

# Hitachi Dynamic Link Manager (for Linux®) 8.8.1-02 Release Notes

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## About this document

This document (RN-00HS284-90, February 2022) provides late-breaking information about Hitachi Dynamic Link Manager (for Linux) v8.8.1-02. 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).

## Getting help

Hitachi Vantara Support Connect is the destination for technical support of products and solutions sold by Hitachi Vantara. To contact technical support, log on to Hitachi Vantara Support Connect for contact information:

[https://support.hitachivantara.com/en\\_us/contact-us.html](https://support.hitachivantara.com/en_us/contact-us.html).

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

## Accessing product downloads

Product software, drivers, and firmware downloads are available on Hitachi Vantara Support Connect: <https://support.hitachivantara.com/>.

Log in and select Product Downloads to access the most current downloads, including important updates that may have been made after the release of the product.

## About this release

This release is a major release that adds new features and resolves multiple known problems.

## Product package contents

Medium	CD-ROM	Revision	Release Type
Software	Hitachi Dynamic Link Manager (for Linux)	8.8.1-02	Full Package

# New features and important enhancements

## 8.8.1-02 Additional Functions and Modifications

None.

## 8.8.1-00 Additional Functions and Modifications

- The following distribution is supported:

The following kernel version of Red Hat Enterprise Linux 8 for EM64T/AMD64:

- 4.18.0-305.el8.x86\_64

The following kernel version of Oracle Linux 8 for EM64T/AMD64:

- 4.18.0-305.el8.x86\_64

The following kernel version of Oracle Unbreakable Enterprise Kernel 8 for EM64T/AMD64:

- 5.4.17-2102.201.3.el8uek.x86\_64

- Hitachi Virtual Storage Platform 5200, 5200H, 5600, and 5600H are now supported.

- Hitachi Virtual Storage Platform E1090 and E1090H are now supported.

## System requirements

Refer to Chapter 3. Creating an HDLM environment of the Hitachi Dynamic Link Manager (for Linux®) User Guide.

### Host

For details on supported hosts, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Hosts and OSs supported by HDLM

Supported OSs in a HAM environment are as follows:

- Red Hat Enterprise Linux 6 (x86/x64)

## Host Bus Adapter (HBA)

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

## Storage

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Storage subsystems supported by HDLM

Requirements to use a HAM environment are as follows:

- HDLM supports the HAM functionality of the following storage system:
  - Hitachi Universal Storage Platform V/VM
  - Hitachi Virtual Storage Platform
  - HPE XP24000/XP20000
  - HPE P9500
  - Hitachi Unified Storage VM

The required microprogram versions are listed below:

Storage system	Interface	Microprogram version	Remark
Universal Storage Platform V/VM	FC I/F	60-06-05-XX/XX or later	X: voluntary number
Virtual Storage Platform	FC I/F	70-01-42-XX/XX or later*	X: voluntary number
XP24000/XP20000	FC I/F	60-06-05-XX/XX or later	X: voluntary number
P9500	FC I/F	70-01-42-XX/XX or later*	X: voluntary number
Hitachi Unified Storage VM	FC I/F	73-03-0X-XX/XX or later	X: voluntary number

\* If you use the HAM functionality with USP V or XP24000, apply 70-03-00-XX/XX or later.

## Virtualization

The virtualization to which HDLM can be applied is as follows:

Hitachi Virtualization Manager (Hitachi Compute Blade with Itanium 2 server modules)

Xen (Virtualization) in SUSE LINUX Enterprise Server 11 SP4, SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 12 SP1, SP2, SP3, SP4, SP5, SUSE LINUX Enterprise Server 15 and SUSE LINUX Enterprise Server 15 SP1, SP2

KVM (Virtualization) in Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 6.1, Red Hat Enterprise Linux 6.2, Red Hat Enterprise Linux 6.3, Red Hat Enterprise Linux 6.4, Red Hat Enterprise Linux 6.5, Red Hat Enterprise Linux 6.6, Red Hat Enterprise Linux 6.7, Red Hat Enterprise Linux 6.8, Red Hat Enterprise Linux 6.9, Red Hat Enterprise Linux 6.10, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 7.1, Red Hat Enterprise Linux 7.2, Red Hat Enterprise Linux 7.3, Red Hat Enterprise Linux 7.4, Red Hat Enterprise Linux 7.5, Red Hat Enterprise Linux 7.6, Red Hat Enterprise Linux 7.7, Red Hat Enterprise Linux 7.8, Red Hat Enterprise Linux 7.9 Red Hat Enterprise Linux 8.1, Red Hat Enterprise Linux 8.2, Red Hat Enterprise Linux 8.3, Red Hat Enterprise Linux 8.4, Oracle Linux 6.5, Oracle Linux 6.6, Oracle Linux 6.7, Oracle Linux 6.8, Oracle Linux 6.9, Oracle Linux 6.10, Oracle Linux 7, Oracle Linux 7.1, Oracle Linux 7.2, Oracle Linux 7.3, Oracle Linux 7.4, Oracle Linux 7.5, Oracle Linux 7.6, Oracle Linux 7.7, Oracle Linux 7.8, Oracle Linux 7.9, Oracle Linux 8.1, Oracle Linux 8.2, Oracle Linux 8.3, Oracle Linux 8.4, Oracle Unbreakable Enterprise Kernel 6.2, Oracle Unbreakable Enterprise Kernel 6.3, Oracle Unbreakable Enterprise Kernel 6.4, Oracle Unbreakable Enterprise Kernel 6.5, Oracle Unbreakable Enterprise Kernel 6.6, Oracle Unbreakable Enterprise Kernel 6.7, Oracle Unbreakable Enterprise Kernel 6.8, Oracle Unbreakable Enterprise Kernel 6.9, Oracle Unbreakable Enterprise Kernel 6.10, Oracle Unbreakable Enterprise Kernel 7, Oracle Unbreakable Enterprise Kernel 7.1, Oracle Unbreakable Enterprise Kernel 7.2, Oracle Unbreakable Enterprise Kernel 7.3, Oracle Unbreakable Enterprise Kernel 7.4, Oracle Unbreakable Enterprise Kernel 7.5, Oracle Unbreakable Enterprise Kernel 7.6, Oracle Unbreakable Enterprise Kernel 7.7, Oracle Unbreakable Enterprise Kernel 7.8, Oracle Unbreakable Enterprise Kernel 7.9, Oracle Unbreakable Enterprise Kernel 8.2, Oracle Unbreakable Enterprise Kernel 8.3, and Oracle Unbreakable Enterprise Kernel 8.4

## Operating systems requirements

For details on supported operating systems, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Hosts and OSs supported by HDLM

## Prerequisite programs

None.

## Related programs

For details on related programs, refer to the following manuals:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 11
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 12
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 15
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 8

## Memory and disk space requirements

For details on memory and disk space requirements, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Memory and disk capacity requirements

## HDLM supported configurations

For details on the condition that HDLM can manage space requirements, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Number of LUs and paths that are supported in HDLM

## Resolved problems

[8.8.1-02 Modifications]

	Corrected Problems	Applicable products	Applicable OS
1	<p>For HDLM for Linux running in an environment where a logical volume (LVM2) is used as a boot disk, one of the following symptoms might occur.</p> <p>- An attempt to create an initial RAM disk image file for HDLM fails, and the <code>dlmmkinitrd</code> utility outputs the following error message:</p> <p>KAPL12321-E An invalid root partition is specified in the file. File name = <code>/etc/fstab</code></p> <p>- An attempt to create an initial RAM disk image file for HDLM fails, and the <code>dracut</code> command outputs the following error message:</p> <p>KAPL12321-E An invalid root partition is specified in the file. File name = <code>/etc/fstab</code></p>	<p>HDLM for Linux 05-94 to 8.8.1-00</p>	<p>Red Hat Enterprise Linux 4</p> <p>Red Hat Enterprise Linux 5</p> <p>Red Hat Enterprise Linux 6</p> <p>Red Hat Enterprise Linux 7</p> <p>Red Hat Enterprise Linux 8</p> <p>Oracle EnterpriseLinux 4</p> <p>Oracle EnterpriseLinux 5</p> <p>Oracle Linux 6, Oracle Linux 7, Oracle Linux 8</p>

	<p>- An attempt to create an initial RAM disk image file for HDLM fails, and the dlmbootstart utility outputs the following error message:</p> <p>KAPL12321-E An invalid root partition is specified in the file. File name = /etc/fstab</p> <p>- During startup of the kdump service, an attempt to create an initial RAM disk image file for kdump fails. As a result, the kdump service cannot start and a kernel dump cannot be collected.</p> <p>When startup of the kdump service fails, the KAPL12321-E message is output to the status information.</p> <pre># systemctl status kdump.service kdump.service - Crash recovery kernel arming : mm dd hh:mm:ss HOSTNAME kdumpctl[ID]: KAPL12321-E An invalid root partition is specified in the file. File name = /etc/fstab : mm dd hh:mm:ss HOSTNAME systemd[ID]: kdump.service failed. #</pre>		<p>Oracle Unbreakable Enterprise Kernel 5</p> <p>Oracle Unbreakable Enterprise Kernel 6</p> <p>Oracle Unbreakable Enterprise Kernel 7</p> <p>Oracle Unbreakable Enterprise Kernel 8</p> <p>SUSE LINUX Enterprise Server 10</p> <p>SUSE LINUX Enterprise Server 11</p> <p>SUSE LINUX Enterprise Server 12</p> <p>SUSE LINUX Enterprise Server 15</p>
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[8.8.1-00 Modifications]

	Corrected Problems	Applicable products	Applicable OS
1	An incorrect audit event category is set for the KAPL15121-I or KAPL15122-W message, which is output to the audit log.	HDLM for Linux 8.0.1-00 to 8.8.0-00	Linux

# Known problems

- If you specify multiple arguments for the `-prsup` parameter by using the `dlnmsetopt` 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`).

