Intel® Storage System SSR212PP

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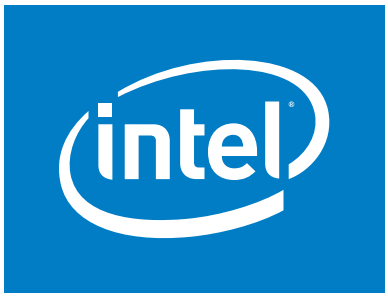

PowerPath for Linux Version 4.5

Installation Guide

Intel Order Number D59960-001

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Preface

Some functions described in this manual may not be supported by all versions of PowerPath or the storage-system hardware it supports. For the most up-to-date information on product features, see your product release notes.

This guide describes how to install and remove PowerPath 4.5.*x* for Windows 2000 and Windows Server 2003. It also includes an introduction to the PowerPath Administrator.

Audience and Prerequisites

This manual is part of the PowerPath documentation set. It is intended for use by storage administrators and other information system professionals responsible for installing, using, and maintaining PowerPath.

Readers of this manual are expected to be familiar with the host operating system, storage-system management, and the applications used with PowerPath.

About this Manual

For information about which accessories, memory, processors, and third-party hardware have been tested and can be used with your storage system, and for ordering information for Intel¤ products, see http://support.intel.com/support/motherboards/server/SSR212PPcompat.htm.

Additional Information and Software

If you need more information about this product or information about the accessories that can be used with this storage system, use the following resources. These files are available at http://support.intel.com/support/motherboards/server/SSR212PP. Unless otherwise indicated in the following table, once on this Web page, type the document or software name in the search field at the left side of the screen and select the option to search "This Product."

For this information or software	Use this Document or Software
For in-depth technical information about this product	Intel® Storage System SSR212PP *Technical Product Specification*
If you just received this product and need to install it	Intel® Storage System SSR212PP *Quick Start User's Guide* in the product box
For virtual system tours and interactive repair information	A link to the SMaRT Tool is available under "Other Resources" at the right side of the screen at http://support.intel.com/support/motherboards/server/SSR212PP
Accessories and spares	Intel® Storage System SSR212PP *Spares Installation Guide*
Hardware (peripheral boards, adapter cards) and operating systems that have been tested with this product	Tested Hardware Operating Systems List (THOL)

Installing PowerPath

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This chapter describes how to install PowerPath on a Linux host. The chapter covers the following topics:

- "Before You Install" on page 1
- "Installing PowerPath" on page 6
- "After You Install" on page 8
- "Upgrading PowerPath" on page 10

Before You Install

This section describes how to prepare a Linux host for an PowerPath¤ installation.

❑ Obtain current information from the SSR212PP support website (http://support.intel.com/support/motherboards/server/SSR212PP).

- *PowerPath Release Notes*.
- *PowerPath upgrades and patches*.
- *PowerPath documentation*.

Installing PowerPath on a host connected to an SSR212PP-Series array does not require a license. PowerPath provides full functionality with or without a PowerPath license when the host is connected to ac SSR212PP-Series array.

❑ Check your storage system configuration. The sequence of steps for configuring a storage system and installing PowerPath on a host depends on which storage system you use.

- *SSR212PP-Series storage systems***.** PowerPath installation is an integral part of the setup and configuration procedure.
  - SSR212PP-Series installation, planning, and troubleshooting documents are located on the SSR212PP support website support website. For information on accessing the site, refer to the support documentation that shipped with your storage system. Refer only to these documents for prescribed installation information when using SSR212PP-Series storage systems.
  - For first-time PowerPath installations, remove any version of Navisphere¤ Application Transparent Failover (ATF) installed on a host that supports this application.

The procedure for migrating from ATF or CDE to PowerPath is not straightforward and could result in data loss if not performed correctly. We strongly recommend that Professional Services perform the migration. If you nevertheless decide to perform the migration yourself, refer to *Removing ATF or CDE Software Before Installing Other Failover Software* for more information. This document is available only on the EMC Powerlink web site.

- If it is running, stop the Navisphere agent before installing either the full release or a patch release of PowerPath.

  ```
  /etc/init.d/naviagent stop
  ```

- *Third-party storage systems.* Install PowerPath *after* you set up and verify that the third-party storage system is working properly. Then, install PowerPath using the instructions in this guide.

❑ Before installing PowerPath on any Linux host, ensure that the host meets the following requirements:

- Ensure that there is only one path per logical device. (Once PowerPath is installed, more than one path per logical device is permitted.) If necessary, disconnect the cable on the host and not on the array.
- Make sure that the root partition has at least 120 MB of free space.

If you attempt to install PowerPath on a host that lacks sufficient space, installation fails as expected. RPM, however, returns a misleading message about the amount of space needed to install PowerPath.

Refer to "Recovering from a Failed PowerPath Installation" on page 27 for more information.

- Configure the HBA BIOS and drivers if you have not already done so.

CAUTION

Be sure to follow the HBA BIOS and driver configuration guidelines outlined in the *Support Matrix* on the SSR212PP support website. Using improper settings can cause erratic failover behavior, such as greatly increased I/O delays.

- If you plan to install PowerPath and VERITAS Volume Manager (VxVM), install PowerPath first if possible. If you install PowerPath on a host on which Storage Foundation is already installed, you may need to reboot the host to populate the VxVM configuration with PowerPath `emcpower` device names.
- On an SuSE host, make sure that the native multipath service is not enabled. Run the `chkconfig | grep boot.multipath` command. If the output indicates that the multipath service is on, run the `chkconfig boot.multipath off` command to disable it before installing PowerPath.

If the chkconfig | grep boot.multipath command returns no output, then the multipathing service is not installed on the host.

- ❑ Configure the kernel. Make the Linux kernel changes described in this section before you install PowerPath. Review the requirements and do all that apply in your configuration. If you do not know which HBA or fibre drivers support PowerPath with your host, refer to the *Support Matrix* on the SSR212PP support website.
  - If you load the HBA driver as a module, install its binary file in its location in /lib/modules/‘uname -r‘/drivers/scsi.
    - Valid module names (depending on the HBA installed) are qla2300, qla4010, and lpfc.
    - If, according to the *Support Matrix* on the SSR212PP support website, for your distribution and the HBA model, the fibre driver does not need to be rebuilt (the version of the driver supplied in your distribution is supported), this copying step is unnecessary.
  - If you have a fibre driver, ensure that it is loaded *before* you install PowerPath. Use the lsmod command to list the modules that are currently loaded. The output should include fibre drivers.

