

Hitachi Dynamic Link Manager (for Linux®) 9.0.0-00 Release Notes

About this document

This document (RN-00HS284-103, June 2024) provides late-breaking information about Hitachi Dynamic Link Manager (for Linux) v9.0.0-00. It includes information that was not available at the time the technical documentation for this product was published, as well as a list of known problems and solutions.

Intended audience

This document is intended for customers and Hitachi Vantara partners who license and use Hitachi Dynamic Link Manager (for Linux).

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About this release

This release adds new features and resolves multiple known problems.

Product package contents

Medium	CD-ROM	Revision	Release Type
Software	Hitachi Dynamic Link Manager (for Linux)	9.0.0-00	Full Package

New features and important enhancements

9.0.0-00 Additional Functions and Modifications

- The following storage systems are now supported:
 - Hitachi Virtual Storage Platform One Block 28
 - Hitachi Virtual Storage Platform One Block 26
 - Hitachi Virtual Storage Platform One Block 24

- The following distributions are now supported:

For SUSE LINUX Enterprise Server 15 SP5 for EM64T/AMD64, kernel version 5.14.21-150500.53-default is now supported:

- The linkage with Global Link Manager is no longer supported.

System requirements

For system requirements, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Host

For details on supported hosts, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

HAM environments support Red Hat Enterprise Linux 6 (x86/x64).

Host Bus Adapter (HBA)

For information on supported HBAs and drivers, see Appendix A - Host Bus Adapter (HBA) Support Matrix.

Storage

For supported storage systems, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Virtualization

HDLM supports the following virtualization environments:

- Hitachi Virtualization Manager (Hitachi Compute Blade with Itanium 2 server modules)
- Xen (Virtualization) in SUSE LINUX Enterprise Server 12, 12 SP1 - SP5, 15, 15 SP1 - SP3, SP5
- KVM (Virtualization) in the following:
 - Red Hat Enterprise Linux 6 - 6.10, 7 - 7.9, 8.1 - 8.4, 8.6, 8.8, 9.1 - 9.2
 - Oracle Linux 6.5 - 6.10, 7 - 7.9, 8.1 - 8.4, 8.6
 - Oracle Unbreakable Enterprise Kernel 6.2 - 6.10, 7 - 7.9, 8.2 - 8.4, 8.6

Operating systems requirements

For details on supported operating systems, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Prerequisite programs

None.

Related programs

For details on related programs, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Memory and disk space requirements

For details on memory and disk space requirements, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

HDLM supported configurations

For details on supported HDLM configuration and space requirements, see Chapter 3. Creating an HDLM environment in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Resolved problems

9.0.0-00 Modifications

None.

Known problems

- Storage systems with the following functionality are no longer supported:
 - Dynamic load balance control function
 - High Availability Manager function
 - Virtual ID function for storage migration

However, the parameters for these functions are displayed for the set and view HDLM commands when you run command help. For example, the following is displayed when you run `view -sys:`

```
Dynamic I/O Path Control
```

- During an unattended HDLM installation, if all keys that can be defined in the [ENVIRONMENT_SETTINGS] section are specified at the same time, the following message is output and the installation fails:
KAPL09234-W A folder or file specified by the installation information settings file does not exist. Name = aa...aa
aa...aa: Name of the folder or file that does not exist.
Therefore, do not modify the keys that are commented out in the [ENVIRONMENT_SETTINGS] section of the sample file (sample_installhdlm.conf). If you want to change these settings, install HDLM first and then specify the new settings by using the `dlmkmgr set` command.

- If you specify multiple arguments for the `-prsup` parameter by using the `dlmsetopt` utility, the following messages are displayed, and HDLM driver options are incorrectly set so that HDLM will not link with clusters that support persistent reservations (`-prsup off`).

```
# /opt/DynamicLinkManager/bin/dlmsetopt -prsup on off
KAPL12554-I The utility for setting HDLM driver option has started.
/opt/DynamicLinkManager/bin/dlmsetopt: line 1156: [: too many
arguments
```

Specify the correct argument (either on or off) for the `-prsup` parameter, and then run the `dlmsetopt` utility again.

```
KAPL12555-I The utility for setting HDLM driver option completed
normally.
KAPL12558-I Please restart the computer so that the option settings
take effect.
```

- If an environment is created in which HDLM is installed on the boot disk, the server is started, and a module name contains a hyphen (-), even if the module is successfully loaded, a message indicating that the module failed to load (KAPL12324-E) might be output to the console and the `/etc/opt/DynamicLinkManager/hdlmboot.log` file.

After the server has started, run the `lsmod` command. If the hyphens in module names are changed and displayed as underscores (`_`), then there are no problems, and the action for the KAPL12324-E message in the *Hitachi Dynamic Link Manager (for Linux®) User Guide* does not need to be taken.

Message output example (example of an error occurring for `dm-region-hash`)

```
# vi /etc/opt/DynamicLinkManager/hdlmboot.log
:
```

```

KAPL12323-I The insertion of the module was started. Module name
= dm-log
KAPL12323-I The insertion of the module was started. Module name
= dm-region-hash
KAPL12324-E The module could not be inserted. Module name = dm-
region-hash
KAPL12323-I The insertion of the module was started. Module name
= dm-mirror
:
#

```

Example of using lsmod to confirm that there are no problems (example of confirming the information displayed for dm_region_hash):

```

# lsmod
:
dm_mirror                14003  0
dm_region_hash           12200  1 dm_mirror
dm_log                   10088  2 dm_mirror,dm_region_hash
:
#

```

- Operation when all paths are disconnected during intermittent error monitoring:

When I/O operations are performed continuously for an LU with paths that are all Offline(E), Online(E), or Offline(C) (because, for example, all paths have been disconnected), the number of times that an error occurs (the IEP value when `dlmkmgr view -path -iem` is run) during intermittent error monitoring might increase even though the auto failback function did not recover all paths. In this case, even though an intermittent error did not occur, HDLM often assumes an intermittent error, and excludes paths from the auto failback function. In this case, after recovery from the failure, to change the status of a path excluded from auto failback to online, manually change the status to online.

- Although the following messages are output when running the "rpm -V HDLM" command, HDLM operations are not affected:
 - Red Hat Enterprise Linux 6 (IA32) - 6.10
 - Oracle Linux 6.5 (IA32) - 6.10
 - Oracle Unbreakable Enterprise Kernel 6.2 (IA32) - 6.8

```
missing /etc/opt/DynamicLinkManager/dlmmgr_e.xml
```

- Red Hat Enterprise Linux 6 (EM64T/AMD64) - 6.10
- Red Hat Enterprise Linux 7 (EM64T/AMD64) - 7.9
- Oracle Linux 6.5 (EM64T/AMD64) - 6.10

- Oracle Linux 7 (EM64T/AMD64) - 7.9
- Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64) - 6.10
- Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64) - 7.9

```
missing /etc/opt/DynamicLinkManager/dlmmgr_e.xml
missing /opt/DynamicLinkManager/lib/libdlm.so_32
missing /opt/DynamicLinkManager/lib/libdlmgui_jni.so_32
missing /opt/DynamicLinkManager/lib/libhdlmhcc-x.x.x.so_32 (*1)
missing /opt/DynamicLinkManager/lib/libhdlmhccmp-x.x.x.so_32 (*1)
```

- Red Hat Enterprise Linux 8.1 (EM64T/AMD64) - 8.4, 8.6
- Red Hat Enterprise Linux 9.1 (EM64T/AMD64) - 9.2
- Oracle Linux 8.1 (EM64T/AMD64) - 8.4, 8.6
- Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64) - 8.4, 8.6

```
missing /etc/opt/DynamicLinkManager/dlmmgr_e.xml
missing /opt/DynamicLinkManager/lib/libdlm.so_32
missing /opt/DynamicLinkManager/lib/libdlmgui_jni.so_32
missing /opt/DynamicLinkManager/lib/libhdlmhcc-x.x.x.so_32 (*1)
missing /opt/DynamicLinkManager/lib/libhdlmhccmp-x.x.x.so_32 (*1)
```

Notes:

*1: voluntary number.