Specify the correct argument (either `on` or `off`) for the `-prsup` parameter, and then re-execute the `dlnmsetopt` utility.

```
# /opt/DynamicLinkManager/bin/dlnmsetopt -prsup on off
```

```
KAPL12554-I The utility for setting HDLM driver option has started.
```

```
/opt/DynamicLinkManager/bin/dlnmsetopt: line 1156: [: too many arguments
```

```
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, execute 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 whose paths 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 executed) during intermittent error monitoring might increase even though the auto failback function did not recover all paths. In such a case, even though an intermittent error did not occur, HDLM often assumes an intermittent error, and excludes paths from the auto failback function. In such a 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 executing the "`rpm -V HDLM`" command, HDLM operations are not affected.

In Red Hat Enterprise Linux 6 (IA32),  
Red Hat Enterprise Linux 6.1 (IA32),  
Red Hat Enterprise Linux 6.2 (IA32),  
Red Hat Enterprise Linux 6.3 (IA32),  
Red Hat Enterprise Linux 6.4 (IA32),  
Red Hat Enterprise Linux 6.5 (IA32),  
Red Hat Enterprise Linux 6.6 (IA32),  
Red Hat Enterprise Linux 6.7 (IA32),  
Red Hat Enterprise Linux 6.8 (IA32),  
Red Hat Enterprise Linux 6.9 (IA32),  
Red Hat Enterprise Linux 6.10 (IA32),  
Oracle Linux 6.5 (IA32),  
Oracle Linux 6.6 (IA32),  
Oracle Linux 6.7 (IA32),  
Oracle Linux 6.8 (IA32),  
Oracle Linux 6.9 (IA32),  
Oracle Linux 6.10 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.2 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.3 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.4 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.5 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.6 (IA32),  
Oracle Unbreakable Enterprise Kernel 6.7 (IA32), and  
Oracle Unbreakable Enterprise Kernel 6.8 (IA32)  
missing `/etc/opt/DynamicLinkManager/dlmmgr_e.xml`

- Red Hat Enterprise Linux 6 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.1 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.2 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.3 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.4 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.5 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.6 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.7 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.8 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.9 (EM64T/AMD64),  
Red Hat Enterprise Linux 6.10 (EM64T/AMD64),  
Red Hat Enterprise Linux 7 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.1 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.2 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.3 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.4 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.5 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.6 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.7 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.8 (EM64T/AMD64),  
Red Hat Enterprise Linux 7.9 (EM64T/AMD64),  
Oracle Linux 6.5 (EM64T/AMD64),  
Oracle Linux 6.6 (EM64T/AMD64),  
Oracle Linux 6.7 (EM64T/AMD64),  
Oracle Linux 6.8 (EM64T/AMD64),  
Oracle Linux 6.9 (EM64T/AMD64),  
Oracle Linux 6.10 (EM64T/AMD64),  
Oracle Linux 7 (EM64T/AMD64),  
Oracle Linux 7.1 (EM64T/AMD64),  
Oracle Linux 7.2 (EM64T/AMD64),  
Oracle Linux 7.3 (EM64T/AMD64),  
Oracle Linux 7.4 (EM64T/AMD64),  
Oracle Linux 7.5 (EM64T/AMD64),  
Oracle Linux 7.6 (EM64T/AMD64),  
Oracle Linux 7.7 (EM64T/AMD64),  
Oracle Linux 7.8 (EM64T/AMD64),  
Oracle Linux 7.9 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.4 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64),

Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.9 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.2 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.3 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.5 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.6 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 7.8 (EM64T/AMD64), and  
Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)

```
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),  
Red Hat Enterprise Linux 8.2 (EM64T/AMD64),  
Red Hat Enterprise Linux 8.3 (EM64T/AMD64),  
Red Hat Enterprise Linux 8.4 (EM64T/AMD64),  
Oracle Linux 8.1 (EM64T/AMD64),  
Oracle Linux 8.2 (EM64T/AMD64),  
Oracle Linux 8.3 (EM64T/AMD64),  
Oracle Linux 8.4 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64),  
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64), and  
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)

```
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)
```

- SUSE LINUX Enterprise Server 11 (IA32)

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

- SUSE LINUX Enterprise Server 11 (EM64T/AMD64)

```
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 SUSE LINUX Enterprise Server 15 (EM64T/AMD64)

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

While installation and uninstallation of HDLM are performed, do not interrupt the processing (for example, do not press the **Ctrl+C** keys).

If the operation is performed with the following procedure, the status is returned to what it was before the refresh operation was executed. As a result, make sure to re-execute the refresh command after restarting the host and recovering from a path failure.

- a) The `dlmkmgr` command is used to perform a refresh.
- b) Path errors occur for some or all of the paths, and a path status becomes Offline(E).
- c) 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 for an HDLM management target.

If you want to execute 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 execute the utility:

- `dlmsetopt` utility
- `dlmmkinitrd` utility

Example for the execution:

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

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

```
zh_CN.gbk
#
```

e) **Change the setting of LANG to C (English).**

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

f) **Execute 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.
#
```

g) **According to the result of (a), return the setting of LANG to the original setting.**

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

## Closing known problems

- The following restriction has been lifted:
  - If logical volumes (LVM2) are used, volume group names must not include hyphens (-).

## Installation precautions

For Hitachi Dynamic Link Manager 6.5.0 and later, the HDLM installation media has been changed to a DVD-ROM. Also, the directory structure of the HDLM installation 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, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 2. HDLM functions - Performing failover and failback using path switching

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Hosts and OSs supported by HDLM
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 11
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 12
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 15
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Knowledge required before you install HDLM

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Notes on creating an HDLM environment
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Installing HDLM for managing boot disks - Notes on installing HDLM in a boot disk environment
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - The process-specific-trace information file - Notes on using the Hitachi Network Objectplaza Trace Library

## Updating installation of HDLM precautions

For details on updating HDLM, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Notes on creating an HDLM environment - Notes on installing HDLM

## Uninstallation precautions

For details on HDLM uninstallation, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Canceling the settings for HDLM - Removing HDLM

## System generation precautions

None.

## Usage precautions

For details on usage precautions when using HDLM, refer to the following manual:

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 2. HDLM Functions - Distributing a load using load balancing - Load balancing algorithms
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 2. HDLM functions - Performing failover and failback using path switching - Path status transition
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 2. HDLM functions - Cluster support
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 6

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Red Hat Enterprise Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 11
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 12
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using SUSE LINUX Enterprise Server 15
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 6
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 7
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Linux 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - HDLM system requirements - Related products when using Oracle Unbreakable Enterprise Kernel 8
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Settings for md Devices - Notes on Settings Up md Devices
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Settings for LVM2
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Settings for Oracle RAC
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Settings for the RHCM - Notes on using RHCM

- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Canceling the Settings for HDLM - Canceling the settings for LVM2
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 3. Creating an HDLM environment - Canceling the Settings for HDLM - Removing HDLM
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 4. HDLM operation - Notes on using HDLM
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 4. HDLM operation - HDLM operations using commands - Notes on using commands
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 4. HDLM operation - HDLM operations using commands - updating the license
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 4. HDLM operation - Starting and stopping the HDLM manager
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 4. HDLM operation - Reconfiguring the HDLM operating environment - Changing the HDLM device configuration
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 5. Troubleshooting - What to do for a path error – Placing the path online
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 6. Command reference - Overview of the HDLM command dlnkmgr
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 7. Utility reference - Overview of the utilities
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 7. Utility reference - DLMgetras utility for collecting HDLM error information - Parameters
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 7. Utility reference - dlmcfmgrp utility for managing the HDLM configuration - Parameters
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 7. Utility reference - dlmsetopt utility for setting HDLM driver options
- Hitachi Dynamic Link Manager (for Linux®) User Guide Chapter 8.Messages - Before viewing the list of messages - Components that output messages to syslog
- Hitachi Dynamic Link Manager (for Linux®) User Guide Notes on Linux commands and files
- Hitachi Dynamic Link Manager (for Linux®) User Guide Functional differences between versions of HDLM

## Additional Usage Precautions

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

To change to a status that does not display a hyphen, execute the dlmcfmgr utility with the -u parameter specified.

For details on the dlmcfmgr utility, see dlmcfmgr Utility for Managing the HDLM Configuration.

Settings of OS and other programs, which were changed at HDLM introduction, must be returned to the original settings after the uninstallation of HDLM.

Version numbers are displayed as follows after this version of HDLM is installed.

Function	Item	Version number
HDLM command (dlnkmgr)	HDLM Version	8.8.1-02
	HDLM Manager	8.8.1-02
	HDLM Alert Driver	8.8.1-02
	HDLM Driver	8.8.1-02

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

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

HDLM Version           : 8.8.1-02

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      8.8.1-02    yyyy/mm/dd hh:mm:ss

HDLM Alert Driver Ver      WakeupTime      ElogMem Size
Alive      8.8.1-02    yyyy/mm/dd hh:mm:ss      1000

HDLM Driver Ver      WakeupTime
Alive      8.8.1-02    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 Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 6.1, Red Hat Enterprise Linux 6.2, Red Hat Enterprise Linux 6.3, Red Hat Enterprise Linux 6.4, Red Hat Enterprise Linux 6.5, Red Hat Enterprise Linux 6.6, Red Hat Enterprise Linux 6.7, Red Hat Enterprise Linux 6.8, Red Hat Enterprise Linux 6.9, Red Hat Enterprise Linux 6.10, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 7.1, Red Hat Enterprise Linux 7.2, Red Hat Enterprise Linux 7.3, Red Hat Enterprise Linux 7.4, Red Hat Enterprise Linux 7.5, Red Hat Enterprise Linux 7.6, Red Hat Enterprise Linux 7.7, Red Hat Enterprise Linux 7.8, Red Hat Enterprise Linux 7.9, Oracle Linux 7, Oracle Linux 7.1, Oracle Linux 7.2, Oracle Linux 7.3, Oracle Linux 7.4, Oracle Linux 7.5, Oracle Linux 7.6, Oracle Linux 7.7, Oracle Linux 7.8, and Oracle Linux 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, the operation 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.

