

NEC Storage PathManager for Linux Installation Guide

Introduction

Thank you for buying our product.

This document describes how to set up this software product. Please be sure to read this document before installing PathManager for Linux.

For how to use this product, refer to the electronic manual included in the installation CD.

The First Edition in October 2017

Remarks

- (1) This manual explains functions implemented by the following software products:
 - NEC Storage PathManager for Linux
 - NEC Storage PathManager for Linux (Bundle Edition)

- (2) The following descriptions mean these names of products unless specified clearly.

Descriptions in text	Product Name
FC	Fibre Channel
HBA	Host Bus Adapter
ESMPRO	ESMPRO/ServerAgent
RHEL	Red Hat Enterprise Linux
SLES	SUSE Linux Enterprise Server

- (3) Trademark:
 - NEC Storage PathManager is a registered trademark of NEC in Japan.
 - Linux is a trademark or registered trademark of Mr. Linus Torvalds in the United States and the other countries.
 - Red Hat is a trademark or registered trademark of Red Hat, Inc. in the United States and the other countries.
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- (4) In this document, matters to which careful attention needs to be paid will be described as follows. Be sure to observe the contents. If the indications are ignored and the system is improperly operated, settings which have been already made might be affected.

Type of Indication	
Type	Description
	Describes contents which require special attention during operation.

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Chapter 1 Preparation for Installation

This chapter describes how to prepare for installation of PathManager.

1.1 System Requirements

The system requirements are shown from "Table 1-1" to "Table 1-4". Check your environment.

Table 1-1 System Requirements

	NEC Storage PathManager for Linux	NEC Storage PathManager for Linux (Bundle Edition)
Server (*1)	Express5800 Rack Servers Express5800 Tower Servers Express5800 Blade Servers Express5800 Scalable Enterprise Servers	
Memory	required by the OS + 2 MB at the minimum	
Disk	5 MB at the minimum	
HBA	FC-HBA specified for the server and the disk array unit (If the server and the disk array are connected by FC) SAS-HBA specified for the server and the disk array (If the server and the disk array are connected by SAS)	
NIC / iSCSI initiator	NIC / iSCSI initiator specified for the server and the disk array unit (If the server and the disk array are connected by iSCSI)	
NEC Storage (*2)	- M5000 series - M700 series (*3) - M500 series - M300 series (*3) - M100 series	- M 100 series
	- D8 series - D4 series - D3 series - D1 series	

(*1) Do not install the PathManager to a virtual machine

(*2) Refer to "Table 1-2", "Table 1-3" and "Table 1-4" for the details.

(*3) "All Flush Storage" is included.

**Table 1-2 Mapping of NEC Storages and OS versions supported by PathManager
(for Express5800 Rack Servers, Tower Servers and Blade Servers) (*2)**

NEC Storage M5000	FC	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 5 (Kernel-2.6.18-308.24.1.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (Kernel-2.6.32-279.el6) (IA32/EM64T) or later - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later
	iSCSI	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 6 (Kernel-2.6.32-504.12.2.el6) (IA32/EM64T) or later - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later
	SAS	-
NEC Storage M series	FC	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 5 (kernel-2.6.18-194.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later - SUSE Linux Enterprise Server 10 (kernel-2.6.16.60-0.57.1) (IA32/EM64T) or later
	iSCSI	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 5 (kernel-2.6.18-194.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later
	SAS	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 5 (kernel-2.6.18-274.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later

NEC Storage D series	FC	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 4 (kernel-2.6.9-42.EL) (IA32/EM64T) or later - Red Hat Enterprise Linux 5 (kernel-2.6.18-53.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later - SUSE Linux Enterprise Server 10 (kernel-2.6.16.60-0.21) (IA32/EM64T) or later
	iSCSI	<ul style="list-style-type: none"> - Red Hat Enterprise Linux 5 (kernel-2.6.18-92.el5) (IA32/EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later

**Table 1-3 Mapping of NEC Storages and OS versions supported by PathManager
(for Express5800 Scalable Enterprise Servers) (*2)**

NEC Storage M5000	FC	- Red Hat Enterprise Linux 5 (Kernel-2.6.18-308.24.1.el5) (EM64T) or later - Red Hat Enterprise Linux 6 (Kernel-2.6.32-279.el6) (EM64T) or later
	iSCSI	-
	SAS	-
NEC Storage M series	FC	- Red Hat Enterprise Linux 5 (kernel-2.6.18-194.el5) (EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el5) (EM64T) or later
	iSCSI	-
	SAS	-
NEC Storage D series	FC	- Red Hat Enterprise Linux 5 (kernel-2.6.18-128.el5) (EM64T) or later - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el5) (EM64T) or later
	iSCSI	-

(*2) Supported kernels are limited to the one shown in the table "Supported Distributions and Kernels (Table 1-4)"

PathManager supports the following distributions and kernels:

Table 1-4 Supported Distributions and Kernels (IA32 and EM64T)

Distribution	Kernel version	Function version of PathManager(*3)
Red Hat Enterprise Linux AS 4 Red Hat Enterprise Linux ES 4	2.6.9-22.EL	3.0.11
	2.6.9-34.EL	
	2.6.9-34.0.1.EL	
	2.6.9-42.EL	
	2.6.9-55.EL	3.0.12
	2.6.9-55.0.12.EL	
	2.6.9-67.EL	3.0.13
	2.6.9-78.EL	3.0.14
	2.6.9-78.0.8.EL	
	2.6.9-89.EL	3.1.0
2.6.9-100.EL	3.1.1	
Red Hat Enterprise Linux 5 Red Hat Enterprise Linux 5 Advanced Platform	2.6.18-53.el5	4.1.7
	2.6.18-92.el5	
	2.6.18-92.1.10.el5	
	2.6.18-92.1.22.el5	
	2.6.18-128.el5	4.2.5
	2.6.18-128.1.10.el5	
	2.6.18-164.el5	4.3.7
	2.6.18-164.9.1.el5	
	2.6.18-194.el5	5.0.7
	2.6.18-194.11.4.el5	
	2.6.18-194.17.1.el5	
	2.6.18-238.el5	
	2.6.18-238.9.1.el5	
	2.6.18-274.el5	
	2.6.18-274.18.1.el5	5.0.20
	2.6.18-308.el5	
	2.6.18-308.24.1.el5	
	2.6.18-348.el5	
2.6.18-371.el5		
2.6.18-371.3.1.el5	5.0.30	
2.6.18-398.el5		
Red Hat Enterprise Linux 6	2.6.32-131.0.15.el6	5.1.5
	2.6.32-220.el6	
	2.6.32-220.4.2.el6	5.1.12
	2.6.32-220.17.1.el6	
	2.6.32-220.45.1.el6	
	2.6.32-220.48.1.el6(*4)	

	2.6.32-279.el6	5.3.0
	2.6.32-279.22.1.el6	
	2.6.32-358.el6	5.8.0
	2.6.32-358.2.1.el6	
	2.6.32-358.6.1.el6	
	2.6.32-358.23.2.el6	
	2.6.32-431.el6	
	2.6.32-431.17.1.el6	
	2.6.32-431.20.3.el6	
	2.6.32-431.29.2.el6	
	2.6.32-504.el6	
	2.6.32-504.3.3.el6	
	2.6.32-504.8.1.el6	
	2.6.32-504.12.2.el6	
	2.6.32-504.23.4.el6	
	2.6.32-504.30.3.el6	
	2.6.32-573.el6	
	2.6.32-573.3.1.el6	
	2.6.32-642.el6	
	2.6.32-642.4.2.el6	
2.6.32-642.6.2.el6		
2.6.32-642.13.1.el6		
2.6.32-696.el6		
2.6.32-696.6.3.el6		
Red Hat Enterprise Linux 7	3.10.0-229.el7	6.5.0
	3.10.0-229.20.1.el7	
	3.10.0-327.el7	
	3.10.0-327.4.5.el7	
	3.10.0-327.36.3.el7	
	3.10.0-327.44.2.el7	
	3.10.0-514.el7	
	3.10.0-514.6.1.el7	
	3.10.0-514.26.2.el7	
SUSE Linux Enterprise Server 10	2.6.16.60-0.21	4.2.5
	2.6.16.60-0.39.3	
	2.6.16.60-0.54.5	4.3.7
	2.6.16.60-0.57.1	5.0.7

(*3)"Function version" is the number written in "X.X.X" part of the RPM package name "sps-*-X.X.X-*.rpm" or "sps-driver-*-X.X.X-*.rpm"

(*4) Only EM64T is supported.



The limit number of paths connected to one logical unit according to the model of disk array unit is shown below.

- NEC Storage M/D series (FC) 32
- NEC Storage M/D series (iSCSI) 8
- NEC Storage M series (SAS) 4

The limit number of paths connected to one server according to the model of disk array unit is shown below.

NEC Storage	Function version of PathManager	Limit number of paths
M series (FC / iSCSI / SAS)	less than 5.0.0	512
	5.5.x	2048
	6.2.0 or later	2048
	the others	1024
D series (FC / iSCSI)	less than 5.0.0	512
	the others	1024

1.2 Before Setup

Before starting the setup of PathManager, check the following items:

- (1) Depending on the connection to a disk array, the following setting has been finished.

[FC/SAS connection]

The Fibre Channel (FC) driver or the Serial Attached SCSI (SAS) is set up according to the HBA setup manual.

(You do not have to set up the driver again if you are using the FC driver or SAS driver supplied with your OS.)

[iSCSI connection]

The setup of iSCSI initiator has been finished.

The recommendation timeout value of the iSCSI initiator is shown below.

```
"/etc/iscsi/iscsid.conf"
```

```
node.session.timeo.replacement_timeout = 30      (default: 120)
```

- (2) Setup the FC-switch when your system uses FC-switch.

- (3) Cross Call of a disk array is set to "On" if any.

For how to set the Cross Call, refer to the manuals attached to the disk array.

- (4) A server recognizes a logical disk (unit) of a disk array unit. And the connection between the server and the disk array unit is redundant.

- (5) EXPRESSCLUSTER is not yet set up.

If you want to use EXPRESSCLUSTER, be sure to set up PathManager before setting up EXPRESSCLUSTER.

You should suspend EXPRESSCLUSTER to install PathManager to the environment where

EXPRESSCLUSTER has been introduced.

Refer to an example in case of EXPRESSCLUSTER X 1.0 to X 3.x / SE Ver3.1 in Appendix "Appendix A Introduction to the EXPRESSCLUSTER Environment".

- (6) In the case you use LVM (Logical Volume Manager), the distribution and kernel version must be one of shown below.

- Red Hat Enterprise Linux AS/ES 4 (Kernel-2.6.9-42.EL) (IA32/EM64T) or later

- Red Hat Enterprise Linux 5 (Kernel-2.6.18-53.el5) (IA32/EM64T) or later

- Red Hat Enterprise Linux 5 Advanced Platform (Kernel-2.6.18-53.el5) (IA32/EM64T) or later

- Red Hat Enterprise Linux 6 (Kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later

- Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later

PathManager does not support LVM when you use the Red Hat Enterprise Linux whose kernel version is earlier than above. And if you use SAN-Boot, PathManager does not support a LVM disk containing an OS area.

- (7) In the case you use FC connections and iSCSI connections concurrently, the distribution and kernel version must be one of shown below.

