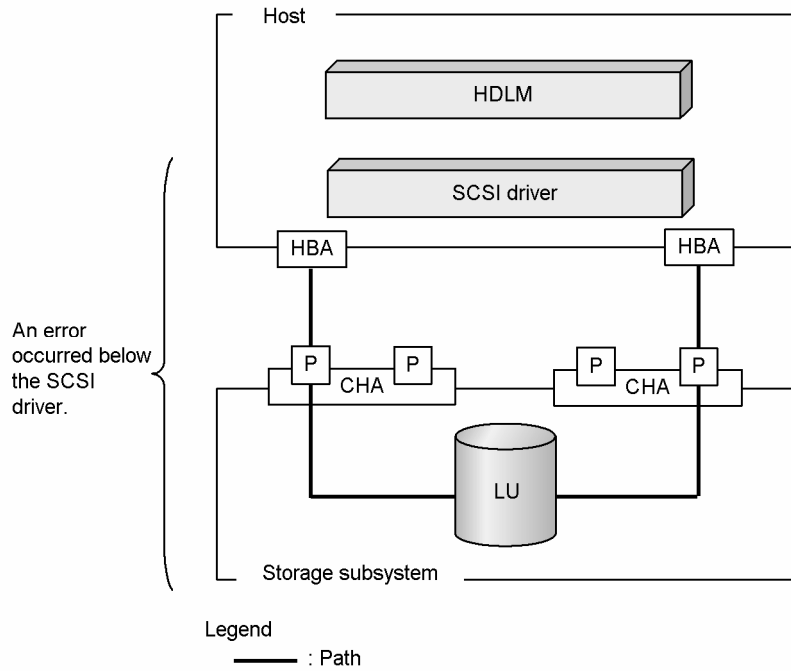


Figure 5.1 Error Location When the KAPL08022-E Message Is Output

Figure 5.2 shows the troubleshooting procedure when the KAPL08022-E message is output.

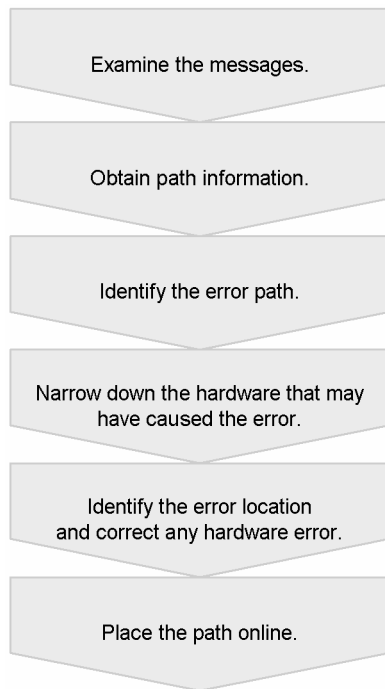


Figure 5.2 Troubleshooting Procedure When a Path Error Occurs

The following shows the procedure for using the HDLM command (`dlnkmgr`) to handle a path error.

5.3.1 Examine 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 occurs. For details on each item displayed in the message, see 5.2.

5.3.2 Obtain Path Information

Obtain path information to narrow down the hardware in which the error occurred.

Execute the following command:

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

`pathinfo.txt` is the redirection-output file name. Use a file name that matches your environment.

5.3.3 Identify the Error Path

Check the obtained path information to find the error path. In the `Status` column, the error path has the status `Offline (E)` or `Online (E)`.

5.3.4 Narrow Down the Hardware That May Have Caused the Error

Check the `DskName`, `iLU`, and `ChaPort` columns for the error path to narrow down the hardware that may be the cause of the error. To physically identify the hardware corresponding to `DskName`, `iLU`, and `ChaPort`, use the information provided by the storage-subsystem management program.

5.3.5 Identify the Error Location and Correct any Hardware Error

Use the HP-UX and hardware management tools to identify the error location, and then take appropriate, corrective action. If an error occurs in the path, HDLM outputs the error message to `syslog` in the management-target host. Also, the information about the path in which the error occurred might be output to `syslog`. The major number of the device number displayed in this information is the major number of the HDLM device. The example is shown below:

```
date/time host1 vmunix: SCSI:    bp: 0000000042a18428
date/time host1 vmunix:          dev: 4e0c2400
date/time host1 vmunix:          cdb: 28 00 00 00 00 00 00 01 00
date/time host1 vmunix:          retry_cnt: 14
date/time host1 vmunix:          residual: 200
date/time host1 vmunix:          status: (200) None -- Select Timeout
```

In the above example, the major number of the device is `0x4e` (78). The minor number of the HDLM device is `0x0c2400` (`c12t2d4`).

By using the `lsdev` command to view the major number, you can ascertain that the above error occurred when an I/O was issued to the character device `c12t2d4`. An example of executing the `lsdev` command is shown below:

```
# lsdev -C disk
  Character    Block      Driver      Class
    78         3         dlmfdrv     disk
   188        31         sdisk       disk
```

For hardware maintenance, contact your hardware vendor or maintenance company if there is a maintenance contract.

5.3.6 Place the Path Online

After the path recovers from the error, use the `dlnkmgr` command's `online` operation to place online the path that went offline due to the error. For details on the `online` operation, see 6.5. 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 appears. To ignore such paths and to continue processing, type `y`. Type `n` to cancel the processing.

Check the status of the paths that cannot be placed online, and take appropriate, corrective action.

Note: Even if you execute the `dlnkmgr` command's `online` operation (with the `-pathid` parameter) for the paths in the `Offline(E)` status, some paths may not be placed online. In this case, use the `offline` operation to change those paths from the `Offline(E)` status to the `Offline(C)` status. Then, execute the `online` operation. The system automatically checks whether the target paths are available, puts available paths into the `Online` status, and puts unavailable paths into the `Offline(E)` status. The paths in the `Offline(E)` status have not recovered from an error yet. Take corrective action for the error, and then execute the `online` operation again. For details on the `online` operation, see 6.5. For details on the `offline` operation, see 6.4.

5.4 Actions Taken for a Program Error

The following describes the troubleshooting procedure for handling errors that occur in an HDLM program. Figure 5.3 shows the troubleshooting procedure.

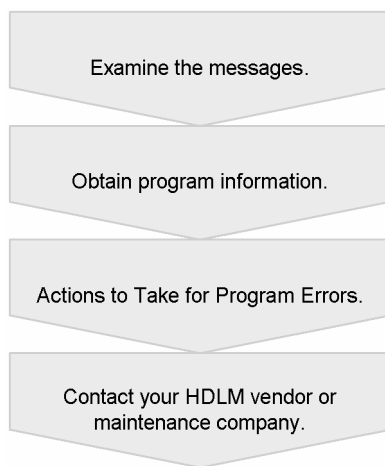


Figure 5.3 Troubleshooting Procedure When a Program Error Occurs

The following shows the procedure for handling a program error by using the HDLM command (`dlnkmgr`).

5.4.1.1 Examine the Messages

Examine the message that is output to `syslog` in the host. If an error occurs in an HDLM program, a message other than `KAPL08xxx` is output to `syslog`. Examine the content of the message. Messages with error level `E` (Error) or higher require corrective action.

5.4.1.2 Obtain Program Information

Obtain the information to be reported to your HDLM vendor or maintenance company (if there is a maintenance contract for HDLM).

Use the `DLMgetras` utility for collecting HDLM error information to collect the error information. For details on the `DLMgetras` utility and the information it collects, see 7.2.

Some of the information collected by the `DLMgetras` utility might be cleared when the system is restarted. When an error occurs, as soon as possible execute the `DLMgetras` utility.

5.4.1.3 Actions to Take for Program Errors

Take the action recommended for the message in Chapter 8.

If the error occurs again after you take the corrective action, use the `dlkmgr` command's `view` operation to check the status of the HDLM program, and then take the appropriate corrective action. For details on the `view` operation, see 6.7.

Execute the following command:

Example:

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

If the KAPL01012-E message appears as a result of executing the command

The following shows the KAPL01012-E message:

```
KAPL01012-E Could not connect the HDLM manager. Operation name =  
view
```

Start the HDLM manager.

For details about how to start the HDLM manager, see 4.3.1.

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
```

An error occurred in internal processing of the HDLM command.

Operation name = aa...aa details = bb...bb

aa...aa indicates character string. Restart the management-target host.

If the same error re-occurs after you take action, go to the following section 5.4.1.4.

5.4.1.4 Contact Your HDLM Vendor or Maintenance Company

If the error cannot be resolved, contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM, and report the information collected by the `DLMgetras` utility.

5.5 Actions Taken for Other Errors

When the cause of an error may be related to HDLM but is neither a path error nor an HDLM program error, execute the `DLMgetras` utility for collecting HDLM error information, and then report the collected information to the HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details about the `DLMgetras` utility and the information it collects, see 7.2.

Chapter 6 Command Reference

This chapter describes the HDLM command (`dlnkmgr`) and its operations.

- 6.1 Overview of the HDLM Command (`dlnkmgr`)
- 6.2 `clear` (Clears the Path Statistics to the Initial Value)
- 6.3 `help` (Displays the Operation Format)
- 6.4 `offline` (Places a Path or Paths Offline)
- 6.5 `online` (Places a Path or Paths Online)
- 6.6 `set` (Sets the Operating Environment)
- 6.7 `view` (Displays information)

6.1 Overview of the HDLM Command (`dlnkmgr`)

This section describes how to specify the HDLM command `dlnkmgr` and its subcommands (called *operations* in HDLM). Note that messages might refer to this command and the operations as the *HDLM command*.

Command format

Enter the command using the following format:

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

`dlnkmgr`

The command name.

operation-name

The type of operation entered after `dlnkmgr`.

parameter

A value required for an operation.

parameter-value

A value required for a parameter.

Operations of the `dlnkmgr` command

Table 6.1 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 6.2.
<code>help</code>	Displays the format of the operation used for HDLM. For details, see 6.3.
<code>offline</code>	Places offline an online path or paths. For details, see 6.4.

Operation	Functions
online	Places online an offline path or paths. For details, see 6.5.
set	Sets the HDLM operating environment. For details, see 6.6.
view	Displays HDLM program information, path information, LU information, and corresponding information about each HDLM device, SCSI device, and LDEV . For details, see 6.7.

Note:

- Execute the command as a user with root privileges.
- To specify a value containing a space in a parameter, enclose the entire value in double quotes (").

6.2 clear (Clears 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 to the initial value.

6.2.1 Format

6.2.1.1 To set the path statistics to 0

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

6.2.1.2 To display the format of the clear operation

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

6.2.2 Parameters

6.2.2.1 To set the path statistics to 0

`-pdst`

Clears statistics (I/O count and I/O errors) of all paths managed by HDLM to the initial value (0).

Example

```
# /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 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
#
```

6.2.2.2 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
#
```

6.3 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.

6.3.1 Format

```
/opt/DynamicLinkManager/bin/dlnkmgr help
```

```
[operation-name] [operation-name] ...
```

6.3.2 Parameter

operation-name

Specify the name of the HDLM command operation whose format you want to know.

You can specify one of the following operation names:

- clear
- help
- online
- offline
- set

```
- view
```

If you do not specify any operation names, the `help` operation displays the names of all operations available for the HDLM command.

Examples

Example 1

The following example shows how to display the names of all the operations available in the HDLM command.

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

Example 2

The following example shows how to display the formats of multiple operations.

```
# /opt/DynamicLinkManager/bin/dlnkmgr help online offline help
online:
  Format
    dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
    dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
    dlnkmgr online [-path] [-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]
  Valid value
    AutoPATH_ID {000000 - 999999} (Decimal)
help:
  Format
    dlnkmgr help { clear | offline | online | set | view }
KAPL01001-I The HDLM command completed normally. Operation name = help, completion time
= yyyy/mm/dd hh:mm:ss
#
```

Example 3

The following example shows how to display the operation names that can be specified by the `help` operation

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

6.4 offline (Places a Path or Paths Offline)

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

The last path accessing each LU cannot be placed offline.

Placing too many paths offline may prevent path switching if an error occurs. Before placing a path offline, use the `view` operation to check how many online paths remain. For details about the `view` operation, see 6.7.

6.4.1 Format

6.4.1.1 To place the path offline

```
/opt/DynamicLinkManager/bin/dlnmgr offline
  [-path]
  {-hba host-port-number.bus-number
  |-cha -pathid AutoPATH_ID
  |-pathid AutoPATH_ID}
  [-s]
```

6.4.1.2 To display the format of the offline operation

```
/opt/DynamicLinkManager/bin/dlnmgr offline -help
```

6.4.2 Parameters

6.4.2.1 To place the path offline

`-path`

Indicates that the target of the operation is a path or paths managed by HDLM.

This parameter is optional because the `offline` operation is only effective on paths.

Make sure, however, that you specify the target path in a subsequent parameter: `-hba`, `-cha`, or `-pathid`.

`-hba host-port-number.bus-number`

Use this parameter to place offline, at one time, all paths that pass through a specific HBA port. The command will place offline all paths connected to the HBA port that has the specified **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 6.7.

Example

The following example shows how to place offline all paths connected to the HBA port whose **host port number** is 0001 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 0001.0000
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]:y
KAPL01061-I 3 path(s) were successfully placed offline(C). 0 path(s) could not be
placed offline(C). Operation name = offline
#
```

`-cha -pathid AutoPATH_ID`

Use this parameter to place offline, at one time, all paths that pass through a specific channel adapter port. The command will place offline all paths that pass through the channel adapter port to which the path with the specified *AutoPATH_ID* is connected.

Specify the current *AutoPATH_ID* of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7. Leading zeros can be omitted (000001 and 1 indicate the same *AutoPATH_ID*); however, when the target *AutoPATH_ID* is 000000, enter 000000 or 0 for the parameter value.

*AutoPATH_ID*s are re-assigned every time the host restarted. 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 paths connected to the channel adapter port 0A. In this example, a path whose *AutoPATH_ID* is 000001 is connected to the target channel adapter port.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

```
# /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]:y
KAPL01061-I 2 path(s) were successfully placed offline(C). 0 path(s) could not be
placed offline(C). Operation name = offline
#
```

`-pathid AutoPATH_ID`

Use this parameter to place a single path offline.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7. 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 restarted. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `offline` operation.

-s

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

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. 0 path(s) could not be
placed offline. Operation name = offline
#
```

6.4.2.2 To display the format of the offline operation

-help

Displays the format of the `offline` operation.

Example

The following example shows how to display the format of the `offline` operation.

```
# /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]
  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 channel adapter port. For details about the `view` operation, see 6.7.

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 paths connected to a specific HBA port or channel adapter 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 commands will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all paths that pass through the channel adapter port 0A of the Thunder 9500V Series.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -stname | grep 9500V | grep 0A
```

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

6.5 online (Places a Path or Paths Online)

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

6.5.1 Format

6.5.1.1 To place the path online

```
/opt/DynamicLinkManager/bin/dlnkmgr online  
[-path]  
[-hba host-port-number.bus-number  
|-cha -pathid AutoPATH_ID  
|-pathid AutoPATH_ID]  
[-s]
```

6.5.1.2 To display the format of the online operation

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

6.5.2 Parameters

6.5.2.1 To place the path online

`-path`

Indicates that the target of the operation is a path managed by HDLM.

This parameter is optional because the `online` operation is only effective on paths.

You can specify the target path in a subsequent parameter: `-hba`, `-cha`, or `-pathid`. If you do not specify any of these parameters, the command places all the offline paths online. If there is a path that cannot be placed online, a message asks whether you would like to continue processing. To ignore the offline path that cannot be placed online and to continue processing, enter `y`. To stop the processing, enter `n`.

`-hba host-port-number.bus-number`

Use this parameter to place online, at one time, all paths that pass through a specific HBA port. The command will place online all paths connected to the HBA port with 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 6.7.

Example

The following example shows how to place online all paths connected to an HBA port whose **host port number** is 0001 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 0001.0000
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) could not be
placed online. Operation name = online
#
```

`-cha -pathid AutoPATH_ID`

Use this parameter to place online, at one time, all paths that pass through a specific channel adapter port. The command will place online all paths that pass through the channel adapter port to which the path with the specified `AutoPATH_ID` is connected.

Specify the current `AutoPATH_ID` of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7. Leading zeros can be omitted (000001 and 1 indicate the same `AutoPATH_ID`); however, when the target `AutoPATH_ID` is 000000, enter 000000 or 0 for the parameter value.

`AutoPATH_ID`s are re-assigned every time the host is restarted. 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 channel adapter port 0A. In this example, a path whose AutoPATH_ID is 000002 is connected to the target channel adapter port.

When the confirmation message is displayed, the user enters `y` to continue, or `n` to cancel the operation.

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

`-pathid` *AutoPATH_ID*

Use this parameter to place a single path online.

Specify the current AutoPATH_ID of the target path, which is displayed by using the `view` operation. For details about the `view` operation, see 6.7. 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. Always make sure that you use the `view` operation to find the current AutoPATH_ID of the target path, before executing the `online` operation.

`-s`

Executes the command without displaying the message asking for confirmation of command execution from the user. Specify this parameter if you want to skip the response to the confirmation message: for example, when you want to execute the command in a shell script or batch file.

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

6.5.2.2 To display the format of the online operation

`-help`

Displays the format of the `online` operation.

Example

The following example shows how to display the format of the `online` operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr online -help
online:
Format
  dlnkmgr online [-path] -hba HBAPortNumber.BusNumber [-s]
  dlnkmgr online [-path] -cha -pathid AutoPATH_ID [-s]
  dlnkmgr online [-path] [-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 channel adapter port. For details about the `view` operation, see 6.7.

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 paths connected to a specific HBA port or channel adapter 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 commands will display information on all the paths that pass through the specified HBA port.

Example 2

The following example shows how to filter and display the information on all paths that pass through the channel adapter port 0A of the Thunder 9500V Series.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -stname | grep 9500V | grep 0A
```

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

6.6 set (Sets the Operating Environment)

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

6.6.1 Format

6.6.1.1 To set up the HDLM operating environment

```
/opt/DynamicLinkManager/bin/dlnkmgr set
{-lb {on [-lbtype {rr|exrr}]|off}
|-ellv error-log-collection-level
|-elfs error-log-file-size
|-elfn number-of-error-log-files
```

```

|-systflv trace-level
|-systfs trace-file-size
|-systfn number-of-trace-files
|-pchk {on [-intvl checking-interval] | off}
|-afb {on [-intvl checking-interval] | off}
|-iem { on [-intvl error-monitoring-interval]
[-iemnum number-of-times-error-is-to-occur] | off }
|-lic}
[-s]

```

6.6.1.2 To display the format of the set operation

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

6.6.2 Parameters

6.6.2.1 To set up the HDLM operating environment

Table 6.2 shows the defaults and recommended values for each setting. If you change the value of the `set` operation, the new value takes effect immediately.

Table 6.2 Default values and recommended values

Item name	Default value	Recommended setting
Load balancing	on Algorithm is round robin	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 level.
Error log file size	9900 (kilobytes)	9900 (kilobytes)
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 (kilobytes)	1000 (kilobytes)
Number of trace files	4	4
Path health checking	on (Interval is 30 minutes.)	on (Interval is 30 minutes.) The recommended checking interval depends on the operating environment.
Automatic failback	off	off
Intermittent Error Monitor	off	off

`-lb {on [-lbtype {rr|exrr}]|off}`

Enables or disables load balancing.

on: Enabled

off: Disabled

`-lbtype {rr|exrr}`

Specify the algorithm to be used for load balancing.

- rr: Round robin
- exrr: Extended round robin

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

Note that a path is not switched for the consecutive I/O operations from VxFS, regardless of the type of load balancing.

`-ellv error-log-collection-level`

Specify the level of error information you want to collect for an error log.

The HDLM manager log (`dlmmgr[1-16].log`) contains log files in which an error log collection level can be set.

Table 6.3 shows the values of the error logging 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 Logging Collection Level

Value	Description
0	Collects no error log.
1	Collects error information for the Error or higher level.
2	Collects error information for the Warning or higher level.
3	Collects error information for the Information or higher level.
4	Collects error information for the Information or higher level (including maintenance information).

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

Example

```
# /opt/DynamicLinkManager/bin/dlnkmgr set -ellv 1
KAPL01049-I Would you like to execute the operation? Operation name = set [y/n]:y
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
#
```

`-elfs error-log-file-size`

Specify a value from 100 to 2000000 (kilobytes) for the size of the error log files (`d1mmgrn.log` (n indicates a file number from 1 to 16)). The specified file size is applied for 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 kilobytes (approximately 30 GB) of error logs in total.

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

`-elfn` *number-of-error-log-files*

Specify the number of error log files (`d1mmgrn.log` (n indicates a file number from 1 to 16)). Specify a value from 2 to 16.

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

`-systflv` *trace-level*

Specify the trace output level.

Log for which trace levels can be set are `hdlmtrn.log` (n indicates a file number from 1 to 64).

Table 6.4 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 larger the trace level value, the larger the amount of log information that is output. As the amount of log information that is output increases, the amount of time before existing information is overwritten becomes shorter.

`-systfs` *trace-file-size*

Specify a value from 100 to 16,000 for the size of the trace log file (in kilobytes).

By specifying both the trace file size and the number of trace files, you can collect up to 1,024,000 kilobytes 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 kilobytes 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, or a host connected to the **Freedom Storage 5700E**, **Freedom Storage 5800**, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series storage subsystem, we recommend that you activate path health checking to enable detection of errors in paths where I/Os do not occur.

When you specify `on`, specify the 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 interval used in the last time

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 (in minutes). 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 immediately.

The path health check interval setting remains stored in the system even if you disable the function by changing the setting of path health checking to `off`. Therefore, when you re-enable path health checking and do not change the interval, path health checking is executed at the interval stored in the system.

`-afb {on [-intvl checking-interval] |off}`

Enables or disables automatic failback.

`on`: Enabled

`off`: Disabled

Enabling automatic failback may automatically place online those paths that were intentionally placed offline (for example, paths placed offline for maintenance work).

If you want to prevent such paths from automatically being placed online, disable this function. When intermittent errors occur in paths or storage subsystems, path status alternates between the online and offline status frequently, so I/O performance might deteriorate.

Automatic failback is executed in the following paths:

- Path where an error occurred and for which the KAPL08022-E message was displayed
- Path where an error occurred at the startup of the HDLM manager.

To prevent an intermittent error from deteriorating I/O performance, we recommend that you also enable intermittent error monitoring when enabling automatic failback. Intermittent error monitoring is specifiable only when automatic failback is enabled.

See Table 6.5 for the relationship between automatic failback and intermittent error monitoring.

When you specify `on`, specify the checking interval of path status by specifying the parameter immediately following `on`. If you do not specify a checking interval, path status is checked in the following interval:

- When the checking interval has not been specified before:
Every minute (default setting)
- When the checking interval has been specified before:
The interval used in the last time

The explanation for the following sub-parameter describes how to specify the interval between path status checks.

`-intvl` *checking-interval*

Specify the interval between path status checks (in minutes). Specify a value from 1 to 1440 minutes. The default is 1. Specify the interval appropriate for your operation 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 is output and an error occurs. In such a case, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

When you 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 failback to `off`. Therefore, when you re-enable automatic failback and do not change the interval, path status checks are executed at the interval 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`.

When you use automatic failback, we recommend that you set intermittent error monitoring to `on` to prevent an intermittent error from reducing I/O performance.

If `on` is specified, in the subsequent parameters specify the intermittent error monitoring interval and the number of times that the error is to occur. The system assumes that an intermittent error is occurring if the specified number of times that the error is to occur is reached during the monitoring interval (from the time that the monitoring interval starts, until the specified interval ends). A path that is assumed to have an intermittent error is excluded from automatic failback. Intermittent error monitoring is performed on individual paths. Intermittent error monitoring starts when a path is recovered from the error by using automatic failback.

If you omit the intermittent error monitoring interval or the number of times that the error is to occur, each setting is specified as follows:

- When the intermittent error monitoring interval or the number of times that the error is to occur has not been specified before:

The intermittent error monitoring interval is set to 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 the last time are set.

When a value of 2 or more is specified in number of times, the following condition must be satisfied:

```
error-monitoring-interval >= checking-interval-for-automatic-failback x number-of-times-error-is-to-occur-during-intermittent-error-monitoring
```

If this condition is not satisfied, the KAPL01080-W message is output and an error occurs. In such a case, change any of the following settings: the checking interval for automatic failback, intermittent error monitoring interval, or the number of times that the error is to occur.

When you set the number of times that the error is to occur to 1, the above condition does not need to be satisfied.

The following shows the sub-parameters to specify the error monitoring interval and the number of times that the error is to occur (in order for the system to determine that an intermittent error is occurring):

`-intvl` *error-monitoring-interval*

Specify the monitoring interval for an intermittent error (in minutes). Use a value from 1 to 1440. The default is 30.

During intermittent error monitoring, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the error count and the elapsed time measured since monitoring starts are set to 0, and monitoring starts by using the new settings.

