
**FUJITSU Storage ETERNUS Multipath Driver V2 (for Linux)
Installation Information**

Dec 2019

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Correspondence of ETERNUS Multipath Driver 's Version Level and Patch

It is possible to update a version Level of ETERNUS Multipath Driver (hereafter referred to as "Multipath Driver") to a later one by applying a patch.

Example: When applying the patch T00812-20 to V2.0L12, the function is equal to V2.0L20.

The correspondence of version levels and patches is as follows.

Multipath Driver's Version Level and Patch correspondence table

Red Hat Enterprise Linux

Version Level *1	Red Hat Enterprise Linux 5	Red Hat Enterprise Linux 6	Red Hat Enterprise Linux 7
V2.0L01	none	none	none
V2.0L02	none	none	none
V2.0L03	none	none	none
V2.0L10	none	none	none
V2.0L11	none	none	none
V2.0L12	T00812-12	none	none
V2.0L13	T00812-17	none	none
V2.0L14	T00812-19	none	none
V2.0L20	T00812-20	none	none
V2.0L21	T00812-22	none	none
V2.0L22	T00812-23	T00812-23	none
V2.0L23	none	none	none
V2.0L24	T00812-27	T00812-27	none
V2.0L25	T00812-28	T00812-28	none
V2.0L26	T00812-29	T00812-29	none
V2.0L27	T00812-30	T00812-30	T00812-30
V2.0L28	T00812-32	T00812-32	T00812-32
V2.0L29	T00812-34	T00812-34	T00812-34
the latest patch	T00812-35	T00812-35	T00812-35

*1 The latest version for Itanium platform is V2.0L22.

*2 The final version. The module of products/patch that is newer than the final version is the same as it.

SUSE Linux Enterprise Server

Version Level *1	SUSE Linux Enterprise Server 11	SUSE Linux Enterprise Server 12
V2.0L01	none	none
V2.0L02	none	none
V2.0L03	none	none
V2.0L10	none	none
V2.0L11	none	none
V2.0L12	none	none
V2.0L13	none	none
V2.0L14	none	none
V2.0L20	none	none
V2.0L21	none	none
V2.0L22	T00812-23	none
V2.0L23	none	none
V2.0L24	T00812-27	none
V2.0L25	T00812-28	none
V2.0L26	T00812-29	none
V2.0L27	T00812-30	T00812-30
V2.0L28	T00812-31 *2	T00812-31 *2
V2.0L29	ditto	ditto
the latest patch	T00812-34	T00812-34

*1 The latest version for Itanium platform is V2.0L22.

*2 The final version. The module of products/patch that is newer than the final version is the same as it.

Supported Operating System (OS) Versions

The following tables show the version of Linux kernels supported by the Multipath Driver. If you are going to install Multipath Driver newly, please install Multipath Driver product, don't reboot the system, and then apply the latest Multipath Driver patch. After that, please reboot the system.

Multipath Driver for Red Hat Enterprise Linux 5

Operating System *1	Linux Kernel Versions	Version Level
Red Hat Enterprise Linux 5	2.6.18-8.el5	V2.0L11 or later
Red Hat Enterprise Linux 5.1	2.6.18-53.el5	V2.0L12 or later
	2.6.18-53.1.21.el5	V2.0L13 or later
Red Hat Enterprise Linux 5.2	2.6.18-92.el5 *2*3	
Red Hat Enterprise Linux 5.3	2.6.18-128.el5 *3	
Red Hat Enterprise Linux 5.4	2.6.18-164.el5 *3	V2.0L14 or later
Red Hat Enterprise Linux 5.5	2.6.18-194.el5 *3*4	V2.0L20 or later
Red Hat Enterprise Linux 5.6	2.6.18-238.el5 *3	V2.0L21 or later
Red Hat Enterprise Linux 5.7	2.6.18-274.el5 *3	V2.0L22 or later
Red Hat Enterprise Linux 5.8	2.6.18-308.el5 *3	
Red Hat Enterprise Linux 5.9	2.6.18-348.el5 *3	V2.0L22 or later
Red Hat Enterprise Linux 5.10	2.6.18-371.el5 *3	
Red Hat Enterprise Linux 5.11	2.6.18-398.el5 *3	

*1 Only x86, Intel64 or Intel Itanium platform.

*2 The kernel version 2.6.18-92.1.18.el5 or later is needed to use Multipath Driver on the server which has a SATA interface HDD.

*3 errata kernel is supported.

*4 Please refer to "Recovery from failure of update to Red Hat Enterprise Linux 5.5", when a server cannot boot after updating OS to Red Hat Enterprise Linux 5.5. This happens when using V2.0L14 or earlier that doesn't support Red Hat Enterprise Linux 5.5.

Multipath Driver for Red Hat Enterprise Linux 6

Operating System *1	Linux Kernel Versions *2	Version Level
Red Hat Enterprise Linux 6	2.6.32-71.el6	V2.0L21 or later
Red Hat Enterprise Linux 6.1	2.6.32-131.0.15.el6	V2.0L22 or later
Red Hat Enterprise Linux 6.2 (for x86)	2.6.32-220.4.1.el6 *3	
Red Hat Enterprise Linux 6.2 (for Intel64)	2.6.32-220.el6	
Red Hat Enterprise Linux 6.3	2.6.32-279.el6	
Red Hat Enterprise Linux 6.4	2.6.32-358.el6	
Red Hat Enterprise Linux 6.5	2.6.32-431.el6	
Red Hat Enterprise Linux 6.6	2.6.32-504.el6	
Red Hat Enterprise Linux 6.7	2.6.32-573.el6	
Red Hat Enterprise Linux 6.8	2.6.32-642.el6	
Red Hat Enterprise Linux 6.9	2.6.32-696.el6	
Red Hat Enterprise Linux 6.10	2.6.32-754.el6	V2.0L22 + T00812-35 or later

*1 Only x86 or Intel64 platform.

*2 errata kernel is supported.

*3 It is necessary to apply the Advisory ID RHSA-2012:0052-01.

Multipath Driver for Red Hat Enterprise Linux 7

Operating System *1 *2	Linux Kernel Versions *3	Version Level
Red Hat Enterprise Linux 7	3.10.0-123.el7	V2.0L26 or later
Red Hat Enterprise Linux 7.1	3.10.0-229.el7	V2.0L27 or later
Red Hat Enterprise Linux 7.2	3.10.0-327.el7	V2.0L27 + T00812-31 or later *4 or V2.0L28 or later
Red Hat Enterprise Linux 7.3	3.10.0-514.el7	V2.0L27 + T00812-31 or later *4 or V2.0L28 or later
Red Hat Enterprise Linux 7.4	3.10.0-693.el7	V2.0L28 or later
Red Hat Enterprise Linux 7.5	3.10.0-862.el7	V2.0L29 or later
Red Hat Enterprise Linux 7.6	3.10.0-957.el7	V2.0L29 or later
Red Hat Enterprise Linux 7.7	3.10.0-1062.el7	V2.0L29 or later

*1 Only Intel64 platform.

*2 Please refer to ["How to Update Linux Kernel"](#) without fail when you update OS.

*3 errata kernel is supported.

*4 Please install Multipath Driver product V2.0L27, and then apply the patch T00812-31 without fail.
After that, please reboot the system.

Multipath Driver for SUSE Linux Enterprise Server 11

Operating System *1	Linux Kernel Versions	Version Level
SUSE Linux Enterprise Server 11 for x86 SUSE Linux Enterprise Server 11 for EM64T	2.6.32.12-0.7 (SP1)	V2.0L21 or later
	3.0.13-0.27 (SP2)	V2.0L23 or later
	3.0.76-0.11 (SP3)	V2.0L25 or later
	3.0.101-0.63.1 (SP4)	

*1 gcc, kernel-source, make and kernel-default-devel (or kernel-pae-devel) package must be installed on the server.

Multipath Driver for SUSE Linux Enterprise Server 12

Operating System *1	Linux Kernel Versions	Version Level
SUSE Linux Enterprise Server 12 for EM64T	3.12.28-4	V2.0L27 or later

*1 gcc, kernel-source, make, kernel-default-devel, linux-glibc-devel and rpm-build packages must be installed on the server.

Restrictions and Resolution schedule

The Multipath Driver has following restrictions on each OS.