- SUSE LINUX Enterprise Server 12 (EM64T/AMD64) and 15

```
missing /etc/opt/DynamicLinkManager/dlmmgr_e.xml
missing /opt/DynamicLinkManager/lib64/libdlm.so_64
missing /opt/DynamicLinkManager/lib64/libdlmgui_jni.so_64
```

- Do not interrupt the HDLM installation or removal process (for example, do not press the **Ctrl+C** keys).
- If an operation is performed with the following procedure, the status is returned to what it was before the refresh operation was run. As a result, make sure to run the refresh command again after restarting the host and recovering from a path failure.
 - 1) The `dlmcmd` command is used to perform a refresh.
 - 2) Path errors occur for some or all of the paths, and a path status becomes Offline(E).
 - 3) The host is restarted before a path failure is recovered.
- The partition numbers that can be used for HDLM management targets are from 1 to 15. A partition number of 16 or higher can be assigned in UEFI, but a SCSI device

with a partition number of 16 or higher cannot be used as an HDLM management target.

- If you want to run either of the following utilities in an environment where the language is Japanese or a language other than English, change the language to English (LANG=C), and then run the utility:
 - dlmsetopt utility
 - dlmmkinitrd utility

Example:

- a) Check the current setting, and then back up LANG information.

```
# echo $LANG
zh_CN.gbk
#
# bk_LANG=$LANG
# echo $bk_LANG
zh_CN.gbk
#
```

- b) Change the setting of LANG to C (English).

```
# export LANG=C
#
```

- c) Run the dlmsetopt utility.

```
# /opt/DynamicLinkManager/bin/dlmsetopt -r -1
KAPL12554-I The utility for setting HDLM driver option has
started.
KAPL12555-I The utility for setting HDLM driver option
completed normally.
KAPL12558-I Please restart the computer so that the option
settings take effect.
#
```

- d) According to the result of (a), return the setting of LANG to the original setting.

```
# export LANG=$bk_LANG
#
# echo $LANG
zh_CN.gbk
#
```

- Connecting a storage system by using iSCSI 25Gbps optic channel boards is restricted.
- In a SUSE LINUX Enterprise Server 15 SP5 environment, you cannot use the HDLM device as a boot disk.
- In a boot disk environment of HDLM for Linux that was created in Red Hat Enterprise Linux 9, if you start the server by using a UEFI boot, only one path to an HDLM

device mounted on `/boot/efi` is placed in online status, and the other paths are placed in the offline status.

To return the paths to online, perform one of the following operations:

- After the server starts, perform the online operation.

```
# /opt/DynamicLinkManager/bin/dlnkmgr online
```
- After the server starts, run the HDLM-configuration definition utility with the `-r` parameter specified.

```
# sbin/dlmcfgmgr -r
```
- Specify the automatic failback function as on and wait until the function starts. The following example shows how to set up the automatic failback function with one-minute checking intervals:

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

Closing known problems

- The following restriction has been lifted:
In a Red Hat Enterprise Linux 9 environment, you cannot use the HDLM device as a boot disk.

Installation precautions

For Hitachi Dynamic Link Manager 6.5.0 and later, the HDLM installation media is a DVD-ROM. Also, the directory structure of the media has changed.

Refer to `Contents_list.txt` on the HDLM installation media, and then replace the descriptions regarding the HDLM installation media directories in the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

For details on HDLM installation, see the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Upgrading HDLM precautions

For details on upgrading HDLM, see the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Removal precautions

For details on removing HDLM uninstallation, see the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Usage precautions

For details on usage precautions when using HDLM, see the *Hitachi Dynamic Link Manager (for Linux®) User Guide*.

Additional Usage Precautions

- When using an Emulex HBA driver, if you run the HDLM-configuration definition utility (`dlmcfmgr -v`), a hyphen (-) might be displayed in the Device column of the results.

To change to a status that does not display a hyphen, run the `dlmcfmgr` utility with the `-u` parameter specified. For details on the `dlmcfmgr` utility, see `dlmcfmgr Utility for Managing the HDLM Configuration`.

- The settings of the OS and other programs, which were changed when installing HDLM, must be returned to the original settings after removing HDLM.
- Version numbers are displayed as follows after this version of HDLM is installed.

Function	Item	Version number
HDLM command (<code>dlnkmgr</code>)	HDLM Version	9.0.0-00
	HDLM Manager	9.0.0-00
	HDLM Alert Driver	9.0.0-00
	HDLM Driver	9.0.0-00

The following example shows the text displayed when `dlnkmgr view -sys` is run.

```
# /opt/DynamicLinkManager/bin/dlnkmgr view -sys
HDLM Version           : 9.0.0-00
Service Pack Version   :
Load Balance           : on(extended lio)
Support Cluster        :
Elog Level             : 3
```

```

Elog File Size (KB)           : 9900
Number Of Elog Files         : 2
Trace Level                   : 0
Trace File Size (KB)         : 1000
Number Of Trace Files        : 4
Path Health Checking          : on(30)
Auto Failback                 : on(1)
Reservation Status            :
Intermittent Error Monitor    : off
Dynamic I/O Path Control     : off(10)
HDLM Manager Ver             WakeupTime
Alive          9.0.0-00      yyyy/mm/dd hh:mm:ss
HDLM Alert Driver Ver        WakeupTime           ElogMem Size
Alive          9.0.0-00      yyyy/mm/dd hh:mm:ss    1000
HDLM Driver Ver              WakeupTime
Alive          9.0.0-00      yyyy/mm/dd hh:mm:ss
License Type Expiration
Temporary      yyyy/mm/dd (2days after)
KAPL01001-I The HDLM command completed normally. Operation name =
view, completion time = yyyy/mm/dd hh:mm:ss

```

- This version of HDLM does not support the virtualization (the Xen function) provided by the following:
 - Red Hat Enterprise Linux 6 - 6.10, 7 - 7.9
 - Oracle Linux 6.5 - 6.10, 7 - 7.9
- HDLM cannot be used in the domain 0 and the domain U of the virtualization (the Xen function).
- HDLM cannot be installed on an unsupported OS. Even if the installation is successful, using the software cannot be guaranteed.
- If HDLM is used with LifeKeeper for Linux, the following message may be output to the LifeKeeper for Linux log, but there is no effect on operation:

```

quickCheck: The daemon "dlmmgr" was restarted by quickCheck.
quickCheck: The daemon "dlmmgr" does not appear to be running and
could not be restarted.
Path failures may not be correctly handled without this daemon.