Execute the following command to check whether the HDLM manager is running:

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

```
HDLM Manager Ver      WakeupTime
Alive                 8.8.1-02 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, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Unbreakable Enterprise Kernel 6, Oracle Linux 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 7, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 11, SUSE LINUX Enterprise Server 12 and SUSE LINUX Enterprise Server 15:
  - If you execute 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 executing the `dlnmcfmgr` utility or the HDLM command `view` operation (specifying `-lu` or `-drv`).
  - If path information is deleted as described above, execute `dlnmcfmgr -r` after recovering the failed path, make sure the recovered path is discovered by HDLM, and then confirm that the path status has become 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 of it.
  - An online operation is performed on an owner path, a non-owner path's 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's status is Online. If the non-owner path's 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.
  - Execute 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 need to 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.
  - Execute the `dlnkmgr view -lu -item hastat` operation, and then confirm that `ha` is displayed in the HaStat column.
  - While the path health check provided by HDLM is enabled (on), if a HAM pair is released, the status of the paths (non-owner paths) connected to the RCU might become Offline(E) or Online(E). After creating (recovering) a HAM pair, return the status of the paths to Online by using the HDLM command `online` operation.
- 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)
    - Red Hat Enterprise Linux 6.4 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.5 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.6 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.7 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.8 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.9 (EM64T/AMD64)
    - Red Hat Enterprise Linux 6.10 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.9 (EM64T/AMD64)
    - Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)
    - SUSE LINUX Enterprise Server 11 SP4 (EM64T/AMD64)

- If you are using SLES 11 SP4 (IA32), do not specify the `inode64` option when mounting an XFS file system.
- If you are using btrfs file systems in SLES 11 SP4 (IA32), do not create more than 232 files in a single file system.
- 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) Execute `/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, execution of the `dlmchname` utility might take some time to finish.
  - In Red Hat Enterprise Linux 7, Oracle Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 7, Oracle Unbreakable Enterprise Kernel 8, SUSE LINUX Enterprise Server 12, or SUSE LINUX Enterprise Server 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:
    - a) Restart the host.
    - b) 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

## Documentation

### Available documents

Document name	Document number	Issue date
Hitachi Dynamic Link Manager (for Linux®) User Guide	MK-92DLM113-56	October 2021

### Documentation errata

Contents of corrections of the Hitachi Dynamic Link Manager Software User Guide for Linux(R):

No.	Location to be corrected	Corrections	
1	Installing HDLM for managing boot disks Settings for a multipath boot disk environment Step 4.	Before	<p>4. Execute the utility for creating an HDLM boot disk environment(dlmbootstart) to configure a boot disk environment that uses HDLM.</p> <pre># /opt/DynamicLinkManager/bin/dlmbootstart -set hdlm</pre> <p>Note</p> <p>Do not turn off the power of the host machine during execution of the dlmbootstart utility. Also, do not turn off the power of the host machine after the dlmbootstart utility is forced to stop.</p> <p>Note that if you turn off the power to the host machine, the OS might be unable to start. If you cannot start the OS, contact your HDLM vendor or maintenance company, and report the information that was collected by the DLMgetras utility.</p>
		After	<p>4. Execute the utility for creating an HDLM boot disk environment(dlmbootstart) to configure a boot disk environment that uses HDLM.</p> <p>- For Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p>

			<p>Make sure that 0 is not set for <code>allow_changes_with_duplicate_pvs</code> in the <code>/etc/lvm/lvm.conf</code> file, and then execute the utility for creating an HDLM boot disk environment (<code>dlmbootstart</code>). If 0 is set for <code>allow_changes_with_duplicate_pvs</code>, change the value to 1. Comment out the <code>allow_changes_with_duplicate_pvs</code> line, and then add the underlined part as follows.</p> <pre># /opt/DynamicLinkManager/bin/dlmbootstart -set hdlm</pre> <p>Note</p> <p>Do not turn off the power of the host machine during execution of the <code>dlmbootstart</code> utility. Also, do not turn off the power of the host machine after the <code>dlmbootstart</code> utility is forced to stop.</p> <p>Note that if you turn off the power to the host machine, the OS might be unable to start. If you cannot start the OS, contact your HDLM vendor or maintenance company, and report the information that was collected by the <code>DLMgetras</code> utility.</p>
2	<p>Canceling the settings for HDLM</p> <p>Canceling the settings for LVM2</p> <p>Step 6.</p>	Before	<p>6. Edit the <code>/etc/lvm/lvm.conf</code> file.</p> <pre>:</pre> <p>- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p> <p>If 1 is set for <code>allow_changes_with_duplicate_pvs</code>, change the value to 0.</p> <p>If you want to use <code>use_lvmetad=0</code> for operation, specify <code>filter</code>, not <code>global_filter</code>.</p> <p>Before:</p> <pre># This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a/*" ] filter = [ "a sddl[a-p][a-p].* ", "r /dev/sd " ] : # write_cache_state = 1 write_cache_state = 0 :</pre>

		<pre> # types = [ "fd", 16 ] types = [ "sddlmfdrv", 16 ] : # md_component_detection = 1 md_component_detection=0 After: # This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a./" ] # filter = [ "a sddlm[a-p][a-p].*", "r /dev/sd " ] filter = [ "r sddlm[a-p][a-p].*", "a /dev/sd " ] : write_cache_state = 1 # write_cache_state = 0 : # types = [ "fd", 16 ] # types = [ "sddlmfdrv", 16 ] : md_component_detection = 1 # md_component_detection=0 : : } Comment out the existing filter and types lines, and then add the underlined parts.  Return md_component_detection and write_cache_state to their original values by commenting out the lines md_component_detection = 0 and write_cache_state = 0 and then removing the comment marks from the lines containing the original values from before the HDLM device configuration was enabled. </pre>
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		After	<p>6. Edit the /etc/lvm/lvm.conf file.</p> <p>:</p> <p>- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p> <p>If you want to use use_lvmetad=0 for operation, specify filter, not global_filter.</p> <p>Before:</p> <pre># This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a/*/" ] filter = [ "a sddlm[a-p][a-p].* ", "r dev/sd " ] : # write_cache_state = 1 write_cache_state = 0 : # types = [ "fd", 16 ] types = [ "sddlmfd", 16 ] : # md_component_detection = 1 md_component_detection=0 After: # This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a/*/" ] # filter = [ "a sddlm[a-p][a-p].* ", "r dev/sd " ] filter = [ "r sddlm[a-p][a-p].* ", "a dev/sd " ]</pre>
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			<pre> : write_cache_state = 1 # write_cache_state = 0 : # types = [ "fd", 16 ] # types = [ "sddlmdrv", 16 ] : md_component_detection = 1 # md_component_detection=0 : : } </pre> <p>Comment out the existing filter and types lines, and then add the underlined parts.</p> <p>Return <code>md_component_detection</code> and <code>write_cache_state</code> to their original values by commenting out the lines <code>md_component_detection = 0</code> and <code>write_cache_state = 0</code> and then removing the comment marks from the lines containing the original values from before the HDLM device configuration was enabled.</p> <p>In addition, if the setting for <code>allow_changes_with_duplicate_pvs</code> was changed before the HDLM device configuration was enabled, return the setting to its original value.</p> <p>Note that if 0 is set for <code>allow_changes_with_duplicate_pvs</code> in a multi-path configuration, duplicate physical volumes might be detected when you attempt to activate volume groups. As a result, you might not be able to activate the volume groups.</p>
3	<p>Canceling the settings for HDLM</p> <p>Removing HDLM</p> <p>Step 3.</p>	Before	<p>3. If LVM is used in a boot disk environment, edit the <code>/etc/lvm/lvm.conf</code> file so that the LVM2 recognizes the SCSI device, not the HDLM device.</p> <pre> : </pre> <p>- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p> <p>If 1 is set for <code>allow_changes_with_duplicate_pvs</code>, change the value to 0.</p> <p>If you want to use <code>use_lvmetad=0</code> for operation, specify <code>filter</code>, not <code>global_filter</code>.</p>