Modify Configuration Files

Make changes to your configuration files according to the following instructions for your distribution. Rebuild the RAM disk after making any of the following changes.

For RHEL

Make the following changes as appropriate in the /etc/modprobe.conf file.

The HBA driver used to access devices can be statically loaded in the kernel or loaded into the kernel as a module.

- ❑ If you want to build the HBA driver into the RAM disk, ensure that the HBA driver is always loaded *after* the internal SCSI adapter driver as specified by the /etc/modprobe.conf file.

  For example, in the following file, the QLogic¤ qla2300 driver is always loaded after all internal SCSI drivers are loaded:

```
alias eth0 eepro100
alias scsi_hostadapter1 aic7xxx
alias scsi_hostadapter2 aic7xxx
alias scsi_hostadapter3 aic7xxx
alias scsi_hostadapter4 qla2300
```

In the line above, the module name could be qla2300, qla4010, or lpfc, depending on the installed HBA.

- Enable the max_scsi_luns parameter in /etc/modprobe.conf.

  In the default RHEL kernel, CONFIG_SCSI_MULTI_LUN is disabled. As a result, if the LUN 0 disappears from the storage group and the host is rebooted or the driver is unloaded and reloaded, the host will see only the ghost LUNs (with ArrayCommPath disabled) or the LUNZ (with ArrayCommPath enabled).

  For example, the max_scsi_luns parameter is enabled in the following modprobe.conf file:

  ```
  alias parport_lowlevel parport_pc
  alias scsi_hostadapter sym53c8xx
  alias scsi_hostadapter1 qla2300
  alias scsi_hostadapter2 qla2300
  alias eth0 tlan
  options scsi_mod max_scsi_luns=256
  ```

- If you use QLogic HBAs, make sure that failover is disabled for those HBAs. Make sure that the ql2xfailover and ConfigReguired parameters are set to 0 in the /etc/modprobe.conf file, as shown below:

  ```
  options qla2xxx ql2xfailover=0 ConfigRequired=0
  ```

- If you use Emulex HBAs, set the value of the lpfc_nodev_tmo parameter to 10 in the /etc/modprobe.conf file:

  ```
  options lpfc lpfc_nodev_tmo=10
  ```

  For SuSE Distributions

  Make the following changes as appropriate. Rebuild the RAM disk after making any of the following changes.

- The HBA driver used to access storage devices can be statically loaded in the kernel or loaded into the kernel as a module. If you want to build the HBA driver into the RAM disk, ensure that the HBA driver is always loaded *after* the internal SCSI adapter driver as specified by the /etc/sysconfig/kernel file.

  For example, in the following file, qla2300 is always loaded after all internal SCSI drivers are loaded:

  ```
  INITRD_MODULES="scsi_mod sd_mod cciss reiserfs qla2300"
  ```

  In the line above, the module name could be qla2300, qla4010, or lpfc, depending on the installed HBA.

  When loading HBA drivers into the RAM disk, make sure that the HBA module name used in /etc/sysconfig/kernel is the same as that used in the /etc/modprobe.conf file.

- If you use QLogic HBAs, make sure that failover is disabled for those HBAs. Make sure that the ql2xfailover and ConfigReguired parameters are set to 0 in the /etc/modprobe.conf.local file, as shown below:

  ```
  options qla2xxx ql2xfailover=0 ConfigRequired=0
  ```

- If you use Emulex HBAs, set the value of the lpfc_nodev_tmo parameter to 10 in the /etc/modprobe.conf.local file:

  ```
  options lpfc lpfc_nodev_tmo=10
  ```

- Rebuild the RAM disk to incorporate the changes made to the kernel configuration files.
  - For RHELdistributions:
    1. Run the ls -l /boot command to determine which initrd file is being used. Run the uname -r command to display the kernel version.
    2. Enter /sbin/mkinitrd -f -v *initrd kernelVersion* where *initrd* corresponds to the configuration identified in step i.
  - For SuSE distributions:
    1. Run the ls -l /boot command to determine which initrd and vmlinuz files are being used. Run the uname -r command to display the kernel version.
    2. Enter /sbin/mk_initrd -k *vmlinuz* -i *initrd* where *vmlinuz* and *initrd* correspond to the configuration identified in step i.

- Ensure that major number 120, which is used by the PowerPath driver, is not already in use.

- The Linux kernel and fibre drivers supported by your version of PowerPath must be installed and running.

- Select a language for installation. The PowerPath 4.5.*x* for Linux installation and startup procedure has been localized for the following languages.

TABLE 1. The LANG Enviroment Variable

Language	Locale ID	Encoding
Chinese (simplified)	zh_CN.utf8	UTF8
English	En_US.utf8	
French	fr_FR.utf8	
German	de_DE.utf8	
Italian	it_IT.utf8	
Japanese	ja_JP.utf8	
Korean	ko_KR.utf8	
Portuguese (Brazilian)	pt_BR.utf8	
Spanish (Latin American)	es_ES.utf8	

LANG Environment Variable

If the LANG environment variable is set to a locale ID listed in Table 1 , messages from the PowerPath installation program are displayed in the language corresponding to that locale ID. If you want to display PowerPath installation messages in a language that is not the default for the host, set the LANG variable for the terminal session to the locale ID for that language. For example, to display installation messages in simplified Chinese, enter one of the following commands (depending on the shell being used):

```
export LANG=zh_CN.utf8
```

or

```
setenv LANG zh_CN.utf8
```

If you set the LANG variable to an unsupported locale ID, PowerPath continues the installation in English.

gettext Utility

The GNU gettext utilities must be installed on the host if you intend to use a language other than English. If the gettext command is present in the /usr/bin/gettext directory, the gettext utilities are installed on the host.

If the gettext utilities are not installed on the host, PowerPath returns a warning and continues the installation in English.

IA64 Systems Only

If you are going to install PowerPath on an IA64 system, then you must install the following packages on that system before installing PowerPath.