```

- Run the following command to check whether the HDLM manager is running:

```

# /opt/DynamicLinkManager/bin/dlnkmgr view -sys -msrv
HDLM Manager Ver             WakeupTime
Alive          9.0.0-00      yyyy/mm/dd hh:mm:ss
KAPL01001-I The HDLM command ended successfully. (operation name =
view, end time = yyyy/mm/dd hh:mm:ss)

```

If you restart the host, the route information changes and an increased number of offline (E) paths per LU might be displayed. If the number of online paths per LU is

the same as before the host was restarted, remove unnecessary offline (E) paths by using `dlnmcfmgr -u {HDLM device}`.

- In Red Hat Enterprise Linux 6, 7, 8, and 9, Oracle Unbreakable Enterprise Kernel 6, 7, and 8, Oracle Linux 7, and 8, SUSE LINUX Enterprise Server 12 and 15:
 - If you run the `dlnmcfmgr` utility (`dlnmcfmgr -u`), path information is deleted when a path failure occurs. The path information is deleted even if a hyphen (-) is not displayed for an SCSI device name in the device row displayed as a result of running the `dlnmcfmgr` utility or the HDLM command view operation (specifying `-lu` or `-drv`).
 - If path information is deleted, run `dlnmcfmgr -r` after recovering the failed path, make sure the recovered path is discovered by HDLM, and then confirm that the path status is online.
- HDLM for Linux does not support cluster software in a HAM environment.
 - In the case of displaying the LU information, the HAM information is not output by specifying the "all" parameter-value for the HDLM command. Specify the "ha" and "hastat" parameter-value instead.
 - When an online operation is performed on an owner path, a non-owner path status may change to Offline(E). After performing an online operation on an owner path, use the HDLM command to make sure that the non-owner path status is Online. If the non-owner path status is Offline(E), change the status of HAM pairs to PAIR, and then perform an online operation on the Offline(E) path again.
 - When you set up a HAM pair to be managed by HDLM, make sure that the host recognizes paths to the MCU (Primary VOL) and RCU (Secondary VOL) after the HAM pair is created.
Run the `dlnkmgr view -lu -item hastat` operation. If `ha` is not displayed in the HaStat column, then the corresponding LU is not recognized as being in a HAM configuration.
If the host recognizes the paths to the MCU and RCU before the HAM pair is created, restart the host after the HAM pair is created.
 - If you release a HAM pair to recover the system after a HAM volume failure, do not restart a host that is connected to the MCU and RCU while the HAM pair is released. If you must restart the host while the HAM pair is released, disconnect all paths to the MCU and RCU, restart the host, re-create the HAM pair, and then reconnect the paths.
 - If you restart a host that is connected to the MCU and RCU while the HAM pair is released, the RCU volume will be recognized as a volume other than an MCU volume. If this occurs, restart the host after the HAM pair is re-created.

- Run the `dlmcmd view -lu -item hastat` operation, and then confirm that `ha` is displayed in the `HaStat` column.
- Do not use an XFS file system or a btrfs file system for a system partition in any of the following environments:
 - Red Hat Enterprise Linux 6.2 (EM64T/AMD64) - 6.10
 - Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64) - 6.10
- If the `KAPL12451-E` error message is output using HDLM 8.5.4-00 or later, perform the following steps:
 - 1) Check whether `write_cache_state=0` is specified in the `/etc/lvm/lvm.conf` file. If `write_cache_state=0` is not specified, specify it.
 - 2) Run `/sbin/vgscan`.
 - 3) Check whether the following files exist. If either or both of the files exist, delete them.
 - `/etc/lvm/.cache`
 - `/etc/lvm/cache/.cache`
 - 4) In an environment where a logical volume (LVM2) on an HDLM device is used as the boot disk, re-create the initial RAM disk image file for HDLM by performing step 9 of the procedure in Settings for a multipath boot disk environment on page 3-148.
- If there are 1025 or more paths, including those with a status other than Online, running the `dlmchnme` utility might take some time to finish.
- In Red Hat Enterprise Linux 6, 7, 8, and 9, Oracle Unbreakable Enterprise Kernel 6, 7, and 8, Oracle Linux 7, and 8, SUSE LINUX Enterprise Server 11, 12 and 15, if the HDLM manager does not start after an attempt to `install(*1)` or `remove` HDLM for Linux fails and the `KAPL09013-E` message is output, perform one of the following procedures:
 - Restart the host.
 - Run the following command to start the HDLM manager:


```
# /opt/DynamicLinkManager/bin/dlmmanager start
```

(*1) The type of installation can be an upgrade installation or a re-installation of HDLM for Linux (but not a new installation).
- In Oracle Linux 8.4 or Oracle Unbreakable Enterprise Kernel 8.4, if one of the following operations is performed, the following message is output, but there is no actual problem. For details, see Oracle® Linux 8 Release Notes for Oracle Linux 8.4.

"/sbin/ldconfig: /etc/ld.so.conf.d/kernel-5.4.17-2102.201.3.el8uek.x86_64.conf:6:
hwcap directive ignored"

- Installing HDLM
 - Removing HDLM
 - Running the dercut command
 - Running the dlmbootstrat utility
- The processing takes time more with HDLM (multipath) than without HDLM (single path) due to the following reason:
 - The open processing is performed for the number of connected paths when open is received for HDLM devices from high-level systems. The disk information acquisition processing is performed from storage systems to check if it is connected to appropriate devices in the open processing for each device. Due to this, it takes time for processing if open and close are repeated. For this reason, verify that a performance problem does not occur by performing a load test when a system is constructed. If the problem occurs, check the number of connected paths, or consider using an LVM environment.

Documentation

Available documents

Document name	Document number	Issue date
Hitachi Dynamic Link Manager (for Linux®) User Guide	MK-92DLM113-62	June 2024

Documentation errata

Corrections for the *Hitachi Dynamic Link Manager Software User Guide for Linux(R)*:

No.	Location to correct	Corrections	
1	Notes on installing HDLM in a boot disk environment	Addition	•For SUSE LINUX Enterprise Server 15 SP5, if you use an environment where a logical volume (LVM2) on an HDLM device is used as a boot disk, the following RPM package must be applied:

			<ul style="list-style-type: none"> • lvm2-2.03.16-150500.7.3.1.x86_64.rpm or later
2	<p>Installing HDLM for managing boot disks</p> <p>Upgrade installation of HDLM in a boot disk environment</p> <p>Step 3.</p>	Before	<ul style="list-style-type: none"> ◦ For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later: • global_filter = ["a sddlm[a-p][a-p].*", "r /dev/sd "] • types = ["sddlmfdrv", 16] • md_component_detection = 0 • allow_changes_with_duplicate_pvs = 1 • multipath_component_detection=0(For Red Hat Enterprise Linux 8.8 or later) • use_devicesfile=0(For Red Hat Enterprise Linux 8.6 or later, or Oracle Linux 8.6 or later)
		After	<ul style="list-style-type: none"> ◦ For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later: • global_filter = ["a sddlm[a-p][a-p].*", "r /dev/sd "] • types = ["sddlmfdrv", 16] • md_component_detection = 0 • allow_changes_with_duplicate_pvs = 1 • multipath_component_detection=0(For Red Hat Enterprise Linux 8.8 or later, or SUSE LINUX Enterprise Server 15 SP5 or later) • use_devicesfile=0(For Red Hat Enterprise Linux 8.6 or later, Oracle Linux 8.6 or later, or SUSE LINUX Enterprise Server 15 SP5 or later)
3	<p>Settings for LVM2</p> <p>Notes on using LVM2</p>	Before	<ul style="list-style-type: none"> ◦ Starting from version lvm2-2.03.14-6.el8.x86_64, the default action of multipath_component_detection in /etc/lvm/lvm.conf has been changed. For this reason, when using version lvm2-2.03.14-6.el8.x86_64 or a later version of LVM, you need to set multipath_component_detection = 0 to disable it. If multipath_component_detection is enabled, multipath devices are excluded by LVM in the boot processing of a SAN boot configuration and will not be recognized, resulting in startup failure. For the following OSs, the default version of LVM is lvm2-2.03.14-6.el8.x86_64 or later, so be sure to set multipath_component_detection = 0. • Red Hat Enterprise Linux 8.8 or later • Red Hat Enterprise Linux 9 or later

		After	<ul style="list-style-type: none"> ◦ Starting from version lvm2-2.03.14-6.el8.x86_64, the default action of multipath_component_detection in /etc/lvm/lvm.conf has been changed. For this reason, when using version lvm2-2.03.14-6.el8.x86_64 or a later version of LVM, you need to set multipath_component_detection = 0 to disable it. If multipath_component_detection is enabled, multipath devices are excluded by LVM in the boot processing of a SAN boot configuration and will not be recognized, resulting in startup failure. For the following OSs, the default version of LVM is lvm2-2.03.14-6.el8.x86_64 or later, so be sure to set multipath_component_detection = 0. • Red Hat Enterprise Linux 8.8 or later • Red Hat Enterprise Linux 9 or later • SUSE LINUX Enterprise Server 15 SP5 or later <p>However, for SUSE LINUX Enterprise Server 15 SP5, multipath_component_detection might not work.</p> <p>Meet the condition of applying the package in Notes on installing HDLM in a boot disk environment.</p>
4	<p>Settings for LVM2</p> <p>When using an HDLM device to create a new logical volume</p> <p>Step 3.</p>	Before	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later: <p>For Red Hat Enterprise Linux 8.8 or later, set the value of multipath_component_detection to 0. For details, see Notes on using LVM2(on page 254) .</p>
		After	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later: <p>For Red Hat Enterprise Linux 8.8 or later, or SUSE LINUX Enterprise Server 15 SP5 or later, set the value of multipath_component_detection to 0. For details, see Notes on using LVM2(on page 254) .</p>
5	<p>Settings for LVM2</p> <p>When moving a logical volume created on a SCSI device in a single-path environment to an HDLM device</p> <p>Step 7.</p>	Before	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later: <p>For Red Hat Enterprise Linux 8.8 or later, set the value of multipath_component_detection to 0. For details, see Notes on using LVM2(on page 254) .</p>
		After	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle

			<p>Unbreakable Enterprise Kernel 8 or SUSE LINUX Enterprise Server 15 SP2 or later:</p> <p>For Red Hat Enterprise Linux 8.8 or later, or SUSE LINUX Enterprise Server 15 SP5 or later, set the value of <code>ofmultipath_component_detection</code> to 0. For details, see Notes on using LVM2(on page 254) .</p>
6	<p>Canceling the settings for HDLM</p> <p>Canceling the settings for LVM2</p> <p>Step 6.</p>	Before	Note that, in Red Hat Enterprise Linux 8.8 or later, if the value of <code>ofmultipath_component_detection</code> is set to 1, physical volumes are excluded during activation of the volume group in a multipath configuration. As a result, the volume group might not be successfully activated.
		After	Note that, in Red Hat Enterprise Linux 8.8 or later, or SUSE LINUX Enterprise Server 15 SP5 or later, if the value of <code>ofmultipath_component_detection</code> is set to 1, physical volumes are excluded during activation of the volume group in a multipath configuration. As a result, the volume group might not be successfully activated.
7	<p>Appendix C: Manually setting a boot disk</p> <p>Settings for a multipath boot disk environment</p> <p>Step 4.</p>	Before	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later: <p>For Red Hat Enterprise Linux 8.8 or later, set the value of <code>multipath_component_detection</code> to 0. For details, see Notes on using LVM2(on page 254).</p>
		After	<ul style="list-style-type: none"> • For Red Hat Enterprise Linux 8, Oracle Linux 8 or SUSE LINUX Enterprise Server 15 SP2 or later: <p>For Red Hat Enterprise Linux 8.8 or later, or SUSE LINUX Enterprise Server 15 SP5 or later, set the value of <code>multipath_component_detection</code> to 0. For details, see Notes on using LVM2(on page 254).</p>
8	Notes on installing HDLM in a boot disk environment	Addition	<ul style="list-style-type: none"> • For SUSE LINUX Enterprise Server 15 SP5, the following RPM package must be applied: • <code>systemd-249.17-150400.8.40.1.x86_64.rpm</code> or later

Appendix A

HBA Driver Support Matrix

Fibre Channel I/F adapters

Use the Fibre Channel I/F adapters listed in the following table. When using two or more adapters, use the same type of adapter. If you combine different types of HBA, HDLM may not be able to switch a path when an error occurs.

QLogic¹

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.03.01.05.06.0-k ^{3,4}
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.03.01.05.06.0-k ^{3,4}
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	8.03.07.03.06.1-k ^{3,4} 8.03.07.13.06.0-k
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	8.03.07.03.06.1-k ^{3,4} 8.03.07.13.06.0-k
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	8.03.07.05.06.2-k ^{3,4} 8.03.07.13.06.0-k 8.04.00.06.06.0-k 8.06.00.10.06.0-k
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	8.03.07.05.06.2-k ^{3,4} 8.03.07.13.06.0-k 8.04.00.06.06.0-k 8.06.00.10.06.0-k
Red Hat Enterprise Linux 6.3 (IA32)	2.6.32-279.el6.i686	8.04.00.04.06.3-k ^{3,4} 8.05.00.03.06.0-k 8.06.00.10.06.0-k
Red Hat Enterprise Linux 6.3 (EM64T/AMD64)	2.6.32-279.el6.x86_64	8.04.00.04.06.3-k ^{3,4} 8.05.00.03.06.0-k 8.06.00.10.06.0-k
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	8.04.00.08.06.4-k ^{3,4}