- Red Hat Enterprise Linux 5 (kernel-2.6.18-164.el5) (IA32/EM64T) or later

- Red Hat Enterprise Linux 5 Advanced Platform (kernel-2.6.18-164.el5) (IA32/EM64T) or later

- Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later

- Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later

- SUSE Linux Enterprise Server 10 (kernel-2.6.16.60-0.57.1) (IA32/EM64T) or later

- (8) In the case you use the NEC Storage which has both FC and iSCSI connections, the distribution and kernel version must be one of shown below.
- Red Hat Enterprise Linux 5 (kernel-2.6.18-194.el5) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 5 Advanced Platform (kernel-2.6.18-194.el5) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later
- (9) In the case you use SAS connections and FC/iSCSI connections concurrently, the function version of PathManager must be 5.0.5 or later. And the distribution and kernel version must be one of shown below.
- Red Hat Enterprise Linux 5 (kernel-2.6.18-274.el5) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 5 Advanced Platform (kernel-2.6.18-274.el5) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6) (IA32/EM64T) or later
 - Red Hat Enterprise Linux 7 (Kernel-3.10.0-229.el7) (EM64T) or later

Table 1-5 shows a list of files in each directory. (a part of files)

Table 1-5 List of Installation CD Files

Directory/File name	Description
<pre>Express5800_100 `-- RPMS -- RHEL4 -- RHEL5 -- 5.1 -- 5.2 -- 5.3 -- 5.4 -- 5.5 -- 5.6 -- 5.7 -- 5.8 -- 5.9 -- 5.10 `-- 5.11 -- IA32 -- sps-driver-E-5.0.30-2.6.18.398.el5.i686.rpm -- sps-utils-5.0.30-1.el5.i686.rpm `-- EM64T -- sps-driver-E-5.0.30-2.6.18.398.el5.x86_64.rpm `-- sps-utils-5.0.30-1.el5.x86_64.rpm -- RHEL6 -- 6.1 -- 6.2 -- 6.3 `-- 6.4-or-later -- IA32 -- sps-driver-E-5.8.0-2.6.32.358.el6.i686.rpm -- sps-utils-5.8.0-0.el6.i686.rpm `-- EM64T -- sps-driver-E-5.8.0-2.6.32.358.el6.x86_64.rpm `-- sps-utils-5.8.0-0.el6.x86_64.rpm -- RHEL7 -- 7.1 -- 7.2 `-- 7.3 `-- EM64T -- sps-driver-E-6.5.0-3.10.0.514.el7.x86_64.rpm `-- sps-utils-6.5.0-0.el7.x86_64.rpm `-- SLES10 -- SP2 `-- SP3 -- IA32 -- sps-driver-E-5.0.7-2.6.16.60.0.57.1.i586.rpm -- sps-kdump-E-5.0.7-2.6.16.60.0.57.1.i586.rpm `-- sps-utils-5.0.4-0.sles10.i586.rpm</pre>	<p>RPM files</p> <p>Packages of PathManager (*1)</p>

<pre> `-- EM64T -- sps-driver-E-5.0.3-2.6.16.60.0.57.1.x86_64.rpm -- sps-kdump-E-5.0.3-2.6.16.60.0.57.1.x86_64.rpm `-- sps-utils-5.0.4-0.sles10.x86_64.rpm </pre>	
<pre> Express5800_100 `-- doc -- IS202_PathManager_Linux.pdf `-- INSTALL.pdf </pre>	PathManager User's Manual (PDF file) PathManager Install Guide (PDF file)
<pre> Express5800_A1000 `-- RPMS -- RHEL5 -- 5.3 -- 5.4 -- 5.5 -- 5.6 -- 5.7 -- 5.8 -- 5.9 -- 5.10 `-- 5.11 `-- EM64T -- sps-driver-E-5.0.30-2.6.18.398.el5.x86_64.rpm -- sps-mcopt-1.1.2-0.el5.x86_64.rpm(*3) `-- sps-utils-5.0.30-1.el5.x86_64.rpm -- RHEL6 -- 6.1 -- 6.2 -- 6.3 `-- 6.4-or-later `-- EM64T -- sps-driver-E-5.8.0-2.6.32.358.el6.x86_64.rpm -- sps-mcopt-1.2.0-0.el6.x86_64.rpm(*3) `-- sps-utils-5.8.0-0.el6.x86_64.rpm `-- RHEL7 -- 7.2 `-- 7.3 `-- EM64T -- sps-driver-E-6.5.0-3.10.0.514.el7.x86_64.rpm -- sps-mcopt-1.2.0-0.el7.x86_64.rpm(*3) `-- sps-utils-6.5.0-0.el7.x86_64.rpm </pre>	For Express5800/Scala ble HA Servers
<pre> Express5800_A1000 `-- doc -- IS202_PathManager_Linux.pdf `-- INSTALL.pdf </pre>	PathManager User's Manual (PDF file) PathManager Install Guide (PDF file)

readme.txt filelist.txt about-license-eng.html gpl.txt install.sh install.txt supportlist	installer (*4)
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- *1: Only some of the files of PathManager are described.
- *2: RPM files of Ver. 4.2.1 or later are separated according to the functions as follows; sps-utils (utilities) , sps-driver (driver), and sps-kdump (kernel dump).
- *3: "sps-mcopt" is the package for the cooperation with RENS. It is not need if the PathManager do not cooperate with RENS.
- *4: The installation using installer is supported on the following environment.
 - Red Hat Enterprise Linux 5.4 (kernel-2.6.18-164.el5) or later
 - Red Hat Enterprise Linux 6.1 (kernel-2.6.32-131.0.15.el6) or later
 - Red Hat Enterprise Linux 7.1 (Kernel-3.10.0-229.el7) or later
 - SUSE Linux Enterprise Server SP3 (kernel-2.6.16.60-0.54.5) or later.

The following packages of PathManager are offered as the RPM file which reduced the kernel dependence. Each RPM file supports plural kernels.

**Table 1-6 Supported kernel list of RPM
(for Express5800 Rack Servers, Tower Servers and Blade Servers)**

RPM files	Supported kernels
File path in installation media:	2.6.32-358.el6.x86_64
Express5800_100/RPMS/RHEL6/RHEL6.4-or-later/EM64T	2.6.32-358.2.1.el6.x86_64
	2.6.32-358.6.1.el6.x86_64
sps-driver-E-5.8.0-2.6.32.358.el6.x86_64.rpm	2.6.32-358.23.2.el6.x86_64
sps-utils-5.8.0-0.el6.x86_64.rpm	2.6.32-431.el6.x86_64
	2.6.32-431.17.1.el6.x86_64
	2.6.32-431.20.3.el6.x86_64
	2.6.32-431.29.2.el6.x86_64
	2.6.32-504.el6.x86_64
	2.6.32-504.3.3.el6.x86_64
	2.6.32-504.8.1.el6.x86_64
	2.6.32-504.12.2.el6.x86_64
	2.6.32-504.23.4.el6.x86_64
	2.6.32-504.30.3.el6.x86_64
	2.6.32-573.el6.x86_64
	2.6.32-573.3.1.el6.x86_64
	2.6.32-642.el6.x86_64
	2.6.32-642.4.2.el6.x86_64
	2.6.32-642.6.2.el6.x86_64
	2.6.32-642.13.1.el6.x86_64
	2.6.32-696.el6.x86_64
	2.6.32-696.6.3.el6.x86_64

RPM files	Supported kernels
File path in installation media:	2.6.32-358.el6.i686
Express5800_100/RPMS/RHEL6/RHEL6.4-or-later/IA32	2.6.32-358.2.1.el6.i686
	2.6.32-358.6.1.el6.i686
sps-driver-E-5.8.0-2.6.32.358.el6.x86_64.rpm	2.6.32-358.23.2.el6.i686
sps-utils-5.8.0-0.el6.x86_64.rpm	2.6.32-431.el6.i686
	2.6.32-431.17.1.el6.i686
	2.6.32-431.20.3.el6.i686
	2.6.32-431.29.2.el6.i686
	2.6.32-504.el6.i686
	2.6.32-504.3.3.el6.i686
	2.6.32-504.8.1.el6.i686
	2.6.32-504.12.2.el6.i686
	2.6.32-504.23.4.el6.i686
	2.6.32-504.30.3.el6.i686
	2.6.32-573.el6.i686
	2.6.32-573.3.1.el6.i686
	2.6.32-642.el6.i686
	2.6.32-642.4.2.el6.i686
	2.6.32-642.6.2.el6.i686
	2.6.32-642.13.1.el6.i686
	2.6.32-696.el6.i686
	2.6.32-696.6.3.el6.i686

RPM files	Supported kernels
<p>File path in installation media: Express5800_100/RPMS/RHEL7/RHEL7.1/EM64T</p> <p>sps-driver-E-6.5.0-3.10.0.229.el7.x86_64.rpm sps-utils-6.5.0-0.el7.x86_64.rpm</p>	3.10.0-229.el7.x86_64
<p>File path in installation media: Express5800_100/RPMS/RHEL7/RHEL7.1/EM64T</p> <p>sps-driver-E-6.5.0-3.10.0.229.20.1.el7.x86_64.rpm sps-utils-6.5.0-0.el7.x86_64.rpm</p>	3.10.0-229.20.1.el7.x86_64
<p>File path in installation media: Express5800_100/RPMS/RHEL7/RHEL7.2/EM64T</p> <p>sps-driver-E-6.5.0-3.10.0.327.el7.x86_64.rpm sps-utils-6.5.0-0.el7.x86_64.rpm</p>	3.10.0-327.el7.x86_64 3.10.0-327.4.5.el7.x86_64 3.10.0-327.36.3.el7.x86_64 3.10.0-327.44.2.el7.x86_64
<p>File path in installation media: Express5800_100/RPMS/RHEL7/RHEL7.3/EM64T</p> <p>sps-driver-E-6.5.0-3.10.0.514.el7.x86_64.rpm sps-utils-6.5.0-0.el7.x86_64.rpm</p>	3.10.0-514.el7.x86_64 3.10.0-514.6.1.el7.x86_64 3.10.0-514.26.2.el7.x86_64

**Table 1-7 Supported kernel list of RPM
(for Express5800 Scalable Enterprise Servers)**

RPM files	Supported kernels
<p>File path in installation media:</p> <p>Express5800_A1000/RPMS/RHEL6/RHEL6.4-or-later/EM64T</p> <p>sps-driver-E-5.8.0-2.6.32.358.el6.x86_64.rpm</p> <p>sps-utils-5.8.0-0.el6.x86_64.rpm</p> <p>sps-mcopt-1.2.0-0.el6.x86_64.rpm</p>	<p>2.6.32-358.el6.x86_64</p> <p>2.6.32-358.2.1.el6.x86_64</p> <p>2.6.32-358.6.1.el6.x86_64</p> <p>2.6.32-358.23.2.el6.x86_64</p> <p>2.6.32-431.el6.x86_64</p> <p>2.6.32-431.17.1.el6.x86_64</p> <p>2.6.32-431.20.3.el6.x86_64</p> <p>2.6.32-431.29.2.el6.x86_64</p> <p>2.6.32-504.el6.x86_64</p> <p>2.6.32-504.3.3.el6.x86_64</p> <p>2.6.32-504.8.1.el6.x86_64</p> <p>2.6.32-504.12.2.el6.x86_64</p> <p>2.6.32-504.23.4.el6.x86_64</p> <p>2.6.32-504.30.3.el6.x86_64</p> <p>2.6.32-573.el6.x86_64</p> <p>2.6.32-573.3.1.el6.x86_64</p> <p>2.6.32-642.el6.x86_64</p> <p>2.6.32-642.4.2.el6.x86_64</p> <p>2.6.32-642.6.2.el6.x86_64</p> <p>2.6.32-642.13.1.el6.x86_64</p> <p>2.6.32-696.el6.x86_64</p> <p>2.6.32-696.6.3.el6.x86_64</p>
<p>File path in installation media:</p> <p>Express5800_A1000/RPMS/RHEL7/RHEL7.2/EM64T</p> <p>sps-driver-E-6.5.0-3.10.0.327.el7.x86_64.rpm</p> <p>sps-utils-6.5.0-0.el7.x86_64.rpm</p> <p>sps-mcopt-1.2.0-0.el7.x86_64.rpm</p>	<p>3.10.0-327.el7.x86_64</p> <p>3.10.0-327.4.5.el7.x86_64</p> <p>3.10.0-327.36.3.el7.x86_64</p> <p>3.10.0-327.44.2.el7.x86_64</p>