TABLE 2. IA64 Installation Prerequisites

Distribution	Packages
RHEL 4.0	ia32el-1.1-20.ia64.rpm (or later)[1] glibc-2.3.4-2.i686.rpm (or later)[2]
SLES 9[3]	ia32el-5.3-2.6 (or later) glibc-x86-9-200411051902 (or later)

NOTES:

1. Available on the Red Hat Extras CD.
2. Available on the Red Hat Compatibility Layer CD.
3. These packages should be installed by default on SLES 9. Check to make sure these packages are installed before installing PowerPath, and install them if necessary.

Installing PowerPath

This section describes how to install PowerPath 4.5.*x* on a Linux host on which PowerPath is not currently installed. Refer to "Upgrading PowerPath" on page 10 for instructions on upgrading PowerPath on a host that has an earlier version of PowerPath.

Take note of the following before installing PowerPath:

- You do not need to reboot the host after installing PowerPath.
- Refer to "Recovering from a Failed PowerPath Installation" on page 27 for information on recovering from a failed PowerPath installation.

STEP 1. Log in as root.

STEP 2. If you are installing from the PowerPath CD-ROM,

a. Insert the PowerPath installation CD-ROM into the CD-ROM drive.

b. Create the directory /cdrom to be the mount point for the CD-ROM:

```
mkdir /cdrom
```

c. Mount the PowerPath CD on /cdrom:

```
mount -o ro /dev/cdrom /cdrom
```

d. Change directories to the directory for your operating system.

- For SLES, enter:

  ```
  cd /cdrom/LINUX/2.6/pp4.5.x/sles
  ```

- For RHEL, enter:

  ```
  cd /cdrom/LINUX/2.6/pp4.5.x/rhel
  ```

e. Go to STEP 3.

STEP 3. Install PowerPath:

```
rpm -i EMCpower.LINUX-4.5.release-build.package.rpm
```

where *package* is:

sles.x86_64	PowerPath 4.5.*x* on SLES x86_64 platforms.
sles.ia64	PowerPath 4.5.*x* on SLES IA64 platforms.
sles.i386	PowerPath 4.5.*x* on SLES i386 platforms.
rhel.x86_64	PowerPath 4.5.*x* on RHEL x86_64 platforms.
rhel.ia64	PowerPath 4.5.*x* on RHEL IA64 platforms.
rhel.i386	PowerPath 4.5.*x* on RHEL i386 platforms.

Register PowerPath

Take note of the following regarding PowerPath registration:

- Installing PowerPath on a host connected to an SSR212PP-Series array does not require a license. PowerPath provides full functionality with or without a PowerPath license when the host is connected to a SSR212PP-Series array. Therefore, you do not need to run the emcpreg -install command when installing PowerPath on a host connected to a SSR212PP-Series array.
- If you do not register the PowerPath software during PowerPath installation (on a host connect to any storage system other than an SSR212PP-Series array), and then subsequently reboot the host, the load balancing and failover policy is set to Basic Failover. If this happens, you must register PowerPath using the emcpreg -install command and then run the powermt set policy command to reset the policy as appropriate. Refer to the *PowerPath Product Guide* for more information.

STEP 4. To register the PowerPath license, enter:

```
emcpreg -install
```

You see the following output:

```
===========   EMC PowerPath Registration ===========
Do you have a new registration key or keys to enter? [n]
```

STEP 5. Enter y. You see the following output:

```
Enter the registration key(s) for your product(s),
one per line, pressing Enter after each key.
After typing all keys, press Enter again.

Key (Enter if done):
```

STEP 6. Enter the 24-character alphanumeric sequence found on the License Key Card delivered with the PowerPath media kit, and press ENTER.

If you enter a valid registration key, you see the following output:

```
1 Key(s) successfully added.
Key successfully installed:
```

If you enter an invalid registration key, the screen displays an error message and prompts you to enter a valid key. Refer to the *PowerPath Product Guide* for a list of error messages returned by the emcpreg license registration utility.

STEP 7. Press ENTER. You see the following output:

```
1 key(s) successfully registered.
```

STEP 8. Start PowerPath:

```
/etc/init.d/PowerPath start
```

Only use the above script to load and unload the PowerPath modules.

If the LANG variable is set to the locale ID for a language listed in Table 1 on page 5, messages from the PowerPath start command are displayed in that language.

STEP 9. If you used a CD-ROM, unmount it:

a. Change to the root directory. Unmount the CD:

```
cd /
umount /cdrom
```

b. Remove the CD-ROM from the CD-ROM drive.

After You Install

- ❑ *Verify that your PowerPath capabilities match your license*. For example, run the powermt display dev=all command and make sure the load balancing and failover policies are correct.

If the load balancing policy does not match your expectations for your license level, check the license registration. Refer to the man pages for the emcpreg and powermt utilities for clarification on licenses and load balancing policies.

Refer to the *PowerPath Product Guide* or the powermt(1) man page for more information about load balancing and failover policies and the powermt display command.

- *Reconfiguring device mappings.* Consult the man page for the powermt command and look for the display dev=all option to view current device mappings. When reconfiguring the device mappings on an array, you should pay careful attention to the resulting configuration. Device names on the host are assigned dynamically during the loading of the HBA driver. Therefore, any changes to the configuration may result in changes in the pre-existing device naming association. For example, this may render some existing mount tables inaccurate if you do not update the mount points to correspond to the new device configuration and its device naming association.

- If you load the HBA driver as a module (not as a static kernel driver), *verify that all extensions are loaded*. Enter lsmod.

  Provided you built the HBA driver as a module, the HBA driver name appears in the lsmod output, below the PowerPath drivers (which begin with emc). See Figure 1.