		8.05.00.03.06.0-k 8.06.00.10.06.0-k 8.07.00.08.06.0-k
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	8.04.00.08.06.4-k ^{3,4} 8.05.00.03.06.0-k 8.06.00.10.06.0-k 8.07.00.08.06.0-k
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.05.00.03.06.5-k ^{2,3,4} 8.07.00.08.06.0-k
Red Hat Enterprise Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	8.05.00.03.06.5-k ^{2,3,4} 8.07.00.08.06.0-k
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	8.07.00.08.06.6-k ^{1,3,4}
Red Hat Enterprise Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	8.07.00.08.06.6-k ^{1,3,4}
Red Hat Enterprise Linux 6.7 (IA32)	2.6.32-573.el6.i686 2.6.32-573.53.1.el6.i686	8.07.00.16.06.7-k ^{3,4}
Red Hat Enterprise Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64 2.6.32-573.53.1.el6.x86_64	8.07.00.16.06.7-k ^{3,4}
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	8.07.00.26.06.8-k ^{3,4}
Red Hat Enterprise Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
Red Hat Enterprise Linux 6.9 (IA32)	2.6.32-696.el6.i686 2.6.32-696.23.1.el6.i686	8.07.00.26.06.8-k ^{3,4}
Red Hat Enterprise Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64 2.6.32-696.23.1.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
		8.07.00.50.06.0-k ^{4,4}
		8.08.00.07.06.0-k ^{1,4}
Red Hat Enterprise Linux 6.10 (IA32)	2.6.32-754.el6.i686	8.07.00.26.06.8-k ^{3,4}

Red Hat Enterprise Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.06.00.08.07.0-k ^{2,3,4}
		8.06.00.08.07.0-k ^{3,4,10}
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	8.07.00.08.07.1-k ^{2,3,4}
		8.07.00.39.07.0-k
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	8.07.00.18.07.2-k ^{3,4}
	3.10.0-327.64.4.el7.x86_64	8.07.00.39.07.0-k
Red Hat Enterprise Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64	8.07.00.33.07.3-k ^{1,3,4}
	3.10.0-514.44.1.el7.x86_64	8.07.00.39.07.0-k
		8.07.00.50.07.0-k ⁴
Red Hat Enterprise Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64	8.07.00.38.07.4-k ^{1,3,4}
	3.10.0-693.21.1.el7.x86_64	8.07.00.50.07.0-k ⁴
		8.08.00.07.07.0-k ^{1,4}
Red Hat Enterprise Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	8.08.00.07.07.5-k ^{1,4}
		8.08.00.08.07.5-k20a ⁴
		9.00.00.00.07.5-k ^{1,3,4}
Red Hat Enterprise Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	10.00.00.06.07.6-k ^{3,4}
		10.01.00.33.07.6-k ²
		10.01.00.52.07.6-k ¹
		10.01.00.64.07.6-k1a ⁴
Red Hat Enterprise Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	10.00.00.12.07.7-k ^{3,4}
		10.01.00.64.07.6-k1a ^{4,11}
Red Hat Enterprise Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	10.01.00.20.07.8-k ^{3,4}
		10.01.00.64.07.6-k1a ^{4,11}
		10.02.01.00.a14-k ^{1,4,11}

Red Hat Enterprise Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	10.01.00.22.07.9-k ^{3,4} 10.02.01.00.a14-k1 ^{4,11}
Red Hat Enterprise Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	10.01.00.64.08.0-k1 ^{4,11}
Red Hat Enterprise Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	10.01.00.21.08.2-k ^{3,4} 10.01.00.64.08.0-k1 ^{4,11} 10.02.01.00.a14-k1 ^{4,11}
Red Hat Enterprise Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	10.01.00.25.08.3-k ^{3,4} 10.02.01.00.a14-k1 ^{4,11}
Red Hat Enterprise Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	10.02.00.104-k ^{3,4} 10.02.01.01.a2-k1 ^{4,11}
Red Hat Enterprise Linux 8.6 (EM64T/AMD64)	4.18.0-372.9.1.el8.x86_64	10.02.06.200-k ^{3,4} 10.02.07.01-k1 ^{3,4}
Red Hat Enterprise Linux 8.8 (EM64T/AMD64)	4.18.0-477.10.1.el8_8.x86_64	10.02.07.900-k ^{3,4}
Red Hat Enterprise Linux 9.1 (EM64T/AMD64)	5.14.0-162.6.1.el9_1.x86_64	10.02.07.400-k ^{3,4}
Red Hat Enterprise Linux 9.2 (EM64T/AMD64)	5.14.0-284.11.1.el9_2.x86_64	10.02.07.900-k ^{3,4}
SUSE LINUX Enterprise Server 12 (EM64T/AMD64)	3.12.28-4-default	8.07.00.08.12.0-k ^{3,4}
	3.12.28-4-xen	8.07.00.08.12.0-k ^{3,4}
	3.12.59-60.45-default	8.07.00.18-k ^{3,4}
	3.12.74-60.64.40-default	8.07.00.18-k ^{3,4}
	3.12.59-60.45-xen	8.07.00.18-k ^{3,4}
	3.12.74-60.64.40-xen	8.07.00.18-k ^{3,4}
	4.4.21-69-default	8.07.00.33-k ^{3,4}
	4.4.103-6.33-default	9.00.00.00-k ^{3,4}

	4.4.114-94.14-default	9.00.00.00-k ^{3,4}
	4.12.14-94.41-default	10.00.00.11-k ^{3,4}
	4.12.14-120-default	10.01.00.18-k ^{3,4}
SUSE LINUX Enterprise Server 15 (EM64T/AMD64)	4.12.14-23-default	10.00.00.06-k ^{3,4}
	4.12.14-195-default	10.00.00.13-k ^{3,4}
	5.3.18-22-default	10.01.00.25-k ^{3,4}
	5.3.18-59.40-default	10.02.07.100-k ^{3,4}
	5.14.21-150500.53-default	10.02.07.900-k ^{3,4}
Oracle Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.05.00.03.06.5-k2 ^{3,4}
Oracle Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64	8.05.00.03.06.5-k2 ^{3,4}
Oracle Linux 6.6 (IA32)	2.6.32-504.el6.i686	8.07.00.08.06.6-k1 ^{3,4}
Oracle Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64	8.07.00.08.06.6-k1 ^{3,4}
Oracle Linux 6.7 (IA32)	2.6.32-573.el6.i686	8.07.00.16.06.7-k ^{3,4}
Oracle Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64	8.07.00.16.06.7-k ^{3,4}
Oracle Linux 6.8 (IA32)	2.6.32-642.el6.i686	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 6.9 (IA32)	2.6.32-696.el6.i686	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 6.10 (IA32)	2.6.32-754.el6.i686	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	8.07.00.26.06.8-k ^{3,4}
Oracle Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.06.00.08.07.0-k ^{3,4}
Oracle Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	8.07.00.08.07.1-k2 ^{3,4}
Oracle Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	8.07.00.18.07.2-k ^{3,4}
Oracle Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64	8.07.00.33.07.3-k1 ^{3,4}