RPM files	Supported kernels
File path in installation media: Express5800_A1000/RPMS/RHEL7/RHEL7.3/EM64T sps-driver-E-6.5.0-3.10.0.514.el7.x86_64.rpm sps-utils-6.5.0-0.el7.x86_64.rpm sps-mcopt-1.2.0-0.el7.x86_64.rpm	3.10.0-514.el7.x86_64 3.10.0-514.6.1.el7.x86_64 3.10.0-514.26.2.el7.x86_64

Chapter 2 Installation

This chapter describes the procedure of installation.



For uninstallation/update, refer to "NEC Storage PathManager for Linux User's Manual".
(It is included in PathManager CD-ROM as "IS202_PathManager_Linux.pdf". File list is shown at
"Table 1-5 List of Installation CD Files".)

2.1 Installation



For installation, please start the OS with the kernel on which you use PathManager and login as root.

2.1.1 Prepare to Install

Mount the installation CD as the root authority. (If the CD is not mounted automatically, mount manually as follows.)

```
# mkdir -p /media/cdrom
# mount /dev/cdrom /media/cdrom
```

Connect the server to the NEC Storage and check whether the server recognizes a logical disk on the NEC Storage.
If "NEC" is displayed in "Vendor" item and "iStorage XXXX" or "DISK ARRAY" is displayed in "Model" item as the result of execution of the command as follows, the NEC Storage is recognized normally. (the shaded part shows it) In the case of NEC Storage E series, "DGC" is displayed in "Vendor" item.

```
# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: NEC          Model: DISK ARRAY      Rev: 1000
  Type:   Direct-Access          ANSI SCSI revision: 05
```

2.1.2 Installing PathManager RPM Package

The Storage PathManager installation procedures depend on the system configuration (OS distribution / kernel).

Refer to Table 2-1 and install with proper procedures.

Table 2-1 Index of Installation Procedure (IA32, EM64T)

OS Distribution	Kernel Version	Installation Procedure
Red Hat Enterprise Linux AS 4 Red Hat Enterprise Linux ES 4	all	2.1.2.2 Manual Installation
Red Hat Enterprise Linux 5 Red Hat Enterprise Linux 5 Advanced Platform	earlier than 2.6.18-164.el5	
	2.6.18-164.el5 or later	2.1.2.1 Installation by Installer
Red Hat Enterprise Linux 6	2.6.32-131.0.15.el6 or later	
Red Hat Enterprise Linux 7	3.10.0-229.el7 or later	
SUSE Linux Enterprise Server 10	earlier than 2.6.16.60-0.54.5	2.1.2.2 Manual Installation
	2.6.16.60-0.54.5 or later	2.1.2.1 Installation by Installer

2.1.2.1 Installation by Installer



The installation using installer is supported on the following environments.

- Red Hat Enterprise Linux 5.4 (kernel-2.6.18-164.el5) or later
- Red Hat Enterprise Linux 6.1 (kernel-2.6.32-131.0.15.el6) or later
- Red Hat Enterprise Linux 7.1 (Kernel-3.10.0-229.el7) or later
- SUSE Linux Enterprise Server SP3 (kernel-2.6.16.60-0.54.5) or later.

If your system does not match above environments, please install manually.

- (i) Go to the directory mounted to the PathManager Installation CD.
(If the CD is mounted automatically, go to the corresponding directory.)

```
# cd /media/cdrom  
#
```

(ii) Execute the "install.sh" with "-i" option (as shown by the underlined part below).

*1: If you use the "--silent" option, the installer reboots the server automatically.

(You must reboot before operating the PathManager.)

*2: If the system uses iSCSI connection, pass the "--iscsi" option. If the system uses both FC/SAS and iSCSI connections, also pass the "--iscsi" option. If the system uses iSCSI and you want to reboot automatically, specify the both options "--silent" and "--iscsi".

If "--iscsi" option is specified in RHEL 7.1 or later, "NetworkManager-wait-online.service" is enabled. This service is executed once, when the system is booted. If this service is enabled at the booting, the system waits until the starting of the network service.

- If the kernel version is 2.6.18-164.el5 and the system uses FC connection -

```
# sh install.sh -i --silent
===== Precheck for SPS Installation / Uninstallation =====
Distribution   : RedHat
Architecture   : i686
Kernel Version: Linux2.6
Kernel Details: 2.6.18-164.el5
----- The following packages will be installed. -----
driver : ./Express5800_100_NX7700i/RPMS/RHEL5/5.4/IA32/sps-driver-E-4.3.7-
2.6.18.164.el5.i686.rpm
utils   : ./Express5800_100_NX7700i/RPMS/RHEL5/5.4/IA32/sps-utils-4.3.0-
0.i686.rpm
=====
Preparing...                               ##### [100%]
  1:sps-driver-E                           ##### [100%]
Preparing...                               ##### [100%]
  1:sps-utils                               ##### [100%]
patching file rc.sysinit
Starting up sps devices:
Couldn't open /etc/sps.conf. No such file or directory.
I try auto setting...
Wait.
parsing... device:/dev/dda (OK)
parsing... disk-info:NEC      ,iStorage 1000
parsing... LoadBalance:D2 (OK)
parsing... path-info:0 Host:scsi:8 Channel:0 Id:0 Lun:0 Priority:1
Watch:Enable Status:ACT (OK)
parsing... path-info:7 Host:scsi:7 Channel:0 Id:0 Lun:0 Priority:2
Watch:Enable Status:ACT (OK)
Wait until all /dev/ddX is made.....END
dd_daemon (pid 3963) is running...
sps Install Completed.....
#
Broadcast message from root (Thu Feb 25 14:15:57 2010):
The system is going DOWN for reboot in 1 minute!
```

This message might appear at the first installation but it does not cause any problem to operation.

- (iii) If the installation is finished normally, the message "sps Install Completed" (the shadowed part in above) will be displayed. If this message is not displayed, that installation is failed. In such a case, please refer to "Appendix D Error Messages from Installer" and handle it.
- (iv) If the installation is finished normally, the system restarts one minute later (if specifying "--silent" or "--reboot" option). And then, confirm that the system restarts normally.

The installation is complete.

- If you use LVM, refer to "Appendix B How to add to LVM" and set LVM according to "Adding PathManager Devices to LVM" section.
- If any application or setting file uses the standard SCSI device of NEC storage as /dev/sdX, go on to 2.1.3 "Shifting to a PathManager Environment".

2.1.2.2 Manual Installation

- (i) When you install PathManager on 'RHEL 6.4 or later' or 'RHEL 7.1 or later', put the supportlist file to the server. The supportlist file is stored in the root directory of installation media. This procedure is not necessary when you do not use 'RHEL 6.4 or later' or 'RHEL 7.1 or later'.

```
# cd /media/cdrom (*)
# mkdir -p /opt/nec/sps
# install -m 400 supportlist /opt/nec/sps/supportlist

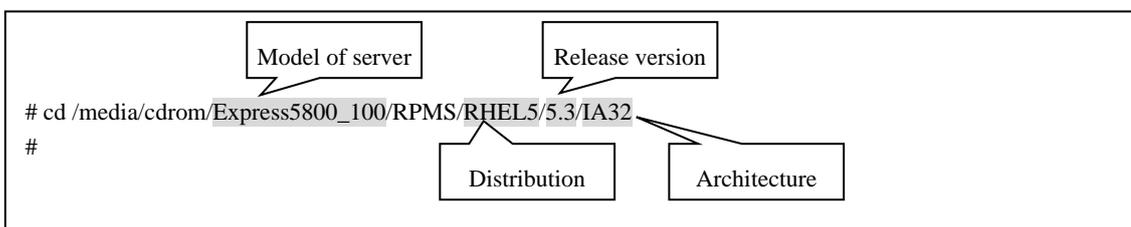
*: When you use automount, move to the mount point of automount.
```

- (ii) Install the RPM file.

Move to the directory of compatible RPM files. How to specify the directory is shown below.

- If the environment is as follows -

Model of the server	Express5800/100 series
Distribution	RHEL5
Release version	5.3
Architecture	IA32



The installation commands from here are a bit different by OSes.

When you install PathManager in 'RHEL 6.4 or later' or 'RHEL 7.1 or later', please refer to the following tables to select a RPM package.

Part I1.2 Before Setup

Table 1-6 Supported kernel list of RPM

(for Express5800 Rack Servers, Tower Servers and Blade Servers)

Table 1-7 Supported kernel list of RPM

(for Express5800 Scalable Enterprise Servers)

1. RHEL 6.4 or later / RHEL 7.1 or later

Install the RPM file which corresponds to a using kernel. Please refer to the following tables to select a RPM package.

Part I1.2 Before Setup

Table 1-6 Supported kernel list of RPM

(for Express5800 Rack Servers, Tower Servers and Blade Servers)

Table 1-7 Supported kernel list of RPM

(for Express5800 Scalable Enterprise Servers)

- In the case if you use the kernel ver.2.6.32-131.0.15.el6 -

```
# uname -r
2.6.32-504.30.3.el6.x86_64
# rpm -ivh sps-utils-5.5.1-0.el6.x86_64.rpm
Preparing... ##### [100%]
 1:sps-utils ##### [100%]
# rpm -ivh sps-driver-E-5.5.2-2.6.32.358.el6.x86_64.rpm
Preparing... ##### [100%]
 1:sps-driver-E ##### [100%]
INFO: Created the symlink to 2.6.32-504.30.3.el6.x86_64.
#
```

2. RHEL 6.1, 6.2 and 6.3

Execute the following command to install the RPM files corresponding to the kernel version you use.

(Shaded part shows the corresponding kernel.)