Outside the duration of intermittent error monitoring, if changes are made in the settings of the intermittent error monitoring interval or the number of times that an error is to occur, the new settings take effect after the next time automatic failback succeeds. Because the errors and elapsed time are not counted or measured while intermittent errors are not monitored, those values do not change.

The monitoring interval specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and the monitoring interval is not specified, error monitoring will be executed for the stored monitoring interval.

`-iemnum` *number-of-times-error-is-to-occur*

Specify the number of times the error is to occur. Use a value from 1 to 99. The default is 3.

During intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, the number of errors and the time that has passed since intermittent error monitoring starts are reset to 0. Then, the changed setting takes effect and intermittent error monitoring starts.

Outside the duration of intermittent error monitoring, if you change the number of times that the error is to occur in order for the system to determine that an intermittent error has occurred, from the next time automatic failback finishes normally, the changed values takes effect. Outside the duration of intermittent error monitoring, the number of errors that determine an intermittent error is not counted and this value is not changed.

The number of times that the error is to occur specified in this parameter is stored even though specifying `-iem off` disables intermittent error monitoring. Therefore, when you re-enable intermittent error monitoring and the number of times is not specified, the error monitoring will be executed using the stored number of times.

When the `set -iem on` operation is executed during error monitoring, even though you do not change the conditions for intermittent error, the number of errors and the time that has passed since the error monitoring starts are reset to 0. Then intermittent error monitoring resumes with the changed settings.

If you set automatic failback to `off` while intermittent error monitoring is `on`, intermittent error monitoring becomes disabled. Note, however, that if you use the `view -sys` operation to display the HDLM functionality configuration, `Intermittent Error Monitor` shows `on`. When automatic failback is returned to `on`, intermittent error monitoring becomes enabled.

The executable operations for automatic failback and intermittent error monitoring depend on the setting status for those functions. Table 6.5 shows the relationship between the setting status for automatic failback and intermittent error monitoring and the executable operations for those functions.

Table 6.5 Relationship between the setting status for automatic failback 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 operates using 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 (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts. When a path is not being monitored (outside the period of conditional intermittent error monitoring), nothing changes.
		Change the IEM settings.	<ul style="list-style-type: none"> When a path is being monitored (in the period of conditional intermittent error monitoring), the value of the error count and the elapsed monitoring time are reset to 0, and then intermittent error monitoring restarts according to the conditions for intermittent error after change.^{#1} When a path is not being monitored (outside the period of conditional intermittent error monitoring), the IEM settings will take effect when the path is recovered from the error status by performing automatic failback.
	Set IEM to <code>off</code> .	<ul style="list-style-type: none"> IEM is disabled. The error count, elapsed monitoring time, and information about paths not subject to automatic failback are cleared. 	
	off	Set AFB to <code>on</code> .	The operations of AFB and IEM do not change.
		Change the AFB setting.	AFB operates using new settings.
		Set AFB to <code>off</code> .	AFB is disabled.
		Set IEM to <code>on</code> .	IEM is enabled. ^{#1}

Setting		Available operation	Result of operation
AFB	IEM		
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 fallback

IEM: Intermittent error monitoring

#1

When this condition is not satisfied, the KAPL01080-W message is output and an error occurs. The status of the intermittent error monitoring does not change.

#2

Since automatic fallback 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 when a license is updated. The HDLM license is provided by a license key or a license key file. A license key file is a file that stores an HDLM license key.

If you use a license key file:

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 described 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 you do not use a license key file:

When the `set -lic` operation is executed, a message (KAPL01068-I) asking the user to enter a license key appears. Enter the license key. A message confirming that the license key has been registered is displayed, depending on the license key type described in the license key file. When a temporary license key or emergency license key has been registered, the expiration period is displayed (KAPL01071-I, KAPL01072-I).

Table 6.6 lists the license key types.

Table 6.6 License key types

Type	Description
Permanent license key	Permanent licenses are valid for using HDLM in an ongoing basis.
Temporary license key#	The temporary license key is used temporarily, for example, when a user performs product evaluations. Temporary licenses are valid for only 120 days after installation. You cannot reuse a temporary license key.
Emergency license key	The emergency license key is used temporarily, for example, when issuing a permanent license key that is delayed for some reasons. Emergency licenses are valid for 30 days after they are entered. You cannot reuse an emergency license key.

#

A temporary license key cannot be installed by using the `dlnmgr set` operation.

Example 1

The following example shows how to update the license key (when the license key file exists).

```
# /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.
KAPL01001-I The HDLM command completed normally. Operation name = set, completion
time = yyyy/mm/dd hh:mm:ss
#
```

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.
KAPL01001-I The HDLM command completed normally. Operation name = set, 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.

6.6.2.2 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 } ]
              | -lb off
              | -ellv ElogLevel
              | -elfs ElogFileSize
              | -elfn Number-Of-ElogFiles
              | -systflv TraceLevel
              | -systfs TraceFileSize
              | -systfn Number-Of-TraceFiles
              | -pchk on [ -intvl Interval-Time ]
              | -pchk off
              | -afb on [ -intvl Interval-Time ]
              | -afb off
              | -iem on
                  [ -intvl Error-Monitor-Interval ]
                  [ -iemnum Number-Of-Times ]
              | -iem off
              | -lic
              }
[-s]

Valid value
ElogLevel          { 0 | 1 | 2 | 3 | 4 } (Default Value 3)
ElogFileSize       { 100 - 2000000 }(KB) (Default Value 9900)
Number-Of-ElogFiles { 2 - 16 }(Files) (Default Value 2)
TraceLevel         { 0 | 1 | 2 | 3 | 4 } (Default Value 0)
TraceFileSize      { 100 - 16000 }(KB) (Default Value 1000)
Number-Of-TraceFiles { 2 - 64 }(Files) (Default Value 4)
Interval-Time      { 1 - 1440 }(Minute) (Default Value 30)
(pchk)
Interval-Time      { 1 - 1440 }(Minute) (Default Value 1)
(afb)
Error-Monitor-Interval { 1 - 1440 }(Minute) (Default Value 30)
Number-Of-Times     { 1 - 99 }(Times) (Default Value 3)
KAPL01001-I The HDLM command completed normally. Operation name = set, completion time =
yyyymmdd hh:mm:ss
#

```

6.7 view (Displays information)

The `dlnkmgr` command's `view` operation displays HDLM program information, path information, LU information, and **corresponding information about an HDLM device, SCSI device, and LDEV.**

6.7.1 Format

6.7.1.1 To display program information

```

/opt/DynamicLinkManager/bin/dlnkmgr view -sys
[-sfunc|-msrv|-advr|-pdrv|-lic]
[-t]

```

6.7.1.2 To display path information

To display path information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path
    [-hdev host-device-name]
    [-stname]
    [-iem]
    [-srt {pn|lu|cp}]
    [-t]
```

To display path information (by selecting a display item)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path -item
    [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
    [-hdev host-device-name]
    [-stname]
    [-srt {pn|lu|cp}]
    [-t]
```

To display a summary of path information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -path -c
    [-stname]
    [-srt {lu|cp}]
    [-t]
```

6.7.1.3 To display LU information

To display LU information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu
    [-hdev host-device-name|-pathid AutoPATH_ID]
    [-t]
```

To display LU information (by adding items to be displayed)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -item
    [ [slpr] [pn] [cp] [clpr] [type] [ic] [ie] [dnu] [iep]
    [hwp] |all]
    [-hdev host-device-name|-pathid AutoPATH_ID]
    [-t]
```

To display a summary of LU information

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -c [-t]
```

To display a summary of LU information (by adding items to be displayed)

```
/opt/DynamicLinkManager/bin/dlnkmgr view -lu -c -item  
    [slpr]  
    [-t]
```

6.7.1.4 To display corresponding information about an HDLM device, SCSI device, and LDEV

```
/opt/DynamicLinkManager/bin/dlnkmgr view -drv [-t]
```

6.7.1.5 To display the format of the view operation

```
/opt/DynamicLinkManager/bin/dlnkmgr view -help
```

6.7.2 Parameters

This section describes the parameters for the view operation, in the following order:

6.7.2.1

6.7.2.2

6.7.2.3

6.7.2.4

6.7.2.5

6.7.2.1 To display program information

```
-sys [-sfunc|-msrv|-adv|-pdrv|-lic]
```

Displays the HDLM program information.

Use one of the subsequent parameters (following `-sys`) to specify the program information that you want to display. If you do not specify a subsequent parameter, the command displays all program information.

Table 6.7 describes the specifiable parameters, displayed information, displayed items, and a corresponding description.

```
-t
```

Does not display the title for each information item.

Table 6.7 Displayed program information

Parameter and program information	Item	Description
-sfunc Information about the HDLM function settings	HDLMVersion	HDLM version number.
	Service Pack Version	HDLM service pack version number. This item is blank if a service pack is not installed.
	Load Balance	<p>Setting for load balancing</p> <ul style="list-style-type: none"> ▪ Setting status on: Enabled off: Disabled ▪ Algorithm When the setting status of load balancing is on, the type of algorithm used for load balancing is displayed after the on. rr: Round robin extended rr: Extended round robin
	Support Cluster	Blank#
	Elog Level	<p>Error logging level</p> <ul style="list-style-type: none"> ▪ 0: Collects no error information. ▪ 1: Collects error information at the Error level or higher. ▪ 2: Collects error information at the Warning level or higher. ▪ 3: Collects error information at the Information level or higher. ▪ 4: Collects error information at the Information or higher level (including maintenance information).
	Elog File Size (KB)	Size of the error log file in kilobytes
	Number Of Elog Files	Number of error log files
	Trace Level	<p>Trace output level</p> <ul style="list-style-type: none"> ▪ 0: Does not output any trace. ▪ 1: Only outputs error information. ▪ 2: Outputs a summary of program operation. ▪ 3: Outputs details of program operation. ▪ 4: Outputs all information.
	Trace File Size (KB)	Trace file size in kilobytes.
	Number Of Trace Files	Number of trace files.

Parameter and program information	Item	Description
	Path Health Checking	<ul style="list-style-type: none"> Setting for path health checking on: Enabled off: Disabled Checking interval When the setting of the path health checking is on, the checking interval of path health checking is displayed within the parentheses, (), after on. The time is in minutes.
	Auto Failback	<ul style="list-style-type: none"> Setting for automatic failback on: Enabled off: Disabled Checking interval When the setting of the automatic failback is on, the checking interval of automatic failback is displayed within the parentheses, (), after on. The time is in minutes.
	Intermittent Error Monitor	<ul style="list-style-type: none"> Setting for intermittent error monitoring on: Enabled off: Disabled When automatic failback is off, intermittent error monitoring is disabled although Intermittent Error Monitor shows on. When automatic failback becomes on, intermittent error monitoring becomes enabled. Intermittent error monitoring interval and number of times that the error is to occur When intermittent error monitoring is set to on, the specified intermittent error monitoring interval and number of times that the error is to occur are displayed in parentheses, (), following on. The format is <i>number-of-times-error-is-to-occur/monitoring-interval</i>. The time is in minutes.
-msrv Information about the HDLM manager	HDLM Manager	Status of the HDLM manager Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM manager
	WakeupTime	Startup time of the HDLM manager
-adrv Information about the HDLM alert driver	HDLM Alert Driver	Status of the HDLM alert driver Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM alert driver
	WakeupTime	Startup time of the HDLM alert driver
	ElogMem Size	Size of error log memory for the HDLM alert driver in kilobytes
-pdrv Information about the HDLM driver	HDLM Driver	Status of the HDLM driver Alive: Normal Dead: Stopped
	Ver	Version number of the HDLM driver

Parameter and program information	Item	Description
	WakeupTime	Startup time of the HDLM driver
-lic Information about the HDLM license	License Type	License type <ul style="list-style-type: none"> Permanent: permanent license Temporary: temporary license Emergency: emergency license
	Expiration	License expiration When using a permanent license: - When using a temporary license or emergency license: The license expiration period is displayed in the format: <i>yyyy/mm/dd_(ndays after)</i> . When the <code>view -sys -lic</code> operation is executed, (<i>ndays after</i>) appears if there are <i>n</i> days left until the license period expires. <ul style="list-style-type: none"> When there are 100 days left until the license period (2006/08/21) expires 2006/08/21 (100days after)

#

When you use cluster software, the settings of the cluster support function and **the kinds of cluster servers are** not displayed. However, the cluster support function will operate normally.

Examples

Example 1

The following example shows how to display information about the HDLM function settings.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -sfunc
HDLM Version           : xx-xx
Service Pack Version   :
Load Balance           : on(rr)
Support Cluster        :
Elog Level             : 3
Elog File Size(KB)     : 9900
Number Of Elog Files   : 2
Trace Level            : 0
Trace File Size(KB)    : 1000
Number Of Trace Files  : 4
Path Health Checking   : on(30)
Auto Failback          : off
Intermittent Error Monitor : off
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= 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                xx-xx  yyyy/mm/dd hh:mm:ss
```

```
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
#
```

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      xx-xx      yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
#
```

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      xx-xx      yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time
= yyyy/mm/dd hh:mm:ss
#
```

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
#
```

6.7.2.2 To display path information

When displaying path information, if the `-item` parameter or the `-c` parameter is specified at the same time as the `-path` parameter, you can select the items to display and display a summary of path information. This section describes each parameter, path information and displayed items.

To display path information

`-path`

When you specify the `-path` parameter and do not specify either the `-c` or `-item` parameter, the command displays information about the paths without abbreviating or selecting items.

In the subsequent sub-parameters (following `-path`), you can filter the paths to be listed (`-hdev`) and sort the list (`-srt`). When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

For details on what is displayed in each item, see Table 6.9.

AutoPATH_IDs displayed by the `-path` parameter depend on the sequence in which HDLM detects the paths when a host is started. Because of this, make sure that you use the path name (*PathName*) to identify a path.

The subsequent sub-parameters (following `-path`) are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify the name of the device file for an HDLM device (`chXtYdZ`, where *X* indicates the card instance number, *Y* indicates the target ID of the iLU, and *Z* indicates a LUN that the host recognizes) to indicate the desired host device.

The *host-device-name* string is case-sensitive.

`-stname`

Use this parameter to display the model ID of the storage subsystem 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 subsystem instead.

For more information pertaining to the storage subsystem and corresponding product ID, see Table 6.11.

`-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 list of path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the storage subsystem (*DskName*), the second sorting key is the value 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 subsystem
- `cp`: Port number of the channel adapter

When the `-srt` parameter is omitted, the path information is listed in order of ascending *AutoPATH_IDs*.

`-t`

Does not display the title for each information item.

Example

The following example shows how to display information about the paths that access a host device `ch8t0d0`.

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -path -hdev ch8t0d0
Paths:000002 OnlinePaths:000002
PathStatus IO-Count IO-Errors
Online      0          0

PathID PathName          DskName
iLU          ChaPort Status      Type IO-Count IO-Errors DNum HDevName
000000 0008.0000.0000000000000000.0000 HITACHI .DF500F      .2334
0000          0A      Online      Non      0          0      0 ch8t0d0
000005 0010.0000.0000000000000000.0000 HITACHI .DF500F      .2334
0000          1A      Online      Own      0          0      0 ch8t0d0
KAPL01001-I The HDLM command completed normally. Operation name = view,
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.

If you specify no value for the `-item` parameter, only the `PathID` and the `Status` fields are displayed.

Table 6.8 shows the items that can be selected by using the `-item` parameter and the parameter values that can be specified after the `-item` parameter.

Table 6.8 Items that can be selected by the `-path -item` parameter and parameter values that can be specified after the `-path -item` parameter

Selectable items	Parameter values that can be specified after the <code>-path -item</code> parameter
PathID#	None
Status#	None
PathName	pn
DskName	dn
iLU	lu
ChaPort	cp
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
HDevName	hd
IEP	iep

#

Because both `PathID` and `Status` are always displayed, they do not require any parameters to be specified.

In the subsequent sub-parameters (following `-path -item`), you can filter the paths to be listed (`-hdev`) and sort the list (`-srt`). When you omit both parameters, the command displays information for all the paths in order of increasing AutoPATH_IDs.

The subsequent sub-parameters (following `-path -item`) are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify the name of the device file for an HDLM device (`chXtYdZ`, where *X* indicates the card instance number, *Y* indicates the target ID of the iLU, and *Z* indicates a LUN that the host recognizes) to indicate the desired host device.

The *host-device-name* string is case-sensitive.

When you specify this parameter, `HDevName` is displayed by default. Therefore, it is not necessary to specify `hd` for the `-item` parameter.

`-stname`

Use this parameter to display the model ID of the storage subsystem in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage subsystem instead.

For more information pertaining to the storage subsystem and corresponding product ID, see Table 6.11.

When you use this parameter, `DskName` is displayed by default. Therefore, it is not necessary to specify `dn` for the `-item` parameter.

`-srt` {`pn|lu|cp`}

Use this parameter to sort the list of path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the storage subsystem (`DskName`), the second sorting key is the value 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 subsystem
- `cp`: Port number of the channel adapter

When the `-srt` parameter is omitted, the path information is listed in order of ascending AutoPATH_IDs.

When you use 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`

Does not display the title for each information item.

Example

In the following example, PathID, PathName, ChaPort, Status, IO-Count, and IO-Errors have been selected as the path information to be displayed.

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -path -item ic -srt lu -stname
Paths:000010 OnlinePaths:000010
PathStatus IO-Count IO-Errors
Online      500      0

PathID DskName                               iLU      Status  IO-
Count
000003 HITACHI .9500V .0123    0180    Online
400
000009 HITACHI .9500V .0123    0180    Online
420
000004 HITACHI .9500V .0123    0181    Online
410
000010 HITACHI .9500V .0123    0181    Online
399
000005 HITACHI .9500V .0123    0182    Online
405
000011 HITACHI .9500V .0123    0182    Online
405
000000 HITACHI .USP_V .0014050 000050  Online
1005
000006 HITACHI .USP_V .0014050 000050  Online
897
000001 HITACHI .USP_V .0014050 000051  Online
0
000007 HITACHI .USP_V .0014050 000051  Online
0
000002 HITACHI .USP_V .0014050 000052  Online
0
000008 HITACHI .USP_V .0014050 000052  Online
0
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#

```

To display a summary of path information

`-path -c`

If the `-c` parameter is specified at the same time as the `-path` parameter, only PathID, DskName, iLU, CP, Status, and Type are displayed from the path information managed by HDLM. The displayed contents are shortened so that each instance of path information is displayed on a single line.

The items that are displayed are PathID, DskName, iLU, CP, Status, and Type.

For details on what is displayed in each item, see Table 6.9.

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. Therefore, when there are 11 or more characters in the product ID, the 8th and following characters are abbreviated to ellipses (. . .).

The subsequent sub-parameters (following `-path -c`) are:

`-stname`

Use this parameter to display the model ID of the storage subsystem in the product ID element of the `DskName` field. When this parameter is omitted, the command displays the product ID or emulation type of the storage subsystem instead.

For more information pertaining to the storage subsystem and corresponding product ID, see Table 6.11.

`-srt {lu|cp}`

Use this parameter to sort the list of path information in ascending order, according to the specified sorting keys.

The sorting keys are as follows: the first sorting key is the name of the storage subsystem (`DskName`), the second sorting key is the value 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 subsystem
- `cp`: Port number of the channel adapter

When the `-srt` parameter is omitted, the path information is listed in order of ascending `AutoPATH_ID`s.

`-t`

Does not display the title for each information item.

Example

The following example shows how to display a summary of the path information in order of iLUs.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -path -c -srt lu
Paths:000010 OnlinePaths:000010
PathStatus IO-Count IO-Errors
Online      0          0

PathID DskName          PathID DskName          iLU          CP Status  Type
000000 HITACHI .DF500F .2334      0000      0A Online  Non
000005 HITACHI .DF500F .2334      0000      1A Online  Own
000001 HITACHI .DF500F .2334      0001      0A Online  Own
000006 HITACHI .DF500F .2334      0001      1A Online  Non
000002 HITACHI .DF500F .2334      0002      0A Online  Non
000007 HITACHI .DF500F .2334      0002      1A Online  Own
000003 HITACHI .DF500F .2334      0003      0A Online  Own
000008 HITACHI .DF500F .2334      0003      1A Online  Non
000004 HITACHI .DF500F .2334      0004      0A Online  Non
000009 HITACHI .DF500F .2334      0004      1A Online  Own
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Displayed path information

Table 6.9 describes the displayed path information. The following explains the table headings:

- No summary displayed: The user specifies the `-path` parameter or `-path -item` parameter.
- Summary displayed: The user specifies the `-path -c` parameter.

Table 6.9 Displayed path information

Displayed Item		Description
No summary displayed	Summary displayed	
Paths		Total number of displayed paths, indicated by a decimal number.
OnlinePaths		Number of available paths in the displayed paths, indicated by a decimal number. When the value of <code>Paths</code> equals the value of <code>OnlinePaths</code> , all paths are online. If the value of <code>OnlinePaths</code> is less than that of <code>Paths</code> , some paths are offline. In this case, you should check the offline paths and take appropriate action for any paths that have an error status.
PathStatus		<p>Status of the displayed paths. The displayed status indicates the following:</p> <ul style="list-style-type: none"> ▪ <code>Online</code>: All paths are available. ▪ <code>Reduced</code>: Some paths are not available. <p><code>Reduced</code> means that some paths might have an error status, in which case you should check the status of individual paths and take appropriate action for any paths that have an error status.</p>
IO-Count		Total I/O count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.
IO-Errors		Total I/O error count for the displayed paths, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.
PathID		<p><code>AutoPATH_ID</code> indicated by a decimal number.</p> <p><code>AutoPATH_ID</code> is assigned when the host is restarted.</p>
PathName#	-	<p>The path name, which indicates a path. When you modify the system configuration or replace a hardware item, you should check the path names to identify the path that will be affected by the change. <code>Path name</code> 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) <p>For details about each element of the path name and its representation in HP-UX, see Table 6.10.</p>
DskName#	DskName	<p>Storage subsystem name, which identifies the storage subsystem that is accessed by a path.</p> <p>A storage subsystem name consists of the following three elements, separated by periods:</p> <ul style="list-style-type: none"> ▪ Vendor ID: The name of the storage subsystem vendor (for example, <code>HITACHI</code>). ▪ Product ID: Indicates the storage subsystem model ID, emulation type, or model name (for example, <code>DF500E</code>). <p>For more details on the storage subsystem and corresponding product ID, see Table 6.11.</p> <ul style="list-style-type: none"> ▪ Serial number: The serial number of the storage subsystem (for example, <code>2334</code>). <p>You can identify an actual storage subsystem by referencing the above information from the storage subsystem management program.</p>

Displayed Item		
iLU#	iLU	<p>LU number of the storage subsystem.</p> <p>This number combined with the storage subsystem name (shown in <code>DskName</code>) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> For Lightning 9900 Series, Lightning 9900V Series, and TagmaStore USP, the first two characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. For the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200 Series, Thunder 9500V Series, and TagmaStore AMS/WMS series, the entire value of <code>iLU</code> is the internal LU number within the storage subsystem. You can identify an actual LU by referencing <code>iLU</code> from the storage subsystem management program. For Universal Storage Platform V, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (<u>D</u>isk <u>C</u>ontroller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU.
ChaPort#	CP	<p>Port number of the channel adapter, which identifies the CHA port that is mounted on the storage subsystem.</p> <p>You can identify an actual CHA port by referencing this number from the storage subsystem management program.</p>
Status		<p>Status of the path</p> <ul style="list-style-type: none"> Online: Online Offline (C): Placed offline using the Path Management window of the HDLM GUI, using the Show Path List subwindow of the HDLM Web GUI, or by a command Offline (E): Offline due to an error Online (E): Failure has occurred (If none of the paths accessing one LU have an Online status, one of those paths is changed to the Online (E) status.) <p>Paths that are Offline (E) or Online (E) require corrective action. The appropriate action can be determined by referring to 5.3</p>
Type#	Type	<p>Attribute of the path</p> <ul style="list-style-type: none"> Own: Owner path Non: Non-owner path <p>When connecting to Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP or Universal Storage Platform V, all paths are owner paths.</p>
IO-Count#	-	<p>Total I/O count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0.</p> <p>To reset the <code>IO-Count</code> value to zero, execute the <code>dlknmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (<code>IO-Errors</code>) to zero. For details about the <code>clear</code> operation, see 6.2.</p>
IO-Errors#	-	<p>Total I/O error count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0.</p> <p>To reset the <code>IO-Errors</code> value to zero, execute the <code>dlknmgr</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 zero.</p> <p>For details about the <code>clear</code> operation, see 6.2.</p>
DNunt#	-	<p>Dev number, indicated by a decimal number.</p> <p>This item pertains to a section number.</p> <p>There is one Dev in an LU, so the number is fixed to 0.</p>

Displayed Item		
HDevName#	-	Host device name. The name of the device file for the HDLM device (chXtYdZ, where X indicates the card instance number, Y indicates the target ID of the iLU, and Z indicates a LUN that the host recognizes) is displayed.
IEP#	-	Information about the intermittent error. This item is displayed only when you specify <code>-iem</code> with the <code>-path</code> parameter. One of the following values is displayed for each path: <ul style="list-style-type: none"> ▪ - Indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. ▪ A value of at least 0 Indicates the number of errors that occurred during intermittent error monitoring. ▪ * Indicates that an intermittent error occurred (automatic failback does not check the path).