Common Restrictions for all OS

Restrictions	Resolution schedule
When using iSCSI or Dual Port SAS card to connect storage systems, do not use <code>iompadm change adapter</code> and <code>iompadm restart adapter</code> commands. Use <code>iompadm change controller</code> and <code>iompadm restart controller</code> commands instead.	TBD

Red Hat Enterprise Linux 5

Restrictions	Resolution schedule
Don't run the <code>"service iscsi stop"</code> command and <code>"service iscsi restart"</code> command when using the <code>iscsi-initiator-utils</code> . Please run the <code>"mpdconfig -d"</code> command when logging out from storage systems by the <code>iscsiadm</code> command.	TBD
When iSCSI interface is used to connect storage systems, FC interface, FCoE interface and SAS interface must not be used to connect storage systems.	TBD
The iSCSI boot environment is not supported, when LVM is used.	TBD

Red Hat Enterprise Linux 6

Restrictions	Resolution schedule
In the iSCSI boot environment, do not run the <code>dracut</code> command with <code>"-hostonly"</code> option to make an <code>initramfs</code> file.	TBD

Red Hat Enterprise Linux 7

Restrictions	Resolution schedule
In the iSCSI boot environment, do not run the dracut command with “-hostonly” option to make an initramfs file.	TBD
SCSI T10 DIF/DIX function is not supported	TBD
Do not perform the following device scan on scsi_host of multipath driver. <pre>echo "c t l"> /sys/class/scsi_host/hosth/scan</pre> When you use sg3_utils package, do not use rescan-scsi-bus.sh. If the patch before T00812-32 is applied, the system may panic. If the patch T00812-33 or later is applied and rescan-scsi-bus.sh execute, all paths may be offline.	TBD

SUSE Linux Enterprise Server 11, SUSE Linux Enterprise Server 12

Restrictions	Resolution schedule
The iSCSI boot environment is not supported.	TBD
The EFI boot environment is not supported.	V2.0L23

Supported Storage Systems

Multipath Driver supports the following storage systems.

ETERNUS DX60 S5/DX60 S4
 ETERNUS DX100 S5/DX100 S4
 ETERNUS DX200 S5/DX200 S4
 ETERNUS DX500 S5/DX500 S4
 ETERNUS DX600 S5/DX600 S4
 ETERNUS AF150 S3
 ETERNUS AF250 S3, AF250 S2, AF250
 ETERNUS AF650 S3, AF650 S2, AF650
 ETERNUS DX60 S2
 ETERNUS DX60 S3
 ETERNUS DX80 S2/DX90 S2
 ETERNUS DX100 S3/DX200 S3
 ETERNUS DX200F
 ETERNUS DX400 S2 series
 ETERNUS DX500 S3/DX600 S3
 ETERNUS DX8000 S2 series
 ETERNUS DX8700 S3/ DX8900 S3
 ETERNUS DX8900 S4

The version of Multipath Driver which supports the storage system is as below.

ETERNUS DX60 S2, ETERNUS DX80 S2, ETERNUS DX90 S2

Storage System	Version Level
ETERNUS DX60 S2	V2.0L22 or later
ETERNUS DX80 S2	
ETERNUS DX90 S2	

ETERNUS DX60 S3, ETERNUS DX100 S3, ETERNUS DX200 S3, ETERNUS DX200F ETERNUS AF150 S3, ETERNUS AF250 S3, ETERNUS AF250 S2, ETERNUS AF250

Storage System	Version Level
ETERNUS DX60 S3	V2.0L25 or later
ETERNUS DX100 S3	
ETERNUS DX200 S3	
ETERNUS DX200F	
ETERNUS AF150 S3	V2.0L27 or later
ETERNUS AF250 S3	
ETERNUS AF250 S2	
ETERNUS AF250	

**ETERNUS DX60 S5, ETERNUS DX100 S5, ETERNUS DX200 S5
ETERNUS DX60 S4, ETERNUS DX100 S4, ETERNUS DX200 S4**

Storage System	Version Level
ETERNUS DX60 S5 ETERNUS DX100 S5 ETERNUS DX200 S5 ETERNUS DX60 S4 ETERNUS DX100 S4 ETERNUS DX200 S4	V2.0L26 or later

ETERNUS DX400 S2 series

Storage System	Version Level
ETERNUS DX400 S2 series	V2.0L22 or later

**ETERNUS DX500 S5, ETERNUS DX600 S5, ETERNUS AF650 S3
ETERNUS DX500 S4, ETERNUS DX600 S4, ETERNUS AF650 S2
ETERNUS DX500 S3, ETERNUS DX600 S3, ETERNUS AF650**

Storage System	Version Level
ETERNUS DX500 S5 ETERNUS DX600 S5 ETERNUS DX500 S4 ETERNUS DX600 S4	V2.0L26 or later
ETERNUS DX500 S3 ETERNUS DX600 S3	V2.0L25 or later
ETERNUS AF650 S3 ETERNUS AF650 S2 ETERNUS AF650	V2.0L27 or later

ETERNUS DX900 S5

Storage System	Version Level
ETERNUS DX900 S5	V2.0L29 or later

ETERNUS DX8000 S2 series

Storage System	Version Level
ETERNUS DX8000 S2 series	V2.0L22 or later

ETERNUS DX8700 S3, ETERNUS DX8900 S3

Storage System	Version Level
ETERNUS DX8700 S3 ETERNUS DX8900 S3	V2.0L27 or later

ETERNUS DX8900 S4

Storage System	Version Level
ETERNUS DX8900 S4	V2.0L29 or later

Connection Requirements

The tables below shows related products supported by Multipath Driver. For combination of servers and FC cards, please contact us.

Hardware Requirements

Please use the same cards of product ID to configure a multipath access. If using the different cards of product ID, a multipath access cannot be configured. For example, the combination of a PG-FC202 and a PG-FC202 is good, but the combination of a PG-FC201 and a PG-FC202 is not good.

FC card

Server	HBA	Version Level
PRIMERGY	PG-FC106	S26361-F2843-E1 / S26361-F2843-E201
	PG-FCD101 PG-FCD102	S26361-F3023-L1
	PG-FC107 PG-FC201	S26361-F3141-E1 S26361-F3141-L10 S26361-F3141-L210
	PG-FC202(L) PG-FCD201	S26361-F3306-L1 S26361-F3306-L201 S26361-F3306-E601 / S26361-F3306-L601
	PY-FC201(L) PY-FC202(L) PY-FCD02 PG-FC203(L) PG-FC204(L) PG-FCD202	S26361-F3961-L1 S26361-F3961-L2 S26361-F3961-L201 S26361-F3961-L202 S26361-F3874-L1
	PY-FC211(L) PY-FC212(L) PG-FC205(L) PG-FC206(L)	S26361-F3631-L1 S26361-F3631-L2
	PY-FC221(L) PY-FC222(L) PY-FCD12 PYBFC221(L) PYBFC222(L) PYBFCD121 PYBFCD122	S26361-F4994-E1 S26361-F4994-E2 S26361-F4994-E402 / S26361-F4994-L402 S26361-F4994-L501 S26361-F4994-L502
	PY-FC311(L) PY-FC312(L)	S26361-F5313-E1 S26361-F5313-E2 S26361-F5313-E201 S26361-F5313-E202 S26361-F5313-L501 S26361-F5313-L502
	PY-FC321(L) PYBFC321(L) PY-FC322(L) PYBFC322(L)	S26361-F5580-E1 S26361-F5580-E2 S26361-F5580-E201 S26361-F5580-E202 S26361-F5580-L501 S26361-F5580-L502
	PY-FC331 PYBFC331(L) PY-FC332 PYBFC332(L)	S26361-F5596-E1 S26261-F5596-E2 S26361-F5596-E201 S26261-F5596-E202 S26361-F5596-L501 S26261-F5596-L502