		<pre> Before: # This section allows you to configure which block devices should # be used by the LVM system. devices { : filter = [ "a sddlm[a-p][a-p].* ", "r /dev/sd " ] : # write_cache_state = 1 write_cache_state = 0 : # types = [ "fd", 16 ] types = [ "sddlmfdv", 16 ] : md_component_detection=0 # md_component_detection=1 : } After: # This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a sddlm[a-p][a-p].* ", "r /dev/sd " ] filter = [ "r sddlm[a-p][a-p].* ", "a /dev/sd " ] : write_cache_state = 1 # write_cache_state = 0 : # types = [ "fd", 16 ] # types = [ "sddlmfdv", 16 ] </pre>
--	--	---

			<pre> : # md_component_detection=0 md_component_detection=1 : } </pre> <p>Mark the existing filter and types lines as comments, and then add the underlined parts.</p> <p>Return md_component_detection and write_cache_state to their original values by commenting out the lines md_component_detection = 0 and write_cache_state = 0 and then removing the comment marks from the lines containing the pre-installation values.</p>
		After	<p>3. If LVM is used in a boot disk environment, edit the /etc/lvm/lvm.conf file so that the LVM2 recognizes the SCSI device, not the HDLM device.</p> <pre> : </pre> <p>- For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15 SP1 or earlier, Red Hat Enterprise Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p> <p>If you want to use use_lvmetad=0 for operation, specify filter, not global_filter.</p> <p>Before:</p> <pre> # This section allows you to configure which block devices should # be used by the LVM system. devices { : filter = [ "a sddlm[a-p][a-p].*", "r /dev/sd " ] : # write_cache_state = 1 write_cache_state = 0 : # types = [ "fd", 16 ] types = [ "sddlmfdrv", 16 ] : md_component_detection=0 </pre>

		<pre> # md_component_detection=1 : } After: # This section allows you to configure which block devices should # be used by the LVM system. devices { : # filter = [ "a sddlm[a-p][a-p].*" , "r /dev/sd " ] filter = [ "r sddlm[a-p][a-p].*" , "a /dev/sd " ] : write_cache_state = 1 # write_cache_state = 0 : # types = [ "fd", 16 ] # types = [ "sddlmfdrv", 16 ] : # md_component_detection=0 md_component_detection=1 : } </pre> <p>Mark the existing filter and types lines as comments, and then add the underlined parts.</p> <p>Return <code>md_component_detection</code> and <code>write_cache_state</code> to their original values by commenting out the lines <code>md_component_detection = 0</code> and <code>write_cache_state = 0</code> and then removing the comment marks from the lines containing the pre-installation values.</p> <p>In addition, if the setting for <code>allow_changes_with_duplicate_pvs</code> was changed before the HDLM device configuration was enabled, return the setting to its original value.</p> <p>Note that if 0 is set for <code>allow_changes_with_duplicate_pvs</code> in a multi-path configuration, duplicate physical volumes might be detected when you attempt to activate volume groups. As a result, you might not be able to activate the volume groups.</p>
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4	Removing HDLM Migration to a single-path boot disk environment Step 9.	Before	If the boot disk environment was configured by performing the procedure described in Settings for a multipath boot disk environment on page C-2, copy the settings contained in the boot loader configuration file that was used for the current startup.
		After	If the boot disk environment was configured by performing the procedure described in Settings for a multipath boot disk environment on page C-2 without using the dlmbootstart utility, copy the settings in the boot loader configuration file that was used for the current startup in step 10 on page C-2.  For SUSE LINUX Enterprise Server 12, SUSE LINUX Enterprise Server 15, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Oracle Linux 7, Oracle Linux 8, Oracle Unbreakable Enterprise Kernel 7, Oracle Unbreakable Enterprise Kernel 7 or Oracle Unbreakable Enterprise Kernel 8, go to step 14. For Red Hat Enterprise Linux 6, Oracle Linux 6, Oracle Unbreakable Enterprise Kernel 6, or SUSE LINUX Enterprise Server 11, go to step 10.
5	Removing HDLM Migration to a single-path boot disk environment Step 20.	Before	20. Delete the initial RAM disk image file for HDLM.  To do this, execute the following command:  - When an IA32 host is used:  <code># rm /boot/initrd-hdlm-2.6.32-71.el6.i686.img</code>
		After	20. Delete the initial RAM disk image file for HDLM.  If you are using one of the following OSs, you do not need to perform this step. Go to step 21.  - Red Hat Enterprise Linux 7 - Red Hat Enterprise Linux 8 - Oracle Linux 7 - Oracle Linux 8 - Oracle Unbreakable Enterprise Kernel 7 - Oracle Unbreakable Enterprise Kernel 8 - SUSE LINUX Enterprise Server 12 - SUSE LINUX Enterprise Server 15  To do this, execute the following command:  - When an IA32 host is used:  <code># rm /boot/initrd-hdlm-2.6.32-71.el6.i686.img</code>

6	dlmbotstart utility for creating an HDLM boot disk environment  Parameters	Addition	<p>- For Red Hat Enterprise Linux 7, Oracle Linux 7 or Oracle Unbreakable Enterprise Kernel 7:</p> <p>Make sure that 0 is not set for allow_changes_with_duplicate_pvs in the /etc/lvm/lvm.conf file, and then execute the utility for creating an HDLM boot disk environment (dlmbotstart). If 0 is set for allow_changes_with_duplicate_pvs, change the value to 1.</p>
7	Messages KAPL12001 to KAPL13000 KAPL12451-E Action  Step d.	Before	<p>d. Create the initial RAM disk image file again. For details on the procedure, see the following:</p> <p>If an HDLM device is being used as a boot disk:</p> <p>See step 9 in Settings for a multipath boot disk environment on page C-2.</p> <p>If an HDLM device is not being used as a boot disk:</p> <p>See the description about executing a command in step 9 in Settings for a multipath boot disk environment on page C-2.</p> <p>For information about the format of the file name of the initial RAM disk image file that is specified in parameters, see Table 3-77 Names of initial RAM disk image files on page 3-159 in Notes on using LVM2 on page 3-156.</p>
		After	<p>d. Create the initial RAM disk image file again. For details on the procedure, see the following:</p> <p>If an HDLM device is being used as a boot disk:</p> <p>See step 9 in Settings for a multipath boot disk environment on page C-2.</p> <p>If an HDLM device is not being used as a boot disk:</p> <p>Create the initial RAM disk image file for HDLM.</p> <p>For details on the procedure, see Step d. Re-create the initial RAM disk image file in Notes on using LVM2.</p>

# Appendix A

## HBA Driver Support Matrix

### Fibre Channel I/F adapters

Use the Fibre Channel I/F adapters given below. 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.

#### QLogic<sup>1</sup>

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.03.01.05.06.0-k8 <sup>3,4</sup>
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.03.01.05.06.0-k8 <sup>3,4</sup>
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	8.03.07.03.06.1-k <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>3,4</sup> 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 <sup>2,3,4</sup> 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 <sup>2,3,4</sup> 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 <sup>1,3,4</sup>
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 <sup>1,3,4</sup>
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 <sup>3,4</sup>
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 <sup>3,4</sup>
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	8.07.00.26.06.8-k <sup>3,4</sup>
Red Hat Enterprise Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>
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 <sup>3,4</sup>
	2.6.32-696.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>

Red Hat Enterprise Linux 6.9 (EM64T/AMD64)	2.6.32-696.23.1.el6.x86_64	8.07.00.50.06.0-k4 <sup>4</sup>
		8.08.00.07.06.0-k1 <sup>4</sup>
Red Hat Enterprise Linux 6.10 (IA32)	2.6.32-754.el6.i686	8.07.00.26.06.8-k <sup>3,4</sup>
Red Hat Enterprise Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.06.00.08.07.0-k2 <sup>3,4</sup>
		8.06.00.08.07.0-k3 <sup>3,4,10</sup>
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	8.07.00.08.07.1-k2 <sup>3,4</sup>
		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 <sup>3,4</sup>
	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 3.10.0-514.44.1.el7.x86_64	8.07.00.33.07.3-k1 <sup>3,4</sup>
		8.07.00.39.07.0-k
		8.07.00.50.07.0-k4 <sup>4</sup>
Red Hat Enterprise Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.21.1.el7.x86_64	8.07.00.38.07.4-k1 <sup>3,4</sup>
		8.07.00.50.07.0-k4 <sup>4</sup>
		8.08.00.07.07.0-k1 <sup>4</sup>
Red Hat Enterprise Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	8.08.00.07.07.5-k1 <sup>4</sup>
		9.00.00.00.07.5-k1 <sup>3,4</sup>
Red Hat Enterprise Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	10.00.00.06.07.6-k <sup>3,4</sup>
		10.01.00.33.07.6-k2 <sup>4</sup>
Red Hat Enterprise Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	10.00.00.12.07.7-k <sup>3,4</sup>