- In the case if you use the kernel ver.2.6.32-131.0.15.el6 -

```
# rpm -ivh sps-utils-*
sps-utils #####
# uname -r
2.6.32-131.0.15.el6.i686
# rpm -ivh sps-driver-E-5.1.3-2.6.32-131.0.15.el6.i686.rpm
sps-driver-E #####
#
```

3. RHEL 5.3 (2.6.18-128.el5) or later / SLES10 SP2 (kernel-2.6.16.60-0.21) or later

Execute the following command to install the RPM files corresponding to the kernel version you use.
(Shaded part shows the corresponding kernel. Even if the displayed kernel version includes "PAE", "default", "smp" or "bigsm", the proper package is the one which doesn't include these words.)
("? indicates an edition of PathManager. "E" or "S" or "M")

- In the case if you use the kernel ver.2.6.18-128.el5 -

```
# rpm -ivh sps-utils-*
sps-utils #####
# uname -r
2.6.18-128.el5 .... (*1)
# rpm -ivh sps-driver-?-4.2.5-2.6.18.128.el5.i686.rpm
sps-driver-? #####
#
```

4. Earlier than RHEL 5.3 (2.6.18-128.el5)

Execute the following command to install the RPM files corresponding to the kernel version you use.
(Shaded part shows the corresponding kernel. Even if the displayed kernel version includes "PAE", "smp", "hugemem" or "largesmp", the proper package is the one which doesn't include these words.)

- In the case if you use the kernel ver.2.6.18-92.el5 -

```
# uname -r
2.6.18-92.el5 .... (*1)
# rpm -ivh sps-E-4.1.7-2.6.18.92.el5.i686.rpm
sps-E #####
#
```



*1: If an errata kernel is installed, please refer to the following tables to reconfirm PathManager supports the installed kernel.

- Table 1-4 Supported Distributions and Kernels (IA32 and EM64T) [[>>Table 1-4](#)]

Example of errata kernels on Red Hat Enterprise Linux 5:

The kernel version like "Kernel-2.6.18.29.1.10.el5" is an errata kernel.

With this operation, the following files are installed:

```

/lib/modules/(kernel version)/ kernel/drivers/scsi/dd_mod.ko
/lib/modules/(kernel version)/ kernel/drivers/scsi/sps_mod.ko
/lib/modules/(kernel version)/ kernel/drivers/scsi/sps_mod2.ko (*2)
/sbin/dd_daemon
/sbin/spscmd
/sbin/spsadmin(*9)
/sbin/hotaddpath
/sbin/hotremovepath
/sbin/removearrayinfo
/sbin/recoverpath
/sbin/mkdd
/sbin/spsconfig
/etc/dualpathrc
/etc/init.d/boot.sps (*3)
/etc/rc.d/init.d/dd_daemon (*10)
/etc/rc.d/init.d/sps_loader (*9)
/etc/rc.d/rc0.d/K77dd_daemon (*4)
/etc/rc.d/rc1.d/K77dd_daemon (*4)
/etc/rc.d/rc2.d/S45dd_daemon (*4)
/etc/rc.d/rc3.d/S45dd_daemon (*4)
/etc/rc.d/rc5.d/S45dd_daemon (*4)
/etc/rc.d/rc6.d/K77dd_daemon (*4)
/etc/logrotate.d/sps/sps.logrotate (*8)
/opt/nec/report/inf/dualpath.inf
/opt/nec/report/table/dualpath.tbl
/opt/nec/sps/esm/report/inf/dualpath.inf (*5)
/opt/nec/sps/esm/report/table/dualpath.tbl (*5)
/opt/nec/sps/esm/report/inf/dualpathE.inf (*5)
/opt/nec/sps/esm/report/table/dualpathE.tbl (*5)
/opt/nec/sps/bin/spslog.sh
/opt/nec/sps/bin/sps_setesmtbl.sh (*5)
/opt/nec/sps/patch/rc.sysint.rhel4.diff (*4) (*6)
/opt/nec/sps/patch/iscsi.rhel5.diff (*4) (*7)
/usr/lib/systemd/system/sps.service (*11)
/usr/lib/systemd/system/dd_daemon.service (*11)

```



- *2: This file is not installed if PathManager function version is 3.0.5 or earlier.
- *3: This file is not installed if the OS is Red Hat Enterprise Linux.
- *4: This file is not installed if the OS is SUSE Linux Enterprise Server.
- *5: This file is not installed if PathManager function version is 3.0.8 or earlier.
- *6: The file name is different by distribution.
- *7: This file is installed if PathManager function version is 4.1.1 or later.
- *8: This file is installed if PathManager function version is 4.4.2 or later.
- *9: This file is installed if the OS is Red Hat Enterprise Linux 6.
- *10: The Path Patrol daemon is not installed as "/etc/rc.d/init.d/dd_daemon", but installed as "/etc/init.d/dd_daemon".
- *11: This file is installed if the OS is Red Hat Enterprise Linux 7.

(iii) Execute the following command to check that no error is displayed.

```
# depmod -a `uname -r`  
#
```



Be sure to type the back quotes (`) at the beginning and end of "uname -r".

(iv) Setup the auto startup.

Skip this procedure if your system is following:

- Red Hat Enterprise Linux 6 and FC/SAS connection
- Red Hat Enterprise Linux 7
- SUSE Linux Enterprise Server 10

You must modify the OS initialization script (/etc/rc.d/rc.sysinit) to make PathManager driver start when OS starts.

Additionally, if you use iSCSI connection, you must also modify the iSCSI initiator startup script (/etc/rc.d/init.d/iscsi). To modify the OS initialization script, please apply the patch file as follows. If you use both FC/SAS and iSCSI connections, apply the iSCSI patch.

The old OS initialization script which is before applying the patch file is left as /etc/rc.d/rc.sysinit.orig.

And the old iSCSI initiator startup script is left as /etc/rc.d/init.d/iscsi.orig.

If the patch file was applied before, re-applying is not required.

<Example of Red Hat Enterprise Linux AS/ES 4>

```
# cd /etc/rc.d
# patch -b -p0 < /opt/nec/sps/patch/rc.sysinit.rhel4.diff
#
```

<Example of Red Hat Enterprise Linux 5 (FC/SAS connection)>

```
# cd /etc/rc.d
# patch -b -p0 < /opt/nec/sps/patch/rc.sysinit.rhel5.diff
#
```

<Example of Red Hat Enterprise Linux 5 (iSCSI connection)> (*12)

```
# cd /etc/rc.d
# patch -b -p0 < /opt/nec/sps/patch/iscsi.rhel5.diff
#
```



*12: A patch file modifies the both files ("/etc/rc.d/rc.sysinit" and "/etc/rc.d/init.d/iscsi").

When you execute the patch command, an error message may appear and the patch file may not be normally applied. In this case, add the lines beginning with the character "+" in the patch file to the /etc/rc.d/rc.sysinit or to the /etc/rc.d/init.d/iscsi.

Please refer to the descriptions of patch file about where to set.

<Example of Red Hat Enterprise Linux 6 (iSCSI connection)>

```
# spsconfig -auto-run-enable iscsi
#
```

- (v) If you want ESMPRO to send a message in English, please execute the **sps_setesmtbl.sh** with option "E".
In the case you use Japanese (default setting) or you do not use ESMPRO, this procedure is not required.

```
# /opt/nec/sps/bin/sps_setesmtbl.sh E
Stopping ESMamvmain: [ OK ]
Starting ESMamvmain: [ OK ]
Stopping ESMamvmain: [ OK ]
Starting ESMamvmain: [ OK ]
#
```

(vi) If iSCSI connection, follow the procedures shown below.



Skip this procedure if your system is following:

- Red Hat Enterprise Linux 5.4 or later
- Red Hat Enterprise Linux 6
- SUSE Linux Enterprise Server 10

1. RHEL7

(1) Execute the following command to be enable "NetworkManager-wait-online.service".

```
# /usr/bin/systemctl enable NetworkManager-wait-online.service
```

"NetworkManager-wait-online.service" is enabled. This service is executed once, when the system is booted. If this service is enabled at the booting, the system waits until the starting of the network service.

2. Earlier than RHEL 5.3

(1) Check the `sg_tablesize` of iSCSI host.

```
# cat
/sys/class/iscsi_host/host*/device/scsi_host:host*/sg_tablesize
255
255
```

In the above example, `sg_tablesize` is 255.

(2) Add the `sps_sg_tablesize`, which is an option of `sps_mod2`, to `/etc/modprobe.conf`.

1. Open the `/etc/modprobe.conf` by an editor.

2. Add the description as below at the tail of the file.

* The `sps_sg_tablesize` value must be 1 less than the `sg_tablesize` value which you checked on (1).

```
alias eth0 e1000
alias eth1 e1000
alias eth2 e1000
alias eth3 e1000
alias scsi_hostadapter mptbase
alias scsi_hostadapter1 mptsas
alias scsi_hostadapter2 aic7xxx
alias scsi_hostadapter3 ata_piix
options sps_mod2 sps_sg_tablesize=254
```

Add this line.

3. Save the file and quit the editor.

- (3) Confirm the /etc/modprobe.conf.

```
# cat /etc/modprobe.conf
alias eth0 e1000
alias eth1 e1000
alias eth2 e1000
alias eth3 e1000
alias scsi_hostadapter mptbase
alias scsi_hostadapter1 mptsas
alias scsi_hostadapter2 aic7xxx
alias scsi_hostadapter3 ata_piix
options sps_mod2 sps_sg_tablesize=254
#
```

(vii) If you use EXPRESSCLUSTER and NEC Storage E series, follow the procedures shown below.

Following procedures are different by the OSes.



PathManager supports a combination use with EXPRESSCLUSTER and NEC Storage E series only if function version of PathManager is 4.1.5 or later.

If iSCSI connection, add the line after description of `sps_tablesize`.

1. Red Hat Enterprise Linux 6

Execute the following command.

```
#echo "options sps_mod2 sps_clustermode=1" >> /etc/modprobe.d/spsoptions.conf
```

2. OSes other than Red Hat Enterprise Linux 6

(1) Specify the following option into `/etc/modprobe.conf` as `sps_mod2` module option.

1. Open the `/etc/modprobe.conf` by an editor.
2. Add the description as shown below at the tail of the file.

* For `sps_clustermode` option, please refer to

"Appendix C How to Set up Cluster Mode" of "PathManager for Linux User's Manual".

```
alias eth0 e1000
alias eth1 e1000
alias scsi_hostadapter mptbase
alias scsi_hostadapter1 mptsas
alias scsi_hostadapter2 aic7xxx
alias scsi_hostadapter3 ata_piix
options sps_mod2 sps_clustermode=1
```

Add `sps_clustermode` option and set the value to "1".

3. Save the file and quit the editor.

(2) Confirm the `/etc/modprobe.conf`.

```
# cat /etc/modprobe.conf
alias eth0 e1000
alias eth1 e1000
alias scsi_hostadapter mptbase
alias scsi_hostadapter1 mptsas
alias scsi_hostadapter2 aic7xxx
alias scsi_hostadapter3 ata_piix
options sps_mod2 sps_clustermode=1
```

(viii) Reboot the system and check that it starts up normally.

```
# sync  
# shutdown -r now
```

The installation is complete.

- If you use LVM, refer to "Appendix B How to Set LVM" and set LVM according to "Adding PathManager Devices to LVM" section.
- If any application or setting file uses the standard SCSI device of NEC storage as /dev/sdX, go on to 2.1.3 "Shifting to a PathManager Environment".

2.1.3 Shifting to a PathManager Environment

If any application or setting file uses the standard SCSI device of NEC storage as /dev/sdX, please follow the procedures below.

<Example to modify /etc/fstab>

If you want to use the disk mounted as /mnt/work with PathManager:

```
# vi /etc/fstab
...
/dev/sdf1          /mnt/work          ext3      defaults      0 0
...
```

- (i) See the device information of /dev/sdf using "sg_scan" command.