Server	HBAs		Version Level
	PY-FC341 PYBFC341(L) PY-FC342 PYBFC342(L)	S26361-F4043-E1 S26261-F4043-E2 S26361-F4043-E201 S26261-F4043-E202 S26361-F4043-L501 S26261-F4043-L502	V2.0L25 or later
	PY-FC351 PYBFC351(L) PY-FC352 PYBFC352(L)	S26361-F4044-E1 S26261-F4044-E2 S26361-F4044-E201 S26261-F4044-E202 S26361-F4044-L501 S26261-F4044-L502	V2.0L25 or later
PRIMEQUEST 3000 series	MC-0JFCF1(L)/ MC-0JFCF2(L) MC-0JFCG1(L)/ MC-0JFCG2(L) MC-0JFCM1(L)/ MC-0JFCM2(L) MC-0JFCN1(L)/ MC-0JFCN2(L) MC-0JFCP1(L)/ MC-0JFCP2(L) MC-0JFCQ1(L)/ MC-0JFCQ2(L) MC-0JFCK1(L)/ MC-0JFCK2(L) MC-0JFCL1(L)		V2.0L26 or later
PRIMEQUEST 2000 series	MC-0JFC31 / MCX0JFC31 / MC-0JFC3L MC-0JFC41 / MCX0JFC41 / MC-0JFC4L MC-0JFC91 / MCX0JFC91 / MC-0JFC9L MC-0JFCA1 / MCX0JFCA1 / MC-0JFCAL		V2.0L22 or later
	MC-0JFC71 / MCX0JFC71 / MC-0JFC7L MC-0JFC72 / MCX0JFC72 MC-0JFC81 / MCX0JFC81 / MC-0JFC8L MC-0JFC82 / MCX0JFC82		
	MC-0JFC51 / MCX0JFC51 / MC-0JFC5L MC-0JFC61 / MCX0JFC61 / MC-0JFC6L		V2.0L26 or later *1
	MC-0JFCB1 / MCX0JFCB1 / MC-0JFCBL MC-0JFCC1 / MCX0JFCC1 / MC-0JFCCL		V2.0L26 or later *2
PRIMEQUEST 1000 series	MC-0JFC11 / MC-0JFC1L MC-0JFC21 / MC-0JFC2L		V2.0L14 or later
PRIMEQUEST 500A/500/400 series	MC-08FC11 / MC-08FC71		V2.0L01 or later
	MC-08FC31 / MC-08FC41 MC-08FC51 / MC-08FC61		V2.0L03 or later
	MC-08FC81 / MC-08FC91		V2.0L13 or later
3rd party PC servers	Emulex FC cards QLogic FC cards		V2.0L02 or later
	Brocade FC cards		V2.0L20 or later

*1 When using on Red Hat Enterprise Linux 6 (Update 1 or Update 2), please apply the patch T00812-31.

*2 When using on Red Hat Enterprise Linux 6 (Update 4 or later), Red Hat Enterprise Linux 7, SUSE Linux Enterprise Server 11 and SUSE Linux Enterprise Server 12, please apply the patch T00812-31.

SAS card

Server	HBAs		Version Level
PRIMERGY	PY-SC1Y0(L) PG-228B(L)	S26361-F3271-L1	V2.0L13 or later
	PY-SC2Z0 PG-22DC(L)	S26361-F3628-L501	V2.0L22 or later *1
	PY-SCD08 PG-SAD201	S26361-F4480-L1	
	PY-SC3FE	S26361-F3845-L501	
3rd party PC servers	LSI Logic 3Gb/s SAS cards		V2.0L13 or later
	LSI Logic 6Gb/s SAS cards		V2.0L22 or later *1

*1 The earlier Multipath Driver doesn't support it even if applying the latest patch.

iSCSI *1

Server	NICs	Version Level
PRIMERGY PRIMEQUEST 3000 series PRIMEQUEST 2000 series PRIMEQUEST 1000 series	NIC which PRIMERGY supports	V2.0L20 or later *2
3rd party PC servers	Intel Pro/1000MT etc.	

*1 Multipath Driver supports the iSCSI interface on Red Hat Enterprise Linux 5 (Update 4 or later), Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 7, SUSE Linux Enterprise Server 9 (Service Pack 3 or later), SUSE Linux Enterprise Server 10 (Service Pack 2 or later), SUSE Linux Enterprise Server 11 and SUSE Linux Enterprise Server 12.

*2 The earlier Multipath Driver doesn't support it even if applying the latest patch.

FCoE

Server	Card	Version Level	
PRIMERGY	PY-CN202(L) PG-292B(L) PG-CND201	S26361-F3592-L2 S26361-F3592-L202	V2.0L20 or later
	PY-CND02 PYBCND021	S26361-F3592-L532 S26361-F3592-E532	
	PY-CN302 PYBCN302(L) PY-CN302U PYBCN302U	S26361-F5250-E1 S26361-F5250-E201 S26361-F5250-L501 S26361-F5302-E211 / S26361-F5302-L211	
	PY-CN3A1(L) PYBCN3A1(L)	S26361-F5539-E1 S26361-F5539-E201 S26361-F5539-L501	
PRIMEQUEST 3000 series	MC-0JCEL1 MC-0JCEL2	V2.0L26 or later	
PRIMEQUEST 2000 series	MC-0JCE61 / MC-0JCE62	V2.0L26 or later	
3rd party PC servers	Emulex CNA cards	V2.0L20 or later	

Topology

Interface	Topology	Version Level
FC	FC-AL	V2.0L01 or later
	Fabric	
SAS	Point-to-Point	V2.0L13 or later
	Fabric *1	V2.0L22 or later
iSCSI	Point-to-Point	V2.0L20 or later
	Switch	
FCoE	Switch	V2.0L20 or later

*1: Only ETERNUS DX80 S2, DX90 S2, DX100 S3 or DX200 S3.

Virtualization Switch

Model Name	Version Level
VS900 model 300	V2.0L13 or later

* When using VS900 model 300, please set the Max Throttle to 16.

Software Requirements

Clustering Software

Clustering Software	Version Level
PRIMECLUSTER	V2.0L01 or later
LifeKeeper for Linux v6 or later	V2.0L12 or later

Virtualization Environments

Virtualization Environments	Running on Host OS	Running on Guest OS
Hyper-V	N/A	Not Supported
VMware	Not Supported	Not Supported
Linux Citrix Xen	Not Supported	Not Supported
Linux Native Xen	Supported *1	Not Supported
Linux KVM	Supported *2	Not Supported

*1 Only Red Hat Enterprise Linux 5.

When using Xen system on the Intel Itanium platform, Red Hat Enterprise Linux 5.1 or later is required.

*2 Only Red Hat Enterprise Linux 6 and Red Hat Enterprise Linux 7.

UEFI Secure Boot

Server	Firmware	Version Level
PRIMERGY	N/A	Not Supported
PRIMEQUEST 3000 Series PRIMEQUEST 2000 Series	BB15071 or later	V2.0L27 or later *1
PRIMEQUEST 1000 Series PRIMEQUEST 500A/500/400 Series	N/A	Not Supported
3rd party PC servers	N/A	Not Supported

*1 Multipath Driver supports the UEFI Secure Boot on Red Hat Enterprise Linux 7.1 or later.

Adapter Port Number and Connection Points

The `iompadm` command with "info" option shows attached disks information with adapter port number as the following example. The adapter port number means a connection point and is uniquely defined on each storage system. The figures below show the adapter port number of supported storage systems.

Example:

```
# /opt/FJSMpd/bin/iompadm info
```

```
IOMP: vhma0
```

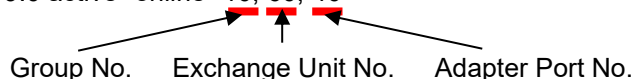
```
Element:
```

```
DISK: ETERNUS_DXM- 000001-0000-0180 (sdf)
```

```
PATH:
```

```
sdf 0000:02:03.0 active "online" 11, 61, 42
```

```
sdf 0000:02:09.0 active "online" 10, 60, 40
```



Note:

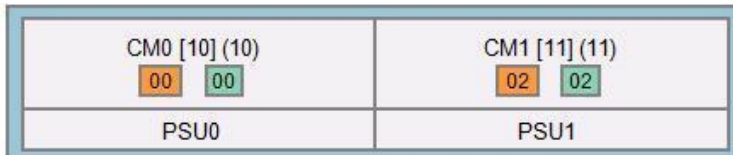
An adapter port number is different from a port number. Please refer to the User's Guide of a storage system to check a port number. The relation between the port number and the physical position of the port depends on a storage system.