		10.01.00.64.07.6-k1a <sup>4,11</sup>
Red Hat Enterprise Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	10.01.00.20.07.8-k <sup>3,4</sup>
		10.01.00.64.07.6-k1a <sup>4,11</sup>

Red Hat Enterprise Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	10.01.00.22.07.9-k <sup>3,4</sup>
Red Hat Enterprise Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	10.01.00.64.08.0-k1 <sup>4,11</sup>
Red Hat Enterprise Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	10.01.00.21.08.2-k <sup>3,4</sup> 10.01.00.64.08.0-k1 <sup>4,11</sup> 10.02.01.00.a14-k1 <sup>4,11</sup>
Red Hat Enterprise Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	10.01.00.25.08.3-k <sup>3,4</sup>
Red Hat Enterprise Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	10.02.00.104-k <sup>3,4</sup>
SUSE LINUX Enterprise Server 11 (IA32)	3.0.101-63.1-default 3.0.101-63.1-pae	8.07.00.18-k <sup>3,4</sup>
	3.0.101-108.21-default 3.0.101-108.21-pae	8.07.00.18-k <sup>3,4</sup>
	3.0.101-108.68-default 3.0.101-108.68-pae	8.07.00.18-k <sup>3,4</sup>
SUSE LINUX Enterprise Server 11 (EM64T/AMD64)	3.0.101-63.1-default 3.0.101-63.1-xen	8.07.00.18-k <sup>3,4</sup>
	3.0.101-108.21-default 3.0.101-108.21-xen	8.07.00.18-k <sup>3,4</sup>
	3.0.101-108.68-default 3.0.101-108.68-xen	8.07.00.18-k <sup>3,4</sup>
SUSE LINUX Enterprise Server 12 (EM64T/AMD64)	3.12.28-4-default	8.07.00.08.12.0-k <sup>3,4</sup>
	3.12.28-4-xen	8.07.00.08.12.0-k <sup>3,4</sup>
	3.12.59-60.45-default	8.07.00.18-k <sup>3,4</sup>
	3.12.74-60.64.40-default	8.07.00.18-k <sup>3,4</sup>

	3.12.59-60.45-xen	8.07.00.18-k <sup>3,4</sup>
	3.12.74-60.64.40-xen	8.07.00.18-k <sup>3,4</sup>
	4.4.21-69-default	8.07.00.33-k <sup>3,4</sup>
	4.4.103-6.33-default	9.00.00.00-k <sup>3,4</sup>
	4.4.114-94.14-default	9.00.00.00-k <sup>3,4</sup>
	4.12.14-94.41-default	10.00.00.11-k <sup>3,4</sup>
	4.12.14-120-default	10.01.00.18-k <sup>3,4</sup>
SUSE LINUX Enterprise Server 15 (EM64T/AMD64)	4.12.14-23-default	10.00.00.06-k <sup>3,4</sup>
	4.12.14-195-default	10.00.00.13-k <sup>3,4</sup>
	5.3.18-22-default	10.01.00.25-k <sup>3,4</sup>
Oracle Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.05.00.03.06.5-k <sup>2,3,4</sup>
Oracle Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64	8.05.00.03.06.5-k <sup>2,3,4</sup>
Oracle Linux 6.6 (IA32)	2.6.32-504.el6.i686	8.07.00.08.06.6-k <sup>1,3,4</sup>
Oracle Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64	8.07.00.08.06.6-k <sup>1,3,4</sup>
Oracle Linux 6.7 (IA32)	2.6.32-573.el6.i686	8.07.00.16.06.7-k <sup>3,4</sup>
Oracle Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64	8.07.00.16.06.7-k <sup>3,4</sup>
Oracle Linux 6.8 (IA32)	2.6.32-642.el6.i686	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 6.9 (IA32)	2.6.32-696.el6.i686	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 6.10 (IA32)	2.6.32-754.el6.i686	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	8.07.00.26.06.8-k <sup>3,4</sup>
Oracle Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.06.00.08.07.0-k <sup>3,4</sup>
Oracle Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	8.07.00.08.07.1-k <sup>2,3,4</sup>

Oracle Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	8.07.00.18.07.2-k <sup>3,4</sup>
Oracle Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64	8.07.00.33.07.3-k <sup>1,3,4</sup>
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 <sup>1,3,4</sup>
Oracle Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	9.00.00.00.07.5-k <sup>1,3,4</sup>
Oracle Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	10.00.00.06.07.6-k <sup>3,4</sup>
Oracle Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	10.00.00.12.07.7-k <sup>3,4</sup>
Oracle Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	10.01.00.20.07.8-k <sup>3,4</sup>
Oracle Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	10.01.00.22.07.9-k <sup>3,4</sup>
Oracle Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	10.01.00.21.08.2-k <sup>3,4</sup>
Oracle Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	10.01.00.25.08.3-k <sup>3,4</sup>
Oracle Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	10.02.00.104-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.686	8.04.00.03.39.0-k <sup>3,4</sup>
	2.6.39-200.29.2.el6uek.686	8.04.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64	8.04.00.03.39.0-k <sup>3,4</sup>
	2.6.39-200.29.2.el6uek.x86_64	8.04.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.686	8.04.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	8.04.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.686	8.05.00.03.39.0-k <sup>3,4</sup>
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	8.05.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.686	8.05.00.03.39.0-k <sup>3,4</sup>

Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64	8.05.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-44.el6uek.x86_64	8.07.00.08.39.0-k1 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (IA32)	2.6.39-400.215.10.el6uek.686	8.05.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	8.07.00.08.39.0-k1 <sup>3,4</sup>
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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.7 (IA32)	2.6.39-400.250.7.el6uek.686	8.05.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)	3.8.13-68.3.4.el6uek.x86_64	8.07.00.16.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (IA32)	2.6.39-400.278.2.el6uek.686	8.05.00.03.39.0-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)	4.1.12-37.4.1.el6uek.x86_64	8.07.00.33.40.0-k <sup>3,4</sup>
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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)	4.1.12-124.16.4.el6uek.x86_64	9.00.00.00.40.0-k1 <sup>3,4</sup>
	4.1.12-124.45.6.el6uek.x86_64	9.00.00.00.42.0-k1-v3 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	8.07.00.08.39.0-k1 <sup>3,4</sup>
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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 7.2 (EM64T/AMD64)	3.8.13-98.7.1.el7uek.x86_64	8.07.00.18.39.0-k <sup>3,4</sup>
	3.8.13-118.10.2.el7uek.x86_64	8.07.00.26.39.0-k <sup>3,4</sup>

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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64)	4.1.12-94.3.9.el7uek.x86_64	8.07.00.38.40.0-k <sup>3,4</sup>
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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 7.6 (EM64T/AMD64)	4.14.35-1818.3.3.el7uek.x86_64	10.00.00.07-k <sup>1,3,4</sup>
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64)	4.14.35-1902.3.2.el7uek.x86_64	10.00.00.13-k <sup>3,4</sup>
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 <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)	5.4.17-2011.6.2.el7uek.x86_64	10.01.00.25-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64)	5.4.17-2011.5.3.el8uek.x86_64	10.01.00.25-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64)	5.4.17-2011.7.4.el8uek.x86_64	10.01.00.25-k <sup>3,4</sup>
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)	5.4.17-2102.201.3.el8uek.x86_64	10.02.00.103-k <sup>3,4</sup>

Notes:

1. Do not use the HBA driver's failover function.

Check the setting for the failover function by performing the following procedure:

For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 6.1, Red Hat Enterprise Linux 6.2, Red Hat Enterprise Linux 6.3, Red Hat Enterprise Linux 6.4, Red Hat Enterprise Linux 6.5, Red Hat Enterprise Linux 6.6, Red Hat Enterprise Linux 6.7, Red Hat Enterprise Linux 6.8, Red Hat Enterprise Linux 6.9, Red Hat Enterprise Linux 6.10, Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 7.1, Red Hat Enterprise Linux 7.2, Red Hat Enterprise Linux 7.3, Red Hat Enterprise Linux 7.4, Red Hat Enterprise Linux 7.5, Red Hat Enterprise Linux 7.6, Red Hat Enterprise Linux 7.7, Red Hat Enterprise Linux 7.8, Red Hat Enterprise Linux 7.9, Red Hat Enterprise Linux 8.2, Red Hat Enterprise Linux 8.3, Red Hat Enterprise Linux 8.4, Oracle Linux 6.5, Oracle Linux 6.6, Oracle Linux 6.7, Oracle Linux 6.8, Oracle Linux 6.9, Oracle Linux 6.10, Oracle Linux 7, Oracle Linux 7.1, Oracle Linux 7.2, Oracle Linux 7.3, Oracle Linux 7.4, Oracle Linux 7.5, Oracle Linux 7.6, Oracle Linux 7.7, Oracle Linux 7.8, Oracle Linux 7.9, Oracle Linux 8.2, Oracle Linux 8.3, Oracle Linux 8.4, Oracle Unbreakable Enterprise Kernel 6.2, Oracle Unbreakable Enterprise Kernel 6.3, Oracle Unbreakable Enterprise Kernel 6.4, Oracle Unbreakable

Enterprise Kernel 6.5, Oracle Unbreakable Enterprise Kernel 6.6, Oracle Unbreakable Enterprise Kernel 6.7, Oracle Unbreakable Enterprise Kernel 6.8, Oracle Unbreakable Enterprise Kernel 6.9, Oracle Unbreakable Enterprise Kernel 6.10, Oracle Unbreakable Enterprise Kernel 7, Oracle Unbreakable Enterprise Kernel 7.1, Oracle Unbreakable Enterprise Kernel 7.2, Oracle Unbreakable Enterprise Kernel 7.3, Oracle Unbreakable Enterprise Kernel 7.4, Oracle Unbreakable Enterprise Kernel 7.5, Oracle Unbreakable Enterprise Kernel 7.6, Oracle Unbreakable Enterprise Kernel 7.7, Oracle Unbreakable Enterprise Kernel 7.8, Oracle Unbreakable Enterprise Kernel 7.9, Oracle Unbreakable Enterprise Kernel 8.2, Oracle Unbreakable Enterprise Kernel 8.3, Oracle Unbreakable Enterprise Kernel 8.4, and SUSE LINUX Enterprise Server 11

- Execute 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
```