Oracle Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.11.6.el7.x86_64	8.07.00.38.07.4-k ^{3,4}
Oracle Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	9.00.00.00.07.5-k ^{3,4}
Oracle Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	10.00.00.06.07.6-k ^{3,4}
Oracle Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	10.00.00.12.07.7-k ^{3,4}
Oracle Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	10.01.00.20.07.8-k ^{3,4}
Oracle Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	10.01.00.22.07.9-k ^{3,4}
Oracle Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	10.01.00.21.08.2-k ^{3,4}
Oracle Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	10.01.00.25.08.3-k ^{3,4}
Oracle Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	10.02.00.104-k ^{3,4}
Oracle Linux 8.6 (EM64T/AMD64)	4.18.0-372.9.1.el8.x86_64	10.02.06.200-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.686	8.04.00.03.39.0-k ^{3,4}
	2.6.39-200.29.2.el6uek.686	8.04.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64	8.04.00.03.39.0-k ^{3,4}
	2.6.39-200.29.2.el6uek.x86_64	8.04.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.686	8.04.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	8.04.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.686	8.05.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.4 (EM64T/AMD64)	2.6.39-400.211.1.el6uek.x86_64	8.05.00.03.39.0-k ^{3,4}
	2.6.39-400.264.1.el6uek.x86_64	
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.686	8.05.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64	8.05.00.03.39.0-k ^{3,4}

Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-44.el6uek.x86_64	8.07.00.08.39.0-k1 ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.6 (IA32)	2.6.39-400.215.10.el6uek.686	8.05.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	8.07.00.08.39.0-k1 ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-68.el6uek.x86_64 3.8.13-68.1.3.el6uek.x86_64	8.07.00.16.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.7 (IA32)	2.6.39-400.250.7.el6uek.686	8.05.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)	3.8.13-68.3.4.el6uek.x86_64	8.07.00.16.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.8 (IA32)	2.6.39-400.278.2.el6uek.686	8.05.00.03.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)	4.1.12-37.4.1.el6uek.x86_64	8.07.00.33.40.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.9 (EM64T/AMD64)	4.1.12-61.1.28.el6uek.x86_64 4.1.12-94.2.1.el6uek.x86_64	8.07.00.38.40.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)	4.1.12-124.16.4.el6uek.x86_64	9.00.00.00.40.0-k1 ^{3,4}
	4.1.12-124.45.6.el6uek.x86_64	9.00.00.00.42.0-k1-v3 ^{3,4}
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	8.07.00.08.39.0-k1 ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-55.1.6.el7uek.x86_64 3.8.13-68.el7uek.x86_64 3.8.13-68.2.2.el7uek.x86_64	8.07.00.16.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.2 (EM64T/AMD64)	3.8.13-98.7.1.el7uek.x86_64	8.07.00.18.39.0-k ^{3,4}
	3.8.13-118.10.2.el7uek.x86_64	8.07.00.26.39.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.3 (EM64T/AMD64)	4.1.12-61.1.18.el7uek.x86_64 4.1.12-61.1.28.el7uek.x86_64	8.07.00.38.40.0-k ^{3,4}

Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64)	4.1.12-94.3.9.el7uek.x86_64	8.07.00.38.40.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.5 (EM64T/AMD64)	4.1.12-112.16.4.el7uek.x86_64 4.1.12-124.16.4.el7uek.x86_64 4.1.12-124.30.1.el7uek.x86_64	9.00.00.00.40.0-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.6 (EM64T/AMD64)	4.14.35-1818.3.3.el7uek.x86_64	10.00.00.07-k1 ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64)	4.14.35-1902.3.2.el7uek.x86_64	10.00.00.13-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.8 (EM64T/AMD64)	4.14.35-1902.300.11.el7uek.x86_64 4.14.35-1902.301.1.el7uek.x86_64	10.00.00.13-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)	5.4.17-2011.6.2.el7uek.x86_64	10.01.00.25-k ^{3,4} 10.02.00.103-k ^{3,4,12} 10.02.00.106-k ^{3,4,13}
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64)	5.4.17-2011.5.3.el8uek.x86_64	10.01.00.25-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64)	5.4.17-2011.7.4.el8uek.x86_64	10.01.00.25-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)	5.4.17-2102.201.3.el8uek.x86_64	10.02.00.103-k ^{3,4}
Oracle Unbreakable Enterprise Kernel 8.6 (EM64T/AMD64)	5.4.17-2136.307.3.1.el8uek.x86_64	10.02.00.106-k ^{3,4}

Notes:

1. Do not use the HBA driver failover function.

Check the setting for the failover function as follows:

For Red Hat Enterprise Linux 6 - 6.10, 7 - 7.9, 8.1 - 8.4, and 8.6, Oracle Linux 6.5 - 6.10, 7-7.9, 8.2, and 8.4, Oracle Unbreakable Enterprise Kernel 6.2 - 6.10, 7 - 7.9, 8.2 - 8.4:

- a. Run the following command to check the version of the driver:
cat /sys/class/scsi_host/hostn/driver_version
n: the instance number of the HBA port
- b. Check the output result to see whether the characters "fo" are added to the version notation.
- When the failover function is enabled:

8.01.07-k1-fo

- When the failover function is disabled:

8.01.07-k1

- The drivers mentioned on the " Hitachi Vantara - HBA Approved Software" page on the QLogic website are supported. Get the drivers from the following URL:
http://support.qlogic.com/support/oem_detail_hds.asp?oemid=84&classid=237
This URL may change without notice. When the URL changes, look for the " Hitachi Vantara - HBA Approved Software" page on the QLogic website.
- Use the driver bundled with the kernel.
- Using an HDLM device as the boot disk is supported.
- HDLM also supports the environments in which 32-bit kernel packages are installed on a system using an AMD Opteron processor.
- Because the failover function is Enable by default, change it to Disable. For changing the setting of the failover function to Disable, set the following in /etc/modprobe.conf file.
Example: When the driver version is 8.01.01.
`options qla2xxx ql2xfailover=0`
Refer to the HBA attachment document for details on changing the failover function setting.
- EM64T indicates the environments in which 64-bit kernel packages are installed on a system using an Intel EM64T processor.
- AMD64 indicates the environments in which 64-bit kernel packages are installed on a system using an AMD Opteron processor.
- Supported by Kernel 2.6.32.24-0.2.1 or later.
- Supported by Kernel 3.10.0-123.13.2 or later.
- HP HBA drivers are supported.
- Supported by Kernel 5.4.17-2102.201.3 or later.
- Supported by Kernel 5.4.17-2136.311.6.1 or later.