  The /etc/modprobe.conf.pp file should look like the following:

```
###BEGINPP
include modprobe.conf.pp
###ENDPP
alias ppemcp emcp
alias ppemcpmp emcpmp
alias ppemcpmpc emcpmpc
alias ppemcpmpaa emcpmpaa
alias ppemcpioc emcpioc
options emcp managedclass=invista,ess,hitachi,hpxp,hphsx
```

```
Module                  Size  Used by
emcphr                 29528  0
emcpmpap              129496  0
emcpmpaa               95360  0
emcpmpc               122168  64
emcpmp                 78004  0
emcp                  615120  5 emcphr,emcpmpap,emcpmpaa,emcpmpc,emcpmp
libnss                 80052  5 emcpmpap,emcpmpaa,emcpmpc,emcpmp,emcp
emcplib                18304  0
usbserial              48240  0
autofs                 33280  5
parport_pc             53568  1
lp                     27908  0
parport                56520  2 parport_pc,lp
edd                    26008  0
joydev                 26816  0
sg                     53920  0
st                     57500  0
sr_mod                 33316  0
ide_cd                 54788  0
cdrom                  55196  2 sr_mod,ide_cd
nvram                  25736  0
ohci_hcd               37124  0
sworks_agp             25760  0
agpgart                48300  1 sworks_agp
speedstep_lib          20352  0
freq_table             21504  0
thermal                28936  0
processor              34496  1 thermal
fan                    20484  0
button                 22672  0
battery                25092  0
ac                     21252  0
ipv6                  326908  25
evdev                  26240  0
usbcore               129244  4 usbserial,ohci_hcd
e1000                 102020  0
subfs                  24448  2
reiserfs              276432  2
dm_mod                 72192  0
xfs                   614360  1
exportfs               22656  1 xfs
dmapi                  66592  1 xfs
qla2300               140160  0
qla2xxx               283336  65 qla2300
mptscsih               52120  0
mptbase                60384  1 mptscsih
sd_mod                 37376  64
scsi_mod              132292  7 emcp,sg,st,sr_mod,qla2xxx,mptscsih,sd_mod
```

FIGURE 1. PowerPath Extensions and Drivers

Upgrading PowerPath

You can only upgrade to PowerPath 4.5.*x* from PowerPath 4.4.*x* or later. You cannot upgrade from a version earlier than PowerPath 4.4.0.

Before You Upgrade PowerPath

- ❑ Check the SSR212PP support website for the most current information.
- ❑ Run the powermt save command to ensure that you have saved the latest PowerPath configuration information. Back up the /etc/powermt.custom and /etc/emcp_registration files.
- ❑ Unmount any file systems mounted on PowerPath devices and deactivate any volume groups using these file systems.
- ❑ Stop powermt display if it is running. Refer to the *PowerPath Product Guide* or the powermt(1) man page for information about powermt display.
- ❑ If the default major and minor numbers associated with a native device (for example, /dev/sda) have been changed, upgrading to PowerPath 4.5.*x* fails to preserve pseudo-to-native device mappings and device policy/priority settings. To avoid this problem:
  - **a.** With the existing version of PowerPath installed, run the powermt display dev=all command and redirect the output to a file.
  - **b.** Run the /etc/init.d/PowerPath stop command.
  - **c.** Delete all the native devices listed in the powermt log file created in step a.
  - **d.** Use the mknod command to recreate the native devices with the default major/minor numbers.
  - **e.** Run the /etc/init.d/PowerPath start command.
- ❑ Localized versions of the PowerPath installer are available in Brazilian Portuguese, French, German, Italian, Korean, Japanese, Latin American Spanish, and simplified Chinese. Refer to "Before You Install" on page 1 for information on using a localized version of the PowerPath installer when upgrading to PowerPath 4.5.*x*.
- ❑ Stop the Navisphere agent.

Upgrading PowerPath on an RHEL System

Take note of the following before upgrading PowerPath:

- Do not use the -i option to upgrade from an earlier version of PowerPath. Using the -i option creates multiple PowerPath entries in the Linux RPM database, which can cause ongoing maintenance problems. If you inadvertently use the -i option to upgrade PowerPath, follow the procedure in "Correcting Multiple PowerPath Entries in the RPM Database" on page 29 to correct the problem.
- Refer to "Troubleshooting a PowerPath Upgrade" on page 28 if you encounter any problems while upgrading PowerPath.

STEP 1. Log in as root.

STEP 2. On a RHEL 4.0 host, install the required update level and kernel revision (documented in the *PowerPath 4.5 for Linux Releases Notes*). After rebooting the host, verify that the correct kernel and HBA drivers are loaded.

STEP 3. To upgrade PowerPath from CD-ROM,

a. Insert the PowerPath installation CD-ROM into the CD-ROM drive.

b. Create the directory /cdrom to be the mount point for the CD-ROM:

```
mkdir /cdrom
```

c. Mount the PowerPath CD on /cdrom:

```
mount -o ro /dev/cdrom /cdrom
```

d. Change directories to the directory for your operating system. For RHEL, enter:

```
cd /cdrom/LINUX/2.6/pp4.5.x/rhel
```

STEP 4. To upgrade from a compressed archive,

a. Download the PowerPath archive from http://Powerlink.EMC.com ▸ Support ▸ Downloads and Patches ▸ Downloads D-R ▸ PowerPath for Linux.

b. Untar the PowerPath archive:

```
tar -xzf EMCpower.LINUX.4.5.release.build.tar.gz
```

STEP 5. Install the new PowerPath version.

a. Enter:

```
rpm -Uv EMCpower.LINUX-4.5.release-build.package.rpm
```

where *package* is:

rhel.x86_64	PowerPath 4.5.*x* on RHEL x86_64 platforms.
rhel.ia64	PowerPath 4.5.*x* on RHEL IA64 platforms.
rhel.i386	PowerPath 4.5.*x* on RHEL i386 platforms.

b. If the PowerPath configuration includes any custom policies or settings, run the powermt load command to load these settings.

Upgrading PowerPath on an SLES Host

STEP 1. Log in as root.

STEP 2. Remove the existing PowerPath package:

```
rpm -e PowerPath_package
```

STEP 3. Install the required SLES service pack and kernel (documented in the *PowerPath 4.5 for Linux Releases Notes*). After rebooting the host, verify that the correct kernel and HBA drivers are loaded.