- 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
```

2. The drivers mentioned in the page of "Hitachi Vantara - HBA Approved Software" in 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](http://support.qlogic.com/support/oem_detail_hds.asp?oemid=84&classid=237)

The above-mentioned URL may be changed without notice. When the URL is changed, look for the page of "Hitachi Vantara - HBA Approved Software" in the QLogic website.

3. Use the driver bundled with the kernel.
4. Using an HDLM device as the boot disk is supported.
5. HDLM also supports the environments in which 32-bit kernel packages are installed on a system using an AMD Opteron processor.
6. Since 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 document of the HBA attachment for details of the setting change of the failover function.
7. EM64T indicates the environments in which 64-bit kernel packages are installed on a system using an Intel EM64T processor.
8. AMD64 indicates the environments in which 64-bit kernel packages are installed on a system using an AMD Opteron processor.
9. Supported by Kernel 2.6.32.24-0.2.1 or later.
10. Supported by Kernel 3.10.0-123.13.2 or later.
11. HP HBA drivers are supported.

## Emulex

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.3.5.17 <sup>2,3</sup>
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.3.5.17 <sup>2,3</sup>
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	8.3.5.30.1p <sup>2,3</sup>
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	8.3.5.30.1p <sup>2,3</sup> 8.3.7.18-1
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	8.3.5.45.4p <sup>2,3</sup>
Red Hat Enterprise Linux 6.2(EM64T/AMD64)	2.6.32-220.el6.x86_64	8.3.5.45.4p <sup>2,3</sup> 8.3.7.18-1
Red Hat Enterprise Linux 6.3 (IA32)	2.6.32-279.el6.i686	8.3.5.68.5p <sup>2,3</sup>
Red Hat Enterprise Linux 6.3(EM64T/AMD64)	2.6.32-279.el6.x86_64	8.3.5.68.5p <sup>2,3</sup> 8.3.7.18-1
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	8.3.5.86.1p <sup>2,3</sup>
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 <sup>2,3</sup> 8.3.7.18-1 <sup>3</sup>
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.3.7.21.4p <sup>2,3</sup>
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 <sup>2,3</sup> 8.3.7.39 10.2.340.16 10.6.144.21 <sup>3</sup> 11.0.240.0
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	10.2.802.1 <sup>2,3</sup> 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 <sup>2,3</sup> 10.2.469.0

		10.6.144.21 <sup>3</sup>
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 <sup>2,3</sup>
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 <sup>2,3</sup> 10.6.144.21 <sup>3</sup> 11.1.38.64 11.1.172.22 <sup>3</sup>
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	11.0.0.4 <sup>2,3</sup>
Red Hat Enterprise Linux 6.8(EM64T/AMD64)	2.6.32-642.el6.x86_64	11.0.0.4 <sup>2,3</sup>
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 <sup>2,3</sup>
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 <sup>2,3</sup> 11.2.156.18 <sup>3</sup> 11.2.307.13 <sup>3,6</sup> 11.4.142.26
Red Hat Enterprise Linux 6.10 (IA32)	2.6.32-754.el6.i686	11.0.1.6 <sup>2,3</sup>
Red Hat Enterprise Linux 6.10(EM64T/AMD64)	2.6.32-754.el6.x86_64	11.0.1.6 <sup>2,3</sup>
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.3.7.31.1p <sup>2,3</sup>
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	10.2.8021.1 <sup>2,3</sup> 10.16.193.12 <sup>3</sup> 11.1.172.22 <sup>3</sup>
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 <sup>2,3</sup> 10.16.193.21 <sup>3</sup> 11.1.172.22 <sup>3</sup>
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 <sup>2,3</sup> 11.2.307.13 <sup>3,6</sup>

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 <sup>2,3</sup> 11.2.307.13 <sup>3,6</sup> 11.4.334.26 <sup>3,6</sup>
Red Hat Enterprise Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	11.4.0.4 <sup>2,3</sup> 11.4.334.26 <sup>3,6</sup>
Red Hat Enterprise Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	12.0.0.5 <sup>2,3</sup> 12.0.346.15 <sup>3,6</sup> 12.0.384.0.4fts <sup>3</sup> 12.4.270.3 <sup>3,6</sup>
Red Hat Enterprise Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	12.0.0.10 <sup>2,3</sup> 12.4.270.3 <sup>3,6</sup>
Red Hat Enterprise Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	12.0.0.13 <sup>2,3</sup> 12.6.275.14 <sup>3,6</sup>
Red Hat Enterprise Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	12.0.0.13 <sup>2,3</sup>
Red Hat Enterprise Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	12.2.0.3 <sup>2,3</sup> 12.6.275.14 <sup>3,6</sup>
Red Hat Enterprise Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	12.6.0.2 <sup>2,3</sup> 12.6.275.14 <sup>3,6</sup>
Red Hat Enterprise Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	12.8.0.1 <sup>2,3</sup> 12.8.352.11 <sup>3,6</sup>
Red Hat Enterprise Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	12.8.0.5 <sup>2,3</sup>
SUSE LINUX Enterprise Server 11 (IA32)	3.0.101-63.1-default 3.0.101-63.1-pae	10.4.8000.0 <sup>2,3</sup>
	3.0.101-108.21-default 3.0.101-108.21-pae	10.4.8000.0 <sup>2,3</sup>
	3.0.101-108.68-default	10.4.8000.0 <sup>2,3</sup>

	3.0.101-108.68-pae	
SUSE LINUX Enterprise Server 11 (EM64T/AMD64)	3.0.101-63.1-default	10.4.8000.0 <sup>2,3</sup>
	3.0.101-63.1-xen	11.2.216.8 <sup>3</sup>
	3.0.101-108.21-default	10.4.8000.0 <sup>2,3</sup>
	3.0.101-108.21-xen	11.2.216.8 <sup>3</sup>
	3.0.101-108.68-default	10.4.8000.0 <sup>2,3</sup>
	3.0.101-108.68-xen	11.2.216.8 <sup>3</sup>
SUSE LINUX Enterprise Server 12 (EM64T/AMD64)	3.12.28-4-default	10.2.8040.1 <sup>2</sup>
	3.12.28-4-xen	10.2.8040.1 <sup>2</sup>
	3.12.59-60.45-default	10.5.0.2 <sup>23</sup>
		11.2.216.8 <sup>3</sup>
	3.12.59-60.45-xen	10.5.0.2 <sup>23</sup>
		11.2.216.8 <sup>3</sup>
	3.12.74-60.64.40-default	10.5.0.2 <sup>23</sup>
		11.2.216.8 <sup>3</sup>
	3.12.74-60.64.40-xen	10.5.0.2 <sup>23</sup>
		11.2.216.8 <sup>3</sup>
	4.4.21-69-default	11.1.0.1 <sup>23</sup>
4.4.103-6.33-default	11.4.0.5 <sup>23</sup>	
4.4.114-94.14-default	11.4.0.5 <sup>23</sup>	
4.12.14-94.41-default	12.0.0.6 <sup>23</sup>	
4.12.14-120-default	12.4.0.0 <sup>23</sup>	
SUSE LINUX Enterprise Server 15 (EM64T/AMD64)	4.12.14-23-default	12.0.0.1 <sup>23</sup>
	4.12.14-195-default	12.2.0.0 <sup>23</sup>
	5.3.18-22-default	12.8.0.0 <sup>23</sup>
Oracle Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.3.7.21.4p <sup>2,3</sup>

Oracle Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64	8.3.7.21.4p <sup>2,3</sup>
Oracle Linux 6.6 (IA32)	2.6.32-504.el6.i686	10.2.802.1 <sup>2,3</sup>
Oracle Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64	10.2.802.1 <sup>2,3</sup>
Oracle Linux 6.7 (IA32)	2.6.32-573.el6.i686	10.6.0.20 <sup>2,3</sup>
Oracle Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64	10.6.0.20 <sup>2,3</sup>
Oracle Linux 6.8 (IA32)	2.6.32-642.el6.i686	11.0.0.4 <sup>2,3</sup>
Oracle Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	11.0.0.4 <sup>2,3</sup>
Oracle Linux 6.9 (IA32)	2.6.32-696.el6.i686	11.0.0.5 <sup>2,3</sup>
Oracle Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64	11.0.0.5 <sup>2,3</sup>
Oracle Linux 6.10 (IA32)	2.6.32-754.el6.i686	11.0.1.6 <sup>2,3</sup>
Oracle Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	11.0.1.6 <sup>2,3</sup>
Oracle Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	8.3.7.34.3p <sup>2,3</sup>
Oracle Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	10.2.8021.1 <sup>2,3</sup>
Oracle Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	10.7.0.1 <sup>2,3</sup>
Oracle Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64	11.1.0.2 <sup>2,3</sup>
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 <sup>2,3</sup>
Oracle Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	11.4.0.4 <sup>2,3</sup>
Oracle Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	12.0.0.5 <sup>2,3</sup>
Oracle Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	12.0.0.10 <sup>2,3</sup>
Oracle Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	12.0.0.13 <sup>2,3</sup>
Oracle Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	12.0.0.13 <sup>2,3</sup>
Oracle Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	12.2.0.3 <sup>2,3</sup>
Oracle Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	12.6.0.2 <sup>2,3</sup>

Oracle Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	12.8.0.1 <sup>2,3</sup>
Oracle Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	12.8.0.5 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.i686	8.3.5.68.6p <sup>2,3</sup>
	2.6.39-200.29.2.el6uek.i686	8.3.5.68.6p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64	8.3.5.68.6p <sup>2,3</sup>
	2.6.39-200.29.2.el6uek.x86_64	8.3.5.68.6p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.i686	8.3.5.68.6p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	8.3.5.68.6p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.i686	8.3.7.26.3p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.4 (EM64T/AMD64)	2.6.39-400.211.1.el6uek.x86_64	8.3.7.26.3p <sup>2,3</sup>
	2.6.39-400.264.1.el6uek.x86_64	
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.i686	8.3.7.26.3p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64	8.3.7.26.2p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-44.el6uek.x86_64	8.3.7.34.4p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (IA32)	2.6.39-400.215.10.el6uek.i686	8.3.7.26.3p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	8.3.7.34.4p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-68.el6uek.x86_64	10.6.61.0 <sup>2,3</sup>
	3.8.13-68.2.2.el6uek.x86_64	
Oracle Unbreakable Enterprise Kernel 6.7 (IA32)	2.6.39-400.250.7.el6uek.i686	8.3.7.26.3p <sup>2,3</sup>

Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)	3.8.13-68.3.4.el6uek.x86_64	10.6.61.0 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (IA32)	2.6.39-400.278.2.el6uek.i686	8.3.7.26.3p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)	4.1.12-37.4.1.el6uek.x86_64	11.0.0.13 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.9 (EM64T/AMD64)	4.1.12-61.1.28.el6uek.x86_64	11.1.0.4 <sup>2,3</sup>
	4.1.12-94.2.1.el6uek.x86_64	11.2.0.5 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)	4.1.12-124.16.4.el6uek.x86_64	11.4.0.7 <sup>2,3</sup>
	4.1.12-124.45.6.el6uek.x86_64	11.4.0.8 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	8.3.7.34.4p <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-55.1.6.el7uek.x86_64	10.2.8061.0 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-68.el7uek.x86_64	10.6.61.0 <sup>2,3</sup>
	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 <sup>2,3</sup>
	3.8.13-118.10.2.el7uek.x86_64	11.0.0.1 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.3 (EM64T/AMD64)	4.1.12-61.1.18.el7uek.x86_64	11.1.0.4 <sup>2,3</sup>
	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 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.5 (EM64T/AMD64)	4.1.12-112.16.4.el7uek.x86_64	11.2.0.5 <sup>2,3</sup>
	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 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64)	4.14.35-1902.3.2.el7uek.x86_64	12.0.0.10 <sup>2,3</sup>

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	12.0.0.13 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)	5.4.17-2011.6.2.el7uek.x86_64	12.6.0.3 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64)	5.4.17-2011.5.3.el8uek.x86_64	12.6.0.3 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64)	5.4.17-2011.7.4.el8uek.x86_64	12.6.0.3 <sup>2,3</sup>
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)	5.4.17-2102.201.3.el8uek.x86_64	12.8.0.5 <sup>2,3</sup>

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.

## 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
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	8.3.7.29-1

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. Since 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 document of the HBA attachment for details of the setting change of the failover function.
4. The drivers mentioned in the page of " Hitachi Vantara - HBA Approved Software" in 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](http://support.qlogic.com/support/oem_detail_hds.asp?oemid=84&classid=237)  
The above-mentioned URL may be changed without notice. When the URL is changed, look for the page of " Hitachi Vantara - HBA Approved Software" in 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

OS	Kernel	Driver
Red Hat Enterprise Linux 6.2(EM64T/AMD64)	2.6.32-220.el6.x86_64	8.04.00.09.06.0-k <sup>3</sup>
Red Hat Enterprise Linux 6.4(EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	8.04.00.12.06.0-k2 8.07.00.08.06.0-k <sup>3</sup>
Red Hat Enterprise Linux 6.5(EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	8.07.00.23.06.0-k2
Red Hat Enterprise Linux 6.6(EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	8.07.00.28.06.0-k1
Red Hat Enterprise Linux 6.7(EM64T/AMD64)	2.6.32-573.el6.x86_64 2.6.32-573.53.1.el6.x86_64	8.07.00.28.06.0-k1 8.07.00.42.06.0-k1
Red Hat Enterprise Linux 6.8(EM64T/AMD64)	2.6.32-642.el6.x86_64	8.07.00.34.06.0-k1

Red Hat Enterprise Linux 6.9(EM64T/AMD64)	2.6.32-696.el6.x86_64 2.6.32-696.23.1.el6.x86_64	8.07.00.50.06.0-k7 <sup>3</sup> 8.08.00.08.06.0-k1 <sup>3</sup>
Red Hat Enterprise Linux 6.10(EM64T/AMD64)	2.6.32-754.el6.x86_64	8.08.00.08.06.0-k1 <sup>3</sup>
Red Hat Enterprise Linux 7(EM64T/AMD64)	3.10.0-123.el7.x86_64	8.07.00.28.07.0_k1
Red Hat Enterprise Linux 7.1(EM64T/AMD64)	3.10.0-229.el7.x86_64	8.07.00.28.07.0_k1
Red Hat Enterprise Linux 7.2(EM64T/AMD64)	3.10.0-327.el7.x86_64 3.10.0-327.64.1.el7.x86_64	8.07.00.28.07.0_k1 8.07.00.34.07.0-k1 8.07.00.50.07.0-k3
Red Hat Enterprise Linux 7.3(EM64T/AMD64)	3.10.0-514.el7.x86_64 3.10.0-514.44.1.el7.x86_64	8.07.00.42.07.0_k1 8.07.00.50.07.0-k7 <sup>3</sup> 11.4.142.26 <sup>3</sup>
Red Hat Enterprise Linux 7.4(EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.21.1.el7.x86_64	8.07.00.50.07.0-k6 <sup>3</sup> 8.07.00.50.07.0-k7 <sup>3</sup> 8.08.00.08.07.0-k1 <sup>3</sup>
Red Hat Enterprise Linux 7.5(EM64T/AMD64)	3.10.0-862.el7.x86_64	8.08.00.08.07.5-k1 <sup>3</sup>
Red Hat Enterprise Linux 7.6(EM64T/AMD64)	3.10.0-957.el7.x86_64	10.01.00.57.07.6-k1 <sup>3</sup> 10.01.00.64.07.6-k1a <sup>3</sup>
Red Hat Enterprise Linux 7.7(EM64T/AMD64)	3.10.0-1062.el7.x86_64	10.01.00.57.07.6-k1 <sup>3</sup>

Notes:

1. QLogic HBA drivers are supported.
2. Use the driver bundled with the kernel.
3. Using an HDLM device as the boot disk is supported.
4. Since 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 document of the HBA attachment for details of the setting change of the failover function.

- The drivers mentioned in the page of "Hitachi Vantara - HBA Approved Software" in 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](http://support.qlogic.com/support/oem_detail_hds.asp?oemid=84&classid=237)  
The above-mentioned URL may be changed without notice. When the URL is changed, look for the page of "Hitachi Vantara - HBA Approved Software" in the QLogic website.
- The supported combinations of HP models and Bus I/Fs are shown below.  
FC2143, FC2243, FC2142SR, FC2242SR
- HDLM also supports the environments in which 32-bit kernel packages are installed on a system using an AMD Opteron processor.
- The supported combinations of HP models and Bus I/Fs are shown below.  
403621-B21
- Emulex HBA drivers are supported.

## Brocade

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	2.3.0.0*
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	2.3.0.0*
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	3.0.0.0*
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	3.0.0.0*

\* Using an HDLM device as the boot disk is supported.

## Cisco

OS	Kernel	Driver
Red Hat Enterprise Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	1.6.0.12b* 1.6.0.18* 1.6.0.23*
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64 3.10.0-327.64.1.el7.x86_64	1.6.0.17*

Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	1.6.0.27*
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	1.6.0.27*
Oracle Unbreakable Enterprise Kernel 7.2 (EM64T/AMD64)	3.8.13-98.7.1.el7uek.x86_64 3.8.13-118.10.2.el7uek.x86_64	1.6.0.27*
Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64)	4.1.12-94.3.9.el7uek.x86_64	1.6.0.24*
* Using an HDLM device as the boot disk is supported.		

## Fibre Channel over Ethernet adapters

Use the Fibre Channel over Ethernet (FCoE) I/F adapters given below. 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.

### QLogic<sup>1</sup>

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.03.04.12.06.0-k0
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.03.04.12.06.0-k0
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.3 (IA32)	2.6.32-279.el6.i686	8.04.00.04.06.3-k

		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.3 (EM64T/AMD64)	2.6.32-279.el6.x86_64	8.04.00.04.06.3-k
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	8.07.00.08.06.0-k
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	8.07.00.08.06.0-k
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	8.07.00.08.06.0-k
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	8.07.00.08.06.0-k
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	Bundle <sup>2,3</sup>
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.7 (IA32)	2.6.32-573.el6.i686 2.6.32-573.53.1.el6.i686	Bundle <sup>2,3</sup>
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64 2.6.32-573.53.1.el6.x86_64	Bundle <sup>2,3</sup>
		Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	Bundle <sup>2,3</sup>
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64	Bundle <sup>2,3</sup>

	3.10.0-327.64.1.el7.x86_64	
Red Hat Enterprise Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64 3.10.0-514.44.1.el7.x86_64	Bundle <sup>2,3</sup>

**Notes:**

1. Do not use the HBA driver's failover function.  
Check the setting for the failover function by performing the following procedure:
  - For Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 6.3, and SUSE LINUX Enterprise Server 11:
  - Execute 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
  - 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
2. QLogic 8400 Series are supported.
3. Using an HDLM device as the boot disk is supported.

## Emulex

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	8.3.5.30.1p 8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	8.3.5.30.1p 8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	8.3.5.65 <sup>1</sup>
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	10.2.370.12

Red Hat Enterprise Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	10.2.370.12
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	10.2.273.0r
Red Hat Enterprise Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	10.2.273.0r
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	10.2.8021.1
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	8.3.7.34.4p <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 7.1 (EM64T/AMD64)	3.8.13-55.1.6.el7uek.x86_64	10.2.8061.0 <sup>2</sup>
Notes:		
<ol style="list-style-type: none"> <li>Using an HDLM device as the boot disk is supported.</li> <li>Use the driver bundled with the kernel.</li> </ol>		

## Brocade

OS	Kernel	Driver
Red Hat Enterprise Linux 6 (IA32)	2.6.32-71.el6.i686	2.3.0.0*
Red Hat Enterprise Linux 6 (EM64T/AMD64)	2.6.32-71.el6.x86_64	2.3.0.0*
* Using an HDLM device as the boot disk is supported.		

## HP

OS	Kernel	Driver
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	8.3.5.77.1p
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	8.3.5.77.1p