[NEC Storage D series]

If "NEC" and "iStorage" are displayed, this device is NEC storage (the shaded part).

```
# sg_scan -i /dev/sdf
/dev/sdf: scsi0 channel=0 id=0 lun=5 [em]
  NEC      iStorage 1000      1000 [rmb=0 cmdq=1 pqual=0 pdev=0x0]
#
```

[NEC Storage M series]

If "NEC" and "DISK ARRAY" are displayed, this device is NEC storage (the shaded part).

```
# sg_scan -i /dev/sdf
/dev/sdf: scsi0 channel=0 id=0 lun=5 [em]
  NEC      DISK ARRAY      1000 [rmb=0 cmdq=1 pqual=0 pdev=0x0]
#
```

[NEC Storage E series]

If "DGC" is displayed, this device is NEC storage (the shaded part).

```
# sg_scan -i /dev/sdf
/dev/sdf: scsi0 channel=0 id=0 lun=5 [em]
  DGC      RAID 10          0223 [rmb=0 cmdq=1 pqual=0 pdev=0x0]
#
```



The **sg_scan** command is included in the rpm called "sg3_utils". sg3_utils may not be installed depending on its designation when installing the OS. If sg3_utils is not installed, get the sg3_utils rpm file from OS installation CD or WEB site of each distribution. Then, install the rpm file.

- (ii) Search /dev/ddX device which corresponds to /dev/sdf. The procedures are different according to the function version of PathManager.

Execute "**spsconfig**" command with "-chk" option, then you can see the corresponding device. The following example shows that /dev/sdf corresponds to /dev/ddd.

```
# spsconfig -chk /dev/sdf
/dev/sdf -> /dev/ddd
#
```

- (iii) Modify the /etc/fstab file. The following example shows making backup file and shifting the device file from /dev/sdf to /dev/ddd, which was shown at (ii).

```
# cp -p /etc/fstab /etc/fstab_sps
# vi /etc/fstab
...
/dev/ddd1          /mnt/work         ext3              defaults          0 0
...
```



You must not write the mount-target device (the shaded part above) by "label name" or "by device ID (the device name in /dev/disk/by-id)". Please write it by the PathManager device name (/dev/ddX).



When iscsi.service is enabled in RHEL7, the starting of OS may fail with the following message.
[TIME]Time out waiting for device dev-ddd1.device
[DEPEND]Dependency failed for /mnt/work.

When you do not use the iSCSI device in the RHEL7, execute the following command to stop iscsi.service.

```
# /usr/bin/systemctl disable iscsi.service
```

If iscsi.service must not be disabled to use iSCSI devices, designate `_netdev` option as a mount option of fstab.

- (iv) If the system uses the NEC Storage as the standard SCSI device (/dev/sdX) in the application or things like that, modify those settings in the same way as (iii).

- (v) Restart the system.

The shifting is complete.

If you use the LVM on PathManager devices, please refer to "Adding PathManager Devices to LVM" in "Appendix B How to add to LVM".

Chapter 3 Starting Operation

3.1 Checking the Condition

After installation of PathManager, restart the system to make PathManager automatically recognize the target disk unit and paths and start operation. To check whether PathManager is normally running, follow the procedures described below.

3.1.1 Checking the Condition (RHEL6, RHEL7)

This section shows how to check the condition using PathManager command (**spsadmin**).

Execute the following procedures.

- (1) Open the terminal.
- (2) Type "spsadmin --lun" and press the return key
- (3) Check the output.

If PathManager works normally and conditions of all paths are normal, plural lines of path information appear under the "LoadBalance" line. The following example is the output when three logical units exist in a disk array unit and there are two paths. For the detail of output items, refer to "PathManager for Linux User's Manual".

If the number of paths under the "LoadBalance" line is only one or "[Normal]" is not displayed in "LogicalUnit" line, please check the environment such as the connection between the server and disk array unit, the condition of FC driver module.

Example:

```
# spsadmin --lun
+++ LogicalUnit 4:0:0:0 /dev/dda [Normal] +++
  SerialNumber=0000000000000000, LUN=0x00000
  LoadBalance=LeastSectors
  0: ScsiAddress=2:0:0:0, ScsiDevice=/dev/sdb, Priority=1, Status=Active
  1: ScsiAddress=3:0:0:0, ScsiDevice=/dev/sdc, Priority=2, Status=Standby

+++ LogicalUnit 4:0:0:1 /dev/ddb [Normal] +++
  SerialNumber=0000000000000000, LUN=0x00001
  LoadBalance=LeastSectors
  2: ScsiAddress=2:0:0:1, ScsiDevice=/dev/sdd, Priority=1, Status=Active
  3: ScsiAddress=3:0:0:1, ScsiDevice=/dev/sde, Priority=2, Status=Standby

+++ LogicalUnit 4:0:0:2 /dev/ddc [Normal] +++
  SerialNumber=0000000000000000, LUN=0x00002
  LoadBalance=LeastSectors
  4: ScsiAddress=2:0:0:2, ScsiDevice=/dev/sdf, Priority=1, Status=Active
  5: ScsiAddress=3:0:0:2, ScsiDevice=/dev/sdg, Priority=2, Status=Standby
```

If you use RHEL6.3 or later, execute the following procedures.

- (1) Open the terminal.
- (2) Type "spsadmin --pathstate" and press the return key
- (3) Check the output.

```
# spsadmin --pathstate  
All paths are good condition.
```

If PathManager is working normally and all paths are redundant, "All paths are good condition" is displayed.

If the other messages are displayed, there may be some problems with paths. In this case, please refer to "NEC Storage PathManager User's Manual (Linux Version) - 3.4.3 Path Status Display - (3) Summary of path information display" and deal with the problems.

3.1.2 Checking the Condition (RHEL4, RHEL5, SLES10)

- (i) Check that installed PathManager supports the kernel you use.

Check that the kernel version (A) displayed under **uname -r** and the kernel version (B) displayed under **rpm -qi** are the same.

```
# uname -r      (Check the kernel version)
2.6.X-XX
# rpm -qa | grep sps
sps-xxx-yyyy
# rpm -qi sps-xxx-yyyy
Name           : sps-X-XXX           Relocations: (not relocatable)
Version        : 4.X.X             Vendor: NEC Corporation
Release        : 2.6.XX.XX         Build Date:  YYYY/MM/DD HH:MM:SS
Install date:  YYYY/MM/DD HH:MM:SS Build Host:  nec.co.jp
Group          : Utilities/System   Source RPM:  sps-X-XX.X.src.rpm
Size           : XXXXXX             License: XXXXXX
Signature      : (none)
Packager       : NEC Corporation
Summary        : SCSI multi-path driver and utilities for NEC iStorage
Description    :
-----
This package contains a driver, daemon and some utilities.
The driver (dd_mod,sps_mod) provides the redundant SCSI-path for
NEC iStorage Disk Array System.
The daemon (dd_daemon) supervises the driver.
And, some utilities work for the maintenance.
This Driver works on Red Hat Enterprise Linux X [Kernel:2.6.X-XX].
-----
#
```

Kernel version you use (A)

Kernel version supported by PathManager (B)

- (ii) Check `/proc/scsi/sps/ddX` (X takes a value of a, b, c, and so on to indicate the number of LUNs created on the disk array). If "partition-info:" is NML, the paths are normally multiplexed. If nothing is displayed, a disk array is not recognized by either path. Check the connection between the server and disk array, application status of the FC driver, Cross Call settings and the other settings of the disk array.

```
# cat /proc/scsi/sps/dda
device:/dev/dda
  disk-info:NEC      ,iStorage 2000  ,0000000931000013,00000
  device-info:Host:scsi:2 Channel:0 Id:0 Lun:0 Status:NML
  LoadBalance:S
  path-info:0 Host:scsi:0 Channel:0 Id:0 Lun:0 Priority:1 Watch:Enable
  Status:ACT
  path-info:1 Host:scsi:1 Channel:0 Id:0 Lun:0 Priority:2 Watch:Enable
  Status:HOT
#
```

- (iii) Check whether `dd_daemon` is active.

When `dd_daemon` is active, the following message appears.

```
# /etc/rc.d/init.d/dd_daemon status
dd_daemon (pid XXX) is running ...
#
```

Chapter 4 Further Information

For further information, please refer to "NEC Storage PathManager for Linux User's Manual" ("IS202_PathManager_Linux.pdf" in the installation CD.).

Appendix A Introduction to the EXPRESSCLUSTER Environment

EXPRESSCLUSTER X 1.0 to 3.x / SE Ver3.1

1. Check the following two points in advance with WebManager.

- All servers are in the normal status (= Green).

2. Manual activation of EXPRESSCLUSTER (for PathManager introduction operation)

Execute the following operations on each server to deactivate the auto startup of EXPRESSCLUSTER so that clusters are not affected by rebooting of PathManager or the others.

- Execute the following command on all the servers:

```
chkconfig --del clusterpro_alertsync
chkconfig --del clusterpro_webmgr
chkconfig --del clusterpro
chkconfig --del clusterpro_md (only EXPRESSCLUSTER X 1.0 to 3.x)
chkconfig --del clusterpro_trn
chkconfig --del clusterpro_evt
```

EXPRESSCLUSTER is configured not to start automatically when OS starts at next time.

Confirm that the above commands are executed on all servers, and then go to the next procedure.

3. Cluster shutdown

Shut down (reboot) the cluster with WebManager.

4. PathManager installation

For details, refer to 2.1 "Installation".

5. Modifying the cluster configuration

Please modify the following contents of configuration using the Builder / trekking tool.

(i) Modifying the device name of disk resource

e.g.) "sdb2" (before modifying) >>> "dda2" (after modifying)

(ii) Modifying the device name of disk monitor

e.g.) "sdb1" (before modifying) >>> "dda1" (after modifying)

(iii) Modifying the device name of disk heartbeat

e.g.) "sdb1" (before modifying) >>> "dda1" (after modifying)

! For the details of process of modifying the cluster configuration, refer to the following:

[If you use EXPRESSCLUSTER X 1.0 (Version 1.1.0-1 or later) to 3.x]

For details of modifying the cluster configuration, refer to "Chapter 7 Modifying the cluster configuration data" in "EXPRESSCLUSTER X for Linux Installation and Configuration Guide".

[If you use EXPRESSCLUSTER X 1.0 (until Version 1.0.3-1)]

For details of modifying the cluster configuration, refer to "Chapter 8 Preparing to operate a cluster system - Modifying the cluster configuration data" in "EXPRESSCLUSTER X for Linux Installation and Configuration Guide".

[If you use EXPRESSCLUSTER SE Ver3.1]

For details of modifying the cluster configuration, refer to "EXPRESSCLUSTER X for Linux Ver3.0 maintenance 7. Directory structure".

6. Reflecting the cluster configuration

- (i) Start the following services manually on each server.

```
/etc/rc.d/init.d/clusterpro_evt start
```

```
/etc/rc.d/init.d/clusterpro_trn start
```

- (ii) Execute the cluster creating command on the master server.

! For the details of process of creating the cluster, refer to the following:

[If you use EXPRESSCLUSTER X 1.0 (Version 1.1.0-1 or later) to 3.x]

For details of creating the cluster, refer to "Chapter 5 Creating the cluster configuration data using the Builder - Creating the cluster configuration data" in "EXPRESSCLUSTER X for Linux Installation and Configuration Guide".