STEP 4. To upgrade from CD-ROM,

a. Insert the PowerPath installation CD-ROM into the CD-ROM drive.

b. Create the directory /cdrom to be the mount point for the CD-ROM:

```
mkdir /cdrom
```

c. Mount the PowerPath CD on /cdrom:

```
mount -o ro /dev/cdrom /cdrom
```

d. Change directories to the directory for your operating system. For SLES, enter:

```
cd /cdrom/LINUX/2.6/pp4.5.x/sles
```

STEP 5. To upgrade from a compressed archive,

a. Download the PowerPath archive from http://Powerlink.EMC.com ▸ Support ▸ Downloads and Patches ▸ Downloads D-R ▸ PowerPath for Linux**.**

b. Untar the PowerPath archive:

```
tar -xzf EMCpower.LINUX.4.5.release.build.tar.gz
```

STEP 6. Install the new PowerPath version:

```
rpm -iv EMCpower.LINUX-4.5.release-build.package.rpm
```

where *package* is:

sles.x86_64	PowerPath 4.5.*x* on SLES x86_64 platforms.
sles.ia64	PowerPath 4.5.*x* on SLES IA64 platforms.
sles.i386	PowerPath 4.5.*x* on SLES i386 platforms.

STEP 7. Start PowerPath:

```
/etc/init.d/PowerPath start
```

STEP 8. If the PowerPath configuration includes any custom policies or settings, run the powermt load command to load these settings.

Configuring a PowerPath Boot Device on Linux

2

This chapter describes how to configure a PowerPath pseudo (emcpower) device as the root device for a Linux host.

- "Introduction" on page 15
- "Configuring a PowerPath Root Device for SLES 9" on page 15
- "Configuring a PowerPath Root Device for RHEL 4.0" on page 17
- "Upgrading the Linux Kernel in a Boot from SAN Setup" on page 18
- "Removing PowerPath from a Root Device" on page 19

Introduction

On SSR212PP-Series storage systems, you can use a PowerPath pseudo (emcpower) device located on external storage as a root device the device that contains the startup image.

EMC recommends using a PowerPath pseudo (emcpower) device as opposed to the native sd device when mounting the /boot file system.

Once the PowerPath drivers have been loaded, using a PowerPath pseudo device as the root device provides load balancing and path failover for the root device.

PowerPath root devices are supported on RHEL 4 and SLES 9 only. Refer to the *PowerPath for Linux Version 4.5 and Point Releases Release Notes* to see the specific supported operating systems, HBAs, and storage systems.

The following sections describe how to configure a PowerPath pseudo (emcpower) device as the root device.

Configuring a PowerPath Root Device for SLES 9

This procedure describes how to configure a PowerPath root device using the LVM on an SLES 9 host.

STEP 1. Install SLES9 on the host. Configure a single active path to the boot LUN during the initial installation. You attach additional LUNs and configure additional paths at the end of this procedure.

STEP 2. Create a custom partition setup on the target storage device for two partitions:

- The /boot partition formatted as either an ext3 or reiserfs file system and at least 100 MB in size.
- A second partition of type 0x8E Linux LVM using the remaining space on the storage device.

STEP 3. Create a volume group for the LVM partition.

STEP 4. In the volume group, create a separate volume for each file system. Format each volume as swap, ext3, or reiserfs and designate the desired mount point.

STEP 5. Change the default boot loader from LILO to GRUB. Be sure that the boot loader location specifies the MBR of the desired device rather than the boot sector of the /boot partition.

STEP 6. Upgrade the kernel revision to a revision compatible with PowerPath. Check the *PowerPath 4.5 and Point Releases Release Notes* for the current PowerPath requirements.

STEP 7. Install and configure PowerPath following the instructions in Chapter 1, "Installing PowerPath.

STEP 8. Edit the /etc/fstab file to mount the /boot partition on PowerPath pseudo device instead of a native sd* device.

Consider the following host where emcpowera is the corresponding PowerPath pseudo name for the boot LUN, sda.

The original /etc/fstab file is shown below.

```
/dev/system/rootvol  /                    ext3       acl,user_xattr        1 1
/dev/sda1            /boot                ext3       acl,user_xattr        1 2
/dev/system/extravol /extra               ext3       acl,user_xattr        1 2
/dev/system/swapvol  swap                 swap       pri=42                0 0
devpts               /dev/pts             devpts     mode=0620,gid=5       0 0
proc                 /proc                proc       defaults              0 0
usbfs                /proc/bus/usb        usbfs      noauto                0 0
sysfs                /sys                 sysfs      noauto                0 0
/dev/cdrom           /media/cdrom         subfs
   fs=cdfss,ro,procuid,nosuid,nodev,exec,iocharset=utf8 0 0
```

Edit the /etc/fstab file so that the /boot partition is mounted by a PowerPath pseudo name; in this example, /dev/emcpowera1. The modified /etc/fstab file is shown below.

```
/dev/system/rootvol  /                    ext3       acl,user_xattr        1 1
/dev/emcpowera1      /boot                ext3       acl,user_xattr        1 2
/dev/system/extravol /extra               ext3       acl,user_xattr        1 2
/dev/system/swapvol  swap                 swap       pri=42                0 0
devpts               /dev/pts             devpts     mode=0620,gid=5       0 0
proc                 /proc                proc       defaults              0 0
usbfs                /proc/bus/usb        usbfs      noauto                0 0
sysfs                /sys                 sysfs      noauto                0 0
/dev/cdrom           /media/cdrom         subfs
   fs=cdfss,ro,procuid,nosuid,nodev,exec,iocharset=utf8 0 0
```

STEP 9. Configure additional paths to the storage devices; attach additional LUNs to the host.

Configuring a PowerPath Root Device for RHEL 4.0

This procedure describes how to configure a PowerPath root device using the LVM on a RHEL 4.0 host.

STEP 1. Install RHEL 4.0 on the host. Configure a single active path to the boot LUN during the initial installation. You attach additional LUNs and configure additional paths at the end of this procedure.

STEP 2. Install and configure PowerPath following the instructions in Chapter 1, "Installing PowerPath.

STEP 3. Edit the /etc/fstab file to use a PowerPath pseudo (emcpower) device instead of mounting by label.

By default, the /boot partition on the host is configured to mount by label. In a Linux 2.6 environment, mounting by label on a host with multiple active paths may cause problems. Consequently, use a PowerPath pseudo name instead of mounting by label.

Consider the following host where emcpowera is the corresponding PowerPath pseudo name for the boot LUN, sda. The /boot partition resides on the sda device.