ETERNUS DX60 S2 rear view (FC, iSCSI connection)



[] : Group No. () : Exchange Unit No. ■ : Adapter Port No. ■ : When using 2 port CM

ETERNUS DX60 S2 rear view (SAS connection)



[] : Group No. () : Exchange Unit No. ■ : Adapter Port No. ■ : When using 2 port CM

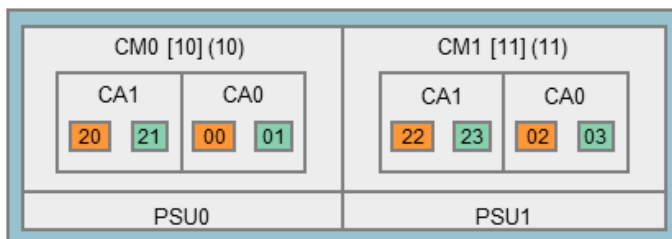
ETERNUS DX60 S5, ETERNUS DX60 S4, ETERNUS DX60 S3 rear view



[] : Group No. () : Exchange Unit No. ■ : Adapter Port No. ■ : When using 2 port CM

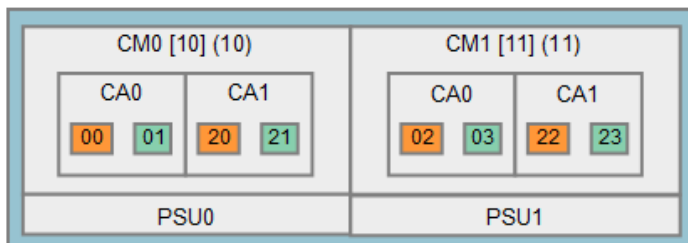
ETERNUS DX100 S5, ETERNUS DX100 S4, ETERNUS DX100 S3 rear view

When CA of FC is installed in the basic host interface



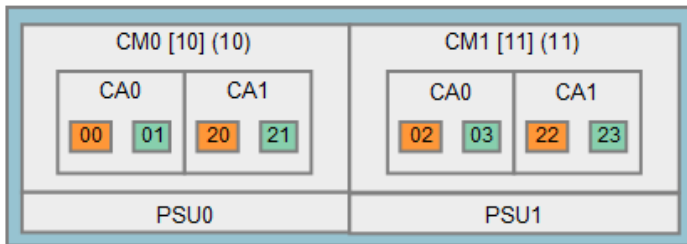
[] : Group No. () : Exchange unit No. ■ : adapter Port No. ■ : When using 2port-CA

When CA other than FC are installed in the basic host interface



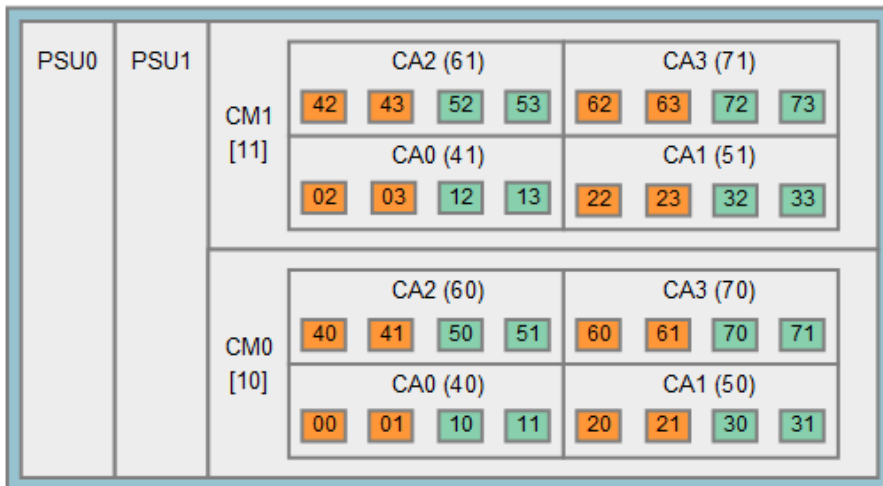
[] : Group No. () : Exchange unit No. ■ : adapter Port No. ■ : When using 2port-CA

ETERNUS DX200 S5, ETERNUS DX200 S4, ETERNUS DX200 S3, ETERNUS AF150 S3, ETERNUS AF250 S3, ETERNUS AF250 S2, ETERNUS AF250, ETERNUS DX200F, ETERNUS DX80 S2, ETERNUS DX90 S2 rear view



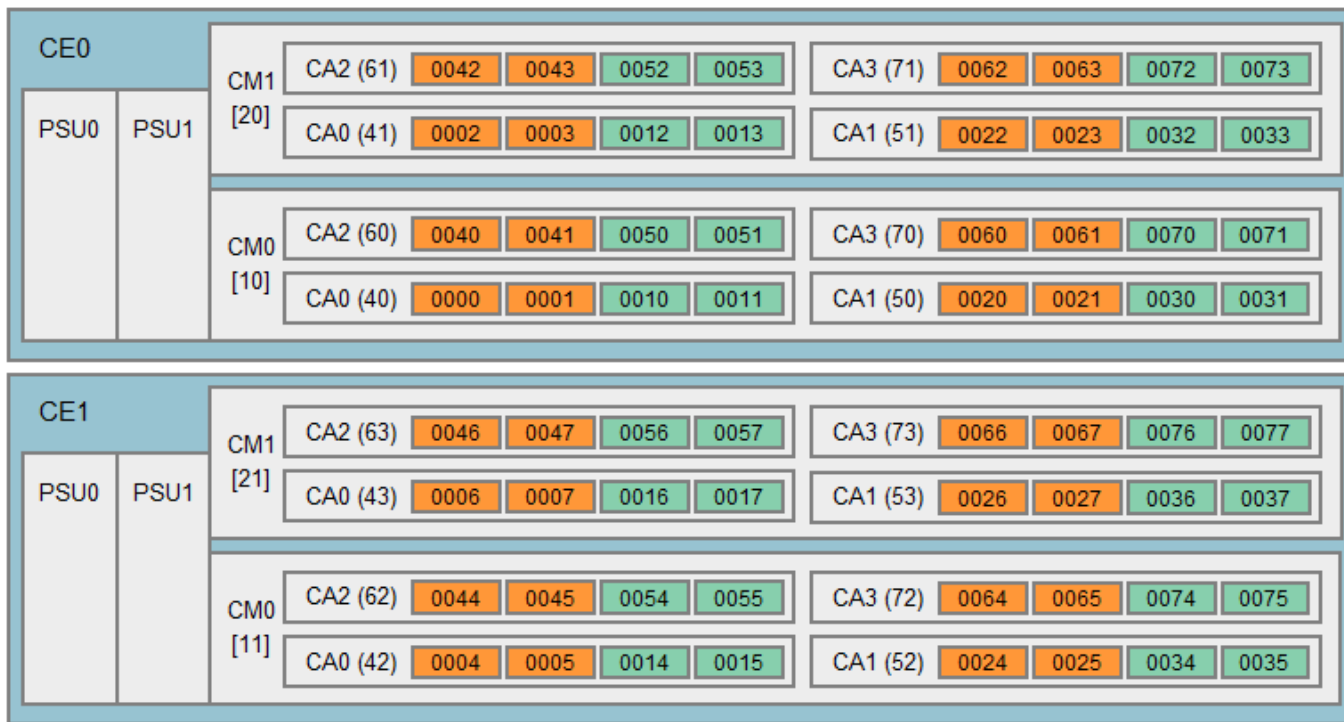
[]: Group No. (): Exchange unit No. : adapter Port No. : When using 2port-CA

ETERNUS DX500 S5, ETERNUS DX500 S4, ETERNUS DX500 S3, ETERNUS DX600 S5, ETERNUS DX600 S4, ETERNUS DX600 S3, ETERNUS AF650 S3, ETERNUS AF650 S2, ETERNUS AF650, ETERNUS DX400 S2 series rear view



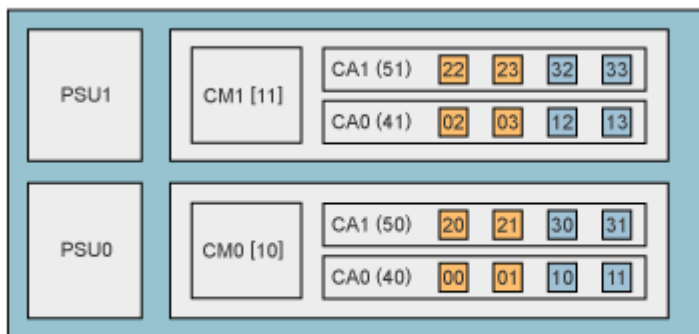
[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA

ETERNUS DX900 S5 rear view



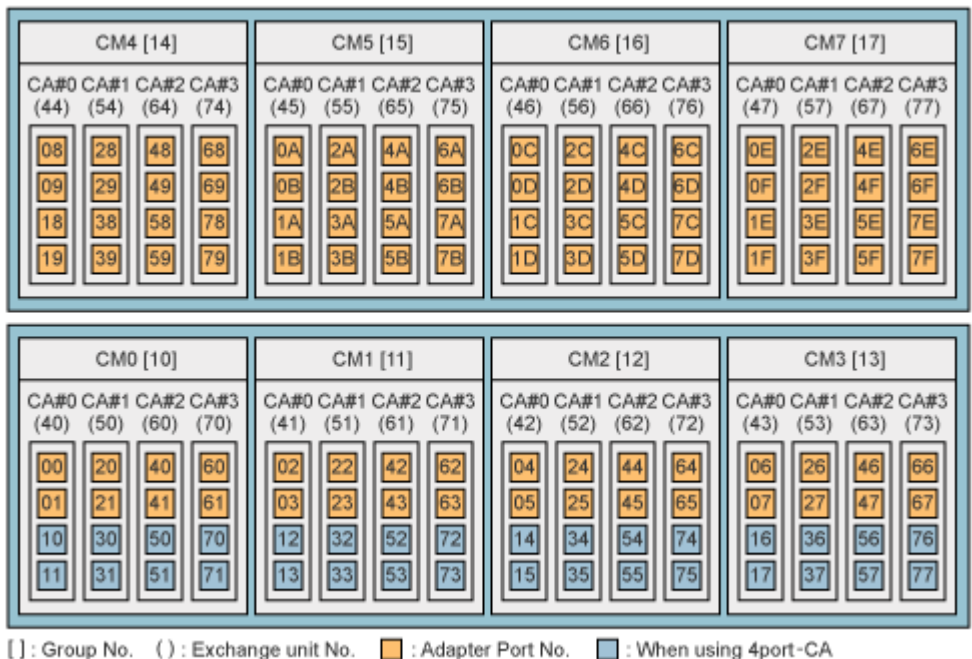
[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA

ETERNUS DX8100 rear view

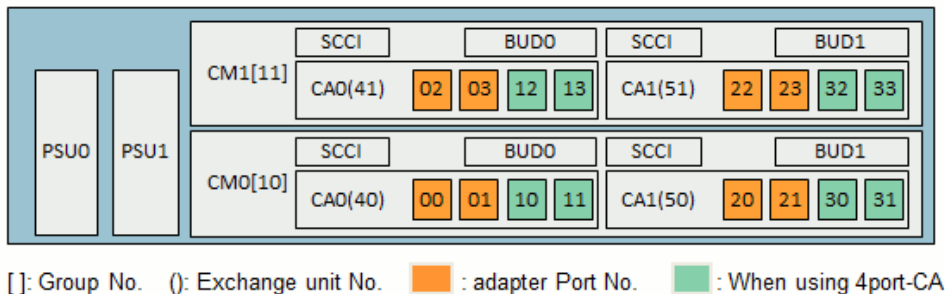


[]: Group No. (): Exchange unit No. : Adapter Port No. : When using 4port-CA

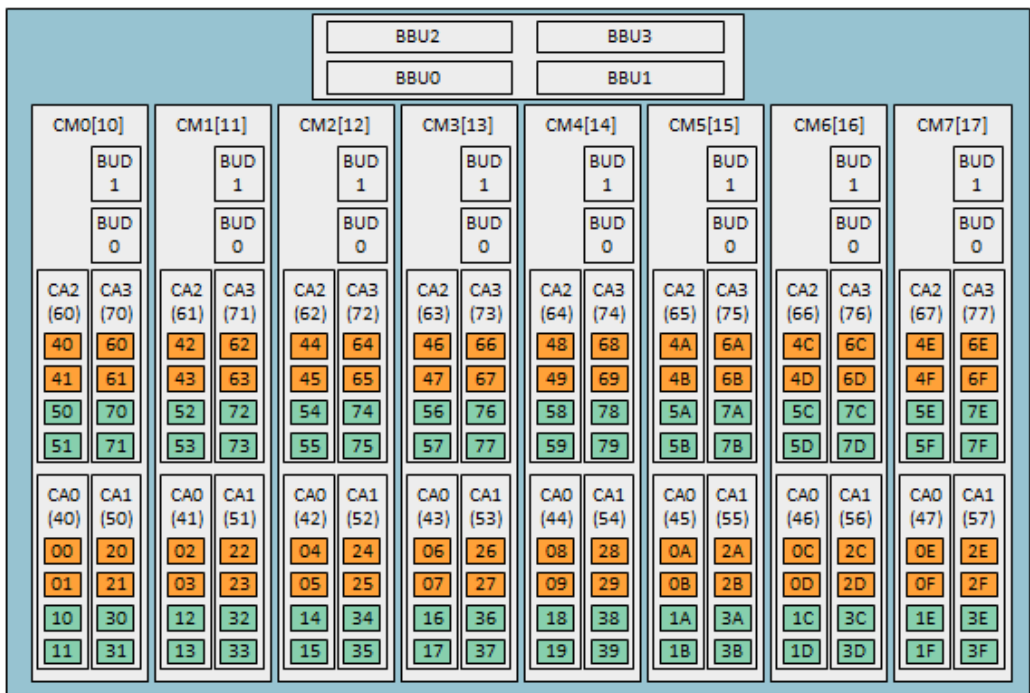
ETERNUS DX8400, ETERNUS DX8700 front view