## Cisco

OS	Kernel	Driver
Red Hat Enterprise Linux 6.0 (EM64T/AMD64)	2.6.32-71.el6.x86_64	1.5.0.1 <sup>1</sup>
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	1.5.0.1 <sup>1</sup>
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	1.5.0.1 <sup>1</sup>
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	1.5.0.45 <sup>2</sup> 1.6.0.12b <sup>2</sup> 1.6.0.18 <sup>2</sup>
Red Hat Enterprise Linux 6.5 EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	1.5.0.45 <sup>3</sup>
Red Hat Enterprise Linux 6.8 EM64T/AMD64)	2.6.32-642.el6.x86_64	1.6.0.27 <sup>3</sup>
Red Hat Enterprise Linux 7.5 EM64T/AMD64)	3.10.0-862.el7.x86_64	1.6.0.37 <sup>3</sup>
Red Hat Enterprise Linux 7.6 EM64T/AMD64)	3.10.0-957.el7.x86_64	1.6.0.47 <sup>3</sup>
<b>Notes:</b> <ol style="list-style-type: none"> <li>1. Only using an HDLM device as the boot disk is supported.</li> <li>2. Using an HDLM device as the boot disk is not supported.</li> <li>3. Using an HDLM device as the boot disk is supported.</li> </ol>		

## iSCSI connections

Use the iSCSI connections given below. 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.

## Red Hat

OS	Kernel	Driver type	Driver
Red Hat Enterprise Linux 6.1 (IA32)	2.6.32-131.0.15.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.1 (EM64T/AMD64)	2.6.32-131.0.15.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>4</sup>
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>4</sup>
Red Hat Enterprise Linux 6.3 (IA32)	2.6.32-279.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.3 (EM64T/AMD64)	2.6.32-279.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>4</sup>
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>4</sup>
Red Hat Enterprise Linux 6.7 (IA32)	2.6.32-573.el6.i686 2.6.32-573.53.1.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.7 (EM64T/AMD64)	2.6.32-573.el6.x86_64 2.6.32-573.53.1.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.8 (IA32)	2.6.32-642.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.8 (EM64T/AMD64)	2.6.32-642.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.9 (IA32)	2.6.32-696.el6.i686 2.6.32-696.23.1.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>

Red Hat Enterprise Linux 6.9 (EM64T/AMD64)	2.6.32-696.el6.x86_64 2.6.32-696.23.1.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.10 (IA32)	2.6.32-754.el6.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 6.10 (EM64T/AMD64)	2.6.32-754.el6.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7 (EM64T/AMD64)	3.10.0-123.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64 3.10.0-327.64.1.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.3 (EM64T/AMD64)	3.10.0-514.el7.x86_64 3.10.0-514.44.1.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.4 (EM64T/AMD64)	3.10.0-693.el7.x86_64 3.10.0-693.21.1.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.5 (EM64T/AMD64)	3.10.0-862.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.6 (EM64T/AMD64)	3.10.0-957.el7.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.7 (EM64T/AMD64)	3.10.0-1062.el7.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.8 (EM64T/AMD64)	3.10.0-1127.el7.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 7.9 (EM64T/AMD64)	3.10.0-1160.el7.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 8.1 (EM64T/AMD64)	4.18.0-147.el8.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 8.2 (EM64T/AMD64)	4.18.0-193.el8.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>

Red Hat Enterprise Linux 8.3 (EM64T/AMD64)	4.18.0-240.el8.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Red Hat Enterprise Linux 8.4 (EM64T/AMD64)	4.18.0-305.el8.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>

Notes:

1. 1GbE NIC is supported. 10GbE NIC is not supported.
2. iSCSI HBA/CNA is not supported.
3. Using an HDLM device as the boot disk is not supported.
4. Using an HDLM device as the boot disk is supported.

## Emulex

OS	Kernel	Driver type	Driver
Red Hat Enterprise Linux 6.2 (IA32)	2.6.32-220.el6.i686	iSCSI HBA/CNA	4.1.334.15 <sup>1</sup>
			4.2.374.0 <sup>2,3</sup>
Red Hat Enterprise Linux 6.2 (EM64T/AMD64)	2.6.32-220.el6.x86_64	iSCSI HBA/CNA	4.1.334.15 <sup>1</sup>
			4.2.374.0 <sup>2,3</sup>
Red Hat Enterprise Linux 6.4 (IA32)	2.6.32-358.el6.i686	iSCSI HBA/CNA	4.2.374.0 <sup>2,3</sup>
Red Hat Enterprise Linux 6.4 (EM64T/AMD64)	2.6.32-358.el6.x86_64 2.6.32-358.87.1.el6.x86_64	iSCSI HBA/CNA	4.2.374.0 <sup>2,3</sup>
Red Hat Enterprise Linux 6.5 (IA32)	2.6.32-431.el6.i686	iSCSI HBA/CNA	Bundle <sup>2</sup>
Red Hat Enterprise Linux 6.5 (EM64T/AMD64)	2.6.32-431.el6.x86_64 2.6.32-431.87.1.el6.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Red Hat Enterprise Linux 6.6 (IA32)	2.6.32-504.el6.i686	iSCSI HBA/CNA	Bundle <sup>2</sup>
Red Hat Enterprise Linux 6.6 (EM64T/AMD64)	2.6.32-504.el6.x86_64 2.6.32-504.66.1.el6.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>

Red Hat Enterprise Linux 7.1 (EM64T/AMD64)	3.10.0-229.el7.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Red Hat Enterprise Linux 7.2 (EM64T/AMD64)	3.10.0-327.el7.x86_64 3.10.0-327.64.1.el7.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.686 2.6.39-200.29.2.el6uek.686	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64 2.6.39-200.29.2.el6uek.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.686	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.686	iSCSI HBA/CNA	Bundle <sup>2</sup>
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	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.686	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64 3.8.13-44.el6uek.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.1.el6uek.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-68.el6uek.x86_64 3.8.13-68.1.3.el6uek.x86_64	iSCSI HBA/CNA	Bundle <sup>2</sup>
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	iSCSI HBA/CNA	Bundle <sup>2</sup>

Notes:

1. Using an HDLM device as the boot disk is not supported.
2. Using an HDLM device as the boot disk is supported.
3. CNA F/W 4.2.433.604 or later is required.

## Novell

OS	Kernel	Driver type	Driver
SUSE LINUX Enterprise Server 11 (IA32)	3.0.101-63.1-default 3.0.101-63.1-pae	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
	3.0.101-108.21-default 3.0.101-108.21-pae		
	3.0.101-108.68-default 3.0.101-108.68-pae		
SUSE LINUX Enterprise Server 11 (EM64T/AMD64)	3.0.101-63.1-default 3.0.101-63.1-xen	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
	3.0.101-108.21-default 3.0.101-108.21-xen		
	3.0.101-108.68-default 3.0.101-108.68-xen		
SUSE LINUX Enterprise Server 12 (EM64T/AMD64)	3.12.28-4-default	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
	3.12.28-4-xen		
	3.12.59-60.45-default		
	3.12.59-60.45-xen		
	4.4.21-69-default		
	4.4.103-6.33-default		
	4.4.114-94.14-default		

	4.12.14-94.41-default		
	4.12.14-120-default		
SUSE LINUX Enterprise Server 15 (EM64T/AMD64)	4.12.14-23-default	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
	4.12.14-195-default		
	5.3.18-22-default		

Notes:

1. 1GbE NIC is supported. 10GbE NIC is not supported.
2. iSCSI HBA/CNA is not supported.
3. Using an HDLM device as the boot disk is not supported.

## Oracle

OS	Kernel	Driver type	Driver
Oracle Unbreakable Enterprise Kernel 6.2 (IA32)	2.6.39-200.29.1.el6uek.i686 2.6.39-200.29.2.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.2 (EM64T/AMD64)	2.6.39-200.29.1.el6uek.x86_64 2.6.39-200.29.2.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (IA32)	2.6.39-200.24.1.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.3 (EM64T/AMD64)	2.6.39-200.24.1.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.4 (IA32)	2.6.39-400.211.1.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.5 (IA32)	2.6.39-400.211.1.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>

Oracle Unbreakable Enterprise Kernel 6.5 (EM64T/AMD64)	3.8.13-16.2.1.el6uek.x86_64 3.8.13-44.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (IA32)	2.6.39-400.215.10.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.6 (EM64T/AMD64)	3.8.13-44.1.el6uek.x86_64 3.8.13-68.el6uek.x86_64 3.8.13-68.1.3.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.7 (IA32)	2.6.39-400.250.7.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.7 (EM64T/AMD64)	3.8.13-68.3.4.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (IA32)	2.6.39-400.278.2.el6uek.i686	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.8 (EM64T/AMD64)	4.1.12-37.4.1.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 6.10 (EM64T/AMD64)	4.1.12-124.16.4.el6uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
	4.1.12-124.45.6.el6uek.x86_64		
Oracle Unbreakable Enterprise Kernel 7 (EM64T/AMD64)	3.8.13-44.el7uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>

Oracle Unbreakable Enterprise Kernel 7.4 (EM64T/AMD64)	4.1.12-94.3.9.el7uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 7.6 (EM64T/AMD64)	4.14.35-1818.3.3.el7uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 7.7 (EM64T/AMD64)	4.14.35-1902.3.2.el7uek.x86_64	iSCSI Initiator <sup>1,2</sup>	Bundle <sup>3</sup>
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	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 7.9 (EM64T/AMD64)	5.4.17-2011.6.2.el7uek.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 8.2 (EM64T/AMD64)	5.4.17-2011.5.3.el8uek.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 8.3 (EM64T/AMD64)	5.4.17-2011.7.4.el8uek.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>
Oracle Unbreakable Enterprise Kernel 8.4 (EM64T/AMD64)	5.4.17-2102.201.3.el8uek.x86_64	iSCSI Initiator <sup>2</sup>	Bundle <sup>3</sup>

Notes:

1. 1GbE NIC is supported. 10GbE NIC is not supported.
2. iSCSI HBA/CNA is not supported.
3. Using an HDLM device as the boot disk is not supported.

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