Legend:

- : Not displayed

#

The path information is displayed only when a value is specified for the `-path -item` parameter.

Table 6.10 Elements of a path name

Element	HP-UX representation
Host port number (example: 0008)	Instance number of HBA port. I (instance number) displayed by <code>ioscan -fC fc</code> .
Bus number (example: 0000)	0 (fixed value)
Target ID (example: 0000000000000000)	0000000XXXXYYY XXXX: card instance number (the letters following <code>c</code> in the device file name) YYYY: Target ID (the letters following <code>t</code> in the device file name)
Host LU number (example: 0001)	Logical unit ID or LUN (the value following <code>d</code> in the device file name)

To obtain information about each element, use the HDLM-configuration definition utility (`dlmcfmgr`). For details about this utility, see 7.3.

Table 6.11 Product ID displayed by the view -path operation

Model names of storage subsystems	Product ID	
	Without the <code>-stname</code> parameter	With the <code>-stname</code> parameter (Displays the following for the

		model ID)
Freedom Storage 5700E	product identifier#	5700E
Freedom Storage 5800		5800
Thunder 9200		9200
Thunder 9500V Series		9500V
TagmaStore AMS		AMS
TagmaStore WMS		WMS
Lightning 9900 Series	Emulation type#	9910/9960
Lightning 9900V Series		9970/9980
TagmaStore USP		USP
Hitachi Universal Storage Platform V		USP_V

#

When a summary is displayed by specifying the `-path -c` parameter and there are more than 11 characters in the summary string, characters after the 9th character are displayed as an ellipsis (...).

6.7.2.3 To display LU information

When displaying LU information, if the `-item` parameter, `-c` parameter, or the `-c -item` parameter is specified at the same time as the `-lu` parameter, you can add and display items and display a summary of LU information. This section describes each parameter and the LU information and displayed items.

To display LU information

`-lu`

When neither the `-c` nor `-item` parameter is specified with the `-lu` parameter, the information about the LU recognized by HDLM is displayed without selecting items to be displayed or displaying a summary. The sorting key is iLU and its configuration information is displayed for each LU.

By using the subsequent parameter (`-hdev` or `-pathid`), you can filter the LU information to be displayed. If you do not specify `-hdev` or `-pathid`, the information about all LUs recognized by HDLM is displayed. For details on the contents of each displayed item, see Table 6.14.

The subsequent parameters are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify the name of the device file for the HDLM device (`chXtYdZ`, where *X* indicates the card instance number, *Y* indicates the target ID of the iLU, and *Z* indicates a LUN that the host recognizes) to indicate the desired host device.

The *host-device-name* string is case-sensitive.

`-pathid AutoPATH_ID`

Use this parameter to display only the information about the LU to which the path with the specified *AutoPATH_ID* is connected.

`-t`

Does not display the title for each information item.

Example

The following example shows how to display the LU information without selecting items to be displayed:

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu
Product      : 9500V
SerialNumber : 0016
LUs          : 2
iLU  HDevName Device PathID Status
0058 ch6t0d0  c6t0d0 000000 Online
      c8t0d0 000002 Online
0059 ch6t0d1  c6t0d1 000001 Online
      c8t0d1 000003 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 added to the items to be displayed by the `-lu` option and displayed.

If no value or `all` is specified for the `-item` parameter, all the items that can be added are displayed.

Table 6.12 shows the items that can be added by using the `-item` parameter and the parameters that can be specified after the `-item` parameter.

Table 6.12 Items that can be added by using the `-lu -item` parameter and parameters that can be specified after the `-lu -item` parameter

Item that can be added	Subsequent parameter
SLPR	slpr
PathName	pn
ChaPort	cp
CLPR	clpr
Type	type
IO-Count	ic
IO-Errors	ie
DNum	dnu
IEP	iep

H/W Path	hwp
All items are displayed	all

In the subsequent sub-parameters (`-hdev` or `-pathid`), you can filter the LU information to be displayed. When you omit both parameters, the command displays the information about all the LUs recognized by HDLM.

For details on the contents of each displayed item, see Table 6.14.

The subsequent sub-parameters are:

`-hdev` *host-device-name*

Filters the information only for the paths accessing the specified host device.

Specify the name of the device file for an HDLM device (`chXtYdZ`, where *X* indicates the card instance number, *Y* indicates the target ID of the iLU, and *Z* indicates a LUN that the host recognizes) to indicate the desired host device.

The *host-device-name* string is case-sensitive.

`-pathid` *AutoPATH_ID*

Use this parameter to display only the information about the LU to which the path with the specified *AutoPATH_ID* is connected.

`-t`

Does not display the title for each information item.

Example

In the following example, IO-Count is selected as the display item and the path information is sorted in ascending order of the LUs.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -item pn cp type ic ie dnu iep
hwp
Product      : USP
SerialNumber : 0014050
LUs          : 3

iLU  SLPR  HDevName Device PathID PathName                               ChaPort CLPR
Status  Type IO-Count  IO-Errors  DNum IEP H/W Path
0540   1 ch6t0d0 c6t0d0 000000 0001.0000.000000000000060000.0000 1D      2
Online  Own      0           0         0 - 0/5/1/0.8.0.0.0.0.0
Online  Own      0           0         0 - 0/2/1/0.8.0.1.0.0.0
0541   1 ch6t0d1 c6t0d1 000001 0001.0000.000000000000060000.0001 1D      2
Online  Own      0           0         0 - 0/5/1/0.8.0.0.0.0.1
Online  Own      0           0         0 - 0/2/1/0.8.0.1.0.0.1
0542   1 ch6t0d2 c6t0d2 000002 0001.0000.000000000000060000.0002 1D      2
Online  Own      0           0         0 - 0/5/1/0.8.0.0.0.0.2
Online  Own      0           0         0 - 0/2/1/0.8.0.1.0.0.2
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

`-lu -c`

When the `-c` parameter is specified with the `-lu` parameter, a summary of LU configuration information is displayed on a line. The total number of paths recognized by HDLM and the number of online paths are displayed for each LU.

You cannot specify the `-c` parameter together with the `-hdev` or `-pathid` parameter.

For details on the contents of each display item, see Table 6.14.

`-t`

Does not display the title for each information item.

Example

The following example shows how to display a summary of the LU information (without selecting items to be displayed):

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -c
Product      S/N  LUs iLU  HDevName Paths  OnlinePaths
9500V        0016  6 0040 ch4t0d0    8      8
              0041 ch4t0d1    8      8
              0042 ch4t0d2    8      8
              0043 ch4t0d3    8      8
              0044 ch4t0d4    8      8
              0045 ch4t0d5    8      8
KAPL01001-I The HDLM command completed normally. Operation name = view, completion
time = yyyy/mm/dd hh:mm:ss
#
```

To display a summary of LU information (by adding items to be displayed)

`-lu -c -item`

The items specified with the `-item` option are added to the items to be displayed by the `-lu -c` option and displayed.

If no value is specified for the `-item` parameter, all the items that can be added are displayed. See Table 6.14 for the contents of each displayed item.

Table 6.13 shows the items that can be added by using the `-item` parameter and the parameters that can be specified after the `-item` parameter.

Table 6.13 Items that can be added by using the `-lu -c -item` parameter and parameters that can be specified after the `-lu -c -item` parameter

Item that can be added	Subsequent parameter
SLPR	slpr

The subsequent sub-parameter is:

`-t`

Does not display the title for each information item.

Example

The following example describes how to add and display a summary of SLPR.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -lu -c -item
Product S/N      LUs iLU  SLPR HDevName Paths  OnlinePaths
USP      0014050    3 0540   1 ch6t0d0    2      2
          0541   1 ch6t0d1    2      2
          0542   1 ch6t0d2    2      2
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#
```

Displayed LU information

Table 6.14 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 6.14 Displayed LU information

Displayed item		Description
No summary displayed	Summary displayed	
Product		Model ID of the storage subsystem
Serial number	S/N	Serial number of the storage subsystem
LUs		Total number of LUs managed by HDLM among the LUs in the storage subsystem
<ul style="list-style-type: none"> ▪ iLU 		<p>LU number in the storage subsystem.</p> <p>This number combined with the storage subsystem name (shown in <code>DskName</code>) identifies the LU that is accessed by a path.</p> <ul style="list-style-type: none"> ▪ For the Lightning 9900 Series, Lightning 9900V Series, and TagmaStore USP, the first two characters of <code>iLU</code> are the CU number, and the last two characters are the internal LU number within the CU. ▪ For the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200 Series, Thunder 9500V Series, and TagmaStore AMS/WMS series, the entire value of <code>iLU</code> is the internal LU number within the storage subsystem. You can identify an actual LU by referencing <code>iLU</code> from the storage subsystem management program. ▪ For Universal Storage Platform V, indicated by a hexadecimal number. The first two characters of <code>iLU</code> are the number of the logical DKC (Disk Controller), the middle two numbers are the CU number, and the last two characters are the internal LU number within the CU.
SLPR#1	SLPR#2	The number of the SLPR to which the LU belongs, indicated by a decimal number from 0 to 31. A hyphen (-) is displayed if the storage logical partition functionality for the storage subsystem for the target LU is not supported.

Displayed item		
HDevName	HDevName	Host device name. The name of the device file for the HDLM device (chXtYdZ, where X indicates the card instance number, Y indicates the target ID of the iLU, and Z indicates a LUN that the host recognizes) is displayed.
Device	-	Name of the device file for the SCSI device that corresponds to the HDLM device
PathID	-	AutoPATH_ID indicated by a decimal number. AutoPATH_ID is assigned when the management target host is restarted.
PathName#1	-	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: <ul style="list-style-type: none"> ▪ Host port number (hexadecimal number) ▪ Bus number (hexadecimal number) ▪ Target ID (hexadecimal number) ▪ Host LU number (hexadecimal number) For details about each element of the path name and its representation in HP-UX, see Table 6.10
ChaPort#1	-	Port number of the channel adapter, which identifies the CHA port that is mounted on the storage subsystem. You can identify an actual CHA port by referencing this number from the storage subsystem management program.
CLPR#1	-	The number of the CLPR to which the CHA belongs, indicated by a decimal number from 0 to 31. Note that a hyphen (-) is displayed if the following items are subject to display: <ul style="list-style-type: none"> ▪ CHA ports in the storage subsystem that do not support cache logical partition functionality ▪ Paths connected to the Snapshot Image of the Copy-on-write Snapshot of the TagmaStore AMS/WMS series
Status	-	Status of the path <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.) Paths that are Offline (E) or Online (E) require corrective action. The appropriate action can be determined by referring to 5.3
Type#1	-	Attribute of the path <ul style="list-style-type: none"> ▪ Own: Owner path ▪ Non: Non-owner path When connected to the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V.

Displayed item		
IO-Count#1	-	Total I/O count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Count value to zero, execute the <code>dlkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also resets the number of I/O errors (IO-Errors) to zero. For details about the <code>clear</code> operation, see 6.2.
IO-Errors#1	-	Total I/O error count for the path, indicated by a decimal number. The maximum value that can be displayed is $2^{32} - 1$ (4294967295). If the total I/O error count reaches the maximum value, it is reset, and the count is re-started from 0. To reset the IO-Errors value to zero, execute the <code>dlkmgr</code> command's <code>clear</code> operation. Executing the <code>clear</code> operation also clears the number of I/O operations (IO-Count) to zero. For details about the <code>clear</code> operation, see 6.2.
DNum#1	-	Dev number, indicated by a decimal number. This item pertains to a section number. There is one Dev in an LU, so the number is fixed to 0.
IEP#1	-	The displayed paths are assumed to be in an intermittent error status and checked whether those paths are to be operated for automatic fallback. One of the following values is displayed for each path: <ul style="list-style-type: none"> ▪ -: Indicates that intermittent error monitoring is disabled or the monitoring time for an intermittent error is out of range. ▪ A value of at least 0: Indicates the number of errors that occurred during intermittent error monitoring. ▪ *: Indicates that an intermittent error occurred (automatic fallback does not check the path).
H/W Path	-	Hardware path.
-	Paths	Total number of the paths recognized by HDLM for the LU to be displayed, indicated by a decimal number
-	OnlinePaths	Number of available paths in the displayed paths, indicated by a decimal number. When the value of <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 offline paths and take appropriate action for any paths that have an error status.

Legend:

- : Not displayed

#1

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -item` parameter.
- `all` was specified.
- No value was specified for the parameter.

#2

This information is displayed when one of the following conditions exist:

- The user selected the item to be displayed by using the `-lu -c -item` parameter.
- No value was specified for the parameter.

6.7.2.4 To display corresponding information about an HDLM device, SCSI device, and LDEV

`-drv`

Using this parameter displays the PathID, HDLM devices, the SCSI devices that corresponds to the HDLM devices, information on the LDEV in the storage subsystem (storage subsystem model ID, serial number, and LU number, separated by period), and information about the supported hardware paths.

For details on the contents of each display item, see Table 6.15.

`-t`

Does not display the title for each information item.

Table 6.15 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.
HDevName	Host device name. The name of the device file for the HDLM device (<code>chXtYdZ</code> , where <i>X</i> indicates the card instance number, <i>Y</i> indicates the target ID of the iLU, and <i>Z</i> indicates a LUN that the host recognizes) is displayed.
Device	Name of the device file for the SCSI device that corresponds to the HDLM device
LDEV	The model ID, serial number, and iLU number for the storage subsystem, separated by periods. The information about an LDEV can physically identify an LU.
H/W Path	Hardware path.

Example

To display corresponding information about an HDLM device, SCSI device, and LDEV

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV H/W Path
000000 ch4t0d0 c4t0d0 9970/9980.15001.0540 0/6/0/0.8.0.0.0.0.0
000001 ch4t0d1 c4t0d1 9970/9980.15001.0541 0/6/0/0.8.0.0.0.0.1
000002 ch4t0d2 c4t0d2 9970/9980.15001.0542 0/6/0/0.8.0.0.0.0.2
:
000024 ch4t0d0 c11t0d0 9970/9980.15001.0540 0/6/2/0.8.0.0.0.0.0
000025 ch4t0d1 c11t0d1 9970/9980.15001.0541 0/6/2/0.8.0.0.0.0.1
000026 ch4t0d2 c11t0d2 9970/9980.15001.0542 0/6/2/0.8.0.0.0.0.2
:
KAPL01001-I The HDLM command completed normally. Operation name = view,
completion time = yyyy/mm/dd hh:mm:ss
#

```

6.7.2.5 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 ] [-t]
dlnkmgr view -path [ -hdev HostDeviceName ] [-stname] [-iem]
[-srt {pn | lu | cp}] [-t]
dlnkmgr view -path
-item [pn] [dn] [lu] [cp] [type] [ic] [ie] [dnu] [hd] [iep]
[ -hdev HostDeviceName ] [-stname] [-srt {pn | lu | cp}] [-t]
dlnkmgr view -path -c [-stname] [-srt {lu | cp}] [-t]
dlnkmgr view -lu [ -hdev HostDeviceName | -pathid AutoPATH_ID ] [-t]
dlnkmgr view -lu
-item [ [slpr] [pn] [cp] [clpr] [type]
[ic] [ie] [dnu] [iep] [hwp] | all ]
[ -hdev HostDeviceName | -pathid AutoPATH_ID ] [-t]
dlnkmgr view -lu -c [-t]
dlnkmgr view -lu -c -item [slpr] [-t]
dlnkmgr view -drv [-t]
KAPL01001-I The HDLM command completed normally. Operation name = view, completion time =
yyyy/mm/dd hh:mm:ss
#

```


Chapter 7 Utility Reference

This chapter explains the utilities used by HDLM.

- 7.1 Overview of the Utilities
- 7.2 DLMgetras (Utility for Collecting HDLM Error Information)
- 7.3 dlmcfgmgr (HDLM-Configuration Definition Utility)
- 7.4 dlmdefpath (HDLM Path-Configuration Definition Utility)

7.1 Overview of the Utilities

HDLM provides the following utilities:

- The `DLMgetras` utility for collecting HDLM error information
When an error occurs, this utility collects the files that contain information to be submitted to your HDLM vendor or maintenance company. For details about the `DLMgetrasr` utility, see 7.2
- The `dlmcfgmgr` utility for managing HDLM-configuration
This utility automatically discovers non-HDLM-managed devices. You can use the utility to view a listing of such devices or to initialize the configuration information. For details about the `dlmcfgmgr` utility, see 7.3
- HDLM path-configuration definition utility (`dlmdefpath`)
This utility registers an HDLM driver for a path, reconfigures the kernel, and restarts the system with the latest configuration information. For details about the `dlmdefpath` utility, see 7.4.

Note:

- The utilities must be executed by a user with root privileges.
- The time required to start a host or execute utilities depends on the number of LUs and paths.

Table 7.1 shows examples of the time required to start a host or execute utilities.

Table 7.1 Approximate Time Required To Start a Host or Execute Utilities

Operation	Number of paths for each LU / number of all paths#2	Required Time#1 (minutes)		
		11i V1.0#3	11i V2.0 IPF#3	11i V2.0 PA-RISC#3
Starting a host (when HDLM is installed)	4/1024	14	8	8
	8/2048	17	10	11
	16/4096	28	16	18
Starting a host (when	4/1024	9	5	5

Operation	Number of paths for each LU / number of all paths ^{#2}	Required Time ^{#1} (minutes)		
		11i V1.0 ^{#3}	11i V2.0 IPF ^{#3}	11i V2.0 PA-RISC ^{#3}
HDLM is not installed)	8/2048	11	5	5
	16/4096	12	5	5
Executing the <code>dldmdefpath -a</code>	4/1024	5	3	3
	8/2048	6	5	6
	16/4096	15	10	12
Executing the <code>dldmcfmgr -e</code>	4/1024	2	1	1
	8/2048	4	2	2
	16/4096	6	4	4

#1

The time required to start a host or execute utilities might be different depending on the following conditions:

- Hardware configuration (whether there is a switch)
- The number of SCSI device files created in the directory `/dev/dsk`

#2

The number of LUs is 256.

#3

Table 7.2 shows the execution environment.

Table 7.2 Execution Environment

Value in Table 7-1	Model
11i V1.0	9000/800/L2000-44 (CPU: PA-8500 (440 MHz) × 2)
11i V2.0 IPF	rx2600 (CPU: Itanium2 (1.6 GHz) × 2)
11i V2.0 PA-RISC	9000/800/L2000-44 (CPU: PA-8500 (440 MHz) × 2)

7.2 DLMgetras (Utility for Collecting HDLM Error Information)

This utility collects information required for analyzing HDLM errors. This includes information such as error logs, integrated trace files, trace files, definition files, core files, system crash dump files, and libraries. The collected information is archived in a file and saved to the directory that you specified. The following files are output:

- *Name-of-the-directory-containing-a-system-crash-dump-file/system-crash-dump-file*
This file contains a symbolic link to the system crash dump file.
- `hbsa.tar.Z`
This file contains compressed error information of the HiCommand products other than HDLM.
This file is output only when using the HiCommand product that is the target for collecting error information.
- `hwlogs.tar.Z`
This file contains compressed hardware information.
- `cluster.tar.Z`
This file contains compressed cluster information.
- `getras.tar.Z`
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*.

When you want to collect information other than that in List of collected error information, define the information to collect in the information- collection- definition file. Information defined in information- collection- definition file is compressed into getras.tar.Z.

When the system is restarted, a part of the information that was collected by the DLMgetras utility will be cleared. If an error occurs, immediately execute this utility.

7.2.1 Format

```
/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`) as follows:

```
/opt/DynamicLinkManager/bin/dmlmgetras {directory-to-which-collected-information-is-output
```

```
[-f file-that-defines-information-to-be-collected] [-h]
```

7.2.2 Parameters

directory-to-which-collected-information-is-output

Specify the output directory for the information that is to be collected by the `DLMgetras` utility for collecting HDLM error information. The collected information is compiled into four files shown in *Function* and output in the specified directory.

`-f` *file-that-defines-information-to-be-collected*

Use this parameter when you want to specify certain directories or files to be collected. In this parameter, specify the *file-that-defines-information-to-be-collected*, which defines the files and directories you want to collect.

Use an absolute path to specify *file-that-defines-information-to-be-collected*.

Figure 7.1 shows an example of the coding in this file.

<pre># DLM manager core file /opt/DynamicLinkManager/bin/core # # Oracle initial parameter /var/oracle/app/oracle/product/9.0.1/dbs/init.ora # # Oracle Alert Directory /var/oracle/app/oracle/product/9.0.1/rdbms/log</pre>	<p>Collects the core file of HDLM.</p> <p>Collects the initial parameter file for the database (Oracle).</p> <p>Collects the alert information directory for the database (Oracle).</p>
--	---

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 the path name.
- Only one file or directory can be specified per line.
- The root directory (`/`) cannot be specified.
- When a directory is specified, the `DLMgetras` utility collects all the files in that directory, including files contained in the directory's subdirectories. If no files are found in a specified directory, the utility does not perform file collection for that directory and does not create a directory for it in the destination directory.
- Set up the specified file or directory so that it can be read by users with root privileges. The `DLMgetras` utility can only obtain information for a file or directory that can be read.

`-h`

Displays the format of the `DLMgetras` utility.

Note

- If you execute the `DLMgetras` utility, only use the standard POSIX shell (`/usr/bin/sh`) for the shell argument.
- Because `DLMgetras` first stores error information in the specified output directory before compressing, ensure that information collection areas allocated are of adequate size.
- If the specified directory to which collected information is output already exists, an overwrite confirmation message is displayed. Responding by entering `y` instructs the `DLMgetras` utility to overwrite the existing files; entering `n` (or anything other than `y`) instructs the utility to terminate without executing.

In the latter case, you can either rename the existing directory before re-executing the utility, or you can execute the utility with a different directory name specified.

- At execution of this utility, if there is insufficient capacity in the file system of the specified output directory, the system outputs the following message and waits for a response.

```
/output_filesystem: write failed, file system is full
Tar: end of tape
Tar: to continue, enter device/file name when ready or null string to quit.
```

If this message appears, you must press the **Return** key.

The following error message is output, and the utility then terminates abnormally.