The original /etc/fstab file is shown below. Note that the /boot partition mounts by label (LABEL=/boot).

```
# This file is edited by fstab-sync - see 'man fstab-sync' for details
/dev/VolGroup00/LogVol00 /                       ext3    defaults        1 1
LABEL=/boot              /boot                   ext3    defaults        1 2
none                     /dev/pts                devpts  gid=5,mode=620  0 0
none                     /dev/shm                tmpfs   defaults        0 0
none                     /proc                   proc    defaults        0 0
none                     /sys                    sysfs   defaults        0 0
/dev/VolGroup00/LogVol01 swap                    swap    defaults        0 0
/dev/hda                 /media/cdrom            auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed
/dev/fd0                 /media/floppy           auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed 0 0
```

Edit the /etc/fstab file so that the /boot partition is mounted by a PowerPath pseudo name; in this example, /dev/emcpowera1. The modified /etc/fstab file is shown below.

```
# cat /etc/fstab
# This file is edited by fstab-sync - see 'man fstab-sync' for details
/dev/VolGroup00/LogVol00 /                       ext3    defaults        1 1
/dev/emcpowera1          /boot                   ext3    defaults        1 2
none                     /dev/pts                devpts  gid=5,mode=620  0 0
none                     /dev/shm                tmpfs   defaults        0 0
none                     /proc                   proc    defaults        0 0
none                     /sys                    sysfs   defaults        0 0
/dev/VolGroup00/LogVol01 swap                    swap    defaults        0 0
/dev/hda                 /media/cdrom            auto
```

```
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed 0 0
/dev/fd0                 /media/floppy           auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed 0 0
```

STEP 4. Configure additional paths to the storage devices; attach additional LUNs to the host.

Upgrading the Linux Kernel in a Boot from SAN Setup

This procedure describes how to upgrade the kernel in a boot from SAN setup on a RHEL 4 or SLES 9 host.

STEP 1. Upgrade the kernel, following the steps provided by RedHat for upgrading the kernel in the host.

STEP 2. Before rebooting the host, edit the /etc/fstab file to comment out entries that refer to the PowerPath pseudo (emcpower) names.

An example /etc/fstab file with a commented out entry for the /boot partition is shown below.

```
/dev/VolGroup00/LogVol00     /                ext3       defaults          1 1
#/dev/emcpowera1             /boot            ext3       defaults          1 2
none                         /dev/pts         devpts     gid=5,mode=620    0 0
none                         /dev/shm         tmpfs      defaults          0 0
none                         /proc            proc       defaults          0 0
none                         /sys             sysfs      defaults          0 0
/dev/VolGroup00/LogVol01     swap             swap       defaults          0 0
/dev/hda                     /media/cdrom     auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed     0 0
/dev/fd0                     /media/floppy    auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed     0 0
```

STEP 3. Reboot the host.

STEP 4. Upgrade PowerPath following the directions "Upgrading PowerPath" on page 18. Load the PowerPath modules and configure the devices using the PowerPath powermt command.

STEP 5. Uncomment all entries in the /etc/fstab file that refer to PowerPath pseudo (emcpower) devices. A modified /etc/fstab file is shown below:

```
/dev/VolGroup00/LogVol00     /                ext3       defaults          1 1
/dev/emcpowera1              /boot            ext3       defaults          1 2
none                         /dev/pts         devpts     gid=5,mode=620    0 0
none                         /dev/shm         tmpfs      defaults          0 0
none                         /proc            proc       defaults          0 0
none                         /sys             sysfs      defaults          0 0
/dev/VolGroup00/LogVol01     swap             swap       defaults          0 0
/dev/hda                     /media/cdrom     auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed     0 0
/dev/fd0                     /media/floppy    auto
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed     0 0
```

STEP 6. Run the mount -a command to ensure that all emcpower partitions in the /etc/fstab file are mounted.

Removing PowerPath from a Root Device

Complete the following steps to remove a PowerPath root device.

STEP 1. Move the /etc/init.d/PowerPath script to a different location.

STEP 2. Edit the /etc/fstab file to remove any references to PowerPath pseudo (emcpower) devices.

STEP 3. Reboot the host.

STEP 4. Remove PowerPath following the instructions in Chapter 4, "Removing PowerPath."

Maintaining PowerPath

3

This chapter describes PowerPath administrative issues. The chapter covers the following topics:

- "Configuring LVM2 Support" on page 21
- "Configuring LVM2 Support" on page 21
- "Upgrading Linux with PowerPath Installed" on page 23

Configuring LVM2 Support

You must modify the /etc/lvm/lvm.conf file to filter out sd device nodes from its internal cache so that LVM2 recognizes a PowerPath pseudo device as the single path to LUN. The following sections describe how to modify /etc/lvm/lvm.conf on a host where the root file system is:

- not mounted on a logical volume.
- is mounted on a logical volume.
- is mounted on mirrored logical volumes.

Root File System Not Mounted on a Logical Volume

Modify the filters field of the /etc/lvm/lvm.conf file to prevent LVM2 from scanning sd device nodes.

STEP 1. Modify the filter field in the /etc/lvm/lvm.conf file. Replace:

```
filter=["a/.*/"]
```

with:

```
filter=["r/sd.*/", "a/.*/"]
```

STEP 2. Rebuild the LVM2 cache:

```
vgscan -v
```

STEP 3. Verify that the filter field is working correctly. Run the command below and verify that the filtered device nodes are not listed in the command output:

```
lvmdiskscan
```

Root File System Mounted on a Logical Volume

Identify the underlying device(s) for the root/swap logical volume(s) and the /boot devices (if any). Modify the filters field of the /etc/lvm/lvm.conf file to prevent LVM2 from scanning all sd device nodes except for root/swap and /boot device(s).

STEP 1. Identify the root/swap logical volume(s) and the /boot devices (if any):

```
df -k
```

or

```
mount
```

STEP 2. Identify the underlying device(s) for the root/swap logical volume(s). For example, if the root file system is mounted on logical volume /dev/vg01/lv01, enter:

```
vgdisplay -v /dev/vg01/lv01
```

STEP 3. Modify the filter field in the /etc/lvm/lvm.conf file to prevent LVM2 from scanning all sd device nodes except for root/swap and /boot devices identified in steps 1 and 2. For example, if the underlying device for the root/swap file system is /dev/sda2 and /boot is mounted on /dev/sda3, set the filter filter field to:

```
filter=["a/sda[1-9]$/", r/sd.*/", "a/.*/"]
```

Modify the filter as needed using standard shell-scripting regular expressions. For example, to include partitions sda1 to sda9 for LVM2 while filtering out the remaining sd device nodes, set the filter field to filter=["a/sda[1-9]$/", "r/sd.*/", "a/.*/"].