[If you use EXPRESSCLUSTER X 1.0 (until Version 1.0.3-1)]

For details of creating the cluster, refer to "Chapter 4 Installing ExpressCluster - Creating a cluster" in "EXPRESSCLUSTER X for Linux Installation and Configuration Guide".

[If you use EXPRESSCLUSTER SE Ver3.1]

For details of creating the cluster, refer to "EXPRESSCLUSTER for Linux Ver3.0 Cluster Installation and Configuration Guide (Shared Disk) 5. How to create cluster".

7. Activation of EXPRESSCLUSTER auto startup

- Execute the following command on all the servers:

```
chkconfig --add clusterpro_evt
```

```
chkconfig --add clusterpro_trn
```

```
chkconfig --add clusterpro_md (only EXPRESSCLUSTER X 1.0 to 3.x)
```

```
chkconfig --add clusterpro
```

```
chkconfig --add clusterpro_webmgr
```

```
chkconfig --add clusterpro_alertsync
```

EXPRESSCLUSTER is configured to start automatically when OS starts at next time.

Confirm that the above commands are executed on all servers, and then go on the next procedure.

8. Rebooting the server

Reboot the all servers in the cluster using **shutdown** command (or any other command) of OS.

9. Check the behavior of all failover groups and the actual operation of application such as Oracle to verify that there is no problem.

Appendix B How to add to LVM

This section shows how to set up the LVM using PathManager devices.



If you use LVM on PathManager devices, you must use the OSES shown below:

- Red Hat Enterprise Linux AS/ES 4 (kernel 2.6.9-42.EL or later)
- Red Hat Enterprise Linux 5 (kernel-2.6.18-53.el5 or later)
- Red Hat Enterprise Linux 5 Advanced Platform (kernel-2.6.18-53.el5 or later)
- Red Hat Enterprise Linux 6 (kernel-2.6.32-131.0.15.el6 or later)
- Red Hat Enterprise Linux 7 (kernel-3.10.0-229.el7 or later)
- SUSE Linux Enterprise Server 10 (kernel-2.6.16.60-0.21 or later)

* PathManager does not support the LVM via iSCSI connection.

In a SAN Boot environment, Path Manager does not support the OS volume managed by LVM.

To add PathManager devices to LVM, follow the procedures described below.

- (i) Execute the **sg_scan** command and confirm the SCSI disks recognized by the OS.

If "NEC" and "iStorage XXXX" are displayed (or "NEC" and "DISK ARRAY"), this SCSI disk is NEC Storage (shown by the shaded part).

If the disk array is NEC Storage E series, "DGC" is displayed.

In the following example, /dev/sda and /dev/sdb are local disks, /dev/sdc and /dev/sdd are the NEC Storage.

```
# sg_scan -i /dev/sda
/dev/sda: scsi0 channel=0 id=0 lun=0 [em]
      xxx      xxxxxxxxxxxxxxxx      xxxx [rmb=0 cmdq=1 pqual=0 pdev=0x0]

# sg_scan -i /dev/sdb
/dev/sdb: scsi0 channel=0 id=0 lun=0 [em]
      xxx      xxxxxxxxxxxxxxxx      xxxx [rmb=0 cmdq=1 pqual=0 pdev=0x0]

# sg_scan -i /dev/sdc
/dev/sdc: scsi0 channel=0 id=0 lun=0 [em]
      NEC      iStorage xxxx      xxxx [rmb=0 cmdq=1 pqual=0 pdev=0x0]

# sg_scan -i /dev/sdd
/dev/sdd: scsi0 channel=0 id=0 lun=0 [em]
      NEC      DISK ARRAY      xxxx [rmb=0 cmdq=1 pqual=0 pdev=0x0]

#
```



The **sg_scan** command is included in the rpm package named "sg3_utils". "sg3_utils" package may not be installed depending on its designation when installing the OS. If "sg3_utils" is not installed, get the sg3_utils rpm package from OS installation CD or WEB site of each distribution. Then, install the rpm package.

(ii) Modify the setting file of LVM. (follow the procedures below)

1. Make a backup copy of setting file of LVM.

Make a backup copy of "/etc/lvm/lvm.conf" to "/etc/lvm/lvm.conf.sps".

2. Modify the filter setting of devices.

If you use RHEL7, modify the "global_filter" entry in "device{" area. If not, modify the "filter" entry in "devices{" area.

Following explanation is a case of RHEL7. In the non-RHEL7 cases, the parameters of setting are same.

In "global_filter" entries, "a" means accept, "r" means reject. You must specify the all partitions managed by LVM.

For example, if sda2 and sdb1 are local disks managed by LVM, set as follows.

- (a) Write "a|/dev/sda2|", "a|/dev/sdb1|" at the "global_filter" entry.

Note: Even if a partition without LVM exists in the /dev/sda or /dev/sdb, there is no problem.

- (b) Write "a|/dev/dd.*|" to accept all PathManager devices.

- (c) Write "r|/dev/.*"|" to reject any other devices.

3. Add the "types" entry in "device{" area.

Add "types = ["dd", 16]"

```
# cp -p /etc/lvm/lvm.conf /etc/lvm/lvm.conf.sps
# vi /etc/lvm/lvm.conf
...
# This section allows you to configure which block devices should
# be used by the LVM system.
device {
...
# By default we accept every block device:
# filter = [ "a/*/" ]
...
# global_filter = []
global_filter = [ "a|/dev/sda2|", "a|/dev/sdb1|", "a|/dev/dd.*|",
"r|/dev/.*" ]
# Exclude the cdrom drive
# filter = [ "r|/dev/cdrom|" ]
...
# Advanced settings.

# List of pairs of additional acceptable block device types found
# in /proc/devices with maximum (non-zero) number of partitions.
# types = [ "fd", 16 ]
types = [ "dd", 16 ]
...
}
```



- If there are some contradictions with accept/reject patterns, the first one is valid. This is because of specification of LVM.
For example, if a reject pattern for all devices (like "r|.*)" and some accept ones are written in that order, the latter ones are not valid. So be sure to write a reject patterns at the end.
- The format of lvm.conf is a bit different from Regular Expression.
For example, if you write "a/dd.*/" into filter entry to manage the ddX devices, LVM will not work as intended.
Make sure to refer the setting examples of lvm.conf file.
- If some servers share some logical volumes, you must set the configuration on every server.

(iii) Make the logical volume on PathManager device. (For details, please refer to other references.)

After that, add the entry of the logical volume name into /etc/fstab.

(For example: The logical volume name you made is /dev/vg0/lv0)

```
# vi /etc/fstab
...
/dev/vg0/lv0          /mnt/work            ext3    defaults    0 0
....
```



Don't write the PathManager device name (ddX) to /etc/fstab. Please write the logical volume name which is made by PathManager devices.

(iv) Restart the OS.

```
# sync
# shutdown -r now
...
```

- (v) After the OS is restarted, check that LVM recognizes the PathManager devices by using **pvdisplay**, **lvmdiskscan** and **dmsetup** command.

In the following example, /dev/dda2 and /dev/sdb1 are local disks managed by LVM, /dev/dda1 and /dev/ddb1 are PathManager devices managed by LVM on the NEC Storage.

```
# pvdisplay
--- Physical volume ---
PV Name           /dev/sda2
VG Name           VolGroup00
PV Size           33.77 GB / not usable 25.25 MB
Allocatable       yes
PE Size (KByte)   32768
Total PE          1080
Free PE           1
Allocated PE      1079
PV UUID           2Toe3W-qwxZ-YNLV-s4n9-uvLa-DbRA-03JByM

--- Physical volume ---
PV Name           /dev/sdb1
VG Name           VolGroup00
PV Size           16.62 GB / not usable 1.98 MB
Allocatable       yes
PE Size (KByte)   4096
Total PE          4255
Free PE           4255
Allocated PE      0
PV UUID           QafExI-VCu3-LVl4-IO84-pq5k-KKnj-Gul2B0

--- Physical volume ---
PV Name           /dev/dda1
VG Name           vg0
PV Size           16.62 GB / not usable 1.98 MB
Allocatable       yes
PE Size (KByte)   4096
Total PE          4255
Free PE           2463
Allocated PE      1792
PV UUID           OTYnJ1-YIPG-bkbd-krzS-FxVf-Zzon-Ho1lE2
```

```

--- Physical volume ---
PV Name                /dev/ddb1
VG Name                vg0
PV Size                16.62 GB / not usable 1.98 MB
Allocatable           yes
PE Size (KByte)       4096
Total PE              4255
Free PE               2463
Allocated PE          1792
PV UUID               NZdzWZ-9znU-RRaF-Ui0Z-dKcP-32ji-1GnMTZ

# lvmddiskscan
/dev/sda1 [          101.94 MB]
/dev/sda2 [          33.77 GB] LVM physical volume
/dev/sdb1 [          16.62 GB] LVM physical volume
/dev/dda1 [          16.62 GB] LVM physical volume
/dev/ddb1 [          16.62 GB] LVM physical volume
X disks
X partitions
X LVM physical volume whole disks
X LVM physical volumes
#

# dmsetup ls --tree -o blkdevname
VolGroup-lv_swap <dm-1> (253:1)
  `-- <sda2> (8:2)
VolGroup-lv_root <dm-0> (253:0)
  `-- <sda2> (8:2)
VolGroup-lv_home <dm-2> (253:2)
  `-- <sda2> (8:2)
vg00-lv00 <dm-3> (253:3)
  `-- <dda1> (245:1)
#

```



If the alert message shown below is displayed as a result of **pvdiskscan** or **lvmdiskscan** command, both the PathManager device (/dev/ddX) and the SCSI device (/dev/sdX) come from the same device are accepted in the "filter" entry of LVM setting file. In this case, modify the LVM setting file so that only the PathManager device (/dev/ddX) is accepted.

(Alert Message)

"Found duplicate PV 8MScmu8H6OG1Lr0JSOJ9cKpNxlZJHKh: using /dev/sdX1 not /dev/ddX1"

The procedures to add PathManager devices to LVM are complete.

Appendix C How to Set up kdump

This section shows how to set the kdump using PathManager devices. It is possible to specify a PathManager device(/dev/ddX) as a target device of kdump output.

Procedures are different by the environment (OSes).

C.1 Red Hat Enterprise Linux 7



- * PathManager does not support the kdump via iSCSI connection.
- * "/etc/sps.conf" which relates logical disk and PathManager device name, is included to the RAM disk of kdump booting. When changing the construction of the logical disk which is referred from a server, correct "/etc/kdump.conf" as the need arises. And re-make a RAM disk of kdump booting by the following command.
- # systemctl restart kdump.service

C.1.1 Setting up kdump with a PathManager Device

To set up kdump with a PathManager device, follow the procedures described below.

Example) If you make kdump output to "/dev/dda1" (file system: ext4).