ETERNUS DX8100 S2 rear view

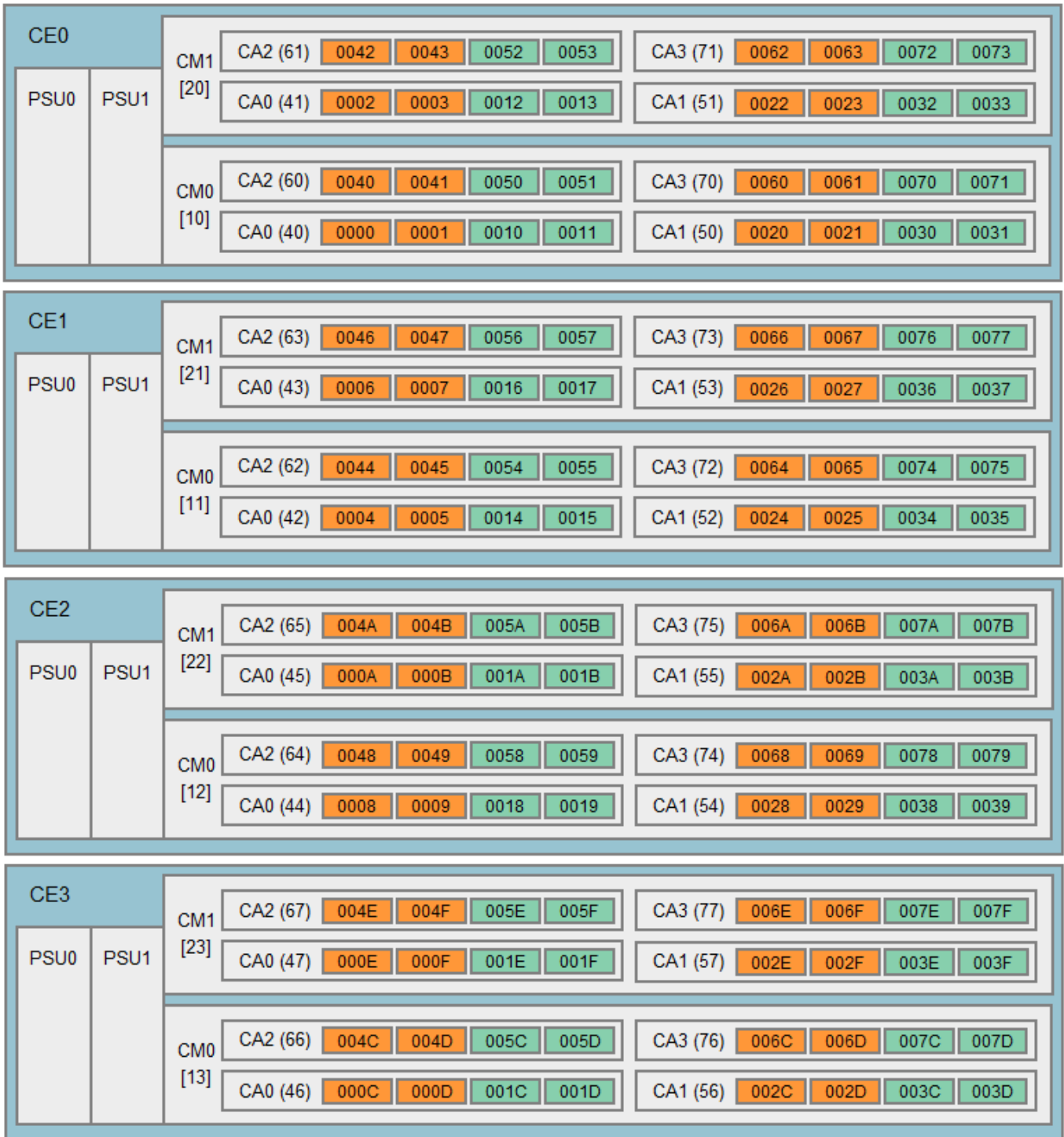


ETERNUS DX8700 S2 front view

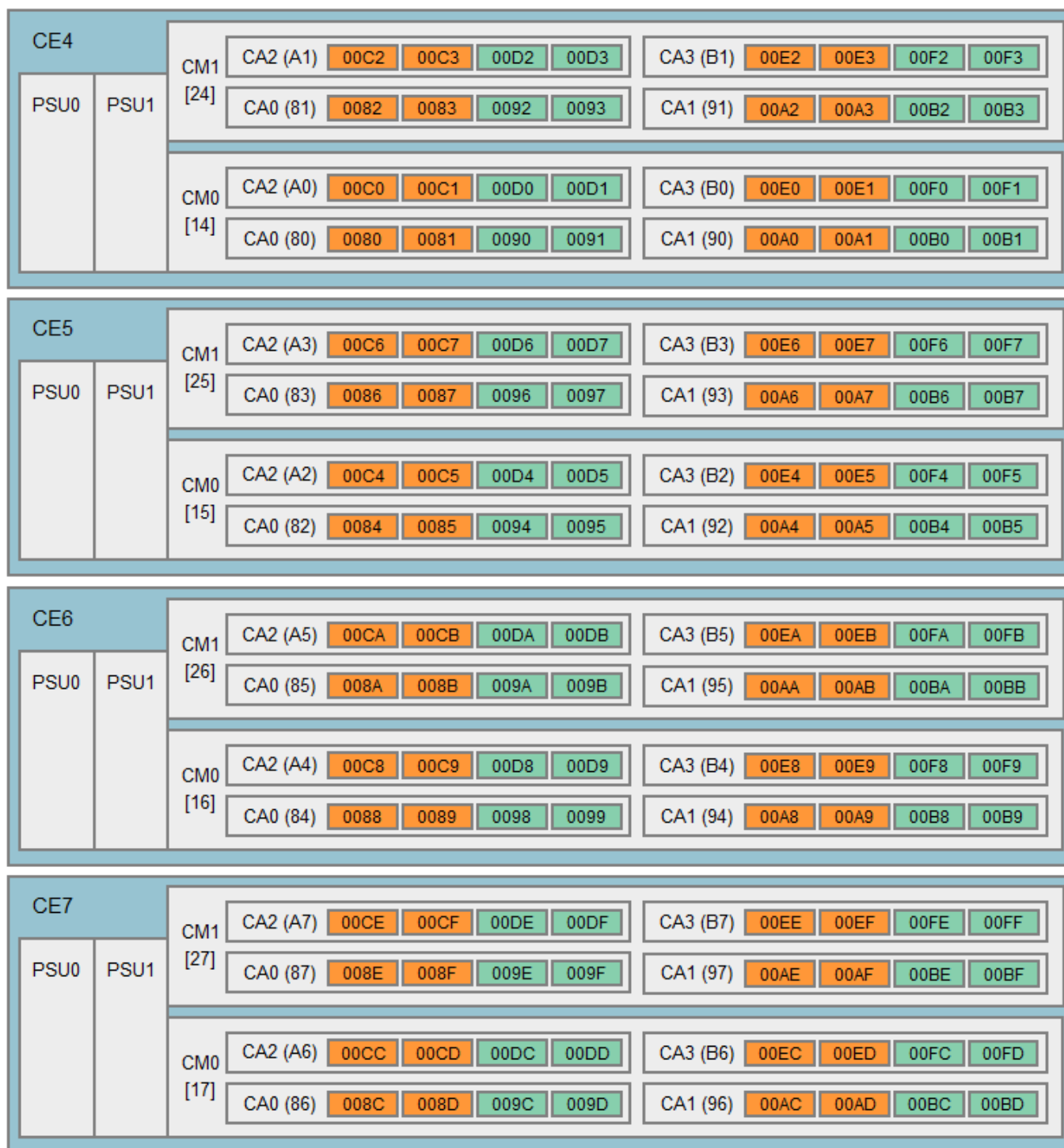


[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA

ETERNUS DX8900 S4, ETERNUS DX8700 S3, ETERNUS DX8900 S3 rear view



[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA



[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA

CE8		PSU0	PSU1	CM1 [28]	CA2 (E1)	0142	0143	0152	0153	CA3 (F1)	0162	0163	0172	0173
	CA0 (C1)				0102	0103	0112	0113	CA1 (D1)	0122	0123	0132	0133	
	CM0 [18]			CA2 (E0)	0140	0141	0150	0151	CA3 (F0)	0160	0161	0170	0171	
				CA0 (C0)	0100	0101	0110	0111	CA1 (D0)	0120	0121	0130	0131	
CE9		PSU0	PSU1	CM1 [29]	CA2 (E3)	0146	0147	0156	0157	CA3 (F3)	0166	0167	0176	0177
	CA0 (C3)				0106	0107	0116	0117	CA1 (D3)	0126	0127	0136	0137	
	CM0 [19]			CA2 (E2)	0144	0145	0154	0155	CA3 (F2)	0164	0165	0174	0175	
				CA0 (C2)	0104	0105	0114	0115	CA1 (D2)	0124	0125	0134	0135	
CE10		PSU0	PSU1	CM1 [2A]	CA2 (E5)	014A	014B	015A	015B	CA3 (F5)	016A	016B	017A	017B
	CA0 (C5)				010A	010B	011A	011B	CA1 (D5)	012A	012B	013A	013B	
	CM0 [1A]			CA2 (E4)	0148	0149	0158	0159	CA3 (F4)	0168	0169	0178	0179	
				CA0 (C4)	0108	0109	0118	0119	CA1 (D4)	0128	0129	0138	0139	
CE11		PSU0	PSU1	CM1 [2B]	CA2 (E7)	014E	014F	015E	015F	CA3 (F7)	016E	016F	017E	017F
	CA0 (C7)				010E	010F	011E	011F	CA1 (D7)	012E	012F	013E	013F	
	CM0 [1B]			CA2 (E6)	014C	014D	015C	015D	CA3 (F6)	016C	016D	017C	017D	
				CA0 (C6)	010C	010D	011C	011D	CA1 (D6)	012C	012D	013C	013D	

[]: Group No. (): Exchange unit No. : adapter Port No. : When using 4port-CA

Assigned-/Non-assigned CM Type Storage Systems

For ETERNUS storage systems, there are two system types: “Assigned-CM” and “Non-assigned-CM.” With Assigned-CM storage systems, the main access path for each LU is assigned to a particular controller. With Non-assigned-CM storage systems, there are no assigned LU access paths as such.

With “Assigned-CM” type storage systems, the path connected to the assigned controller is active. Paths to other controllers are on standby. With “Non-assigned-CM” type storage systems, all paths are active and used for access.

The table below shows the “Assigned-CM” and “Non-assigned-CM” storage systems.

Load balancing/Failover performance can differ depending on “Assigned-CM” and “Non-assigned-CM” use and the number of paths employed. For details, refer to the supplied product manual.

Assigned CM type	ETERNUS DX60 S5, DX60 S4, DX60 S3 ETERNUS DX100 S5, DX100 S4, DX100 S3 ETERNUS DX200 S5, DX200 S4, DX200 S3 ETERNUS DX500 S5, DX500 S4, DX500 S3 ETERNUS DX600 S5, DX600 S4, DX600 S3 ETERNUS DX60 S2, ETERNUS DX80 S2 ETERNUS DX90 S2 ETERNUS DX400 S2 series ETERNUS AF150 S3 ETERNUS AF250 S3, AF250 S2, AF250 ETERNUS AF650 S3, AF650 S2, AF650 ETERNUS DX200F
Non-assigned CM type	ETERNUS DX8900 S4 ETERNUS DX8000 S3 series ETERNUS DX8000 S2 seies

Change Unit of Storage Systems

The `iompadm change/restart` command has a “change unit” parameter. The change unit represents a module of a storage system as follows.