STEP 4. Rebuild the LVM2 cache:

```
vgscan -v
```

STEP 5. Verify that the filter field is working correctly. Run the command below and verify that the sd device nodes containing the root/swap/boot devices identified in steps 1 and 2 are listed in the command output, and that the filtered device nodes are not listed in the command output:

```
lvmdiskscan
```

STEP 6. Recreate the initrd image to reflect the changes to the /etc/lvm/lvm.conf file:

```
mkinitrd
```

Root File System Mounted on Mirrored Logical Volumes

Identify the underlying device(s) for the root/swap logical volume(s) and the /boot devices (if any). Modify the filters field of the /etc/lvm/lvm.conf file to prevent LVM2 from scanning all sd device nodes except for root/swap and /boot device(s).

STEP 1. Identify the root/swap logical volume(s) and the /boot devices (if any):

```
df -k
```

or

```
mount
```

STEP 2. Identify the underlying device(s) for the root/swap and mirror logical volume(s). For example, if the root file system is mounted on logical volume /dev/vg01/lv01 and its mirror is mounted on /dev/vg01/lv02, enter:

```
vgdisplay -v /dev/vg01/lv01
vgdisplay -v /dev/vg01/lv02
```

STEP 3. Modify the filter field in the /etc/lvm/lvm.conf file to prevent LVM2 from scanning all sd device nodes except for root/swap and /boot devices identified in steps 1 and 2. For example, if the underlying logical device for the root/swap file system is /dev/sda2 and its mirror is /dev/sdb3, set the filter field to:

```
filter=["a/sda[1-3]$/", "a/sdb[1-3]$/", "r/sd.*/", "a/.*/"]
```

Modify the filter as needed using standard shell-scripting regular expressions. For example, to include partitions sda1 to sda9 for LVM2 while filtering out the remaining sd device nodes, set the filter field to filter=["a/sda[1-9]$/", "r/sd.*/", "a/.*/"].

STEP 4. Rebuild the LVM2 cache:

```
vgscan -v
```

STEP 5. Verify that the filter field is working correctly. Run the command below and verify that the sd device nodes containing the root/swap/boot devices identified in steps 1 and 2 are listed in the command output, and that the filtered device nodes are not listed in the command output:

```
lvmdiskscan
```

STEP 6. Reeate the initrd image to reflect the changes to the /etc/lvm/lvm.conf file:

```
mkinitrd
```

Upgrading Linux with PowerPath Installed

Before upgrading to a new version of Linux, check the *Support Matrix* to verify that that version of Linux has been qualified with PowerPath.

To upgrade the Linux kernel on a host with PowerPath installed:

STEP 1. Install the new errata version.

STEP 2. Boot to the new kernel.

STEP 3. Reinstall the supported HBA driver.

STEP 4. Upgrading a Linux kernel results in the deletion of the installed PowerPath drivers. Replace the PowerPath package so that the PowerPath drivers are copied to the new Linux kernel directory. Use the following command to replace PowerPath after you have upgraded your Linux kernel:

```
rpm -Uvh --replacepkgs EMCpower.LINUX-4.5.releaseBuildPackage.rpm
```

Removing PowerPath

4

This chapter describes how to remove PowerPath from a Linux host. The chapter covers the following topics:

- "Before You Remove PowerPath" on page 25
- "Removing PowerPath" on page 25

Before You Remove PowerPath

Before you remove PowerPath from the host:

- ❑ If the powermt display every= command is running in a loop, cancel the command. (Refer to the *PowerPath Product Guide* or the powermt(1) man page for information about powermt display.)
- ❑ Make sure no PowerPath devices are in use; for example, unmount a mounted file system.
- ❑ Stop the Navisphere agent.
- ❑ Manually remove references to PowerPath pseudo devices from system configuration files such as /etc/fstab.
- ❑ If you removed a PowerPath-managed native device file (that is, /dev/sd[a-z][a-z]) while PowerPath was loaded, you must use the **mknod** command to recreate that native device file with its default major/minor numbers before trying to unload or uninstall PowerPath.
- ❑ If the host is configured to boot off a SSR212PP-Series storage system, move the /etc/init.d/PowerPath script to a different location. Then reboot the host. After the host reboots, continue with the steps in "Removing PowerPath" below.

Removing PowerPath

STEP 1. Log in as root.

STEP 2. Display the package name:

```
rpm -qa | grep EMCpower.LINUX
```

STEP 3. Remove the software:

```
rpm -e EMCpower.LINUX-4.5.release-build
```

If the PowerPath uninstall program displays a message saying that it could not unload the emcp module, run the lsmod | grep emcp command to determine if any PowerPath modules are loaded on the host. If so, reboot the host after the uninstallation completes to unload the modules.

Saved Configuration Files

The PowerPath uninstall process saves the PowerPath configuration files in the /etc/emc/archive directory. If necessary, you can use these configuration files to restore the PowerPath 4.5.*x* configuration on the host, or upgrade to a later version of PowerPath without PowerPath 4.5.*x* installed on the host while re-using the 4.5.*x* configuration.

Troubleshooting

5

This chapter describes how to fix installation and other problems that you may encounter with PowerPath. The chapter covers the following topics:

- "Recovering from a Failed PowerPath Installation" on page 27
- "Troubleshooting a PowerPath Upgrade" on page 28
- "No Visible Pseudo Devices" on page 29
- "Missing or Deleted Files" on page 30
- "Incorrect PowerPath Configuration" on page 31
- "Problems Booting the Host" on page 31
- "System Hangs" on page 31

Recovering from a Failed PowerPath Installation

If PowerPath installation fails, correct any error conditions reported by the install program. Then complete each item in the following checklist. After completing the checklist, install PowerPath following the instructions in Chapter 1, "Installing PowerPath."