- (i) Modify the "/etc/kdump.conf" file.
 1. Making a backup copy of kdump.conf. (This will be used to reset.)
Make a backup copy of "/etc/kdump.conf" to "/etc/kdump.conf.sps".
 2. Specify a PathManager device(/dev/ddX) as a target device of kdump output.

```
# cp -p /etc/kdump.conf /etc/kdump.conf.sps

# vi /etc/kdump.conf
...
#default shell
#force_rebuild 1
#dracut_args --omit-drivers "cfg80211 snd" --add-drivers "ext2 ext3"
#fence_kdump_args -p 7410 -f auto -c 0 -i 10
#fence_kdump_nodes node1 node2
ext4 /dev/dda1
...
```

Diagram annotations: A box labeled "1." points to the command `# cp -p /etc/kdump.conf /etc/kdump.conf.sps`. A box labeled "2." points to the line `ext4 /dev/dda1` in the configuration file.

- (ii) Mount a PathManager device(/dev/ddX) as a target device of kdump output, to any directory.

Note: A mount point is an example.

```
# mount /dev/dda1 /var/crash
```

- (iii) Restart kdump to re-make a RAM disk of booting.

```
# systemctl restart kdump.service
```

C.2 Red Hat Enterprise Linux 5/6



If you use kdump with PathManager devices, you must use the OS shown below:

- Red Hat Enterprise Linux 5 (Kernel-2.6.18-53.el5 or later)
- Red Hat Enterprise Linux 5 Advanced Platform (Kernel-2.6.18-53.el5 or later)
- Red Hat Enterprise Linux 6 (Kernel-2.6.32-131.0.15.el6 or later)

* PathManager does not support the kdump via iSCSI connection.

C.2.1 Setting up kdump with a PathManager Device

To set up kdump with a PathManager device, follow the procedures described below.

Example) If you make kdump output to `"/dev/dda1"` (file system: ext3).

- (i) Modify the `"/etc/kdump.conf"` file.
 1. Making a backup copy of `kdump.conf`. (This will be used to reset.)
Make a backup copy of `"/etc/kdump.conf"` to `"/etc/kdump.conf.sps"`.
 2.
 - (a) Write the setting that kdump loads the `"dd_mod.ko"`.
 - (b) Write the setting that the target of kdump is `/dev/dda1`.

```
# cp -p /etc/kdump.conf /etc/kdump.conf.sps

# vi /etc/kdump.conf
...
...
#link_delay 60
#kdump_post /var/crash/scripts/kdump-post.sh
#extra_bins /usr/bin/lftp
#extra_modules gfs2
#default shell
extra modules dd_mod
ext3 /dev/dda1
...
```

1.

2. (a)

2. (b)

The procedures from here are different by OSes.

<Red Hat Enterprise Linux 6>

- (ii) Execute "**spsconfig**" command with "-kdump-cfg-add" option.

```
#spsconfig -kdump-cfg-add /dev/dda >> /etc/kdump.conf
```

Next, go on to the procedure (iv).

<Red Hat Enterprise Linux 5>

(iii) Modify the "/etc/modprobe.conf" file.

1. Making the backup copy of modprobe.conf. (This will be used to reset)
Make the backup copy of "/etc/modprobe.conf" to "/etc/modprobe.conf.sps".
2. Update of modprobe.conf.
Update "/etc/modprobe.conf" executing the **spsconfig** command with "-add" option so that "/dev/dda1" is built into the kernel.
3. Confirming modprobe.conf.
Open "/etc/modprobe.conf", and confirm that the shaded part shown below is added.

```
# cp -p /etc/modprobe.conf /etc/modprobe.conf.sps
# spsconfig -add /dev/dda >> /etc/modprobe.conf
# cat /etc/modprobe.conf
...
# Please add the following line to /etc/modprobe.conf
options sps_mod dda=NEC____,iStorage_2000____,0000000929200235,00000
...
```

(iv) Restart kdump to rebuild the boot RAM disk image.

```
# /etc/rc.d/init.d/kdump restart
Stopping kdump: [ OK ]
Detected change(s) the following file(s):

    /etc/kdump.conf
Rebuilding /boot/initrd-2.6.18-53.el5kdump.img
Starting kdump: [ OK ]
#
```

Setting up kdump with a PathManager device (RHEL5/6) is complete.

C.3 SUSE Linux Enterprise Server 10



- The following three RPM packages are required to use PathManager device as kdump output. Install them before setup from installation CD of OS or web site of each OS distribution.

Example) in the case of kernel-2.6.16-60-0.39.3

- kernel-kdump-2.6.16-60.0.39.3.*.rpm
- kdump-0.3.0-8.9.*.rpm
- kexec-tools-1.101-32.48.*.rpm

- PathManager driver package for kdump (sps-kdump-*.rpm) should be installed after the following procedure "C.3.1 Setting up kdump with a PathManager Device". Do not change the order of setup.
- Do not specify a device of disk array unit connected via iSCSI.

C.3.1 Setting up kdump with a PathManager Device

To set up kdump with a PathManager device, follow the procedures described below.

Example) If you make kdump output to "/dev/ddc1".

- (i) Modify the "/etc/sysconfig/kernel" file.
1. Making a backup copy of "/etc/sysconfig/kernel".
Make a backup copy of "/etc/sysconfig/kernel" as "/etc/sysconfig/kernel.sps".
 2. Write the setting that kdump loads the "dd_mod.ko".
(* Place the text "dd_mod" in the end of "INITRD_MODULES" line.)

```
# cp -p /etc/sysconfig/kernel /etc/sysconfig/kernel.sps
#
# vi /etc/sysconfig/kernel

## Path:          System/Kernel
## Description:
## Type:          string
## Command:       /sbin/mkinitrd
#
# This variable contains the list of modules to be added to the initial
# ramdisk by calling the script "mkinitrd"
# (like drivers for scsi-controllers, for lvm or reiserfs)
#
#INITRD_MODULES="piix aic79xx lpfc processor thermal fan reiserfs edd"
INITRD_MODULES="piix aic79xx lpfc processor thermal fan reiserfs edd dd_mod"
...
```

The diagram consists of two boxes with arrows pointing to specific lines in the code block. Box 1 points to the command `cp -p /etc/sysconfig/kernel /etc/sysconfig/kernel.sps`. Box 2 points to the modification of the `INITRD_MODULES` line, where `dd_mod` is added to the end of the string.

(ii) Modify the "/etc/sysconfig/kdump" file.

1. Making a backup copy of "/etc/sysconfig/kdump"
Make a backup copy of "/etc/sysconfig/kdump" as "/etc/sysconfig/kdump.sps".
2. Write the setting that kdump outputs to "/dev/ddc1"

```
# cp -p /etc/sysconfig/kdump /etc/sysconfig/kdump.sps

# vi /etc/sysconfig/kdump
...
...
# Important: The KDUMP_DUMPDEV is overwritten by kdump, so don't use it for
# saving any data. Also don't use the currently used swap partition.
#
KDUMP_DUMPDEV="/dev/ddc1"
...
...
```

1.

2.



- If you specify an in-use partition as a destination of kdump, kdump breaks the file system of it when dumping. Therefore, be careful to set the configuration.

(iii) Modify the "/etc/modprobe.conf" file.

1. Making a backup copy of "/etc/modprobe.conf".
Make a backup copy of "/etc/modprobe.conf" as "/etc/modprobe.conf.sps".
2. Updating the "/etc/modprobe.conf" file.
Execute the "spsconfig" command with "-add" option to update the "/etc/modprobe.conf" file.
(with specifying the device name (/dev/ddc) of the destination of kdump)
3. Confirming modprobe.conf.
Open "/etc/modprobe.conf", and confirm that the shaded part shown below is added.

```
# cp -p /etc/modprobe.conf /etc/modprobe.conf.sps
#
# spsconfig -add /dev/ddc >> /etc/modprobe.conf
#
# cat /etc/modprobe.conf
...
# Please add the following line to /etc/modprobe.conf
options sps_mod ddc=NEC_____,iStorage_2000_____,0000000929200235,00002
...

```

With that, setting up the kdump with PathManager device is complete.

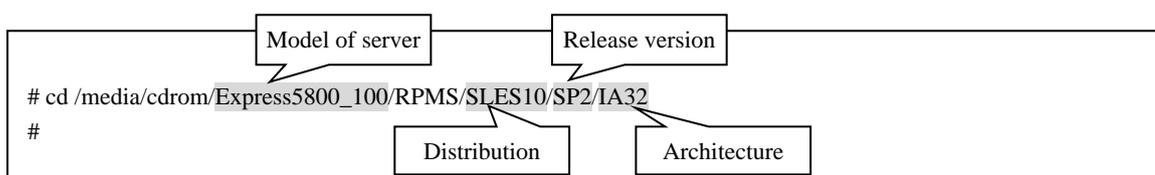
Next, go on to "C.2.2. Installation of PathManager driver for kdump".

C.3.2 Installation of PathManager driver for kdump

- (i) Install the RPM file of PathManager driver for kdump

Move to the directory of compatible RPM files in installation CD-ROM. How to specify the directory is shown below.

- If the kernel version of your system is 2.6.16-60-0.39.3, and its architecture is IA32 (smp) -



Execute the following command to install the RPM files corresponding to the kernel version you use.

(Shaded part shows the corresponding kernel.)

```
# uname -r
2.6.16.60-0.39.3-smp
# rpm -ivh sps-kdump-E-4.2.4-2.6.16.60.0.39.3.i586.rpm

Preparing...                               ##### [100%]
 1:sps-kdump-E                             ##### [100%]
Setting up /lib/modules/2.6.16.60-0.39.3-kdump
Root device:  /dev/disk/by-id/scsi-3500cca002d49f14-part2 (/dev/sda2)
(mounted on / as reiserfs)
Module list:  piix aic79xx lpfc processor thermal fan reiserfs edd dd_mod
(xennet xenblk)

Kernel image:  /boot/vmlinuz-2.6.16.60-0.39.3-kdump
Initrd image:  /boot/initrd-2.6.16.60-0.39.3-kdump
Shared libs:   lib64/ld-2.4.so lib64/libacl.so.1.1.0 lib64/libattr.so.1.1.0
lib64/libc-2.4.so lib64/libdl-2.4.so lib64/libhistory.so.5.1
lib64/libncurses.so.5.5 lib64/libpthread-2.4.so lib64/libreadline.so.5.1
lib64/librt-2.4.so lib64/libuuid.so.1.2 lib64/libnss_files-2.4.so
lib64/libnss_files.so.2 lib64/libgcc_s.so.1

Driver modules: ide-core ide-disk scsi_mod sd_mod piix scsi_transport_spi
aic79xx scsi_transport_fc firmware_class lpfc processor thermal fan edd
sps_mod2 sps_mod dd_mod libata ahci ata_piix
Filesystem modules:  reiserfs
Including:            kdump initramfs fsck.reiserfs
No bootsplash for kernel flavor kdump
17422 blocks
#
```

Check `dd_mod` is displayed in the list

Check both `sps_mod` and `sps_mod2` are displayed in the list

- (ii) Execute the following command to check that no error is displayed.

```
# depmod -a `uname -r`
#
```

- (iii) Modify the bootloader configuration file to add the "crashkernel=64M@16M" as a boot option.