Storage System	cu/controllerunit	g/groupmodule
ETERNUS DX60 S5, DX60 S4, DX60 S3 ETERNUS DX100 S5, DX100 S4, DX100 S3 ETERNUS DX200 S5, DX200 S4, DX200 S3 ETERNUS DX60 S2 ETERNUS DX80 S2 ETERNUS DX90 S2 ETERNUS AF150 S3 ETERNUS AF250 S3, AF250 S2, AF250	-	CM
ETERNUS DX500 S5, DX500 S4, DX500 S3 ETERNUS DX600 S5, DX600 S4, DX600 S3 ETERNUS DX8700 S3/DX8900 S3 ETERNUS DX400 S2 series ETERNUS DX8000 S2 series ETERNUS DX8900 S4 ETERNUS AF650 S3, AF650 S2, AF650	CA	CM

When a CA of ETERNUS DX500 S4 is exchanged, the change unit must be `cu` or `controllerunit`. When a CM of ETERNUS DX100 S4 is exchanged, the change unit must be `g` or `groupmodule`.

Linux Kernel and Multipath Driver Update

Multipath Driver Update

Never use '-U' option of the rpm command. Please check a software information or a patch installation manual.

How to Update Linux Kernel

Apply the latest patch of Multipath Driver Update the Linux kernel. If the update fails, refer to the next section.

1. In the case of Red Hat Enterprise Linux 7

If a kernel is updated, make sure to execute the following command before rebooting the OS.

```
# /opt/FJSVmpd/system/mpdchkdup
```

If the following message is displayed, the Multipath Driver cannot operate with the updated kernel. Change the configuration to a single path, or update the Multipath Driver.

```
!!! ERROR !!!
```

```
In ETERNUS Multipath Driver, this kernel is not supported.
```

2. In the case of SUSE Linux Enterprise Server

When the kernel is updated, the renewal of the following packages are needed.

Operating System	packages
SUSE Linux Enterprise Server 11	kernel-source, kernel-xxxx-devel
SUSE Linux Enterprise Server 12	kernel-source, kernel-xxxx-devel, linux-glibc-devel

If a kernel or a device driver is updated after the Multipath Driver is installed, make sure to execute the following command before rebooting the OS

```
# /opt/FJSVmpd/system/mpdsetup
```

WARNING Message During Linux Kernel Update

The following message might be displayed when updating the Linux kernel on Red Hat Enterprise Linux AS v.4, Red Hat Enterprise Linux ES v.4 or Red Hat Enterprise Linux 5. Please ignore the message.

```
WARNING: No module mpdh found for kernel XXXXX, continuing anyway
(XXXXX: kernel version)
```

Recovery from Failure of Update to Red Hat Enterprise Linux 5.5

OS doesn't start in the following conditions.

- 1.The Multipath Driver before V2.0L14 is installed in the Red Hat Enterprise Linux 5.5
- 2.The environment that uses the Multipath Driver before V2.0L14 is updated to Red Hat Enterprise Linux 5.5.
- 3.The environment that uses the Multipath Driver that applies the patches before T000972LP-09, T000973LP-09 or T000971QP-09 is updated to Red Hat Enterprise Linux 5.5.

Please follow the instructions below to recover from the failure.

(Please prepare installation CD1 of Red Hat Enterprise Linux 5.5 and product CD of Multipath Driver V2.0L20 or later.)

Set installation CD1 of Red Hat Enterprise Linux 5.5 to the drive, and boot up a system in the rescue mode.

"Selection of the language" and "Selection of the keyboard" screen are displayed, and select the item corresponding to the environment.

"Setting of the network" screen is displayed, and select "no".

"Selection of the method of the mount" screen is displayed, and select either following methods.

- "Continue" is selected.:automatic mount to /mnt/sysimage is done.
- "skip" is selected. manual mount to /mnt/sysimage,after the shell starts.

Execute/usr/sbin/chroot command after the shell starts, and change the root directory.

```
# /usr/sbin/chroot /mnt/sysimage
```

In case /boot partition etc. are set besides/root partition, execute the mount command for those partitions.

Take out installation CD1, and exchange it for product CD of Multipath Driver V2.0L20 or later.

Execute the mount command for product CD of Multipath Driver V2.0L20 or later.

For instance, it becomes the following when the device of the CD drive is /dev/hda.

```
# mount /dev/hda /media
```

Move to the CD, and install Multipath Driver V2.0L20 or later by the mdpkgadd command.

```
# cd /media
```

```
# ./mpdpkgadd
```

Move to the root, and take out product CD of Multipath Driver V2.0L20 or later after unmounting.

```
# cd /
```

```
# umount /media
```

Execute exit twice, and end the chroot environment and the rescue mode. The server reactivates by the automatic operation after the rescue mode ends.

```
# exit
```

```
# exit
```

Notes

When using Retpoline Kernel

1) About the patch for Retpoline

Please apply the following patch when you use Retpoline Kernel before V2.0L29.

T00812-35 or later

[Retpoline Kernel]

< Red Hat Enterprise Linux 7 >

Red Hat Enterprise Linux 7.2 AUS errata (RHBA-2018:0390) Kernel-3.10.0-327.64.1.el7 or later
 Red Hat Enterprise Linux 7.3 EUS/AUS errata (RHSA-2018:0399) Kernel-3.10.0-514.44.1.el7 or later
 Red Hat Enterprise Linux 7.4 errata (RHSA-2018:0395) Kernel-3.10.0-693.21.1.el7 or later

< Red Hat Enterprise Linux 6 >

Red Hat Enterprise Linux 6.4 AUS errata (RHBA-2018:0509) Kernel-2.6.32-358.87.1.el6 or later
 Red Hat Enterprise Linux 6.5 AUS errata (RHBA-2018:0394) Kernel-2.6.32-431.87.1.el6 or later
 Red Hat Enterprise Linux 6.6 AUS errata (RHBA-2018:0507) Kernel-2.6.32-504.66.1.el6 or later
 Red Hat Enterprise Linux 6.7 EUS/AUS errata (RHSA-2018:0496) Kernel-2.6.32-573.53.1.el6 or later
 Red Hat Enterprise Linux 6.9 errata (RHSA-2018:0512) Kernel-2.6.32-696.23.1.el6 or later

< Red Hat Enterprise Linux 5 >

Red Hat Enterprise Linux 5.9 AUS errata (RHSA-2018:1252) Kernel-2.6.18-348.39.1.el6 or later
 Red Hat Enterprise Linux 5.11 ELS errata (RHSA-2018:1196) Kernel-2.6.18-430.el5 or later

When not applying patch, the following warning message is output to the system log (/var/log/messages etc.) when the server booted.

```
WARNING: module 'mpdt' built without retpoline-enabled compiler,may affect Spectre v2 mitigation
```

2) Patch application procedure

- When using Retpoline Kernel

After the patch is applied, the Retpoline driver is installed. The warning message is not output.

- When using non-Retpoline Kernel (*2)

After the patch is applied, the Retpoline driver is not installed. Therefore, when errata of [Retpoline Kernel] is applied after the patch is applied, the warning message is output.

Please install the driver according to the following procedures. As a result, the warning message is not output.

[Install the Retpoline driver]

1. Install the Retpoline driver.

```
# /opt/FJSVmpd/system/mpdchkp
Preparing... ##### [100%]
1:kmod-FJSVmpd_rh ##### [100%]
:
Please reboot this system.
```

2. Reboot the server.

```
# reboot
```

*2 Kernel that errata of [Retpoline Kernel] is not applied.

3) Notes

Please replace the driver according to the following procedures when switching from Retpoline Kernel to non-Retpoline Kernel.

1. The default boot is set to target Kernel(non-Retpoline Kernel) by using boot loader.

2. Install the non-Retpoline driver.

```
# /opt/FJSVmpd/system/mpdchkrp chgpk
Preparing... ##### [100%]
1:kmod-FJSVmpd_rh ##### [100%]
:
Please reboot this system.
```

3. Reboot the server.
 - # reboot

[Notice]

When you change Kernel without following the above procedure on Red Hat Enterprise Linux 5, the server repeats rebooting by Multipath Driver checking. To restore it, please boot Retpoline Kernel, and execute the above procedure.