```
KAPL10035-E An attempt to archive the error information failed. details = xxxxx
```

Delete or compress files to make more room available in the file system of the specified output directory, and then re-execute the utility. Alternatively, re-execute the utility specifying a different output directory.

- If you create an archive for the system crash dump collected by the `DLMgetras` utility, execute the following:

```
# cd directory-to-which-collected-information-is-output
# tar cvfh archive-file-name ./var
```

7.2.3 List of Collected Error Information

The following illustrates the error information collected by executing the `DLMgetras` utility, which is explained separately in each output file.

- *Name-of-the-directory-containing-a-system-crash-dump-file/name-of-the-system-crash-dump-file*

This file contains a symbolic link to the system crash dump file.

This file contains information about all files in the `/var/adm/crash/` directory.

- `hbsa.tar.Z`

This file contains compressed error information of the HiCommand products other than HDLM.

This file is output only when using the HiCommand product that is the target for collecting error information.

- `hwlogs.tar.Z`

This file contains hardware information. Table 7.3 lists the detailed information stored in the `hwlogs.tar.Z` file.

- `cluster.tar.Z`

This file contains cluster information. Table 7.4 shows the detailed information stored in the `cluster.tar.Z` file.

- `getras.tar.Z`

This file contains HDLM information and system information.

When you execute the `DLMgetras` utility, specifying the file that defines information to be collected, the `getras.tar.Z` file contains the information stored in the file that defines information to be collected.

Table 7.5 lists the detailed information stored in the `getras.tar.Z` file.

Table 7.5 lists the collected information with or without specifying the file that defines information to be collected.

Table 7.3 Information Stored in the `hwlogs.tar.Z` File

Output directory#1	Files	Description
<code>hwlogs/stmlogs</code>	All the directories and files under <code>/var/stm/logs/os</code> .	Hardware logs
<code>hwlogs/evlogs</code>	All the directories and files under <code>/var/opt/resmon/log</code> .	Event logs

#1

An output directory is created in the specified directory when you open the `hwlogs.tar.Z` file.

Table 7.4 Information Stored in the `cluster.tar.Z` File

Output directory#1	Files	Description
<code>cmcluster#2</code>	All the directories and files under <code>/etc/cmcluster</code> .	Definitions and log files for MC/ServiceGuard

#1

An output directory is created in the specified directory when you open the `cluster.tar.Z` file.

#2

Collected only if the collection-target software is installed.

Table 7.5 Information Stored in the getras.tar.Z File

Output directory#1	Files	Description
(Not applicable)	getras.log	Log file generated at DLMgetras utility execution
var/opt/DynamicLinkManager/log	dldmgr[1-16].log	HDLM Manager log (including the driver log)
	dldmfgmgr.log dldmfgmgr[1-3].log	dldmfgmgr utility log
	dldmkernel.log	Log generated at kernel creation
	logdldmwebagent[1-N].log#2	HDLM remote access interface log file
	hcmdlicense2.log	License command log
	hdlmtr[1-64].log	Trace logs for the HDLM Manager, command, and API
var/opt/DynamicLinkManager/log/mmap	hdlmtr.mm	Trace management file
opt/hitachi/HNTRLlib/mmap	hntrmmap.mm	Memory mapped file (HNTRLlib)
opt/hitachi/HNTRLlib/spool	hntr[1-16].log	Integrated Trace file (HNTRLlib)
opt/hitachi/HNTRLlib2/mmap	hntr2mmap.mm	Memory mapped file (HNTRLlib2)
<i>Integrated-trace-file-output-directory-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility</i> (Default: var/opt/hitachi/HNTRLlib2/spool)	<i>Integrated-trace-file-prefix-specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility2[1-16].log#3</i> (default prefix: hntr)	Integrated trace file (HNTRLlib2)
etc	syslog.conf	File defining the syslog output directory
	fstab	Information for automatically mounting the file system at startup
	exports	File system mount information
	inittab	Boot processing script
	rc.log	Startup script log
	ioconfig	System I/O configuration information
	hosts	Host name database file
	nsswitch.conf	Name service switch configuration file
	lvmtab	LVM configuration information

Output directory#1	Files	Description
etc/opt/DynamicLinkManager	dlimfdrv.unconf	File that defines non-HDLM-managed disks
	dlimcfmgr.log	dlimcfmgr utility log
	dlimwebagent.properties	HDLM remote access interface settings file
	dlimmgr.xml	dlimmgr setting file
stand	system	Kernel parameters information
directory-for-syslog-output	syslog-name	According to information defined in /etc/syslog.conf
var/adm	kc.log	A history log for kernel configuration (HP-UX 11i v2.0)
var/adm/sw	swagent.log	Historical information on installation and uninstallation
var/adm/syslog	OLDsyslog.log	syslog backup file
var/opt/ignite/recovery/latest	recovery.log	Ignite-UX log
getrasinfo	(Not applicable)	Directory for storing all command execution results
	dev_dsk.txt	List of devices treated as block devices
	Dev_rdisk.txt	List of devices treated as character devices
	dev_dlm.txt	List of dummy devices
	dlimmgr-lu.txt	HDLM LU information
	dlimmgr-lu-all.txt	HDLM LU information (including the number of times an intermittent error occurred)
	dlimmgr-path-iem.txt	HDLM path information (including the number of times an intermittent error occurred)
	vgdisplay-v.txt	Volume group information
	ioscan-fnk.txt	Device configuration information
	Bdf.txt	Mount information
	mount-v.txt	Mount information
	getconfPAGESIZE.txt	Display of memory page size
	uname-a.txt	OS version
	getconfKERNEL_BITS.txt	OS type (32bit/64bit)

Output directory ^{#1}	Files	Description
	ulimit-a.txt	Display of limit values on system resources (data segments, stack segments, and file descriptors) that are available to processes
	ps-efl.txt	Information about the process being executed
	swlist.txt	Display of the bundled software that has been installed
	swlist-l_fileset.txt	Display of the installed package list
	swlist-l_patch.txt	Display of the installed patch list
	sysdef.txt	Display of kernel parameters
	swapinfo-a.txt	Display of swap area information
	dmesg.txt	System diagnostic messages
	dlmmgr-path.txt	Display of HDLM path information
	dlmmgr-sys.txt	Display of HDLM system settings
	kctune.txt	Adjustable kernel parameters and their values (HP-UX 11i v2.0)
	dlmmgr-drv.txt	Displays the correspondence between the HDLM device, physical volume, and LDEV information
	lsdev.txt	Display of driver list
	dlmgetomtrace.dmp	HDLM function trace
	whatlist.txt	Information output by <code>what</code> command
	env.txt	Execution result (environment variable) of <code>env</code> command
usr/lib/hpux32	dld.so libc.so libdl.so.1 uld.so	Libraries used by <code>dlmcfgmgr</code> (HP-UX 11i v2.0 IPF)

#1

An output directory is created in the specified directory when you open the `getras.tar.Z` file.

#2

The value *N* depends on the setting in the `dlmwebagent.properties` file. The default is 8.

#3

In the actual file name, a file number is appended to *Trace-file-prefix specified-in-the-Hitachi-Network-Objectplaza-Trace-Library-utility*². For example, the default will be `hntr21.log` to `hntr216.log`. Note that the 2 following the integrated trace file prefix does not represent a file number.

7.3 dlmcfmgr (HDLM-Configuration Definition Utility)

This utility automatically recognizes and outputs devices not managed by HDLM. When you write the execution results of this utility in the file `/etc/opt/DynamicLinkManager/dlmfdrv.unconf` (for example, using output by redirection), you can create a file that defines the non-HDLM-managed disks.

When the host is restarted, HDLM recognizes the CCI command device or the storage subsystems that are not supported and automatically removes them from the management-targets even if you do not write them in the file that defines the non-HDLM-managed disks. However, we recommend that you write them in this file to shorten startup time when the host starts.

7.3.1 Format

```
/sbin/dlmcfmgr {-e [device-file-name...] | -l device-file-name...}
```

7.3.2 Parameters

`-e [device-file-name...]`

This option automatically recognizes and lists devices not managed by HDLM. When a device file name is specified, the utility adds the specified file to the list of devices not managed by HDLM without opening and checking the device.

Devices that meet at least one of the following conditions are excluded from the HDLM management:

- Devices whose names match a device specified from the command.
- Devices for which `/dev/dsk/cXtYdZ` (where X is the card instance number, Y is the target ID of the iLU, and Z is the LUN identified by the host) cannot be opened, or for which the specified device (`/dev/dsk/cXtYdZ`) is not a block device.
- Devices for which `/dev/rdisk/cXtYdZ` (where X is the card instance number, Y is the target ID of the iLU, and Z is the LUN identified by the host) cannot be opened, or for which the specified device (`/dev/rdisk/cXtYdZ`) is not a character device.
- Device for which the device type is not a disk device.
For details about device types, see the file `/usr/include/sys/diskio.h`.
- The device file (`cXtYdZ`) is stored in `/dev/dsk` or `/dev/rdisk` and is not connected to the SCSI device.
- The target device is the device, such as the CD-ROM drive, that is not a disk.

`-l device-file-name...`

This option displays a list of associated devices.

The list includes only block device names (`/dev/dsk/...`) matching the specified device file names.

Specify the device file name by an absolute path. You can specify multiple device file names. You may also use metacharacters. File name matches will be checked from the beginning forward. Two types of file are available: block (`/dev/dsk/...`) and character (`/dev/rdsk/...`).

Return values

0: Completed successfully

1: Abnormal termination (which might be caused by an invalid parameter or OS function, or a system call that cannot be issued)

Examples of usage

Example 1:

In this example, the utility automatically detects devices not managed by HDLM, and creates a file that defines these devices:

- When the devices not managed by HDLM are not known:

```
# /sbin/dlmcfgmgr -e  
>/etc/opt/DynamicLinkManager/dlmfdrv.unconf
```

- When the specified device is that of a CD-ROM or other media for which detection takes an extended period of time (`/dev/dsk/c1t2d0` is an example of a CD-ROM):

We recommend this usage, since it can reduce processing time.

```
# /sbin/dlmcfgmgr -e /dev/dsk/c1t2d0 >/etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

- When the file name is to be specified using metacharacters (in this case, excluding `c0t9d*`):

```
# /sbin/dlmcfgmgr -e /dev/dsk/c0t9d* >/etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

- When the file name is to be specified using metacharacters (in this case, excluding `c0t9d3` to `c0t9d6`):

```
# /sbin/dlmcfgmgr -e /dev/dsk/c0t9d[3-6] >/etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

- When the file name is to be specified using an incomplete file name (in this case, excluding `c0t9d*`):

```
# /sbin/dlmcfgmgr -e /dev/dsk/c0t9d >/etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

Example 2:

In this example, the utility displays the specified file without automatically detecting devices not managed by HDLM.

You can use this option to add devices not managed by HDLM to an existing file that defines such devices.

- The following command adds the file name `/dev/dsk/c0t9d0` to the file that defines non-HDLM-managed disks:

```
# /sbin/dlmcfgmgr -l /dev/dsk/c0t9d0 >> /etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

- The following command adds the file name `/dev/dsk/c0t9d*` to the file that defines non-HDLM-managed disks:

```
# /sbin/dlmcfgmgr -l /dev/dsk/c0t9d* >> /etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

The following command is also available:

```
# /sbin/dlmcfgmgr -l /dev/dsk/c0t9d >> /etc/opt/  
DynamicLinkManager/dlmfdrv.unconf
```

Note:

- The HDLM-configuration definition utility (`dlmcfgmgr`) automatically starts when the host starts, and then automatically configures the system (configuration recognition). When you change the system configuration, such as by adding or deleting paths or LUs or by updating a file that defines non-HDLM-managed disks, execute the HDLM path-configuration definition utility (`dlmdefpath`). Then restart the host to report the updated information to HDLM. After restarting the host, check both the output log (`/var/opt/DynamicLinkManager/log/dlmcfgmgr.log`) during the automatic configuration, and the execution results of the `view` operation of the `dlnkmgr` command. Once the system changes are complete, check the HDLM devices and the corresponding SCSI devices again. For details about the `view` operation, see 6.7.
- When you restart a host, HDLM recognizes the system configuration based on the system configuration information that existed before the host was restarted. When you change the whole path configuration, such as by rebuilding the system, uninstall and then perform a new installation of HDLM so that the system configuration information is removed.
- Do not concurrently execute more than one `dlmcfgmgr` utility or HDLM path-configuration definition utility (`dlmdefpath`). Before executing the `dlmcfgmgr` or `dlmdefpath` utilities, make sure that no other users are executing these utilities.

- In a SAN boot environment, you have to code the names of all device files, which include the names of device files to be mirrored, corresponding to the boot disk into the file that defines non-HDLM-managed disks. If you execute the `dmlmdefpath` utility without coding the names of device files into the file, the system will not start.

To code the names of device files into the file that defines non-HDLM-managed disks:

1. Check the names of device files corresponding to the boot disk.

Execute the following command, and check the names of device files specified as the physical volumes in `/dev/vg00`. These device files are the ones corresponding to the boot disk.

```
# vdisplay -v /dev/vg00
--- Volume groups ---
VG Name                /dev/vg00
:
  --- Logical volumes ---
  LV Name              /dev/vg00/lvol1
  :
  --- Physical volumes ---
  PV Name              /dev/dsk/c4t0d0
  PV Name              /dev/dsk/c6t0d0      Alternate Link
  PV Status            available
:
#
```

Note:

In HP-UX 11i v2.0(IPF), PV Name is displayed in the the following `cXtXdXsX` format:

```
PV Name                /dev/dsk/c4t0d0s2
PV Name                /dev/dsk/c6t0d0s2      Alternate Link
```

2. Code the names of all device files corresponding to the boot disk into the file that defines non-HDLM-managed disks.

In HP-UX 11i v2.0(IPF), PV Name is displayed in the format of `cXtXdXsX`. However, in the file that defines non-HDLM-managed disks, PV Name is coded in the format of `cXtXdX`, with the `sX` part deleted.

The following is an example of this coding:

```
# /sbin/dlmcfgmgr -l /dev/dsk/c4t0d0 /dev/dsk/c6t0d0 >>
/etc/opt/DynamicLinkManager/dlmdrv.unconf
#
```

3. Check the name of the file that defines non-HDLM-managed disks.

The following is an example of the command:

```
# cat /etc/opt/DynamicLinkManager/dlmdrv.unconf
:
/dev/dsk/c4t0d0
/dev/dsk/c6t0d0
#
```

- If a path that has been managed by HDLM is deleted, the `KAPL10307-W` message is output to the log file[#] when the host is restarted. To suppress this message, do the following:

4. Add, to the file (`/etc/opt/DynamicLinkManager/dlmdrvr.unconf`) that defines non-HDLM-managed disks, the deleted path and the device that was connected to the path.
5. Execute the `dldmdefpath` utility.

#

The log file (`/var/opt/DynamicLinkManager/log/dlmcfgmgr.log`) that is output when the `dldmdefpath` or `dldmdefpath` utility is executed.

7.4 dldmdefpath (HDLM Path-Configuration Definition Utility)

This utility registers an HDLM driver for a path, reconfigures the kernel, and restarts the system. The latest configuration information is applied after a hardware change or after modifying the file that defines non-HDLM-managed disks.

7.4.1 Format

```
/opt/DynamicLinkManager/bin/dldmdefpath -a
```

7.4.2 Parameters

-a

This parameter registers a driver in HDLM.

Return values

0: Completed successfully

1: Abnormal termination

Note

- Always run the HDLM path-configuration definition utility (`dldmdefpath`) in the following circumstances. If you restart the system without first running the `dldmdefpath` utility, commands executed on HDLM-managed devices will not work properly.
 - When changing the hardware configuration such as LUs or paths
 - When changing the contents of the HDLM file that defines non-HDLM-managed disks.
- After the `dldmdefpath` utility is executed and then the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dlmdefpath` utility again, and make sure the above message does not appear this time after the host is restarted.

- Before you execute the `dlmdefpath` utility, execute the `ioscan` command to make sure that the H/W State of the paths already managed by HDLM or paths to be managed by HDLM is CLAIMED.
- Do not concurrently execute more than one `dlmdefpath` utility or HDLM-configuration definition utility (`dlmcfmgmgr`). Before executing the `dlmdefpath` or `dlmcfmgmgr` utilities, make sure that no other users are executing these utilities.
- If you directly specify the `dlmdefpath` utility for an argument of a shell and execute this utility, use the standard POSIX shell (`/usr/bin/sh`) only.
- The kernel may be reconfigured and the host may be restarted when you perform any of the following tasks using the `sam`, `swinstall`, or `kmtune` commands:
 - Add, uninstall, or upgrade software by the `swinstall`, `swremove`, or other command
 - Add, remove, or change a swap device or dump device
 - Change a reconfigurable kernel parameter
 - Upgrade or re-install HDLM

After one of the above operations is performed and the host is restarted, access the `/var/opt/DynamicLinkManager/log/dlmcfmgmgr.log` file to see if the following message was output during or after restart:

```
KAPL10317-E The path configuration definition has not been set.
```

This message means that the hardware configuration or the driver configuration has changed or the file that defines non-HDLM-managed disks has been modified. Run the `dlmdefpath` utility again, and make sure the above message does not appear this time after the host is restarted.

- If a path that has been managed by HDLM is deleted, the `KAPL10307-W` message is output to the log file[#] when the host is restarted. To suppress this message, do the following:
 1. Add, to the file (`/etc/opt/DynamicLinkManager/dlmfdrv.unconf`) that defines non-HDLM-managed disks, the deleted path and the device that was connected to the path.
 2. Execute the `dlmdefpath` utility.

#

The log file (`/var/opt/DynamicLinkManager/log/dlmcfmgmgr.log`) that is output when the `dlmcfmgmgr` or `dlmdefpath` utility is executed.

Chapter 8 Messages

This chapter provides information about viewing messages output by HDLM. It also lists and explains the HDLM messages and shows the actions to be taken in response to each message. Section 8.14 describes the meanings and actions to be taken of return codes output by HDLM when the HDLM remote access interface sends a request to HDLM.

- 8.1 Before Viewing the List of Messages
- 8.2 HDLM Command (dlnkmgr and Operations) Messages
- 8.3 HDLM API messages
- 8.4 HDLM Mmanager Messages
- 8.5 HDLM Driver (Filter Component) Messages
- 8.6 HDLM Alert Driver Messages
- 8.7 HDLM Driver (Core Logic Component) Messages
- 8.8 HDLM Management Target Messages
- 8.9 HDLM Installation Program Messages
- 8.10 Messages from the DLMgetras Utility for Collecting HDLM Error Information
- 8.11 Messages from the HDLM-Configuration Definition Utility (dlmcfmgr)
- 8.12 Messages from the HDLM Path-Configuration Definition Utility (dlmdefpath)
- 8.13 Messages from HDLM remote access interface
- 8.14 Return Codes for the HDLM Remote Access Interface

8.1 Before Viewing the List of Messages

This section explains the following information that is needed to locate messages and understand the message explanations in the section from 8.2.

- Format and meaning of message IDs
- Terms used in messages and message explanations

The information is described below.

8.1.1 Format and Meaning of Message IDs

Each message has a message ID. The following shows the format and meaning of message IDs.

Table 8.1 Format and Meaning of the Message ID *KAPLmmnnn-I*

Format	Meaning
--------	---------

KAPL	Indicates that the message is an HDLM message.
<i>mm</i>	Number of the HDLM module that issued the message. 01: HDLM command 03: HDLM API 04: HDLM manager 05: HDLM driver (filter component) 06: HDLM alert driver 07: HDLM driver (core logic component) 08: HDLM management target 09: HDLM installation program 10: The following utilities: <ul style="list-style-type: none"> ▪ DLMgetras utility (KAPL100nn) ▪ dlmcfgmgr utility (KAPL103nn) ▪ dlmdfpath utility (KAPL104nn) 11: HDLM remote access interface
<i>nnn</i>	Message serial number for the module
<i>l</i>	Message level C: Critical E: Error W: Warning I: Information

8.1.2 Terms Used in Messages and Message Explanations

The following shows the terms that may appear in messages and message explanations.

Table 8.2 Terms Used in Messages and Message Explanations

Terms	Meaning
<i>aa...aa</i>	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	Type of the operation that is entered after <code>dlmkmgr</code> in the command.

Some messages for the following components are output to syslog:

- HDLM manager
- HDLM driver (filter component)
- HDLM alert driver
- HDLM management target

8.2 HDLM Command (dlnkmgr and Operations) Messages

KAPL01001-I	The HDLM command completed normally. Operation name = <i>aa...aa</i> , completion time = <i>bb...bb</i>	<p>Details</p> <p>The HDLM command completed successfully.</p> <p><i>aa...aa</i>: clear, help, offline, online, set, view</p> <p><i>bb...bb</i>: the year of grace/month/day hour:minute:second</p> <p>Action</p> <p>None.</p>
KAPL01002-I	The HDLM command started. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The HDLM command was executed.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p>Action</p> <p>None.</p>
KAPL01003-W	No operation name is specified.	<p>Details</p> <p>The operation name is missing.</p> <p>Action</p> <p>Specify the operation name, and then retry.</p>
KAPL01004-W	The operation name is invalid. Operation name = <i>aa...aa</i>	<p>Details</p> <p><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 6.3.</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>: clear, set, online, offline, view</p> <p><i>bb...bb</i>: Specified parameter</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter, and then retry. For details on the <code>help</code> operation, see 6.3.</p>
KAPL01006-W	A necessary parameter is not specified. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The specified operation does not contain the necessary parameter.</p> <p><i>aa...aa</i>: clear, set, offline, view</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter. Specify the correct parameter, and then retry. For details on the <code>help</code> operation, see 6.3.</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>: clear, offline, online, set, view</p> <p><i>bb...bb</i>: Duplicate parameter</p> <p>Action</p> <p>Delete the duplicate parameter, and then retry.</p>

KAPL01008-W	A necessary parameter value is not specified. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i>	<p>Details</p> <p><i>aa...aa</i>: offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p>Action</p> <p>Specify the parameter value, and then retry.</p>
KAPL01009-W	A parameter value is invalid. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter value = <i>cc...cc</i> , Valid value = <i>dd...dd</i>	<p>Details</p> <p><i>aa...aa</i>: offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Specified parameter value</p> <p><i>dd...dd</i>: Specifiable parameter value range</p> <p>Action</p> <p>Specify the correct value for the parameter, and then retry.</p>
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> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check whether the HDLM manager has started. Start the HDLM manager if it has not started, and then retry the HDLM command. For details on the <code>view</code> operation, see 6.7.</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 whose cause does not seem to be a user operation occurred during command processing.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p><i>bb...bb</i>: Function name and contents of error</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL01014-W	No authority to execute the HDLM command. Operation name = <i>aa...aa</i>	<p>Details</p> <p>You are not authorized to execute the HDLM command as the administrator.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p>Action</p> <p>Execute the command as a user with <code>root</code> privileges.</p>
KAPL01015-W	The target HBA was not found. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The path having the <code>host</code> port number and path number specified in the <code>-hba</code> parameter could not be found.</p> <p><i>aa...aa</i>: offline, online</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) and 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 6.7.</p>

KAPL01016-W	The target CHA port was not found. Operation name = aa...aa	<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>aa...aa: offline, online</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) and then check the value displayed in <code>ChaPort</code>. Specify the <code>PathID</code> of a path that passes through the relevant CHA port, and then retry. For details on the <code>view</code> operation, see 6.7.</p>
KAPL01018-W	The target device was not found. Operation name = aa...aa	<p>Details</p> <p>The specified host device name could not be found.</p> <p>aa...aa: view</p> <p>Action</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnkmgr view -path</code>) to check the value displayed in <code>HDevName</code>. Specify the value of <code>HDevName</code> for the host device to be operated and then retry. For details on the <code>view</code> operation, see 6.7.</p>
KAPL01019-W	The target path was not found. Operation name = aa...aa	<p>Details</p> <p>aa...aa: offline, online, 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 <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the specification, and then retry. For details on the <code>view</code> operation, see 6.7.</p> <ul style="list-style-type: none"> ▪ view operation <p>Refer to Chapter 3. Creating an HDLM Environment or 4.4, and then configure the path. 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. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL01021-E	Cannot execute the HDLM command due to insufficient memory.	<p>Details</p> <p>Memory required for HDLM command processing could not be allocated.</p> <p>Action</p> <p>Terminate unnecessary applications to increase the amount of free memory, and then retry.</p>

KAPL01023-W	The last Online path for the device cannot be placed Offline(C).	<p>Details</p> <p>The path specified in the <code>offline</code> operation cannot be placed Offline(C) because it is the last path of the LU.</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 6.7.</p>
KAPL01024-W	The specified parameters cannot be specified at the same time. Operation name = <code>aa...aa</code> , parameters = <code>bb...bb</code>	<p>Details</p> <p><code>aa...aa</code>:<code>offline</code>, <code>online</code>, <code>set</code>, <code>view</code></p> <p><code>bb...bb</code>:Parameters cannot be specified at the same time</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter that can be specified, and then retry. For details on the <code>help</code> operation, see 6.3.</p>
KAPL01036-E	The Offline path cannot be placed online. PathID = <code>aa...aa</code>	<p>Details</p> <p><code>aa...aa</code>: Path ID (decimal number)</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
KAPL01039-W	During the online operation processing of the HDLM command, a path that cannot be placed in the Online status was detected. PathID = <code>aa...aa</code> Would you like to continue the processing of the online operation? [y/n]:	<p>Details</p> <p>A path that cannot be placed Online was detected during multipath online processing.</p> <p>To ignore this path and perform online processing for the next path, enter <code>y</code>.</p> <p>To cancel processing, enter <code>n</code>.</p> <p><code>aa...aa</code>: Path ID (decimal number)</p> <p>Action</p> <p>If you want to continue processing of the <code>online</code> operation of the HDLM command for other paths, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>online</code> operation, see 6.5.</p>
KAPL01040-W	The entered value is invalid. Re-enter [y/n]:	<p>Details</p> <p>A value other than <code>y</code> and <code>n</code> was entered. Enter <code>y</code> or <code>n</code>.</p> <p>Action</p> <p>Enter <code>y</code> or <code>n</code>.</p>
KAPL01041-E	The entered value is invalid. The operation stops. Operation name = <code>aa...aa</code>	<p>Details</p> <p>Command processing will be aborted because an incorrect response was made three times in reply to the request.</p> <p><code>aa...aa</code>: <code>clear</code>, <code>offline</code>, <code>online</code>, or <code>set</code></p> <p>Action</p> <p>To execute the operation, re-execute the HDLM command.</p>
KAPL01044-W	A duplicate parameter value is specified. Operation name = <code>aa...aa</code> , parameter = <code>bb...bb</code> , parameter value = <code>cc...cc</code>	<p>Details</p> <p><code>aa...aa</code>:<code>view</code></p> <p><code>bb...bb</code>: Parameter name</p> <p><code>cc...cc</code>: Duplicated parameter value</p> <p>Action</p> <p>Delete the duplicate parameter value name, and then retry.</p>

KAPL01045-W	Too many parameter values are specified. Operation name = <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, 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 6.3.</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 6.3.</p>
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>: clear, set</p> <p>Action</p> <p>If you want to execute operation of the HDLM command, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>clear</code> operation, see 6.2. For details on the <code>set</code> operation, see 6.6.</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 the online processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>online</code> operation, see 6.5.</p>
KAPL01051-I	Because no path has been selected among the currently displayed paths, the paths in the Offline(C), Offline(E), and Online(E) statuses will be changed to the Online status. Is this OK? [y/n]:	<p>Details</p> <p>All the paths will be placed Online because the path selection parameter is not specified in the <code>online</code> operation. To place all the paths Online, enter <code>y</code>. To not place them online, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the online processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>view</code> operation, see 6.7. For details on the <code>online</code> operation, see 6.5.</p>
KAPL01052-I	The currently selected paths will be changed to the Offline(C) status. Is this OK? [y/n]:	<p>Details</p> <p>The <code>offline</code> operation will be started. To continue the <code>offline</code> operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute the offline processing, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>. For details on the <code>offline</code> operation, see 6.4.</p>

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]:	<p>Details</p> <p>The <code>offline</code> operation will be started. To continue the <code>offline</code> operation, enter y. To cancel the operation, enter n.</p> <p>Action</p> <p>If you want to execute the offline processing, enter y. If you want to terminate the processing, enter n. For details on the <code>offline</code> operation, see 6.4.</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 = aa...aa Would you like to continue the processing of the offline operation? [y/n]:	<p>Details</p> <p>A path that cannot be placed Offline(C) was detected during multipath offline processing. To ignore this path and perform offline processing for the next path, enter y. To cancel offline processing, enter n.</p> <p>aa...aa: Path ID (decimal number)</p> <p>Action</p> <p>If you want to continue processing of the <code>offline</code> operation of the HDLM command for other paths, enter y. If you want to terminate the processing, enter n. For details on the <code>offline</code> operation, see 6.4.</p>
KAPL01055-I	All the paths which pass the specified aa...aa will be changed to the Offline(C) status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively placed Offline(C) because the <code>-hba</code> or <code>-cha</code> parameter was specified. To collectively place multiple paths Offline(C), enter y. To not collectively place them Offline(C), enter n.</p> <p>aa...aa: CHA port, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.</p>
KAPL01056-I	If you are sure that there would be no problem when all the paths which pass the specified aa...aa are placed in the Offline(C) status, enter y. Otherwise, enter n. [y/n]:	<p>Details</p> <p>This message re-asks the user whether to place all the paths Offline(C). To place all the paths Offline(C), enter y. To not place them Offline(C), enter n.</p> <p>aa...aa: CHA port, HBA</p> <p>Action</p> <p>If you want to execute the offline processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.</p>
KAPL01057-I	All the paths which pass the specified aa...aa will be changed to the Online status. Is this OK? [y/n]:	<p>Details</p> <p>Multiple paths will be collectively placed Online because the <code>-hba</code> or <code>-cha</code> parameter has been specified. To continue processing, enter y. To cancel processing, enter n.</p> <p>aa...aa: CHA port, HBA</p> <p>Action</p> <p>If you want to execute the online processing for the paths that pass the specified target, enter y. If you want to terminate the processing, enter n.</p>

KAPL01058-W	The specified parameter value is not needed. Operation name = <i>aa...aa</i> , parameter = <i>bb...bb</i> , parameter value = <i>cc...cc</i>	<p>Details</p> <p>A parameter value was specified in a parameter that does not need any parameter value.</p> <p><i>aa...aa</i>: clear, offline, online, set, view</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Parameter value</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter and parameter value, and then retry. For details on the <code>help</code> operation, see 6.3.</p>
KAPL01059-W	Cannot specify the parameter <i>aa...aa</i> at the same time if you specify parameter <i>bb...bb</i> and parameter value <i>cc...cc</i> . Operation name = <i>dd...dd</i>	<p>Details</p> <p>A parameter value conflicts with the specification of another parameter.</p> <p><i>bb...bb</i>: Parameter name</p> <p><i>cc...cc</i>: Parameter value</p> <p><i>aa...aa</i>: Parameter name</p> <p><i>dd...dd</i>: view, set</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlnkmgr</code>) to check the parameter and parameter value, and then retry. For details on the <code>help</code> operation, see 6.3.</p>
KAPL01060-I	The user terminated the operation. Operation name = <i>aa...aa</i>	<p>Details</p> <p>The command processing will be aborted because n was entered in reply to the acknowledgment.</p> <p><i>aa...aa</i>: online, offline, set, clear</p> <p>Action</p> <p>None.</p>
KAPL01061-I	<i>aa...aa</i> path(s) were successfully placed <i>bb...bb</i> ; <i>cc...cc</i> path(s) were not. Operation name = <i>dd...dd</i>	<p>Details</p> <p>This message indicates the number of the paths processed in the <code>online/offline</code> operation.</p> <p><i>aa...aa</i>: Number of paths where <code>online/offline</code> operation is successful (decimal number)</p> <p><i>bb...bb</i>: Online or Offline(C)</p> <p><i>cc...cc</i>: Number of paths where <code>online/offline</code> is unsuccessful (decimal number)</p> <p><i>dd...dd</i>: online, offline</p> <p>Action</p> <p>None. For details on the <code>online</code> operation, see 6.5. For details on the <code>offline</code> operation, see 6.4.</p>
KAPL01063-I	The target path(s) are already <i>aa...aa</i> .	<p>Details</p> <p>As a result of executing the <code>online/offline</code> operation, the specified path is already placed Online/Offline(C).</p> <p><i>aa...aa</i>: Online or Offline(C)</p> <p>Action</p> <p>Use the <code>view</code> operation of the HDLM command (<code>dlnkmgr</code>) to check the status of the path. For details on the <code>view</code> operation, see 6.7. For details on the <code>online</code> operation, see 6.5. For details on the <code>offline</code> operation, see 6.4.</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 will be aborted because an invalid license key was entered three times.</p> <p>Action</p> <p>Obtain a valid license key, and then retry.</p>
KAPL01071-I	The permanent license was installed.	<p>Details</p> <p>The license was renewed into a permanent license.</p> <p>Action</p> <p>None.</p>
KAPL01072-I	The emergency license was installed. The license expires on aa...aa.	<p>Details</p> <p>A license was renewed into the emergency license.</p> <p>aa...aa: 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>
KAPL01073-E	The temporary license expired.	<p>Details</p> <p>The temporary license expired. Register a permanent license.</p> <p>Action</p> <p>Register a permanent license.</p>
KAPL01074-E	The emergency license expired.	<p>Details</p> <p>The emergency license expired. Register a permanent license.</p> <p>Action</p> <p>Register a permanent license.</p>
KAPL01075-E	A fatal error occurred in HDLM. The system environment is invalid.	<p>Details</p> <p>The license information file is missing.</p> <p>Action</p> <p>Re-install HDLM.</p>
KAPL01076-I	The permanent license has been installed.	<p>Details</p> <p>You need not install a license because a permanent license has already been installed.</p> <p>Action</p> <p>None.</p>

KAPL01077-W	The path configuration definition has not been set.	<p>Details</p> <p>The HDLM path-configuration definition utility (<code>dldmdefpath</code>) has not been executed but the configuration of a path has changed.</p> <p>Actions</p> <p>Execute the <code>dldmdefpath</code> utility. For details on the <code>dldmdefpath</code> utility, see 7.4.</p>
KAPL01079-W	The intermittent error monitoring function cannot be set up because automatic failback is disabled.	<p>Details</p> <p>The intermittent error monitoring function cannot be set up because automatic failback is disabled.</p> <p>Action</p> <p>Enable automatic failback, and then re-execute.</p>
KAPL01080-W	The error monitoring interval and the number of times that the error is to occur conflict with the automatic failback checking interval.	<p>Details</p> <p>An intermittent error cannot be detected by using the values specified for the following: the checking interval for automatic failback, the error monitoring interval, and the number of times the error is to occur.</p> <p>Action</p> <p>Set the intermittent error monitoring interval to a value that is equal to or more than (<i>automatic-failback-checking-interval x number-of-times-error-is-to-occur-for-intermittent-error-monitoring</i>).</p>
KAPL01081-E	The license key file is invalid. File name = <code>aa...aa</code>	<p>Details</p> <p>The format of the license key file is invalid.</p> <p><code>aa...aa: /var/tmp/hdlm_license</code></p> <p>Action</p> <p>Save the correct license key file in the designated, and then re-execute.</p> <p><code>/var/tmp/hdlm_license</code></p>
KAPL01082-E	There is no installable license key in the license key file. File name = <code>aa...aa</code>	<p>Details</p> <p>There is no HDLM-installable license key in the license key file.</p> <p><code>aa...aa: /var/tmp/hdlm_license</code></p> <p>Action</p> <p>Make sure that the license key file is correct, and then re-execute.</p> <p><code>/var/tmp/hdlm_license</code></p>
KAPL01083-I	There is no license key file. File name = <code>aa...aa</code>	<p>Details</p> <p>There is no license key file in the designated directory:</p> <p><code>aa...aa: /var/tmp/hdlm_license</code></p> <p>Action</p> <p>When the message that prompts you to enter the license key is displayed, enter the license key.</p> <p>Alternatively, cancel the HDLM command, save the correct license key file in the designated directory, and then re-execute the HDLM command.</p> <p><code>aa...aa: /var/tmp/hdlm_license</code></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/hdml_license</p> <p>Action</p> <p>If the following license key file exists, delete it: /var/tmp/hdml_license</p>
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 cannot be specified at the same time</p> <p>Action</p> <p>Execute <code>help operation-name</code> of the HDLM command (<code>dlmkmgr</code>) to check the parameter that can be specified, and then retry. For details on the <code>help</code> operation, see 6.3.</p>
KAPL01089-E	One of the following was executed at the same time as an HDLM command <code>set -lic</code> operation: another <code>set -lic</code> operation, or an update of the license for an update installation.	<p>Action</p> <p>Check the license by using the HDLM command's <code>view -sys -lic</code> operation. Then, if necessary, re-execute the HDLM command's <code>set -lic</code> operation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>Do not perform the following operations:</p> <ul style="list-style-type: none"> ▪ Simultaneous executions of the HDLM command's <code>set -lic</code> operation ▪ Execution of the HDLM command's <code>set -lic</code> operation simultaneously with an update of the license for an upgrade 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 reason for error</p> <p>Action</p> <p>Re-execute. If the same error occurs again, execute the <code>DLMgetras</code> utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.</p>
KAPL01096-E	An attempt to acquire the Service Pack version information has failed. details = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Code showing reason for error</p> <p>Action</p> <p>Re-execute. If the same error occurs again, execute the <code>DLMgetras</code> utility for collecting HDLM error information, acquire the error information, and then contact your HDLM vendor or the company for which you have a service contract.</p>
KAPL01097-W	All the current trace files will be deleted. Is this OK? [y/n]	<p>Details</p> <p>If you set a value less than the current value of the trace file size or number of trace files, all the current trace files will be deleted. To continue the operation, enter <code>y</code>. To cancel the operation, enter <code>n</code>.</p> <p>Action</p> <p>If you want to execute operation of the HDLM command, enter <code>y</code>. If you want to terminate the processing, enter <code>n</code>.</p>

KAPL01100-I	aa...aa	<p>Details</p> <p>This message indicates the executed command line.</p> <p>Action</p> <p>None.</p>
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 set the load balancing type for the system, enter <i>y</i>. If you want to terminate the processing, enter <i>n</i>.</p>

8.3 HDLM API messages

KAPL03001-I	HDLM API information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : Trace information</p> <p>Action</p> <p>None.</p>
KAPL03003-E	HDLM API Error information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL03004-C	A critical error occurred in the HDLM API. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL03006-E	An access to the HDLM driver causes an error. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

KAPL03007-E	An error occurred during communication with the HDLM manager. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL03008-E	An error occurred during log input to the HDLM alert driver. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa : API trace error information</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL03999-E	An unexpected error occurred.	<p>Details</p> <p>A conflict occurred in the versions of the modules that HDLM uses internally.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

8.4 HDLM Mmanager Messages

KAPL04001-I	HDLM manager started.	<p>Action</p> <p>None.</p>
KAPL04002-E	Could not start the HDLM manager.	<p>Details</p> <p>HDLM manager failed to start because the environment is incorrect for the manager to run properly.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL04003-E	The startup parameter is invalid.	<p>Details</p> <p>The parameter held internally by the HDLM manager is incorrect.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

KAPL04004-I	HDLM manager will now terminate.	Action None.
KAPL04008-E	Cannot open the option definition file (aa...aa).	Details HDLM manager cannot start normally (unable to open the option definition file). aa...aa: Option definition file name Action Check whether another program is using the file (or has opened the file with Notepad), or whether the file has been deleted inadvertently.
KAPL04009-E	The option definition is invalid.	Details HDLM manager cannot start normally (some of the definition in the option definition file is invalid). Action If the KAPL04033-W message is output after this message, execute <code>dlnkmgr view -sys -sfunc</code> and check the option settings. For options with setting values that have returned to default values, use the <code>dlnkmgr set</code> operation to reset the values. If the KAPL04033-W message is not output, restart HDLM Manager. If the same error occurs, re-install HDLM. For details on the <code>view</code> operation, see 6.7. For details on the <code>set</code> operation, see 6.6.
KAPL04010-E	Could not open the error log file.	Details HDLM manager cannot start normally (unable to open the error log file <code>/var/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code>). Action Check whether another program is using the file (or has opened the file with Notepad), or whether the error log file has been deleted inadvertently.
KAPL04011-E	Could not output the error log file.	Details The log information could not be output to the error log file <code>/var/opt/DynamicLinkManager/log/dlmmgr[1-16].log</code> . Action Check that the disk has sufficient free space.
KAPL04012-E	Could not create a communication pipe. RC = aa...aa	Details HDLM manager cannot start normally (unable to create a pipe file to be used in communication with HDLM commands). aa...aa: OS error code (decimal 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 7.2.

KAPL04013-E	Input is impossible via the communication pipe. RC = aa...aa	<p>Details</p> <p>Data could not be read from the pipe file during the communication with the HDLM command.</p> <p>aa...aa: OS error code (decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL04014-E	Output is impossible via the communication pipe. RC = aa...aa	<p>Details</p> <p>Data could not be written to the pipe file during the communication with the HDLM command.</p> <p>aa...aa: OS error code (decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL04019-E	Could not collect the error information. RC = aa...aa	<p>Details</p> <p>An attempt to read the log information from the alert driver failed.</p> <p>aa...aa: API return code (decimal number)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL04021-I	HDLM manager information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa: HDLM manager trace information</p> <p>Action</p> <p>None.</p>
KAPL04022-W	HDLM manager warning information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa: HDLM manager trace 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 7.2.</p>
KAPL04023-E	HDLM manager error information - aa...aa	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa: 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 7.2.</p>

KAPL04024-C	A critical error occurred in the HDLM manager. (aa...aa)	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p>aa...aa: 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 7.2.</p>
KAPL04025-C	A memory shortage occurred in the HDLM manager.	<p>Details</p> <p>Sufficient memory to process the HDLM manager could not be obtained.</p> <p>Action</p> <p>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 aa...aa days on (bb...bb).	<p>Details</p> <p>aa...aa: Number of remaining valid days</p> <p>bb...bb: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL04027-I	The emergency license is valid. The license expires in aa...aa days on (bb...bb).	<p>Details</p> <p>aa...aa: Number of remaining valid days</p> <p>bb...bb: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the emergency license by the expiration day.</p>
KAPL04028-E	The temporary license expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04029-E	The emergency license expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04030-E	The temporary license has already expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04031-E	The emergency license has already expired.	<p>Action</p> <p>Install the permanent license.</p>
KAPL04032-C	A fatal error occurred in HDLM. The system environment is invalid	<p>Details</p> <p>A part of the HDLM configuration file is missing.</p> <p>Action</p> <p>Re-install HDLM.</p>
KAPL04033-W	The option definition file was re-created.	<p>Details</p> <p>An option definition file was re-created using the default values. The specified values are set when some of the options have been read.</p> <p>Action</p> <p>As for the options other than the defaults, use the <code>dlnkmgr set</code> operation to set the options again. For details on the <code>set</code> operation, see 6.6.</p>

KAPL04034-E	An attempt to create the option definition file has failed.	<p>Details</p> <p>An attempt to re-create an option definition file (<code>/etc/opt/DynamicLinkManager/dlmmgr.xml</code>) using the default values has failed.</p> <p>Action</p> <p>Remove unnecessary files to secure free space on the file system, or check the write permissions for the directory and file.</p>
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 the path health check.</p> <p><i>bb...bb</i>: Number of error paths by the path health check.</p> <p>Action</p> <p>None.</p>
KAPL04037-I	The path health check completed normally. Path ID = <i>aa...aa</i>	<p>Details</p> <p>There were no error paths as a result of executing the path health check.</p> <p><i>aa...aa</i>: PathID for executing the path health check.</p> <p>Action</p> <p>None.</p>
KAPL04042-I	HDLM SNMP TRAP information - <i>aa...aa</i>	<p>Details</p> <p>There were no error paths as a result of executing the path health check.</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>: Send data</p> <p>Action</p> <p>None.</p>

8.5 HDLM Driver (Filter Component) Messages

KAPL05003-I	The HDLM driver (filter component) was successfully attached to Disk (<i>aa...aa</i>), Partition (<i>bb...bb</i>).	<p>Details</p> <p>The path to disk (<i>aa...aa</i>: SCSI device sequence number (minor number in decimal notation)) and Partition (<i>bb...bb</i>: Fixed to 0) was successfully registered in the core logic.</p> <p>Action</p> <p>None.</p>
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KAPL05004-I	The filtering function (<i>aa...aa</i>) for the HDLM driver (filter component) was initialized successfully.	<p>Details</p> <p>The HDLM driver was successfully initialized.</p> <p><i>aa...aa</i> : File ID, line number (hexadecimal number)</p> <p>Actions</p> <p>None.</p>
KAPL05005-I	The control function (<i>aa...aa</i>) for the HDLM driver (filter component) was initialized successfully.	<p>Details</p> <p>The HDLM driver was successfully initialized.</p> <p><i>aa...aa</i> : File ID, line number (hexadecimal number)</p> <p>Actions</p> <p>None.</p>
KAPL05008-E	Could not allocate memory. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>The OS memory allocation function was started but an error was returned from the memory allocation function. (<i>aa...aa</i>: File ID, line number, (hexadecimal number) <i>bb...bb</i>: Memory capture size (hexadecimal number))</p> <p>Action</p> <p>Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</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>)	<p>Details</p> <p>HDLM failed in FO processing in the path.</p> <p><i>aa...aa</i> : Path ID (hexadecimal number)</p> <p><i>bb...bb</i> : Error code (the four leftmost digits are <code>errno#1</code>, and the four rightmost digits are <code>cdb_status#2</code>)</p> <p><i>cc...cc</i> : Fixed at 0</p> <p>#1</p> <p>For details on <code>errno</code>, see the man page for <code>errno(2)</code> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <code>cdb_status</code>, see the man page for <code>sioc_io(7)</code> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Action</p> <p>The I/O being processed is discarded. Check the status of the device path and take an appropriate action.</p>
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>HDLM succeeded in path failover.</p> <p><i>aa...aa</i> : Path ID (hexadecimal number)</p> <p><i>bb...bb</i> : Path ID (hexadecimal number)</p> <p>Actions</p> <p>None.</p>
KAPL05020-I	Processing of IOCTL(<i>aa...aa</i>) will now start.	<p>Details</p> <p>The ioctl request was accepted.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p>Actions</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>)	<p>Details</p> <p>Processing corresponding to the ioctl request is unsuccessful.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Fixed at 0</p> <p><i>cc...cc</i> : Fixed at 0</p> <p>Action</p> <p>Check the message of the HDLM command (<code>dlnkmgtr</code>) or the HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL05601-E	An error was received during processing of an IOCTL (<i>aa...aa</i>). SCSI Code = <i>bb...bb</i> , HDLM Minor = <i>cc...cc</i> , ErrorCode = <i>dd...dd</i>	<p>Details</p> <p>An error was reported to the application because an ioctl request to the SCSI driver has failed.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Operation code (hexadecimal number)</p> <p><i>cc...cc</i> : Minor number of the HDLM driver (hexadecimal number)</p> <p><i>dd...dd</i> : Error code (the four leftmost digits are <code>errno</code>^{#1}, and the four rightmost digits are <code>cdb_status</code>^{#2}) (hexadecimal number)</p> <p>#1</p> <p>For details on <code>errno</code>, see the man page for <code>errno(2)</code> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <code>cdb_status</code>, see the man page for <code>sioc_io(7)</code> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Actions</p> <p>Check whether the path indicated in KAPL05602-E is correctly connected to the LU.</p>

KAPL05602-E	An error was received from the disk driver during processing of an IOCTL (<i>aa...aa</i>). SCSI Code = <i>bb...bb</i> , PathID = <i>cc...cc</i> , ErrorCode = <i>dd...dd</i>	<p>Details</p> <p>The ioctl request to the SCSI driver failed.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Operation code (hexadecimal number)</p> <p><i>cc...cc</i> : Path ID of the SCSI device (decimal number)</p> <p><i>dd...dd</i> : Error code (the four leftmost digits are <code>errno</code>^{#1}, and the four rightmost digits are <code>cdb_status</code>^{#2}) (hexadecimal number)</p> <p>#1</p> <p>For details on <code>errno</code>, see the man page for <code>errno(2)</code> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <code>cdb_status</code>, see the man page for <code>sioc_io(7)</code> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Actions</p> <p>Check whether the path is correctly connected to the LU.</p>
KAPL05603-E	An Offline path exists, so ioctl (<i>aa...aa</i>) processing cannot be executed. HDLM Minor = <i>bb...bb</i>	<p>Details</p> <p>An ioctl request was issued to an HDLM-managed device that contains an Offline path.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Minor number of the HDLM device (hexadecimal number)</p> <p>Actions</p> <p>Confirm that all the paths of the specified HDLM-managed device are Online, and then re-issue the ioctl system call.</p>
KAPL05604-W	An error was received during processing of an IOCTL (<i>aa...aa</i>). SCSI Code = <i>bb...bb</i> , HDLM Minor = <i>cc...cc</i> , ErrorCode = <i>dd...dd</i>	<p>Details</p> <p>An error was reported to the application because an ioctl request to the SCSI driver has failed.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Operation code (hexadecimal number)</p> <p><i>cc...cc</i> : Minor number of the HDLM device (hexadecimal number)</p> <p><i>dd...dd</i> : Error code (the four leftmost digits are <code>errno</code>^{#1}, and the four rightmost digits are <code>cdb_status</code>^{#2}) (hexadecimal number)</p> <p>#1</p> <p>For details on <code>errno</code>, see the man page for <code>errno(2)</code> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <code>cdb_status</code>, see the man page for <code>sioc_io(7)</code> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Actions</p> <p>Confirm whether the transition of the application that issued the ioctl system call is correct.</p>

KAPL05605-W	An error was received from the disk driver during processing of an IOCTL (<i>aa...aa</i>). SCSI Code = <i>bb...bb</i> , PathID = <i>cc...cc</i> , ErrorCode = <i>dd...dd</i>	<p>Details</p> <p>An ioctl request was issued in an HDLM device that contains an Offline path.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p><i>bb...bb</i> : Operation code (hexadecimal number)</p> <p><i>cc...cc</i> : Path ID of the SCSI device (decimal number)</p> <p><i>dd...dd</i> : Error code (the four leftmost digits are <code>errno</code>^{#1}, and the four rightmost digits are <code>cdb_status</code>^{#2}) (hexadecimal number)</p> <p>#1</p> <p>For details on <code>errno</code>, see the man page for <code>errno(2)</code> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <code>cdb_status</code>, see the man page for <code>sioc_io(7)</code> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Actions</p> <p>Confirm whether the transition of the application that issued the ioctl system call is correct.</p>
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8.6 HDLM Alert Driver Messages

KAPL06004-E	Could not allocate memory. (<i>aa...aa:bb...bb</i>)	<p>Details</p> <p>An attempt to reserve memory to save alert information has failed.</p> <p><i>aa...aa</i>: Program line (hexadecimal number)</p> <p><i>bb...bb</i>: Target memory size (hexadecimal number)</p> <p>Action</p> <p>Check whether the HDLM driver has started normally. If it has not started or contains an error, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL06007-I	IOCTL processing (<i>aa...aa</i>) will now start.	<p>Details</p> <p>The ioctl request was accepted.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p>Actions</p> <p>None.</p>
KAPL06008-I	IOCTL processing (<i>aa...aa</i>) completed normally.	<p>Details</p> <p>The ioctl request was processed normally.</p> <p><i>aa...aa</i> : ioctl code (hexadecimal number)</p> <p>Actions</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. <i>aa...aa</i>: IOCTL code (hexadecimal number) <i>bb...bb</i>: errno (hexadecimal number) <i>cc...cc</i>: 0 (fixed)</p> <p>Action</p> <p>Check the message of the HDLM command (<code>dlnkmgx</code>) or HDLM manager, and then take the appropriate action. If you do not know the appropriate action, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM and report the error and detail code. For details on the <code>DLMgetras</code> utility, see 7.2.</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) <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 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 7.2.</p>

KAPL06014-E	Could not write emergency information into the emergency information buffer. (<i>aa...aa:bb...bb</i>)	<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) <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 7.2.</p>
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8.7 HDLM Driver (Core Logic Component) Messages

KAPL07819-I	Data for maintenance: <i>aa...aa bb...bb cc...cc dd...dd</i> .	<p>Details</p> <p>This message is generated by the core logic for maintenance.</p> <p><i>aa...aa</i>: Detailed information 1 (decimal number) <i>bb...bb</i>: Internal function number of the core logic (decimal number) <i>cc...cc</i>: Detailed information 2 (decimal number) <i>dd...dd</i>: Detailed information 3 (decimal number)</p> <p>Action</p> <p>None.</p>
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8.8 HDLM Management Target Messages

<p>KAPL08019-E</p>	<p>The path (<i>aa...aa</i>) detected an error (<i>bb...bb</i>). (<i>cc...cc</i>)</p>	<p>Details</p> <p>An error occurred in the path because of a condition such as a disconnection.</p> <p><i>aa...aa</i>: Path identifier (hexadecimal number)</p> <p><i>bb...bb</i>: Error code (the four leftmost digits are <i>errno</i>^{#1}, and the four rightmost digits are <i>cdb_status</i>^{#2}) (hexadecimal number)</p> <ul style="list-style-type: none"> ▪ When the path error was detected by a path health checking or the online operation Displays 0x000F0000 (Fixed). ▪ When the path error was detected through an I/O error Displays the OS error code. <i>cc...cc</i>: 0x00000000 (fixed) <p>#1</p> <p>For details on <i>errno</i>, see the man page for <i>errno(2)</i> and the <code>/usr/include/sys/errno.h</code> file.</p> <p>#2</p> <p>For details on <i>cdb_status</i>, see the man page for <i>sioc_io(7)</i> and the <code>/usr/include/sys/scsi.h</code> file.</p> <p>Action</p> <p>Check the path in which the error was detected.</p>