(* If that has already been described, skip here.)

```
# vi /boot/grub/menu.lst
# Modified by YaST2. Last modification on Mon Aug 24 14:00:59 JST 2009
default 0
timeout 8
##YaST - generic_mbr
gfxmenu (hd0,1)/boot/message
##YaST - activate

###Don't change this comment - YaST2 identifier: Original name: linux-
2.6.16.60-0.39.3-smp###
title SUSE Linux Enterprise Server 10 SP2 - 2.6.16.60-0.39.3 (smp)
    root (hd0,1)
    kernel /boot/vmlinuz-2.6.16.60-0.39.3-smp root=/dev/disk/by-id/ata-
Maxtor_2F040L0_F1HQF6GE-part2 vga=0x317 resume=/dev/hda1 splash=silent
showopts crashkernel=64M@16M
    initrd /boot/initrd-2.6.16.60-0.39.3-smp

###Don't change this comment - YaST2 identifier: Original name: failsafe-
2.6.16.60-0.39.3-smp###
title Failsafe -- SUSE Linux Enterprise Server 10 SP2 - 2.6.16.60-0.39.3
(smp)
    root (hd0,1)
    kernel /boot/vmlinuz-2.6.16.60-0.39.3-smp root=/dev/disk/by-id/ata-
Maxtor_2F040L0_F1HQF6GE-part2 vga=normal showopts ide=nodma apm=off acpi=off
noresume nosmp noapic maxcpus=0 edd=off 3
    initrd /boot/initrd-2.6.16.60-0.39.3-smp
...

```

- (iv) Execute the "**chkconfig**" command to check that auto startup configuration of kdump is "on"

(* If all configuration items are off as shown below, please turn on with "--add" option.)

```
# chkconfig --list kdump
kdump                0:off  1:off  2:off  3:off  4:off  5:off  6:off
# chkconfig --add kdump
kdump                0:off  1:on   2:on   3:on   4:off  5:on   6:off

```

- (v) Reboot the system and check that it starts up normally.

```
# sync
# shutdown -r now
#
```

- (vi) Check the status of kdump to check that it starts up normally.

```
# /etc/init.d/kdump status
kdump kernel loaded
#
```

With that, installation of PathManager driver for kdump is complete.

Appendix D Error Messages from Installer

This section shows the description and handling of each error message from installer (install.sh/uninstall.sh).

Table 4-1 Error Message List

Error Message	Handling No.*	
Description	(refer to Handling List)	
ErrCode:[1-01] sps doesn't support iSCSI connection with RENS. Installer cannot accept both option "mcopt" and "iscsi".	1 (PARAM)	
ErrCode:[1-02] sps-kdump need not to be installed on RedHat. If the system is Red Hat Enterprise Linux, sps-kdump is unnecessary. Please use the built-in kdump.		
ErrCode:[1-03] sps doesn't support iSCSI connection on SuSE. PathManager doesn't support iSCSI connection on SuSE.		
ErrCode:[1-04] sps-mcopt doesn't support on SuSE. PathManager doesn't support sps-mcopt on SuSE.		
ErrCode:[1-05] sps-mcopt is only supported on x86_64 architecture. PathManager supports sps-mcopt only on x86_64 architecture.		
ErrCode:[2-01] sps doesn't support this kernel. This kernel is not supported by PathManager's installer.		2 (STATUSERR)
ErrCode:[2-02] This installer is for RHEL5.4 or later and SLES10 SP3 or later. This installer is for RHEL5.4 or later.		
ErrCode:[2-03] Some of sps rpm packages are already installed. Some of PathManager RPM packages are already installed.		
ErrCode:[2-04] Failed to read the media. Failed to read the media. When installation, the current directory should be the one where the installer exists in the media.		
ErrCode:[3-01] Couldn't find sps-driver-xxx.rpm in this media. Couldn't find the PathManager driver RPM package corresponding to the kernel of this system.	3 (RPMPKG)	
ErrCode:[3-02] Couldn't find sps-utils rpm in this media. Couldn't find the PathManager utils RPM package corresponding to the kernel of this system.		
ErrCode:[3-03] Couldn't find sps-mcopt rpm in this media. Couldn't find the sps-mcopt RPM package corresponding to the kernel of this system.		
ErrCode:[3-04] Couldn't find sps-kdump rpm in this media. Couldn't find the sps-kdump RPM package corresponding to the kernel of this system.		

Error Message	Handling No.*
Description	(refer to Handling List)
ErrCode:[4-01] mcl-reus-kernel rpm is needed by sps-mcopt.	4 (EXTERNAL)
mcl-reus-kernel should be installed before installation of sps-mcopt.	
ErrCode:[4-02] mcl-reus-base rpm is needed by sps-mcopt.	
mcl-reus-base should be installed before installation of sps-mcopt.	
ErrCode:[4-03] kernel-kdump rpm is needed by sps-kdump.	
kernel-kdump should be installed before installation of sps-kdump.	
ErrCode:[4-04] kdump rpm is needed by sps-kdump.	
kdump should be installed before installation of sps-kdump.	
ErrCode:[4-05] kexec-tools rpm is needed by sps-kdump.	
kexec-tools should be installed before installation of sps-kdump.	
ErrCode:[4-06] iscsi-initiator-utils rpm is needed by iSCSI connection.	
If PathManager connects via iSCSI, iscsi-initiator-utils should be installed.	
ErrCode:[4-07] Please stop spsmonitor(spsmon) by RENS command before uninstallation.	
spsmonitor (spsmon) should be stopped by RENS command before installation of sps-mcopt.	
ErrCode:[5-01] Failed to modprobe.	5 (DRIVER)
Failed to probe the sps driver.	
ErrCode:[5-02] dd_mod.ko isn't found.	
Couldn't find the dd_mod.ko.	
ErrCode:[5-03] sps_mod.ko isn't found.	
Couldn't find the sps_mod.ko.	6 (MKDD)
ErrCode:[6-01] Failed to mkdd.	
Failed to build the PathManager device.	
ErrCode:[6-02] /proc/scsi/sps or /sbin/mkdd isn't found.	
Couldn't find the files related to mkdd.	

Error Message	Handling No.*
Description	(refer to Handling List)
ErrCode:[7-01] Failed to dd_daemon.	7 (DDDAEMON)
Failed to start dd_daemon.	
ErrCode:[7-02] /sbin/dd_daemon or /etc/init.d/dd_daemon isn't found.	
Couldn't find the files related to dd_daemon.	
ErrCode:[8-01] Failed to patched for FC.	8 (PATCH)
Failed to apply a patch for fibre channel in installation.	
ErrCode:[8-02] Failed to patched for iSCSI.	
Failed to apply a patch for iSCSI in installation.	
ErrCode:[8-03] Couldn't find /opt/nec/sps/patch directory.	
Couldn't find /opt/nec/sps/patch directory in installation.	
ErrCode:[8-04] Failed to depatched for FC.	
Failed to unpatch (depatch) for fibre channel.	
ErrCode:[8-05] Failed to depatched for iSCSI.	
Failed to unpatch (depatch) for fibre channel.	
ErrCode:[8-06] Couldn't find /opt/nec/sps/patch directory.	
Couldn't find /opt/nec/sps/patch directory in uninstallation.	
ErrCode:[9-01] Couldn't find patch for FC.	
Couldn't find the patch file for fibre channel in installation.	
ErrCode:[9-02] Couldn't find patch for iSCSI.	
Couldn't find the patch file for iSCSI in installation.	
ErrCode:[9-03] Couldn't find patch for FC.	
Couldn't find the patch file for fibre channel in uninstallation.	
ErrCode:[9-04] Couldn't find patch for iSCSI.	
Couldn't find the patch file for iSCSI in uninstallation.	
ErrCode:[10-01] Failed to sps-driver rpm installation.	
Failed to install the sps-driver RPM package.	
ErrCode:[10-02] Failed to sps-utils rpm installation.	
Failed to install the sps-utils RPM package.	
ErrCode:[10-03] Failed to sps-mcopt rpm installation.	
Failed to install the sps-mcopt RPM package.	
ErrCode:[10-04] Failed to sps-kdump rpm installation.	
Failed to install the sps-kdump RPM package.	

Error Message	Handling No.*
Description	(refer to Handling List)
ErrCode:[11-01] Failed to sps-kdump rpm uninstallation.	9 (UNINSTALL)
Failed to uninstall the sps-kdump RPM package.	
ErrCode:[11-02] Failed to sps-mcopt rpm uninstallation.	
Failed to uninstall the sps-mcopt RPM package.	
ErrCode:[11-03] Failed to sps-utils rpm uninstallation.	
Failed to uninstall the sps-utils RPM package.	
ErrCode:[11-04] Failed to sps-driver rpm uninstallation.	
Failed to uninstall the sps-driver RPM package.	

* "Handling No." is an exit code of installer, and used as handling number.

Table 4-2 Handling List

Handling No.	Meaning	Detail and How to do
1 (PARAM)	Parameter Error	Specify the correct parameters and execute the installer again.
2 (STATUSERR)	Status Error or Environment Error	<p>[Status Error]</p> <ul style="list-style-type: none"> - There are some installed RPM packages related to PathManager. Uninstall them and try again. - Failed to read the media. Perhaps installer was executed from wrong directory. <p>On installation, the current directory should be the one where the installer exists in the media.</p> <p>[Environment Error]</p> <ul style="list-style-type: none"> - Check the environment. PathManager is supported to work on Red Hat Enterprise Linux and SUSE Linux Enterprise Server. - You can use installer on Red Hat Enterprise Linux 5.4 or later / SUSE Linux Enterprise Server 10 SP3 or later. Don't use on other OS distributions.
3 (RPMPKG)	Search RPM Package Error	<p>Installation may start on a non-supported kernel.</p> <p>Check whether the kernel is the one on which PathManager can be supported.</p>
4 (EXTERNAL)	External Cause Error	<p>[Red Hat Enterprise Linux] (in Installation)</p> <ul style="list-style-type: none"> - iscsi-initiator-utils RPM package should be installed before PathManager work with iSCSI. <p>[SUSE Linux Enterprise Server] (in Installation)</p> <ul style="list-style-type: none"> - The kdump modules are required for PathManager kdump driver to install. <p>Please install the modules.</p>

Handling No.	Meaning	How to do
5 (DRIVER)	Driver Error	sps-driver may fail to start, or some files related to sps-driver may be missing. Uninstall the PathManager and then install it again.
6 (MKDD)	MKDD Error	<ul style="list-style-type: none"> - Check whether FC/LAN cables are connected correctly. If incorrect, connect correctly. - If iSCSI, check whether the iscsi-initiator starts normally. If abnormal, restart the iscsi-initiator. - Check whether /etc/sps.conf (which was created before) exists. If it exists, rename it and execute mkdd command. If same error still occurred in the above execution, probably some files related to mkdd are missing. Uninstall the PathManager and then install it again. - Check whether the server recognizes the logical disk of NEC Storage. If the server does not recognize correctly, check the configuration of NEC Storage so that the server recognizes it. After that, restart the server. Then PathManager will work correctly. (Because the installation was complete.)
7 (DDDAEMON)	dd_daemon Error	Restart the path patrol daemon (dd_daemon). # /etc/init.d/dd_daemon restart If same error still occurred in above procedure, probably some files related to dd_daemon are missing. Uninstall the PathManager and then install it again.
8 (PATCH)	Failed to apply / release a patch	Failed to apply / release the auto-startup patch file. (in installation) Apply the auto-startup patch according to (iv) of "2.1.2.2 Manual Installation". And check whether it was applied correctly. (in uninstallation) Unpatch the auto-startup patch according to "Uninstallation" in PathManager User's Manual. And check whether it was unpatched correctly.
9 (UNINSTALL)	Uninstallation Error	Failed to uninstall the RPM package. Try again please.