[Note]

When you change Kernel from non-Retpoline Kernel to Retpoline kernel again, Please execute the procedure described in "2) [Install the Retpoline driver]".

Storage Cluster of ETERNUS DX series

Please set it according to the following procedures when ETERNUS DX series is connected with the server by the iSCSI interface, and the Storage Cluster function is used.

1. Please edit the mpd.conf file of /var/opt/FJSVmpd/ directory.
 - Please add "mpdh-nocon-retry=120" to the part of "# Global define".

Example:

```
# Global define
mpdh-set-order=0;
mpdh-rsv-key=5004c9cb;
dev_loss_tmo=2147483;
fast_io_fail_tmo=1;
mpdh-nocon-retry=120;
```

2. Please execute the following commands.
 - # /opt/FJSVmpd/bin/mpdconfig -g

Procedure for releasing setting

1. Please edit the mpd.conf file of /var/opt/FJSVmpd/ directory.
 - Please delete "mpdh-nocon-retry=120" added to "# Global define".

2. Please execute the following commands.
 - # /opt/FJSVmpd/bin/mpdconfig -g

When the Storage failover/failback of Storage Cluster is done while recognizing the multipath of the server start etc. , the multipath might not be recognized.

In this case, please recognize the multipath again by the following commands.

```
# /opt/FJSVmpd/bin/mpdconfig -a
```

FC Switch

When using Multipath Driver with FC switches, zoning settings must be defined. For the details of setting zones, please refer to the manual of FC switches.

When connecting to both the storage system that is supported by Multipath Driver and the storage system that is not supported by Multipath Driver, use different HBA(or port) in both storage systems.

Emulex OneCommand Manager

When using Emulex OneCommand Manager on Red Hat Enterprise Linux 7.1, please run the following command to load sg driver.

```
# modprobe sg
```

Setting of qla2xxx driver

When using the Red Hat Enterprise Linux 5 and a driver downloaded from the QLogic web site is installed, the following messages that are described below may be added in the "/etc/modprobe.conf" file. Multipaths cannot be configured with these messages. When these messages are added, add "#" on the top of the lines to comment-out these messages. If the Multipath Driver is already installed, comment-out these messages and then execute the "mpdsetup" command.

```
install qla2xxx /sbin/modprobe qla2xxx_conf; /sbin/modprobe --ignore-install qla2xxx
remove qla2xxx /sbin/modprobe -r --first-time --ignore-remove qla2xxx && { /sbin/modprobe -r --ignore-remove
qla2xxx_conf; }
```

iSCSI

When iSCSI interface is used to connect storage systems, please set the iSCSI timer using the iscsiadm command. Please refer to the guide of the storage system for details concerning the use of iSCSI initiator.

When executing the "iompadm info" command, the pci_bus_number of iSCSI path displayed "platform" .

Notes when Multipath is Composed

Please connect the HBA in the server and the disk array device as there is a redundancy. For instance, please use CM0 and CM1 of ETEURNUS DX400 series to configure multipaths. Moreover, it is necessary to consider even number/odd number of CM for the disk array device with three CMs or more such as ETEURNUS DX8000 series. Contact a Fujitsu engineer for details.

LU Configuration

The LU number has to be allocated from 0 in ascending order, and the LU configuration of each port that configure a multipath has to be equal. Please refer to the manual of ETERNUS storage system for the details of how to set LUN Mapping, Affinity Group or Zone and how to check a logical volume number.

Storage/LU/Path Addition without Server Rebooting

When executing the "iompadm info" command just behind the addition, the path_status may be displayed as follows.

```
fail "empty status"
```

In that case, please execute the "iompadm info" command after it waits for a moment.

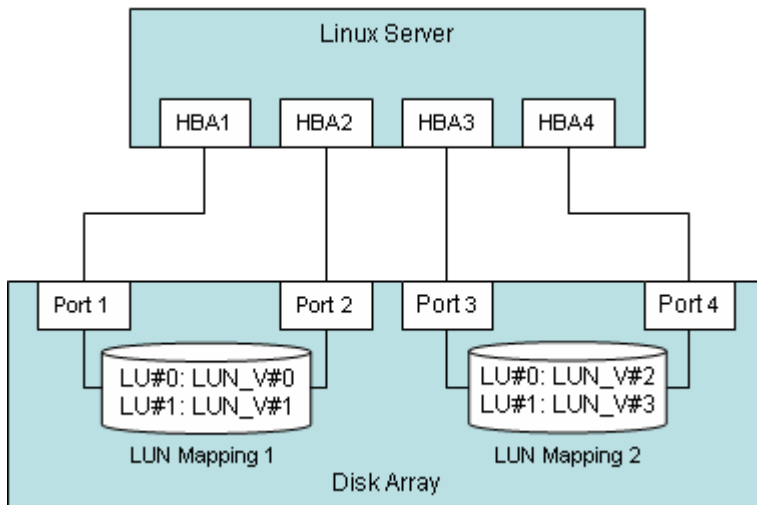
Hotplug of FC card on Red Hat Enterprise Linux 5.3 (for Intel Itanium)

The lpfc driver bundled with Red Hat Enterprise Linux 5.3 (for Intel Itanium) has a problem about hotplug. The problem is that hotplug procedure takes a lot of time. The problem has been resolved by the following version of the lpfc driver which is released by Fujitsu.

```
lpfc-fjstd-RHEL5-8.2.0.33.3p-2 / lpfc-fjext-RHEL5-8.2.0.33.3p-2
lpfc-fjstd-RHEL5-xen-8.2.0.33.3p-2 / lpfc-fjext-RHEL5-xen-8.2.0.33.3p-2
```

Multiple LUN Mappings Configuration

In the case of Multipath Driver V2.0L10 or later, a server can recognize multiple LUN Mappings, Affinity Group or Zones set in a storage system as follows.



LUN Mapping 1

The logical volume (LUN_V) #0 is mapped on LU#0, and the logical volume (LUN_V) #1 is mapped on LU#1.

LUN Mapping 2

The logical volume (LUN_V) #2 is mapped on LU#0, and the logical volume (LUN_V) #3 is mapped on LU#1.

Notes in Linux KVM environment

It is necessary to do the following procedures in guest OS.

- Guest OS is Red Hat Enterprise Linux 6, and
- LU of the storage system is allocated on a virtual disk as IDE Disk for guest OS.

1. Please arrange "50- ide.rules" in/etc/udev/rules.d/directory.
Please set the following to "50- ide.rules".

```
ACTION=="add", SUBSYSTEM=="scsi" , SYSFS{type}=="0", RUN+="/bin/sh -c 'echo 40 > /sys$DEVPATH/timeout'"
```

2. Please reboot guest OS.

udev Configuration

When you use the follow OS, please use by-id names of udev function.

- Red Hat Enterprise Linux 5
- Red Hat Enterprise Linux 6
- Red Hat Enterprise Linux 7
- SUSE Linux Enterprise Server 11
- SUSE Linux Enterprise Server 12

When the Multipath Driver is installed, the by-path names as the device names of the disks in the storage system cannot be used. To install the Multipath Driver into the system where the by-path names are used as the device names of the disks in the storage system, change the by-path names in all setting files to the by-id names.

1. Correspondence between the by-id names and the usual /dev/sda type names

The by-id names are symbolic link to /dev/sdX name. So you can confirm relation between the by-id name and /dev/sdX name by executing the 'ls -l /dev/disk/by-id' command.

Example: Check the by-id name of /dev/sdb

```
# ls -l /dev/disk/by-id/
total 0
lrwxrwxrwx 1 root root 9 Dec 2 2006 scsi-3600e00000cb000000000100000000 -> ../../sdb
```

```
lrwxrwxrwx 1 root root 9 Dec 2 2006 scsi-3600e00000cb0000000000100010000 -> ../../sdc
```

The result shows that the by-id name of /dev/sdb is /dev/disk/by-id/scsi-3600e00000cb0000000000100000000.

2. Notice

When you use by-id names as device names of disks in a storage system, change all storage system related settings of OS and applications from /dev/sdX type names to by-id names.

It isn't necessary to use the recognition order setting (fixed-recognition-order initial RAM disk), if by-id names are specified as the device names for all configuration file such as /etc/fstab.

About This Installation Information

This Installation Information is devoted to providing technical information and an overview of the basic facilities of Multipath Driver. The contents of this document may be modified without any prior notice.

Please contact FUJITSU LIMITED if you find any error in descriptions.

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