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<p>KAPL08022-E</p>	<p>A path error occurred. ErrorCode = aa...aa, PathID = bb...bb, PathName = cc...cc.dd...dd.ee...ee.ff...ff, DNum = gg...gg, HDevName = hh...hh</p>	<p>Details</p> <p>A physical or logical error occurred in the path.</p> <p>aa...aa: Error code (the four leftmost digits are errno^{#1}, and the four rightmost digits are cdb_status^{#2}) (hexadecimal number)</p> <ul style="list-style-type: none"> ▪ When the path error was detected by a path health checking or the online operation Displays 0x000F0000 (Fixed). ▪ When the path error was detected through an I/O error Displays the OS error code. <p>bb...bb: Path ID (same as PathID of view - path) (decimal number)</p> <p>cc...cc : Host port number (same as PathName of view -path) (hexadecimal number)</p> <p>dd...dd: Bus number (hexadecimal number)</p> <p>ee...ee: Target ID (hexadecimal number)</p> <p>ff...ff: Host LU number (same as PathName of view -path) (hexadecimal number)</p> <p>gg...gg: Dev number (same as DNum of view - path) (decimal number)</p> <p>hh...hh: Host device name</p> <p>#1 For details on errno, see the man page for errno(2) and the /usr/include/sys/errno.h file.</p> <p>#2 For details on cdb_status, see the man page for sioc_io(7) and the /usr/include/sys/scsi.h file.</p> <p>Action</p> <p>There could be an error in the path. See 5.3 and restore the path displayed in the message to running status.</p>
<p>KAPL08023-I</p>	<p>A path was recovered. PathID = aa...aa, PathName = bb...bb.cc...cc.dd...dd.ee...ee, DNum = ff...ff, HDevName = gg...gg</p>	<p>Details</p> <p>The path was recovered from the error.</p> <p>aa...aa: Path ID (same as PathID of view - path) (decimal number)</p> <p>bb...bb : Host port number (same as PathName of view -path) (hexadecimal number)</p> <p>cc...cc: Bus number (same as PathName of view -path) (hexadecimal number)</p> <p>dd...dd: Target ID (same as PathName of view -path) (hexadecimal number)</p> <p>ee...ee: Host LU number (same as PathName of view -path) (hexadecimal number)</p> <p>ff...ff: Device number (same as DNum of view - path)</p> <p>gg...gg: Host Dev name (same as HDevName of view -path)</p> <p>Action</p> <p>None.</p>

KAPL08026-E	An error occurred on all the paths of the LU. PathID = aa...aa	<p>Details</p> <p>An error occurred in the last path of one LU because of a condition such as a disconnection.</p> <p>aa...aa: Path ID (same as PathID of <code>view - path</code>) (decimal number)</p> <p>Action</p> <p>Errors are detected in all the paths connected to the LUs. See 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 = aa...aa	<p>Details</p> <p>A path was excluded from the items subject to automatic failback because the system judged that an intermittent error was occurring in that path.</p> <p>aa...aa: Path ID (same as PathID of <code>view - path</code>) (decimal number)</p> <p>Action</p> <p>An intermittent error was occurring. The path may have a problem. For details on the action to be taken, see 5.3 and switch the path shown in the message into Online.</p>

8.9 HDLM Installation Program Messag

KAPL09002-E	The disk does not have sufficient free space.	<p>Details</p> <p>The target file system of the installation does not have sufficient free space to install HDLM.</p> <p>Action</p> <p>Increase the amount of free space in <code>/opt</code>, and then retry.</p>
KAPL09006-E	Could not install HDLM.	<p>Action</p> <p>If installation was interrupted, incomplete files and directories may remain. Delete such files and directories.</p>
KAPL09019-E	An attempt to cancel the registration of the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	<p>Action</p> <p>Manually cancel the registration of the bundle PP name and uninstall HNTRLib2. If the attempt to cancel the registration of the bundle PP name and to uninstall HNTRLib2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL09020-E	An attempt to uninstall Hitachi Network Objectplaza Trace Library 2 failed.	<p>Details</p> <p>An attempt to uninstall HNTRLib2 has failed.</p> <p>Action</p> <p>Manually uninstall HNTRLib2. If the attempt to uninstall HNTRLib2 fails again, contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>

KAPL09021-E	An attempt to register the bundle PP name of Hitachi Network Objectplaza Trace Library 2 failed.	<p>Details</p> <p>An attempt to register the PP name of HNTRLib 2 has failed.</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contact of HDLM.</p>
KAPL09026-I	Hitachi Network Objectpraza Trace Library 2 wasn't uninstalled because it was being used for other products.	<p>Details</p> <p>Hitachi Network Objectplaza Trace Library 2 was not uninstalled because it was being used for other products.</p> <p>Actions</p> <p>None.</p>
KAPL09028-E	An attempt to install Hitachi Network Objectplaza Trace Library 2 failed.	<p>Actions</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09076-I	The permanent license was installed.	<p>Details</p> <p>The permanent license was installed.</p> <p>Action</p> <p>None.</p>
KAPL09077-I	The temporary license was installed. The license expires on aa...aa.	<p>Details</p> <p>The temporary license was installed.</p> <p>aa...aa: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09078-I	The emergency license was installed. The license expires on aa...aa.	<p>Details</p> <p>The emergency license was installed.</p> <p>aa...aa: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09079-I	The permanent license has been installed.	<p>Action</p> <p>None.</p>
KAPL09080-I	The temporary license has been installed. The license expires on aa...aa.	<p>Details</p> <p>The temporary license has been installed.</p> <p>aa...aa: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>

KAPL09081-I	The emergency license has been installed. The license expires on aa...aa.	<p>Details</p> <p>The emergency license has been installed.</p> <p>aa...aa: The year of grace (4 numeric characters)/Month (01-12)/Day (01-31)</p> <p>Action</p> <p>Install the permanent license by the expiration day.</p>
KAPL09082-W	The temporary license expired.	<p>Action</p> <p>Enter the permanent license key.</p>
KAPL09083-W	The emergency license expired.	<p>Action</p> <p>Enter the permanent license key.</p>
KAPL09086-W	The entered license key is invalid.	<p>Action</p> <p>Enter a valid license key.</p>
KAPL09087-E	The entered license key is invalid. Renewal of the license key will now stop.	<p>Details</p> <p>The renewal of the license key will be aborted because an invalid license key was entered three times.</p> <p>Action</p> <p>Obtain a valid license key, and then retry.</p>
KAPL09088-E	The entered license key is invalid. The HDLM installation will now terminate.	<p>Action</p> <p>Retry installation.</p>
KAPL09089-W	License information cannot be acquired.	<p>Details</p> <p>You need to install a license because the license information cannot be acquired.</p> <p>Action</p> <p>Case of the license key file being placed in the designated directory (<code>/var/tmp/hdlm_license</code>):</p> <p>In this case, a license is installed from the license key file. No special operations are needed.</p> <p>For cases other than above:</p> <p>When the message that prompts you to enter the license key is displayed, enter the license key.</p> <p>Alternatively, cancel the installation, save the correct license key file in the designated directory, and then re-execute installation.</p> <p><code>/var/tmp/hdlm_license</code></p>
KAPL09090-W	This operation will now be continued without updating the license.	<p>Details</p> <p>This operation will be continued without updating the license.</p> <p>Action</p> <p>Install the permanent license later.</p>
KAPL09091-E	A fatal error occurred in HDLM. The system environment is invalid.	<p>Details</p> <p>A part of the HDLM configuration file is missing.</p> <p>Action</p> <p>Re-install HDLM.</p>

KAPL09099-I	Additional information: <i>aa...aa</i>	<p>Details</p> <p>Show additional information for the message last output.</p> <p><i>aa...aa</i>: additional information</p> <p>Action</p> <p>Perform things described in "action" for the message last output.</p>
KAPL09112-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>: <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.</p> <p><code>/var/tmp/hdlm_license</code></p>
KAPL09113-E	There is no installable license key in the license key file. File name = <i>aa...aa</i>	<p>Details</p> <p>There is no HDLM-installable license key in the license key file.</p> <p><i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>Make sure that the license key file is correct, and then re-execute.</p> <p><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.</p> <p><i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>When the message that prompts you to enter the license key is displayed, enter the license key. Alternatively, cancel the installation, save the correct license key file in the designated directory, and then re-execute installation.</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.</p> <p><i>aa...aa</i>: <code>/var/tmp/hdlm_license</code></p> <p>Action</p> <p>If a license key file exists, delete it.</p> <p><code>/var/tmp/hdlm_license</code></p> <p>Store a correct license key file in the designated directory, and then re-execute.</p>

KAPL09135-E	One of the following was executed at the same time as an HDLM command <code>set -lic</code> operation: another <code>set -lic</code> operation, or an update of the license for an update installation.	<p>Action</p> <p>Check the license by using the HDLM command's <code>view -sys -lic</code> operation. Then, if necessary, update the license by using the <code>set -lic</code> operation during or after installation. If the same error message is output, contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p> <p>Do not perform the following operation:</p> <p>Execution of the HDLM command's <code>set -lic</code> operation simultaneously with an update of the license for an upgrade or re-installation.</p>
KAPL09138-E	An attempt to add the <code>aa...aa</code> driver has failed.	<p>Details</p> <p>An attempt to add the <code>aa...aa</code> driver has failed. <code>aa...aa</code>: Driver name</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM.</p>
KAPL09139-E	An attempt to remove the <code>aa...aa</code> driver has failed.	<p>Details</p> <p>An attempt to remove the <code>aa...aa</code> driver has failed. <code>aa...aa</code>: Driver name</p> <p>Action</p> <p>Contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM.</p>
KAPL09142-E	HDLM <code>aa...aa</code> cannot be performed. Wait a while, and then perform <code>aa...aa</code> again. Error Code = <code>bb...bb</code>	<p>Details</p> <p>HDLM cannot be installed or uninstalled. <code>aa...aa</code> : "installation" or "uninstallation" <code>bb...bb</code> : Internal code (decimal number)</p> <p>Action</p> <p>Wait a while, and then reperform the installation or uninstallation.</p>
KAPL09143-E	HDLM <code>aa...aa</code> cannot be performed. Error Code = <code>bb...bb</code>	<p>Details</p> <p>HDLM cannot be installed or uninstalled. <code>aa...aa</code>: "installation" or "uninstallation" <code>bb...bb</code>: Internal code (decimal number)</p> <p>Action</p> <p>Contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM.</p>
KAPL09150-I	The kernel configuration information has been changed.	<p>Details</p> <p>The kernel configuration information was updated.</p> <p>Action</p> <p>None.</p>

KAPL09178-I	After a successful installation, please do the following: <i>aa...aa</i> .	<p>Details</p> <p>After a successful installation, please do the following: <i>aa...aa</i></p> <p><i>aa...aa</i>: Operating procedure</p> <p>Action</p> <p>Carry out the displayed operation procedure.</p>
KAPL09501-E	HDLM is not installed on this system.	<p>Details</p> <p>The SP cannot be applied because HDLM is not installed on this system.</p> <p>Action</p> <p>Check whether HDLM has been correctly installed.</p>
KAPL09502-E	An equivalent patch is already installed.	<p>Action</p> <p>When you execute HDLM installation, choose update install when the same version of HDLM is already installed.</p>
KAPL09503-E	A new patch is already installed.	<p>Action</p> <p>When you execute HDLM installation, uninstall HDLM and then retry.</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 update installation on the already installed HDLM or installed SP (<i>bb...bb</i>).</p> <p><i>aa...aa</i>: The-HDLM-to-be-installed HDLM-version or the-SP-to-be-installed HDLM-version</p> <p><i>bb...bb</i>: the-installed-HDLM HDLM-version or the-installed-SP HDLM-version</p> <p>Action</p> <p>An update installation cannot be performed on the already installed HDLM or SP. When installing a HDLM: Uninstall the installed HDLM or SP, and then perform installation. When installing a SP: Obtain, and then install, a SP or corrected version that can be applied to the installed HDLM.</p>

8.10 Messages from the DLMgetras Utility for Collecting HDLM Error Information

KAPL10001-W	No parameter has been specified.	<p>Details</p> <p>No parameter (directory to which collected information is output) has been specified.</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
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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 7.2.</p>
KAPL10003-W	The first parameter has not been set to a directory. Value = <code>aa...aa</code>	<p>Details</p> <p>A value which is not a directory name is set for the first parameter. The first parameter must be set to a directory to which collected information is output.</p> <p><code>aa...aa</code>: 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 7.2.</p>
KAPL10004-W	The parameter contains an incorrect value. Value = <code>aa...aa</code>	<p>Details</p> <p>The first parameter must be a directory. The second parameter must be <code>-f</code>.</p> <p><code>aa...aa</code>: 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 7.2.</p>
KAPL10005-W	The number of parameters is insufficient.	<p>Details</p> <p>The <code>-f</code> parameter exists but the file for defining the information to be collected does not exist. 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 7.2.</p>
KAPL10006-W	The file for defining the information to be collected does not exist, or cannot be read. Value = <code>aa...aa</code>	<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><code>aa...aa</code>: Name of the file for defining the information to be collected</p> <p>Action</p> <p>Check whether the specified file for defining the information to be collected exists, and check whether you have access permission for the specified file.</p>

KAPL10007-W	A directory has been specified in the third parameter. Value = aa...aa	<p>Details</p> <p>The <code>-f</code> parameter is specified to a directory. aa...aa: Third parameter</p> <p>Action</p> <p>Check the parameters of the <code>DLMgetras</code> utility for collecting HDLM error information, and then retry. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10008-W	You lack write permission for the specified directory. Value = aa...aa	<p>Details</p> <p>You do not have write permission for the specified directory, or the creation of a subdirectory of the specified directory failed. aa...aa: First parameter</p> <p>Action</p> <p>Check the following.</p> <ol style="list-style-type: none"> 1. Check whether you have access permission for the specified directory. 2. Check whether the specified directory name is correct. 3. Check that the disk has sufficient free space.
KAPL10009-W	The specified directory already exists. Do you want to overwrite it? [y/n]:	<p>Details</p> <p>The specified directory already exists. Enter <code>y</code> to overwrite it, or <code>n</code> to cancel.</p> <p>Action</p> <p>The specified directory already exists. Enter <code>y</code> to overwrite the existing file. Enter <code>n</code> or press any other key to terminate the <code>DLMgetras</code> utility for collecting HDLM error information without executing it. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10010-W	A root directory has been specified. Line = aa...aa	<p>Details</p> <p>The root "/" has been specified as a directory to be collected in the file for defining the information to be collected. aa...aa: Line number of the file for defining information to be collected (decimal number)</p> <p>Action</p> <p>Delete the coding of the root directory from the specified file. The displayed directory will be ignored and the <code>DLMgetras</code> utility for collecting HDLM error information will continue. For details on the <code>DLMgetras</code> utility, see 7.2.</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> <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 7.2.</p>
KAPL10012-W	The specified file or directory does not exist. Line = <i>aa...aa</i> , Value = <i>bb...bb</i>	<p>Details</p> <p>The specified file or directory does not exist in the file for defining the information to be collected.</p> <p><i>aa...aa</i>: Line number of the file for defining information to be collected (decimal number)</p> <p><i>bb...bb</i>: Indicated contents in a line</p> <p>Action</p> <p>After the <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 7.2.</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> <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 7.2.</p>

KAPL10014-W	You lack read permission for the specified directory. Line = aa...aa, Value = bb...bb	<p>Details</p> <p>You lack read permission for the specified directory in the file for defining information to be collected.</p> <p>aa...aa: Line number of the file for defining information to be collected (decimal number)</p> <p>bb...bb: 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 7.2.</p>
KAPL10015-W	The file format is invalid. Value = aa...aa	<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> <p>aa...aa: 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 7.2.</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 7.2.</p>
KAPL10017-W	You lack privileges for executing the utility for collecting HDLM error information.	<p>Details</p> <p>The <code>DLMgetras</code> utility for collecting HDLM error information must be executed by a user with root privileges.</p> <p>Action</p> <p>Re-execute as a user with root .privileges. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10020-I	The file has been obtained successfully. File = aa...aa, Collection time = bb...bb(GMT:bb...bb)	<p>Details</p> <p>The file to be collected has been obtained.</p> <p>aa...aa: Collected file name</p> <p>bb...bb: the year of grace/month/day hour:minute:second</p> <p>Action</p> <p>None.</p>

KAPL10021-I	Processing terminated before completion because a signal was received.	<p>Details</p> <p>The process has been terminated by an operation such as Ctrl+C.</p> <p>Action</p> <p>The utility for collecting HDLM error information terminated before completion. If the directory is unnecessary, delete directory. For details on the <code>DLMgetras</code> utility, see 7.2.</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 7.2.</p>
KAPL10030-I	A user terminated the utility for collecting HDLM error information.	<p>Details</p> <p>Processing of the <code>DLMgetras</code> utility has been terminated because <code>n</code> was sent as a confirmation reply.</p> <p>Action</p> <p>None. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10031-W	The entered value is invalid. Continue operation ? [y/n]:	<p>Details</p> <p>A value other than <code>y</code> or <code>n</code> has been entered for a [y/n] request. Enter <code>y</code> or <code>n</code>.</p> <p>Action</p> <p>Enter <code>y</code> or <code>n</code>.</p>
KAPL10032-W	The entered value is invalid. The utility for collecting HDLM error information stops.	<p>Details</p> <p>Processing of the <code>DLMgetras</code> utility for collecting HDLM error information will terminate because an invalid response was sent three times to a request.</p> <p>Action</p> <p>Re-execute the <code>DLMgetras</code> utility. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10033-W	The file does not exist. Filename = <code>aa...aa</code>	<p>Details</p> <p>The file to collect does not exist.</p> <p><code>aa...aa</code>: File to collect</p> <p>Action</p> <p>The file that should be obtained under normal operation does not exist. HDLM might be operated under invalid environment. Check the system configuration.</p>
KAPL10034-E	The file could not be copied. Filename = <code>aa...aa</code> , Details = <code>bb...bb</code>	<p>Details</p> <p>Execution of the <code>cp</code> command failed.</p> <p><code>aa...aa</code>: File name you tried to copy</p> <p><code>bb...bb</code>: <code>cp</code> output message</p> <p>Action</p> <p>An error occurred while the file to be collected was being copied. The user environment might have been unstable. Check the system configuration.</p>

KAPL10035-E	An attempt to archive the error information failed. Details = aa...aa	<p>Details</p> <p>Execution of the tar command failed.</p> <p>aa...aa: tar 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 = aa...aa	<p>Details</p> <p>Execution of the compress command failed.</p> <p>aa...aa: compress 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>

8.11 Messages from the HDLM-Configuration Definition Utility (dlmcfmgr)

KAPL10301-I	/sbin/dlmcfmgr started : aa...aa	<p>Details</p> <p>The HDLM-configuration definition utility (<code>dlmcfmgr</code>) has started.</p> <p>aa...aa : date and time (for example, Fri Aug 23 19 : 12 : 50 2004)</p> <p>Actions</p> <p>None. For details on the <code>dlmcfmgr</code> utility, see 7.3.</p>
KAPL10302-I	/sbin/dlmcfmgr completed normally.	<p>Details</p> <p>The HDLM-configuration definition utility (<code>dlmcfmgr</code>) has completed successfully.</p> <p>Actions</p> <p>None. For details on the <code>dlmcfmgr</code> utility, see 7.3.</p>
KAPL10303-W	usage : dlmcfmgr {-e [special-file-name ...] -l special-file-name ...}	<p>Details</p> <p>Indicates the method for using the HDLM-configuration definition utility (<code>dlmcfmgr</code>).</p> <p>Actions</p> <p>Specify appropriate parameters, and then retry. For details on the <code>dlmcfmgr</code> utility, see 7.3.</p>
KAPL10304-E	The HDLM drivers have not been built into the kernel.	<p>Details</p> <p>The HDLM drivers have not been built into the kernel.</p> <p>Actions</p> <p>Restart the host.</p>

KAPL10305-E	A special file could not be created. Filename = <i>aa...aa</i>	<p>Details</p> <p>A device file for the HDLM device cannot be created.</p> <p><i>aa...aa</i>: device file name of the HDLM device</p> <p>Actions</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 7.2.</p>
KAPL10306-W	The configuration definition file is invalid.	<p>Details</p> <p>The configuration definition file is invalid, therefore, it will be created again.</p> <p>Actions</p> <p>Execute the <code>view</code> operation of the HDLM command (<code>dlnmgr</code>) to check the configuration. For details on the <code>view</code> operation, see 6.7.</p>
KAPL10307-W	A device could not be recognized. Device = <i>aa...aa</i>	<p>Details</p> <p>A SCSI device could not be recognized.</p> <p><i>aa...aa</i>: device file name of the SCSI device</p> <p>Actions</p> <p>Check the path in which the error was detected. If the path has been deleted, add the SCSI device name of the deleted path to the file that defines non-HDLM-managed disks (<code>/etc/opt/DynamicLinkManager/dlmdrv.unconf</code>), and then execute the HDLM path-configuration definition utility (<code>dldfpath</code>).</p>
KAPL10308-W	The configuration definition file could not be created.	<p>Details</p> <p>The configuration definition file could not be created.</p> <p>Actions</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 7.2.</p>
KAPL10309-W	The HDLM management-target disk does not exist.	<p>Details</p> <p>The HDLM management-target device does not exist.</p> <p>Actions</p> <p>Check the system configuration.</p>
KAPL10310-I	A device was added. Device = <i>aa...aa</i>	<p>Details</p> <p>A SCSI device was added.</p> <p><i>aa...aa</i>: device file name of the SCSI device</p> <p>Actions</p> <p>None.</p>
KAPL10311-I	A device was deleted. Device = <i>aa...aa</i>	<p>Details</p> <p>A SCSI device was deleted.</p> <p><i>aa...aa</i>: device file name of the SCSI device</p> <p>Actions</p> <p>None.</p>

KAPL10312-I	HDLM has created an HDLM device special file. Device = aa...aa	<p>Details</p> <p>A device file for the HDLM device has been created.</p> <p>aa...aa: device file name of the HDLM device</p> <p>Actions</p> <p>None.</p>
KAPL10313-I	HDLM has deleted an HDLM device special file. Device = aa...aa	<p>Details</p> <p>A device file for the HDLM device has been deleted.</p> <p>aa...aa: device file name of the HDLM device</p> <p>Actions</p> <p>None.</p>
KAPL10314-I	HDLM has updated an HDLM device special file. Device = aa...aa	<p>Details</p> <p>A device file for the HDLM device has been updated.</p> <p>aa...aa: device file name of the HDLM device</p> <p>Actions</p> <p>None.</p>
KAPL10315-I	The device configuration has been changed. Device = aa...aa	<p>Details</p> <p>The SCSI device configuration has been changed.</p> <p>aa...aa: device file name of the SCSI device</p> <p>Actions</p> <p>None.</p>
KAPL10316-E	Could not allocate memory. Size = aa...aa	<p>Details</p> <p>Securing of memory failed.</p> <p>aa...aa : Target memory size</p> <p>Actions</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 7.2.</p>
KAPL10317-E	The path configuration definition has not been set.	<p>Details</p> <p>The HDLM path-configuration definition utility (<code>dlmdefpath</code>) has not been executed but the configuration of a path has changed.</p> <p>Actions</p> <p>Execute the HDLM path-configuration definition utility (<code>dlmdefpath</code>). For details on the <code>dlmdefpath</code> utility, see 7.4.</p>

KAPL10318-E	An internal error occurred in the HDLM-configuration definition utility. Code = <i>aa...aa</i> Errno = <i>bb...bb</i> <i>cc...cc</i>	<p>Details</p> <p>An internal error occurred in the HDLM-configuration definition utility (<code>dlnmcfmgmr</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>Actions</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 7.2. For details on the <code>dlnmcfmgmr</code> utility, see 7.3.</p>
KAPL10901-W	A file could not be opened. File name = <i>aa...aa</i> , Errno = <i>bb...bb</i>	<p>Details</p> <p>A file could not be opened.</p> <p><i>aa...aa</i>: file name</p> <p><i>bb...bb</i>: errno (decimal number)</p> <p>Actions</p> <p>Confirm the existence of the file and access permission. If there is no problem, contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM.</p>
KAPL10902-W	Processing terminated before completion because a signal was received. signal = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: signal number</p> <p>Actions</p> <p>Restart the host.</p>
KAPL10903-I	HDLM has reinstalled the device special file for the SCSI device. hardware path = <i>aa...aa</i>	<p>Details</p> <p><i>aa...aa</i>: Hardware path of the SCSI device.</p> <p>Actions</p> <p>None.</p>
KAPL10904-I	After this utility completes, please do the following: <i>aa...aa</i>	<p>Details</p> <p>After this utility completes, please do the following:</p> <p><i>aa...aa</i>: Operating procedure</p> <p>Action</p> <p>Carry out the displayed operation procedure.</p>
KAPL10905-E	The user does not have execution permission for the <code>dlnmcfmgmr</code> utility. <i>aa...aa</i>	<p>Details</p> <p>The user does not have execution permission for the <code>dlnmcfmgmr</code> utility.</p> <p><i>aa...aa</i>: Results of the <code>ls -lc /sbin/dlnmcfmgmr</code> command</p> <p>Action</p> <p>Grant execution permission for <code>/sbin/dlnmcfmgmr</code>.</p>
KAPL10921-I	The kernel configuration information has been changed.	<p>Details</p> <p>The kernel configuration information has been changed.</p> <p>Action</p> <p>None.</p>

8.12 Messages from the HDLM Path-Configuration Definition Utility (dlmdefpath)

KAPL10401-W	usage : dlmdefpath -a	<p>Details</p> <p>Indicates the method for using the HDLM path-configuration definition utility (dlmdefpath).</p> <p>Actions</p> <p>Specify the correct option, and then retry. For details on the dlmdefpath utility, see 7.4.</p>
KAPL10402-W	You lack permission to execute the HDLM path-configuration definition utility.	<p>Details</p> <p>You lack permission to execute the HDLM path-configuration definition utility (dlmdefpath).</p> <p>Actions</p> <p>Retry as a user with root privileges. For details on the dlmdefpath utility, see 7.4.</p>
KAPL10403-E	A kernel update request has already been registered in the OS.	<p>Details</p> <p>A kernel update request has already been registered.</p> <p>Actions</p> <p>Restart the host, and then retry the HDLM path-configuration definition utility (dlmdefpath). For details on the dlmdefpath utility, see 7.4.</p>
KAPL10404-E	The HDLM settings have not been applied. Restart the computer.	<p>Details</p> <p>The HDLM settings have not been applied. Restart the host.</p> <p>Actions</p> <p>Restart the host, and then retry the HDLM path-configuration definition utility (dlmdefpath). For details on the dlmdefpath utility, see 7.4.</p>
KAPL10405-W	aa...aa - The disk device does not exist.	<p>Details</p> <p>The SCSI device does not exist. aa...aa : SCSI device file name</p> <p>Actions</p> <p>Check whether the files of SCSI device exists and LUs are connected to the system, and then retry.</p>
KAPL10406-I	The path configuration has already been set. You do not need to build a new kernel and restart the host.	<p>Details</p> <p>The path configuration has already been set. Building a new kernel and restarting the host is not required.</p> <p>Actions</p> <p>None.</p>
KAPL10407-I	A kernel will be built. Is this OK? [y/n] :	<p>Details</p> <p>A kernel will be built. Is this OK?</p> <p>Actions</p> <p>Enter y to build a kernel. Enter n to cancel.</p>

KAPL10408-E	A new kernel could not be built.	<p>Details</p> <p>Building of a kernel failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (<code>dldmdefpath</code>). If the same error occurs again, collect the error information from the log output by the <code>dldmdefpath</code> utility and 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>dldmdefpath</code> utility, see 7.4. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
KAPL10409-W	The kernel has already been set by another process; therefore, the previous kernel update will be invalidated.	<p>Details</p> <p>The kernel has already been set by another process; therefore, the previous kernel update will be invalidated.</p> <p>Actions</p> <p>Restart the host, and then retry the HDLM path-configuration definition utility (<code>dldmdefpath</code>). For details on the <code>dldmdefpath</code> utility, see 7.4.</p>
KAPL10410-W	The previous kernel update request will be invalidated. Is this OK? [y/n] :	<p>Details</p> <p>The previous kernel update request will be invalidated. Is this OK?</p> <p>Actions</p> <p>Enter y to invalidate the kernel update request that was executed before. Enter n to cancel.</p>
KAPL10411-I	The current kernel will be replaced. Is this OK? [y/n] :	<p>Details</p> <p>The current kernel will be replaced.</p> <p>Actions</p> <p>Enter y to update the kernel. Enter n to cancel.</p>
KAPL10412-E	kmupdate : The attempt to replace the kernel failed.	<p>Details</p> <p>kmupdate : Replacing of the kernel failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (<code>dldmdefpath</code>). If the same error occurs again, collect the error information from the log output by the <code>dldmdefpath</code> utility and 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>dldmdefpath</code> utility, see 7.4. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

KAPL10413-E	The ioconfig processing failed.	<p>Details</p> <p>ioconfig processing failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (dlmdefpath). If the same error occurs again, collect the error information from the log output by the dlmdefpath utility and 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 dlmdefpath utility, see 7.4. For details on the DLMgetras utility, see 7.2.</p>
KAPL10414-I	The computer must be restarted to make the path configuration effective. Would you like to restart the computer now? [y/n] :	<p>Details</p> <p>The host must be restarted to make the path configuration effective.</p> <p>Actions</p> <p>Enter y to restart the host. Enter n to cancel.</p>
KAPL10415-I	The HDLM path-configuration definition utility (dlmdefpath aa...aa) completed normally.	<p>Details</p> <p>The HDLM path-configuration definition utility (dlmdefpath aa...aa) has been completed successfully.</p> <p>aa...aa : argument</p> <p>Actions</p> <p>None For details on the dlmdefpath utility, see 7.4.</p>
KAPL10416-E	The dlmcfmgmr processing failed.	<p>Details</p> <p>The HDLM-configuration definition utility (dlmcfmgmr) processing failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (dlmdefpath). If the same error occurs again, collect the error information from the log output by the dlmdefpath utility and 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 dlmdefpath utility, see 7.4. For details on the DLMgetras utility, see 7.2. For details on the dlmcfmgmr utility, see 7.3.</p>
KAPL10417-W	The HDLM path-configuration definition utility stops.	<p>Details</p> <p>The HDLM path-configuration definition utility (dlmdefpath) has been cancelled.</p> <p>Actions</p> <p>Path information was not set. Re-execute the dlmdefpath utility. For details on the dlmdefpath utility, see 7.4.</p>

KAPL10418-W	Processing terminated before completion because a signal was received.	<p>Details</p> <p>The processing has been terminated because a signal was received.</p> <p>Actions</p> <p>Path information was not set. Re-execute the HDLM path-configuration definition utility (<code>dldmdefpath</code>). For details on the <code>dldmdefpath</code> utility, see 7.4.</p>
KAPL10419-E	An internal error occurred in the HDLM path-configuration definition utility (<code>dldmdefpath</code>) Code = <i>aa...aa</i> Erno = <i>bb...bb</i> <i>cc...cc</i> <i>dd...dd</i>	<p>Details</p> <p>An internal error occurred while the HDLM path-configuration definition utility (<code>dldmdefpath</code>) was executing.</p> <p><i>aa...aa</i> : error code (line number of message output) (decimal number)</p> <p><i>bb...bb</i>, <i>cc...cc</i> : error number (decimal number)</p> <p><i>dd...dd</i> : detailed information</p> <p>Actions</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 7.2. For details on the <code>dldmdefpath</code> utility, see 7.4.</p>
KAPL10421-W	The HDLM management-target disk does not exist.	<p>Details</p> <p>The HDLM management-target device does not exist.</p> <p>Actions</p> <p>Check the system configuration.</p>
KAPL10422-E	The hardware path could not be obtained.	<p>Details</p> <p>The processing for obtaining the hardware path has failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (<code>dldmdefpath</code>). If the same error occurs again, collect the error information from the log output by the <code>dldmdefpath</code> utility and 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>dldmdefpath</code> utility, see 7.4. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

KAPL10423-E	kconfig: The attempt to replace the kernel failed.	<p>Details</p> <p>kconfig: Replacing of the kernel failed.</p> <p>Actions</p> <p>Path information was not set. Retry the HDLM path-configuration definition utility (dlmdefpath). If the same error occurs again, collect the error information from the log output by the dlmdefpath utility, execute the DLMgetras utility for collecting HDLM error information to collect the error information, and then contact your HDLM vendor or the maintenance company if there is a maintenance contract for HDLM. For details on the dlmdefpath utility, see 7.4. For details on the DLMgetras utility, see 7.2.</p>
KAPL10429-I	The kernel configuration information has been changed.	<p>Details</p> <p>The kernel configuration information was updated.</p> <p>Action</p> <p>None.</p>

8.13 Messages from HDLM remote access interface

KAPL11901-I	aa...aa has started.	<p>Details</p> <p>The operation has started the host.</p> <p>aa...aa : Operation (character string)</p> <ul style="list-style-type: none"> ▪ Get Path Information ▪ Get Option Information ▪ Set Option Information ▪ Clear Data ▪ Get HDLM Manager Status ▪ Get HDLM Driver Status ▪ Get HDLM Alert Driver Status <p>Action</p> <p>None.</p>
KAPL11902-I	aa...aa has started. PathID = bb...bb	<p>Details</p> <p>The operation has started on the host.</p> <p>aa...aa: Operation (character string)</p> <ul style="list-style-type: none"> ▪ Online ▪ Offline <p>bb...bb: The Path ID of the target path for the operation. (decimal number)</p> <p>Action</p> <p>None.</p>

KAPL11903-I	aa...aa has completed normally.	<p>Details</p> <p>Operation has completed normally on the host. aa...aa: Operation (character string)</p> <ul style="list-style-type: none"> ▪ Get Path Information ▪ Get Option Information ▪ Set Option Information ▪ Clear Data ▪ Get HDLM Driver Status ▪ Get HDLM Manager Status ▪ Get HDLM Alert Driver Status ▪ Online ▪ Offline ▪ Get SNMP Trap Information ▪ Set SNMP Trap Information ▪ Set LU Load Balance <p>Action</p> <p>None.</p>
KAPL11904-E	aa...aa has completed abnormally. Error status = bb...bb	<p>Details</p> <p>Operation has completed abnormally on the management-target host. aa...aa: Operation (character string)</p> <ul style="list-style-type: none"> ▪ Get Path Information ▪ Get Option Information ▪ Set Option Information ▪ Clear Data ▪ Get HDLM Driver Status ▪ Get HDLM Manager Status ▪ Get HDLM Alert Driver Status ▪ Online ▪ Offline ▪ Get SNMP Trap Information ▪ Set SNMP Trap Information ▪ Set LU Load Balance <p>bb...bb: Error-status-returned-from-API (character string)</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, 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 7.2.</p>

KAPL11905-E	An unexpected error occurred.	<p>Details</p> <p>An exception occurred during processing in the 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 7.2.</p>
KAPL11906-I	GUI information - <code>aa...aa</code>	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><code>aa...aa</code> : Trace information (character string)</p> <p>Action</p> <p>None.</p>
KAPL11907-I	XML reception - <code>aa...aa</code>	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><code>aa...aa</code> : XML information (character string)</p> <p>Action</p> <p>None.</p>
KAPL11908-I	XML transmission - <code>aa...aa</code>	<p>Details</p> <p>This information is required for determining the cause of the problem (if any).</p> <p><code>aa...aa</code> : XML information (character string)</p> <p>Action</p> <p>None.</p>

8.14 Return Codes for the HDLM Remote Access Interface

The HDLM remote access interface is an interface used by other HiCommand products to access hosts. HDLM outputs a return code when the operation that the HDLM remote access interface requested to HDLM terminates abnormally, or when there is a warning while the operation terminates normally.

1002	<p>Details</p> <p>There is no path on which the operation can be performed.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>
1003	<p>Details</p> <p>No path was detected.</p> <p>Action</p> <p>Check whether a path between the host and the storage subsystem is connected. If a path is connected, check whether HDLM is configured correctly.</p>

1004	<p>Details</p> <p>Memory required for HDLM internal processing could not be allocated.</p> <p>Action</p> <p>Terminate unnecessary applications to increase free memory, or restart the host.</p>
1006	<p>Details</p> <p>The Offline path cannot be placed Online.</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
1007	<p>Details</p> <p>The target path of the offline operation is the last path of the device and cannot be placed in the offline status.</p> <p>Action</p> <p>Click Refresh to update the host information, check the path status, and then retry the offline operation.</p>
1015	<p>Details</p> <p>The Offline path cannot be placed Online.</p> <p>Action</p> <p>Remove the error in the path, and then retry.</p>
1016	<p>Details</p> <p>The target path(s) are already Online.</p> <p>Action</p> <p>Update the host information, and then check the path status.</p>
1017	<p>Details</p> <p>The target path(s) are already Offline(C).</p> <p>Action</p> <p>Update the host information, and then check the path status.</p>
1019	<p>Details</p> <p>An error occurred during HDLM internal processing.</p> <p>Action</p> <p>Execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or the maintenance company if you have a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</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 7.2.</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 even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

1026	<p>Details</p> <p>The Path Information has been stopped because the configuration of paths was changed during the processing of 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 is to occur conflict with the automatic failback checking interval.</p> <p>Action</p> <p>Set the monitoring interval to a value that is equal to or more than (auto failback checking interval x number of times).</p>
1033	<p>Details</p> <p>An attempt to acquire the HDLM version information failed.</p> <p>Action</p> <p>Re-execute. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</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. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</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. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
1036	<p>Details</p> <p>An attempt to acquire information about the HDLM version or SP version has failed.</p> <p>Action</p> <p>Re-execute. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if there is a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
1037	<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
1041	<p>Details</p> <p>An attempt to communicate with the HDLM Manager has failed.</p> <p>Action</p> <p>Check whether the HDLM Manager is running on the host. If it is not running, start the HDLM Manager.</p>

1042	<p>Details</p> <p>Information about the path configuration on the specified LU does not match the path configuration information held by HDLM.</p> <p>Action</p> <p>Refresh the host information, check the path status, and then perform the operation again.</p>
1045	<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>
1046	<p>Details</p> <p>A parameter value is invalid.</p> <p>Action</p> <p>Refresh the host information, and then perform the operation again. If the same error occurs even after removing the reservation, execute the <code>DLMgetras</code> utility for collecting HDLM error information, and then contact your HDLM vendor or maintenance company if you have a maintenance contract for HDLM. For details on the <code>DLMgetras</code> utility, see 7.2.</p>

Appendix A Cautions on Using HP-UX Commands

Restrictions apply to the operation of some HP-UX commands when SCSI devices are set as HDLM management targets. This appendix explains the restrictions on HP-UX commands. There are no restrictions on SCSI devices not set as HDLM management targets.

A.1 `diskinfo` Command

The following error occurs if you execute the `diskinfo` command, specifying the name of a SCSI device file that HDLM manages:

```
# diskinfo /dev/rdisk/c24t0d0
io_search failed: No match found.
```

In the `diskinfo` command, specify an HDLM device file name as shown below:

```
# diskinfo /dev/rdisk/ch24t0d0
SCSI describe of /dev/rdisk/ch24t0d0:
    vendor: HP
    product id: OPEN-K
    type: direct access
    size: 1830960 Kbytes
    bytes per sector: 512
```

A.2 `ioscan` Command

The `ioscan` command outputs information about HDLM devices whose `Class` is `disk` and are managed by HDLM or an `sdisk` driver.

The following shows an example of executing the `ioscan` command (HP-UX 11i v1.0) on devices managed by HDLM.

```
# iostat -fnC disk
Class   I  H/W Path          Driver  S/W State  H/W Type  Description
-----
      :
disk   982  0/9/0/0.1.16.0.0.0  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c24t0d0  /dev/dsk/ch24t0d0  /dev/rdisk/ch24t0d0
disk   983  0/9/0/0.1.16.0.0.0.1  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c24t0d1  /dev/dsk/ch24t0d1  /dev/rdisk/ch24t0d1
disk   984  0/9/0/0.1.16.0.0.0.2  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c24t0d2  /dev/dsk/ch24t0d2  /dev/rdisk/ch24t0d2
      :
disk  1136  0/9/0/0.1.17.0.0.0.0  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c27t0d0
disk  1137  0/9/0/0.1.17.0.0.0.1  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c27t0d1
disk  1138  0/9/0/0.1.17.0.0.0.2  dlmfdrv CLAIMED   DEVICE    HP        OPEN-K
      /dev/dlm/c27t0d2
      :
```

The `Driver` and the device file names appearing in the execution result are explained below.

`Driver`

Shown as `dlmfdrv` (`zdlmfdrv` in the HP-UX 11i v2.0), not `sdisk`.

`Device file name`

Shown as one of the following HDLM device file names, not the SCSI device file name.

- HDLM-specific device file name: `/dev/dlm/cXtYdZ`
- HDLM device file name (block type): `/dev/dsk/chXtYdZ`
- HDLM device file name (character type): `/dev/rdisk/chXtYdZ`

When there are multiple paths to a SCSI device, the HDLM device file name appears as a single path only.

By executing the `view -drv` operation, you can see the hardware paths of SCSI device files set as HDLM management targets.

A.3 iostat Command

The devices displayed by the `iostat` command are the individual device file names associated with the specific hardware paths, not the HDLM device file name. An execution example is shown below.

```
# iostat

device      bps      sps      msp
c1t2d0      0        0.0      1.0
c24t0d0      0        0.0      1.0
c24t0d1      0        0.0      1.0
c24t0d2      0        0.0      1.0
:
c27t0d0      0        0.0      1.0
c27t0d1      0        0.0      1.0
c27t0d2      0        0.0      1.0
c27t0d3      0        0.0      1.0
:
```

A.4 lssf Command

The following error occurs if you execute the `lssf` command specifying an HDLM device file name:

```
# lssf /dev/rdisk/ch24t0d0
lssf: Don't know how to handle driver "dlmfdrv"
```

In the `lssf` command, specify a SCSI device file name set as an HDLM management target, as shown below:

```
# lssf /dev/rdisk/c24t0d0
sdisk card instance 24 SCSI target 0 SCSI LUN 0 section 0 at address ??? /dev/rdisk/c24t0d0
```

You can check the hardware path by executing the `view -drv` operation.

A.5 mediainit Command

The `mediainit` command is not supported. The following error occurs if you attempt to execute the `mediainit` command specifying either a SCSI device file name that is an HDLM management target or an HDLM device file name:

```
# mediainit /dev/rdisk/c24t0d0
mediainit: get_driver_info: failed
# mediainit /dev/rdisk/ch24t0d0
mediainit: this type of device unsupported
```

A.6 sam Commands

The `sam` command is not supported. You cannot use `sam` to install or uninstall HDLM, or to manipulate an HDLM device file managed by the logical volume manager (LVM) or other program.

A.7 sar Command

The devices displayed by the `sar` command with the `-d` or `-A` option specified are the individual device file names associated with each hardware path, not the HDLM device file name. An execution example is shown below.

```
# sar -d 10 2

HP-UX host1 B.11.11 U 9000/800    12/19/03

09:45:37  device  %busy  avque  r+w/s  blks/s  await  avserv
09:45:47   c1t2d0   0.40   0.50    1      5    0.19   8.68
           c24t0d0  19.68   0.50  1568   1568   5.01   0.12
           c27t0d0  20.28   0.50  1568   1568   5.01   0.11
           c31t0d0  18.38   0.50  1568   1568   5.01   0.11
           c34t0d0  18.68   0.50  1568   1568   5.00   0.11
09:45:57   c24t0d0  21.72   0.50  1629   1629   5.02   0.11
           c27t0d0  17.32   0.50  1629   1629   5.01   0.10
           c31t0d0  17.52   0.50  1629   1629   5.01   0.11
           c34t0d0  17.62   0.50  1629   1629   5.02   0.10

Average   c1t2d0   0.20   0.50    1      2    0.19   8.68
Average   c24t0d0  20.70   0.50  1598   1598   5.01   0.12
Average   c27t0d0  18.80   0.50  1599   1599   5.01   0.10
Average   c31t0d0  17.95   0.50  1599   1599   5.01   0.11
Average   c34t0d0  18.15   0.50  1599   1599   5.01   0.10
```

A.8 scsictl Command

The following error occurs if you execute the `scsictl` command specifying a SCSI device file name set as an HDLM management target:

```
# scsictl -a /dev/rdisk/c24t0d0
scsictl: io_dev_to_node: I/O tree node does not exist.
```

In the `scsictl` command, specify an HDLM device file name, as shown below:

```
# scsictl -a /dev/rdisk/ch24t0d0
immediate_report = 0; queue_depth = 8
```

A.9 vgscan Command

In an environment that contains a volume group consisting of an HDLM device file specified as physical volumes, if the `/etc/lvmtab` file has been deleted when you execute the `vgscan` command, the physical volumes of that volume group contained in the `/etc/lvmtab` file will be rewritten as SCSI device file names. Therefore, if you inadvertently delete the `/etc/lvmtab` file, use the following procedure to restore the volume group.

To restore the volume group:

1. Execute the `vgscan -a` command to create an `/etc/lvmtab` file.

```
# vgscan -a
Creating "/etc/lvmtab".
:
*** LVMTAB has been created successfully.
*** If PV links are configured in the system.
*** Do the following to resync information on disk.
*** #1.  vgchange -a y
*** #2.  lvlnboot -R
#
```

2. Execute the `strings` command and check the created `/etc/lvmtab` file.

Check the correspondence between the volume groups in the `/etc/lvmtab` file and the device file names.

In the following example, the HDLM device file specified as the physical volumes for volume group `/dev/vg01` is now replaced by the corresponding SCSI device file names.

```
# strings /etc/lvmtab
/dev/vg00
/dev/dsk/c1t2d0
/dev/vg01
/dev/dsk/c8t0d4
/dev/dsk/c57t0d4
#
```

3. Execute the `view -drv` operation and check the correspondence between the SCSI device file names and the HDLM device file name.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -drv
PathID HDevName Device LDEV H/W Path
:
000003 ch8t0d4 c8t0d4 9200.2334.0004 0/6/0/0.8.0.1.0.0.4
:
000016 ch8t0d4 c57t0d4 9200.2334.0004 0/6/2/0.8.0.7.0.0.4
:
#
```

4. Execute the `vgchange -a n` command to deactivate the volume group.

The system outputs a warning message, as shown below, although the volume group is successfully deactivated.

```
# vgchange -a n /dev/vg01
vgchange: Warning: couldn't query physical volume "/dev/dsk/c8t0d4":
The specified path does not correspond to physical volume attached to
this volume group
vgchange: Warning: couldn't query physical volume "/dev/dsk/c57t0d4":
The specified path does not correspond to physical volume attached to
this volume group
vgchange: Warning: couldn't query all of the physical volumes.
vgchange: Warning: couldn't query physical volume "/dev/dsk/c8t0d4":
The specified path does not correspond to physical volume attached to
this volume group
vgchange: Warning: couldn't query physical volume "/dev/dsk/c57t0d4":
The specified path does not correspond to physical volume attached to
this volume group
vgchange: Warning: couldn't query all of the physical volumes.
Volume group "/dev/vg01" has been successfully changed.
#
```

5. Execute the `vgexport` command.

Execute the `ls -l` command to get the minor number of the `group` file. Then execute the `vgexport -m mapfile volume-group-name` command to create a map file and delete the volume group.

```
# ls -l /dev/vg01/group
crw-rw-rw-  1 root      sys          64 0x050000 Dec 19 11:57 /dev/vg01/group
# vgexport -m /tmp/vg01.mapfile /dev/vg01
#
```

6. Execute the `mkdir` and `mknod` commands.

Execute the `mkdir` command to create a volume group directory. Then execute the `mknod` command to create a `group` file. In the argument of the `mknod` command, specify the major number or minor number that you acquired at step 5.

```
# mkdir /dev/vg01
# mknod /dev/vg01/group c 64 0x050000
#
```

7. Execute the `vgimport` command.

Execute the `vgimport -m mapfile volume-group-name` command to register the HDLM device file name as a volume group.

```
# vgimport -m /tmp/vg01.mapfile /dev/vg01 /dev/dsk/ch8t0d4
Warning: A backup of this volume group may not exist on this machine.
Please remember to take a backup using the vgcfgbackup command after
activating the volume group.
#
```

8. Execute the `strings` command and check the `/etc/lvmtab` file.

Check the correspondence between the volume groups in the `/etc/lvmtab` file and the device file names. In the following example, the physical volumes specified for the volume group have been restored to the associated HDLM device file name.

```
# strings /etc/lvmtab
/dev/vg00
/dev/dsk/clt2d0
/dev/vg01
/dev/dsk/ch8t0d4
#
```

9. Activate the volume groups as required.

Up to step 8, the volume groups are inactive.