Emulex

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.3.5.17 ^{2,3}
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.3.5.17 ^{2,3}
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	8.3.5.30.1p ^{2,3}
Red Hat Enterprise Linux 6.1	2.6.32-131.0.15.el6.x86_64	8.3.5.30.1p ^{2,3}

(EM64T/AMD64)		8.3.7.18-1
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	8.3.5.45.4p ^{2,3}
Red Hat Enterprise Linux 6.2(EM64T/AMD64)	2.6.32-220.el6.x86_64	8.3.5.45.4p ^{2,3} 8.3.7.18-1
Red Hat Enterprise Linux 6.3 (IA32)	2.6.32-279.el6.i686	8.3.5.68.5p ^{2,3}
Red Hat Enterprise Linux 6.3(EM64T/AMD64)	2.6.32-279.el6.x86_64	8.3.5.68.5p ^{2,3} 8.3.7.18-1
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	8.3.5.86.1p ^{2,3}
Red Hat Enterprise Linux 6.4(EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	8.3.5.86.1p ^{2,3} 8.3.7.18-1 ³
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.3.7.21.4p ^{2,3}
Red Hat Enterprise Linux 6.5(EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	8.3.7.21.4p ^{2,3} 8.3.7.39 10.2.340.16 10.6.144.21 ³ 11.0.240.0
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	10.2.802.1 ^{2,3} 10.2.469.0
Red Hat Enterprise Linux 6.6(EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	10.2.802.1 ^{2,3} 10.2.469.0 10.6.144.21 ³
Red Hat Enterprise Linux 6.7 (IA32)	2.6.32-573.el6.i686 2.6.32-573.53.1.el6.i686	10.6.0.20 ^{2,3}
Red Hat Enterprise Linux 6.7(EM64T/AMD64)	2.6.32-573.el6.x86_64 2.6.32-573.53.1.el6.x86_64	10.6.0.20 ^{2,3} 10.6.144.21 ³ 11.1.38.64 11.1.172.22 ³
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	11.0.0.4 ^{2,3}

Red Hat Enterprise Linux 6.8(EM64T/AMD64)	2.6.32-642.el6.x86_64	11.0.0.4 ^{2,3}
Red Hat Enterprise Linux 6.9 (IA32)	2.6.32-696.el6.i686 2.6.32-696.21.1.el6.i686	11.0.0.5 ^{2,3}
Red Hat Enterprise Linux 6.9(EM64T/AMD64)	2.6.32-696.el6.x86_64 2.6.32-696.21.1.el6.x86_64	11.0.0.5 ^{2,3} 11.2.156.18 ³ 11.2.307.13 ^{3,6} 11.4.142.26
Red Hat Enterprise Linux 6.10 (IA32)	2.6.32-754.el6.i686	11.0.1.6 ^{2,3}
Red Hat Enterprise Linux 6.10(EM64T/AMD64)	2.6.32-754.el6.x86_64	11.0.1.6 ^{2,3}
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	10.2.340.16 8.3.7.31.1p ^{2,3}
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	10.2.8021.1 ^{2,3} 10.16.193.12 ³ 11.1.172.22 ³
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64 3.10.0-327.64.1.el7.x86_64	10.7.0.1 ^{2,3} 10.16.193.21 ³ 11.1.172.22 ³
Red Hat Enterprise Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64 3.10.0-514.44.1.el7.x86_64	11.1.0.2 ^{2,3} 11.2.307.13 ^{3,6}
Red Hat Enterprise Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.21.1.el7.x86_64	11.2.0.6 ^{2,3} 11.2.307.13 ^{3,6} 11.4.334.26 ^{3,6}
Red Hat Enterprise Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	11.4.0.4 ^{2,3} 11.4.334.26 ^{3,6}
Red Hat Enterprise Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	12.0.0.5 ^{2,3} 12.0.346.15 ^{3,6} 12.0.384.0.4fts ³

		12.4.270.3 ^{3,6}
Red Hat Enterprise Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	12.0.0.10 ^{2,3} 12.4.270.3 ^{3,6}
Red Hat Enterprise Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	12.0.0.13 ^{2,3} 12.6.275.14 ^{3,6} 12.8.352.11 ^{3,6} 12.8.528.7 ^{3,6}
Red Hat Enterprise Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	12.0.0.13 ^{2,3} 12.8.352.11 ^{3,6} 12.8.528.7 ^{3,6} 14.0.639.18 ^{3,6,8}
Red Hat Enterprise Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	12.2.0.3 ^{2,3} 12.6.275.14 ^{3,6}
Red Hat Enterprise Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	12.6.0.2 ^{2,3} 12.6.275.14 ^{3,6} 12.8.352.11 ^{3,6} 14.0.639.18 ^{3,6,9}
Red Hat Enterprise Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	12.8.0.1 ^{2,3} 12.8.352.11 ^{3,6} 12.8.528.7 ^{3,6} 14.0.639.18 ^{3,6}
Red Hat Enterprise Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	12.8.0.5 ^{2,3} 12.8.528.7 ^{3,6} 14.0.639.18 ^{3,6}
Red Hat Enterprise Linux 8.6 (EM64T/AMD64)	4.18.0-372.9.1.el8.x86_64	14.0.0.4 ^{2,3} 14.0.499.31 ^{2,3}
Red Hat Enterprise Linux 8.8 (EM64T/AMD64)	4.18.0-477.10.1.el8_8.x86_64	14.0.0.18 ^{2,3}
Red Hat Enterprise Linux 9.1	5.14.0-162.6.1.el9_1.x86_64	14.2.0.5 ^{2,3}

(EM64T/AMD64)		
Red Hat Enterprise Linux 9.2 (EM64T/AMD64)	5.14.0-284.11.1.el9_2.x86_64	14.2.0.8 ^{2,3}
SUSE LINUX Enterprise Server 12 (EM64T/AMD64)	3.12.28-4-default	10.2.8040.1 ²
	3.12.28-4-xen	10.2.8040.1 ²
	3.12.59-60.45-default	10.5.0.2 ^{2,3} 11.2.216.8 ³
	3.12.59-60.45-xen	10.5.0.2 ^{2,3} 11.2.216.8 ³
	3.12.74-60.64.40-default	10.5.0.2 ^{2,3} 11.2.216.8 ³
	3.12.74-60.64.40-xen	10.5.0.2 ^{2,3} 11.2.216.8 ³
	4.4.21-69-default	11.1.0.1 ^{2,3}
	4.4.103-6.33-default	11.4.0.5 ^{2,3}
	4.4.114-94.14-default	11.4.0.5 ^{2,3}
	4.12.14-94.41-default	12.0.0.6 ^{2,3}
4.12.14-120-default	12.4.0.0 ^{2,3}	
SUSE LINUX Enterprise Server 15 (EM64T/AMD64)	4.12.14-23-default	12.0.0.1 ^{2,3}
	4.12.14-195-default	12.2.0.0 ^{2,3}
	5.3.18-22-default	12.8.0.0 ^{2,3}
	5.3.18-59.40-default	14.0.0.3 ^{2,3}
	5.14.21-150500.53-default	14.2.0.9 ^{2,3}
Oracle Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.3.7.21.4p ^{2,3}
Oracle Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64	8.3.7.21.4p ^{2,3}
Oracle Linux 6.6 (IA32)	2.6.32-504.el6.i686	10.2.802.1 ^{2,3}