Activate or deactivate the volume groups as required.

An execution example is shown below.

- When activating a volume group (non-cluster configuration):

```
# vgchange -a y volume-group-name
```

- When activating a volume group (cluster configuration):

```
# vgchange -a e volume-group-name
```

Appendix B Cautions on Using Ignite-UX

This section gives cautions on creating a recovery archive or performing system recovery. Use the Ignite-UX `make_net_recovery` or `make_tape_recovery` command.

Do not use the `make_recovery` command.

When you use the `make_net_recovery` or `make_tape_recovery` command to create a recovery archive or perform system recovery, use Ignite-UX 3.7 or later. If you use any other version of Ignite-UX, a device file for the same SCSI device might change before or after system recovery. In this case, the HDLM device can no longer be recovered correctly.

B.1 Creating a Recovery Archive

B.1.1 Creating a recovery archive using the `make_net_recovery` command

To create a recovery archive by using the `make_net_recovery` command:

1. Execute the following command so that the configuration definitions of the HDLM device will not run when performing the first system reboot after system recovery:

```
# chmod 400 /sbin/dlmcfgmgr
```

2. Create a recovery archive.

Create a recovery archive by using the `make_net_recovery` command.

3. Edit the file (`/var/opt/ignite/clients/host-name /recovery/latest/control_cfg`) on the host performing system recovery so that recovery processing of the LVM information (volume group environment), which includes the HDLM device, will not be performed during system recovery processing.

Additionally, after system recovery processing ends, manually perform the recovery processing of the LVM information that was changed so that recovery processing would not be performed during system recovery processing. Since the recovery processing is performed manually, backup the relevant data, such as using the `cp` command, before editing the `control_cfg` file.

For details about the recovery processing of the LVM information, see *Appendix B.3*.

Edit Example:

In the `post_config_cmd` part of the `control_cfg` file, delete the recovery processing of the LVM information (shaded portion) that specified the HDLM device, as shown below:

```

post_config_cmd="
/usr/sbin/vgimport -v -m /etc/lvmconf/vg01.mapfile /dev/vg01 \
/dev/dsk/c4t0d1 \
/dev/dsk/c9t0d1
/usr/sbin/vgchange -a r vg01

/usr/sbin/vgimport -v -m /etc/lvmconf/vgdlm.mapfile /dev/vgdlm \
/dev/dsk/ch4t0d2
/usr/sbin/vgchange -a r vgdlm

/usr/sbin/vgimport -v -m /etc/lvmconf/vgtest.mapfile /dev/vgtest \
/dev/dsk/ch4t0d3
/usr/sbin/vgchange -a r vgtest

/usr/sbin/vgcfgbackup /dev/vg00
/usr/sbin/vgcfgbackup /dev/vg01
/usr/sbin/vgcfgbackup /dev/vgdlm
/usr/sbin/vgcfgbackup /dev/vgtest
"

```

4. After creating the recovery archive, execute the following command to return the change of step 1 to the original.

```
# chmod 500 /sbin/dlmcfgmgr
```

B.1.2 Creating a recovery archive using the `make_tape_recovery` command

To create a recovery archive by using the `make_tape_recovery` command:

1. Execute the following command so that the configuration definitions of the HDLM device will not run when performing the first system reboot after system recovery:

```
# chmod 400 /sbin/dlmcfgmgr
```

2. Create a recovery archive image.

When you use the `make_tape_recovery` command, specify the `-A -p` option and create a recovery archive image on a disk.

```
# make_tape_recovery -A -p
```

The `lsssf` command is executed by the `make_tape_recovery` command. For this reason, when an HDLM device file name is specified for a volume group, the following message appears, however the recovery archive image is successfully created.

```
lsssf: Don't know how to handle driver "dlmfdrv"
```

The following example illustrates execution of the `make_tape_recovery` command:

```
# make_tape_recovery -A -p
* Creating local directories for configuration files and archive.
===== mm/dd/yy hh:mm:ss MST Started make_tape_recovery. (date/time
MST yyyy)
@(#) Ignite-UX Revision B.4.3.91
@(#) net_recovery (opt) $Revision: 10.609 $
:
Volume Group configuration for /dev/vgdlm has been saved in /etc/lvmconf/
vgdlm.conf
* Creating Map Files for Volume Group /dev/vgdlm
* /usr/sbin/vgexport -p -m /etc/lvmconf/vgdlm.mapfile /dev/vgdlm
vgexport: Volume group "/dev/vgdlm" is still active.

* Creating Control Configuration.
lsssf: Don't know how to handle driver "dlmfdrv"
* Creating Archive File List
* Creating Archive Configuration
:
===== mm/dd/yy hh:mm:ss MST make_tape_recovery completed successfully!
#
```

3. Edit the file (`/var/opt/ignite/recovery/latest/control_cfg`) on the host performing system recovery so that recovery processing of the LVM information (volume group environment), which includes the HDLM device, will not be performed during system recovery processing.

Additionally, after system recovery processing ends, manually perform the recovery processing of the LVM information that was changed so that recovery processing would not be performed during system recovery processing. Since the recovery processing is performed manually, backup the relevant data, such as using the `cp` command, before editing the `control_cfg` file.

For details about recovery processing of the LVM information, see *Appendix B.3*.

Edit Example:

In the `post_config_cmd` part of the above file, delete the recovery processing of the LVM information (shaded portion) that specified the HDLM device, as shown below:

```
post_config_cmd="
/usr/sbin/vgimport -v -m /etc/lvmconf/vg01.mapfile /dev/vg01 ¥
/dev/dsk/c4t0d1 ¥
/dev/dsk/c9t0d1
/usr/sbin/vgchange -a r vg01

/usr/sbin/vgimport -v -m /etc/lvmconf/vgdlm.mapfile /dev/vgdlm ¥
/dev/dsk/ch4t0d2 ¥
/usr/sbin/vgchange -a r vgdlm

/usr/sbin/vgimport -v -m /etc/lvmconf/vgtest.mapfile /dev/vgtest ¥
/dev/dsk/ch4t0d3 ¥
/usr/sbin/vgchange -a r vgtest

/usr/sbin/vgcfgbackup /dev/vg00
/usr/sbin/vgcfgbackup /dev/vg01
/usr/sbin/vgcfgbackup /dev/vgdlm
/usr/sbin/vgcfgbackup /dev/vgtest
"
```

4. Create a recovery archive.

When you use the `make_tape_recovery` command, specify the `-r` option[#], and then create the recovery archive from the recovery archive image that was created in step 2.

#

Note that if you specify the `-A` option, the recovery archive image that was created in step 2 will be ignored. Do not specify the `-A` option.

```
# make_tape_recovery -r
```

5. After creating the recovery archive, execute the following command to return the change of step 1 to the original:

```
# chmod 500 /sbin/dlmcfgmgr
```

B.2 Creating a Recovery Archive (Backing Up HDLM-managed Devices)

The `make_net_recovery` and `make_tape_recovery` commands cannot back up data on HDLM-managed devices into a recovery archive.

When an HDLM device file name is specified in a volume group, the following errors occur when you attempt to back up data, using the `make_net_recovery` or `make_tape_recovery` command, on HDLM-managed devices into a recovery archive:

```
# /opt/ignite/bin/make_tape_recovery -a /dev/rmt/lmn -x inc_entire=vg00 -x
inc_entire=vgdmlm -v
    * Creating local directories for configuration files and archive.

===== mm/dd/yy hh:mm:ss JST  Started /opt/ignite/bin/make_tape_recovery.
        (date/time JST yyyy)
        @(#) Ignite-UX Revision B.4.1.55
        @(#) net_recovery (opt) $Revision: 10.597 $

    :
    * Creating System Configuration.
    * /opt/ignite/bin/save_config -f
      /var/opt/ignite/recovery/yyyy-mm-dd,hh:mm/system_cfg vg00 vgdmlm
lssf: Don't know how to handle driver "dlmfdrv"
save_config: error - unknown disk type for /dev/dsk/ch6t0d0, not SCSI or HPFL
grep: can't open /var/tmp/vgdisplay.tmp
cp: cannot access /var/tmp/config.tmp: No such file or directory
ERROR:  Cannot stat file: /var/opt/ignite/recovery/yyyy-mm-dd,hh:ss/
system_cfg
ERROR:  System error, /opt/ignite/bin/instl_adm failed checking
      /var/opt/ignite/recovery/yyyy-mm-dd,hh:ss/system_cfg

===== mm/dd/yy hh:mm:ss JST  make_tape_recovery completed unsuccessfully
#
```

To back up data on HDLM-managed devices, use the following commands and software:

- Standard commands for your operating system (`tar`, `fbackup`, `dd`, etc.)
- HP OpenView OmniBack II
- Facilities such as TrueCopy, ShadowImage, or MRCF-Lite provided by storage management software such as CCI

B.3 System Recovery Using a Recovery Archive

After system recovery from an archive made by the `make_net_recovery` or `make_tape_recovery` command, restore HDLM devices and the logical volume manager information (volume group environment) including the HDLM device information, using the following procedure.

Complete these steps after system recovery from the recovery archive has completed and the system has restarted.

To restore the logical volume manager information:

1. Execute the following command to enable the configuration definition of the HDLM device in a system reboot:

```
# chmod 500 /sbin/dlmcfgmgr
```

2. Delete the device file for the HDLM device:

```
# rm /dev/dsk/ch*  
# rm /dev/rdisk/ch*  
# rm /dev/dlm/c*
```

3. Execute the following commands to temporarily release all HDLM devices:

```
# mv /etc/opt/DynamicLinkManager/dlmdrv.unconf /etc/opt/DynamicLinkManager/  
dlmdrv.unconf.org  
# ls /dev/dsk/c* > /etc/opt/DynamicLinkManager/dlmdrv.unconf  
# /opt/DynamicLinkManager/bin/dlmdfpath -a
```

This process temporarily changes the HDLM devices into SCSI devices. After the above step, the following message is output and a reboot is performed:

After the system reboot, perform procedures from step 4 shown below.

```
KAPL10407-I A kernel will be built. Is this OK? [y/n] : y
KAPL10411-I The current kernel will be replaced. Is this OK? [y/n] : y
Kernel update request is scheduled.
Default kernel /stand/vmunix will be updated by
newly built kernel /stand/build/vmunix_test
at next system shutdown or startup time.
KAPL10414-I The computer must be restarted to make the path configuration effective. Would
you like to restart the computer now? [y/n] : y
```

Note that the following KAPL10421-W message might appear before the KAPL10407-I message. Enter `y` in response to all the prompting messages subsequently output, regardless of whether the KAPL10421-W message is displayed.

```
KAPL10421-W The HDLM management-target disk does not exist.
```

4. Re-create the device file for the SCSI device:

```
# insf -e
```

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

```
# mv etc/opt/DynamicLinkManager/dlmdrv.unconf.org /etc/opt/DynamicLinkManager/
dlmdrv.unconf
# /opt/DynamicLinkManager/bin/dlmdfpath -a
```

The same messages as step 3 are output, and a system reboot is performed.

After the system reboot, perform procedures from step 6 shown below.

6. Reference the LVM recovery commands generated by Ignite-UX to recover the HDLM device.

The LVM recovery commands generated by Ignite-UX are the processes that were deleted in *Appendix B.1.1.1*.

7. Manually execute the recovery command.

On the host where you restored the system, execute the LVM recovery command written in `post_config_cmd` in the `control_cfg` file that you referenced at step 6.

LVM recovery commands can only be executed on volume groups consisting of HDLM devices. An error results if you attempt to execute an LVM recovery command on a volume group that has no HDLM device.

The following example shows an LVM recovery command executed on a volume group that has no HDLM device.

```
# vgimport -v -m /etc/lvmconf/vg01.mapfile /dev/vg01 /dev/dsk/c4t0d1 /dev/dsk/c9t0d1
Beginning the import process on Volume Group "/dev/vg01".
vgimport: Volume group "/dev/vg01" already exists in the "/etc/lvmtab" file.
# vgchange -a r vg01
Volume group "vg01" is activated for read/write, not changed to read-only.
```

The following example shows an LVM recovery command executed on a volume group that contains an HDLM device.

```
# vgimport -v -m /etc/lvmconf/vgdlm.mapfile /dev/vgdlm /dev/dsk/ch4t0d2
Beginning the import process on Volume Group "/dev/vgdlm".
Logical volume "/dev/vgdlm/lvol1" has been successfully created
with lv number 1.
Volume group "/dev/vgdlm" has been successfully created.
Warning: A backup of this volume group may not exist on this machine.
Please remember to take a backup using the vgcfgbackup command after
activating the volume group.
# vgchange -a r vgdlm
Activated volume group
Volume group "vgdlm" has been successfully changed.
# vgimport -v -m /etc/lvmconf/vgtest.mapfile /dev/vgtest /dev/dsk/ch4t0d3
Beginning the import process on Volume Group "/dev/vgtest".
/usr/sbin/vgchange -a r vgtestLogical volume "/dev/vgtest/lvol1" has been
successfully created
with lv number 1.
Volume group "/dev/vgtest" has been successfully created.
Warning: A backup of this volume group may not exist on this machine.
Please remember to take a backup using the vgcfgbackup command after
activating the volume group.
# vgchange -a r vgtest
Activated volume group
Volume group "vgtest" has been successfully changed.
```

8. Create or update the backup file for setting volume groups as required.

The following example shows command execution:

```
# vgcfgbackup /dev/vgdlm
Volume Group configuration for /dev/vgdlm has been saved in /etc/lvmconf/vgdlm.conf
# vgcfgbackup /dev/vgtest
Volume Group configuration for /dev/vgtest has been saved in /etc/lvmconf/vgtest.conf
```

9. Make sure that the LVM information (volume group environment) has been restored.

Execute the `vgdisplay -v` command and verify that the volume groups containing HDLM devices have been restored.

An example of command execution is shown below.

```

# vgdisplay -v
:
VG Name                /dev/vgdlm
:

--- Logical volumes ---
LV Name                /dev/vgdlm/lvol1
:
--- Physical volumes ---
PV Name                /dev/dsk/ch4t0d2
PV Status              available
Total PE              586
Free PE               561
Autoswitch            On

VG Name                /dev/vgtest
:
--- Logical volumes ---
LV Name                /dev/vgtest/lvol1
:
--- Physical volumes ---
PV Name                /dev/dsk/ch4t0d3
PV Status              available
Total PE              586
Free PE               561
Autoswitch            On

```

10. Activate or deactivate the volume groups as required.

Up to step 8, the volume groups have been active in read-only mode. Activate or deactivate the volume groups as required.

To activate a volume group (non-cluster configuration):

```
# vgchange -a y volume-group-name
```

To activate a volume group (cluster configuration):

```
# vgchange -a e volume-group-name
```

To deactivate a volume group:

```
# vgchange -a n volume-group-name
```

Appendix C ioctl System Call

Table C.1 describes processing for when HDLM receives ioctl system calls from the application.

Table C.1 ioctl codes and corresponding processing

ioctl Code	Processing
SIOC_SET_IR	<p>Issue ioctl for all the paths when all the paths managed by the specified HDLM device are Online. #1 If even one path is Offline, the operation ends with an error. In this case the errno is ENXIO.</p> <ul style="list-style-type: none"> If a failure is detected in the online paths as a result of ioctl being issued, the paths become either Offline(E) or Online(E). If the ioctl is issued normally for all the paths, normal termination is returned to the upper level. If even one path fails, an error is returned to the upper level. #2
SIOC_SET_LUN_LIMITS#3 SIOC_SET_TGT_LIMITS SIOC_SET_BUS_LIMITS DIOC_SET_PFTIMEOUT	<p>Issue ioctl for all the paths managed by the specified HDLM devices irrespective of whether they are Online or Offline. #1</p> <ul style="list-style-type: none"> If a failure is detected in the online paths as a result of ioctl being issued, the paths become either Offline(E) or Online(E). If the ioctl is issued normally for all the paths, normal termination is returned to the upper level. If even one path fails, an error is returned to the upper level. #2 Even if ioctl issue to Offline(E), Online(E) and Offline@ paths is successful, they do not become Online.
Other than above	<p>Issue ioctl for one Online path managed by the specified HDLM devices.</p> <ul style="list-style-type: none"> If the issue of ioctl fails, the applicable path becomes Offline(E) or Online(E). If there is another online path, change the path and issue again (failover). #1 If the issue of ioctl for one path is successful, it terminates and normal termination is returned to the upper level layer. If issuing of ioctl fails for all the Online paths, an error is returned to the upper level. Even if the ioctl issue to Online(E) paths is successful, they do not become Online.

#1

ioctl is issued in order from the smallest paths of the PathID for owner paths. If ioctl has been issued to all of the owner paths, subsequently ioctl is issued in order from the smallest paths of the PathID for non-owner paths.

#2

If an error is returned, depending on the paths, the information might not match. Therefore, after recovery of the path error, re-issue ioctl system call.

#3

If you issue an ioctl specifying SIOC_SET_LUN_LIMITS for the HDLM devices or the SCSI devices managed by the HDLM devices, the following warning message is output to syslog but the settings can be set normally.

```
Oct dd hh:mm:ss host1 vmunix: warning: SIOC_SET_LUN_LIMITS: dec bc0a0000 node not found
```



If an ioctl request is performed with `SIOC_SET_IR` specified, before issuing the ioctl system call, make sure all the paths managed by the specified HDLM devices are Online. If a path contains an error, a message is output to syslog and the error log, and then it terminates with an error.

If you issue an ioctl system call without specifying either of the following codes, check if there are at least 1 or more Online paths in the paths managed by the specified HDLM devices.

- `SIOC_SET_IR`
- `SIOC_SET_LUN_LIMITS`
- `SIOC_SET_TGT_LIMITS`
- `SIOC_SET_BUS_LIMITS`
- `DIOC_SET_PFTIMEOUT`

If an error is occurring on a path, I/O timeout value is not effected until the ioctl system call error is returned to the application.

Glossary

automatic failback	Functionality for checking the status of paths at regular intervals, and automatically placing the status of a path recovered from an error into Online status.
CHA	An adapter for controlling a channel of a storage subsystem.
CLPR	The CLPR function enables logical splitting of a cache supported by the TagmaStore USP, and Universal Storage Platform V. This function splits the cache by array groups in the storage subsystem, so that other array groups do not affect cache performance.
cluster	A system that connects multiple hosts having the same OS or platform (that is, an environment in which the same application can run) and treats them as one system.
Dev	A logical division of an LU that HDLM controls and operates. A Dev is equivalent to a <i>physical volume</i> in HP-UX.
device file	A device file under <code>/dev/dsk</code> or <code>/dev/rdisk</code> .
Dev number	<p>In UNIX, a device number usually indicates a combination of the major device number and minor device number. In HDLM, a device number is a number that is displayed in the DNum field.</p> <p>A device number is assigned to a device within an LU. The device numbers are assigned sequentially from 0. A device number is called a <i>section number</i> in HP-UX.</p> <p>In HDLM, this value is fixed to 0 because each LU contains only one device.</p>
emulation type	<p>An LU type accessible from a host. Since an HDLM management-target host is an open-system host such as a PC or a UNIX machine, the HDLM management-target host can access only the LUs that have open-system emulation types.</p> <p>For details on emulation types supported by a storage subsystem, see the maintenance manual for that storage subsystem.</p>
failback	Functionality for placing the status of a path recovered from an error into Online status, and switching the access path to the recovered path.
failover	Functionality for switching to another normal path if there is an error in a path, thereby enabling the system to continue to operate.

HBA	Device that functions as an interface connecting a host with external devices. In this manual, the term <i>HBA</i> refers to an interface card installed in a host, in configurations where the host and storage units are connected via a SCSI or a Fibre Channel 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 the HDLM functionality, manages paths, and detects errors.
HDLM manager	A program that manages error information. The HDLM manager receives the 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 within a host LU.
host device name	A name assigned to a host device. A device file name of an HDLM device is assigned.
host LU	An LU that the host recognizes. Each host LU has a <i>host LU number</i> .
host LU number	A number assigned to a host LU. The host LU number is a part of a path name.
intermittent error	An error that occurs irregularly due to reasons such as a loose cable connection.
LDEV	The value that identifies an LDEV consisting of a combination of storage subsystem product names, serial numbers, and internal LUs. HDLM uses this value to identify an LU.
load balancing	Functionality for distributing the load across the paths that access each logical area within an LU. To distribute loads, load balancing uses multiple paths to perform I/O operations. Two types of algorithms are available: round-robin and extended round-robin.
LU	A logical unit that is a logical volume defined in the storage subsystem, and with which the host can perform input or output operations.
node	A server of cluster members.

non-owner controller	<p>A controller other than an owner controller.</p> <p>Non-owner controllers exist only when the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series is in use.</p>
non-owner path	<p>A path that passes through a controller other than an owner controller.</p> <p>Non-owner paths exist only when the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series is in use.</p>
owner controller	<p>A controller that has been set as an owner controller for an LU on the storage subsystem when using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series. A controller other than an owner controller is called a <i>non-owner controller</i>.</p> <p>When using Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, all controllers are owner controllers.</p>
owner path	<p>A path that passes through a controller that has been set as an owner controller for an LU on the storage subsystem when using the Freedom Storage 5700E, Freedom Storage 5800, Thunder 9200, Thunder 9500V Series, or TagmaStore AMS/WMS series. A path that passes through a controller other than an owner controller is called a <i>non-owner path</i>.</p> <p>When using the Lightning 9900 Series, Lightning 9900V Series, TagmaStore USP, or Universal Storage Platform V, all paths are owner paths.</p>
path	<p>An access path from a host to storage subsystem. Access to a logical area within an LU in a storage subsystem is made via a cable connecting the host bus adapter on the host and the channel adapter on the storage subsystem. Each path has an <code>AutoPATH_ID</code>. Functionality for checking the status of paths at regular intervals.</p>
path health checking	<p>When an error occurs at a path that was in the Online status, path health checking changes the status of the path to the Offline(E) status.</p> <p>Path health checking checks only those paths that have Online status.</p>
path name	<p>The name consisting of the following four elements, separated by periods:</p> <ul style="list-style-type: none"> - Host port number (hexadecimal number) - Bus number (hexadecimal number) - Target ID (hexadecimal number) - Host LU number (hexadecimal number) <p>A path name is used to identify a path.</p>

persistent reservation	<p>Similar to <i>reservation</i>, persistent reservation enables a host to declare that it has exclusive use of an LU, and prevents other hosts from accessing that LU. Note, however, that <i>reservation</i> allows a host to have exclusive use of only one path to the LU, but persistent reservation allows a host to have exclusive use of more than one path.</p> <p>If HDLM applies persistent reservation, a host can have exclusive use of multiple paths to an LU, so load balancing among these exclusively used paths is possible.</p>
reservation	<p>The reservation functionality enables a host to declare that it has exclusive use of an LU, and prevents other hosts from accessing that LU. Access permission for an LU that has been reserved is given only to the host that issued the reservation, so the LU cannot be accessed from multiple paths simultaneously. As a result, load balancing is not possible.</p>
SAN	<p>A high-speed network connecting hosts and storage subsystems. This network is independent of a LAN and is dedicated to data transfer. A SAN provides faster accesses to storage subsystems, and prevents the transfer of high-volumes of data from deteriorating LAN performance.</p>
SCSI device	<p>A SCSI disk device</p>
SLPR (Storage Logical Partition)	<p>The SLPR function enables logical splitting of a storage subsystem supported by the TagmaStore USP, and Universal Storage Platform V. This function splits the resources (ports, CLPR, and volumes) in the storage subsystem, so that the user can manage each resource independently.</p>

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