Oracle Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64	10.2.802.1 ^{2,3}
Oracle Linux 6.7 (IA32)	2.6.32-573.el6.i686	10.6.0.20 ^{2,3}
Oracle Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64	10.6.0.20 ^{2,3}
Oracle Linux 6.8 (IA32)	2.6.32-642.el6.i686	11.0.0.4 ^{2,3}
Oracle Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	11.0.0.4 ^{2,3}
Oracle Linux 6.9 (IA32)	2.6.32-696.el6.i686	11.0.0.5 ^{2,3}
Oracle Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64	11.0.0.5 ^{2,3}
Oracle Linux 6.10 (IA32)	2.6.32-754.el6.i686	11.0.1.6 ^{2,3}
Oracle Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	11.0.1.6 ^{2,3}
Oracle Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.3.7.34.3p ^{2,3}
Oracle Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	10.2.8021.1 ^{2,3}
Oracle Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	10.7.0.1 ^{2,3}
Oracle Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64	11.1.0.2 ^{2,3}
Oracle Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.11.6.el7.x86_64	11.2.0.6 ^{2,3}
Oracle Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	11.4.0.4 ^{2,3}
Oracle Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	12.0.0.5 ^{2,3}
Oracle Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	12.0.0.10 ^{2,3}
Oracle Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	12.0.0.13 ^{2,3}
Oracle Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	12.0.0.13 ^{2,3}
Oracle Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	12.2.0.3 ^{2,3}
Oracle Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	12.6.0.2 ^{2,3}
Oracle Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	12.8.0.1 ^{2,3}
Oracle Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	12.8.0.5 ^{2,3}

Oracle Linux 8.6 (EM64T/AMD64)	4.18.0-372.9.1.el8.x86_64	14.0.0.4 ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.i686	8.3.5.68.6p ^{2,3}
	2.6.39-200.29.2.el6uek.i686	8.3.5.68.6p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64	8.3.5.68.6p ^{2,3}
	2.6.39-200.29.2.el6uek.x86_64	8.3.5.68.6p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.i686	8.3.5.68.6p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	8.3.5.68.6p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.i686	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.4 (EM64T/AMD64)	2.6.39-400.211.1.el6uek.x86_64 2.6.39-400.264.1.el6uek.x86_64	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.i686	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64	8.3.7.26.2p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-44.el6uek.x86_64	8.3.7.34.4p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.6 (IA32)	2.6.39-400.215.10.el6uek.i686	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	8.3.7.34.4p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-68.el6uek.x86_64 3.8.13-68.2.2.el6uek.x86_64	10.6.61.0 ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.7 (IA32)	2.6.39-400.250.7.el6uek.i686	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)	3.8.13-68.3.4.el6uek.x86_64	10.6.61.0 ^{2,3}

Oracle Unbreakable Enterprise Kernel 6.8 (IA32)	2.6.39-400.278.2.el6uek.i686	8.3.7.26.3p ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)	4.1.12-37.4.1.el6uek.x86_64	11.0.0.13 ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.9 (EM64T/AMD64)	4.1.12-61.1.28.el6uek.x86_64	11.1.0.4 ^{2,3}
	4.1.12-94.2.1.el6uek.x86_64	11.2.0.5 ^{2,3}
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)	4.1.12-124.16.4.el6uek.x86_64	11.4.0.7 ^{2,3}
	4.1.12-124.45.6.el6uek.x86_64	11.4.0.8 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	8.3.7.34.4p ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-55.1.6.el7uek.x86_64	10.2.8061.0 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-68.el7uek.x86_64	10.6.61.0 ^{2,3}
	3.8.13-68.2.2.el7uek.x86_64	
Oracle Unbreakable Enterprise Kernel 7.2 (EM64T/AMD64)	3.8.13-98.7.1.el7uek.x86_64	10.6.61.0 ^{2,3}
	3.8.13-118.10.2.el7uek.x86_64	11.0.0.1 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.3 (EM64T/AMD64)	4.1.12-61.1.18.el7uek.x86_64	11.1.0.4 ^{2,3}
	4.1.12-61.1.28.el7uek.x86_64	
Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64)	4.1.12-94.3.9.el7uek.x86_64	11.2.0.5 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.5 (EM64T/AMD64)	4.1.12-112.16.4.el7uek.x86_64	11.2.0.5 ^{2,3}
	4.1.12-124.16.4.el7uek.x86_64	
	4.1.12-124.30.1.el7uek.x86_64	
Oracle Unbreakable Enterprise Kernel 7.6 (EM64T/AMD64)	4.14.35-1818.3.3.el7uek.x86_64	12.0.0.5 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64)	4.14.35-1902.3.2.el7uek.x86_64	12.0.0.10 ^{2,3}
Oracle Unbreakable Enterprise Kernel 7.8 (EM64T/AMD64)	4.14.35-1902.300.11.el7uek.x86_64	12.0.0.13 ^{2,3}
	4.14.35-1902.301.1.el7uek.x86_64	

Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)	5.4.17-2011.6.2.el7uek.x86_64	12.6.0.3 ^{2,3}
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64)	5.4.17-2011.5.3.el8uek.x86_64	12.6.0.3 ^{2,3}
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64)	5.4.17-2011.7.4.el8uek.x86_64	12.6.0.3 ^{2,3}
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)	5.4.17-2102.201.3.el8uek.x86_64	12.8.0.5 ^{2,3}
Oracle Unbreakable Enterprise Kernel 8.6 (EM64T/AMD64)	5.4.17-2102.310.7.el8uek.x86_64	12.8.0.11 ^{2,3}

Notes:

1. AMD64 indicates the environments in which 64-bit kernel packages are installed on a system using an AMD Opteron processor.
2. Use the driver bundled with the kernel.
3. Using an HDLM device as the boot disk is supported.
4. HDLM also supports the environments in which 32-bit kernel packages are installed on a system using an AMD Opteron processor.
5. EM64T indicates the environments in which 64-bit kernel packages are installed on a system using an Intel EM64T processor.
6. HP HBA drivers are supported.
7. Supported by Kernel 2.6.32.36-0.5.2 or later.
8. Supported by Kernel 3.10.0-1160.92.1 or later.
9. Supported by Kernel 4.18.0-193.95.1 or later.

Hitachi

Hitachi HBA supports the environment combined with Hitachi Compute Blade only.

All drivers applied to Hitachi HBA cards for Hitachi Compute Blade are supported.

IBM

OS	Kernel	Driver
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	8.3.7.29-1

	2.6.32-352.18.1.el6.i686	
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64	8.3.7.29-1

Notes:

1. QLogic HBA drivers are supported.
2. HDLM also supports the environments in which 32-bit kernel packages are installed on a system using an AMD Opteron processor.
3. Because the failover function is Enable by default, change it to Disable. For changing the setting of the failover function to Disable, set the following in /etc/modprobe.conf file.
Example: When the driver version is 8.01.01.
`options qla2xxx ql2xfailover=0`
Refer to the HBA attachment document for details on changing the failover function setting.
4. The drivers mentioned in the "Hitachi Vantara - HBA Approved Software" page on the QLogic website are supported. Get the drivers from the following URL:
http://support.qlogic.com/support/oem_detail_hds.asp?oemid=84&classid=237
This URL may change without notice. When the URL changes, look for the "Hitachi Vantara - HBA Approved Software" page on the QLogic website.
5. Emulex HBA drivers are supported.
6. The supported combination of IBM model and Bus I/F are shown below.
44X1945
7. Using an HDLM device as the boot disk is supported.

HP

Brocade

Cisco

Fibre Channel over Ethernet adapters

iSCSI connections

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