- ❑ Edit the /etc/init.d/boot.localfs file on SLES or the /etc/rc.sysinit file on RHEL and remove the following lines:

```
# Configure and initialize PowerPath.
if [ -f /etc/init.d/PowerPath ];
then /etc/init.d/PowerPath start
fi
```

If the RPM installation succeeds yet the error message indicating that the patch failed is displayed, you should verify that the /etc/init.d/boot or /etc/rc.sysinit file contains the lines above.

- ❑ Edit the /etc/modprobe.conf file and remove the following lines:

```
###BEGINPP
include /etc/modprobe.conf.pp
###ENDPP
```

- ❑ Enter the following command to determine if the PowerPath modules are loaded:

```
lsmod | grep emc
```

If the modules are loaded, enter the following command to unload them:

```
/etc/init.d/PowerPath stop
```

- Rename the /etc/init.d/PowerPath file:

  ```
  mv /etc/init.d/PowerPath /etc/init.d/PowerPath.saved
  ```

- Check the /etc/opt/emcpower/EMCpower.LINUX-4.5/log file for additional information about the failure.

- Remove the PowerPath entry in the RPM database (if it exists). Enter the following commands to remove the entry:

  ```
  rpm -qa | grep EMCpower.LINUX
  rpm -ev EMCpower.LINUX-4.5.release-build
  ```

  If this command fails, use the rpm -ev --noscripts command.

  ```
  rm -rf /etc/opt/emcpower
  ```

  Make sure that you have unloaded the PowerPath modules and renamed the /etc/init.d/PowerPath file before running these commands.

Troubleshooting a PowerPath Upgrade

This sections describes how to resolve problems that can occur when upgrading to PowerPath 4.5.*x*.

PowerPath Custom Settings Not Preserved during Upgrade

If your custom PowerPath settings are lost during the upgrade, check the following for the possible source of the error:

- The configuration files are corrupt.
- The PowerPath configuration recorded in the powermt.custom file is outdated and does not match the current PowerPath configuration.
- The filesystem where the powermt.custom file is stored or the filesystem where PowerPath is being upgraded is full.
- Connectivity problems on the SAN that cause some devices not to be seen by the host.
- A fibre driver was not properly loaded when the configuration file was saved or when the upgrade was performed.

Corrupt Configuration Files

If the PowerPath configuration files are corrupt, your custom configuration is no longer available after you upgrade to PowerPath 4.5.*x*. If an application was configured to use PowerPath pseudo devices, you must reconfigure that application to use the appropriate PowerPath pseudo devices after upgrading to PowerPath 4.5.*x* (if the native-to-pseudo device mapping has changed). Also, run the powermt set command to reset the desired policy/priority settings for the storage devices in your PowerPath configuration.

Outdated Configuration Files

If you change your PowerPath configuration but do not run the powermt save command, and then upgrade to PowerPath 4.5.*x*, the custom configuration recorded in the saved powermt.custom file is not applied during the upgrade to PowerPath 4.5.*x*. Run the powermt set command to reset the desired policy/priority settings for the storage devices in your PowerPath configuration.

Full Filesystem

Expand the space in the filesystem. Then run the powermt set command to reset the desired policy/priority settings for the storage devices in your PowerPath configuration.

SAN Connectivity Problems / Unloaded Fibre Driver

If there is a connectivity problem in the SAN, you must first repair that problem. If a fibre driver was not properly loaded, load the fibre driver. Once all devices are visible to the host, complete the following steps in reinstall PowerPath on the host:

STEP 1. Copy the /etc/emc/archive/powermt.custom.saved file to a different directory. Then copy the /etc/emcp_registration file to this same directory, renaming it emcp_registration.saved.

STEP 2. Uninstall PowerPath following the instructions in Chapter 4, *Removing PowerPath*.

STEP 3. Remove any file saved to the /etc/emc/archive directory by the uninstall process.

STEP 4. Copy the powermt.custom.saved and emcp_registration.saved files that you move to a different directory in step 1 back to the /etc/emc/archive directory.

STEP 5. Reinstall PowerPath on the host. Refer to "Installing PowerPath" on page 11 for more information.

Correcting Multiple PowerPath Entries in the RPM Database

Using the -i option to upgrade to PowerPath 4.5.*x* creates multiple PowerPath entries in the RPM database, which can cause ongoing maintenance issues. To resolve this problem, remove the PowerPath 4.4 for Linux package using the following commands:

```
rpm -qa | grep EMCpower.LINUX
rpm -ev --noscripts EMCpower.LINUX-4.4.0-buildNumber
```

No Visible Pseudo Devices

Once you install, register, and start PowerPath, you should see devices in the output of the powermt display command. If you do not see any devices, do the following:

STEP 1. Stop PowerPath:

```
/etc/init.d/PowerPath stop
```

Use only the above script for loading and unloading PowerPath modules.

STEP 2. If it is not present already, add the following line to the /etc/modprobe.conf.pp file:

```
install emcp /sbin/modprobe hbaModuleName;

/sbin/modprobe emcp --ignore-install
```

STEP 3. Restart PowerPath:

```
/etc/init.d/PowerPath start
```

STEP 4. Ensure that all of the PowerPath modules amd the HBA driver are loaded. See "After You Install" on page 8 and Figure 1, "PowerPath Extensions and Drivers," on page 10 for more information.

Missing or Deleted Files

If PowerPath files are missing or deleted after installation, PowerPath may not run correctly (or at all). If this happens, remove and then reinstall PowerPath:

STEP 1. Stop PowerPath:

```
/etc/init.d/PowerPath stop
```

Use only the above script for EMC PowerPath module loading and unloading.

STEP 2. Remove PowerPath:

```
rpm -qa | grep EMCpower.LINUX
rpm -ev EMCpower.LINUX-4.5.release-build
```

If this command fails, use the rpm -ev --noscripts command.

STEP 3. Remove /etc/opt/emcpower:

```
rm -rf /etc/opt/emcpower
```

CAUTION

Remove the **emcpower** directory *only* if you cannot restore the deleted or corrupted files from backups.

STEP 4. Reinstall PowerPath. Refer to "Installing PowerPath" on page 6 for more information.

Incorrect PowerPath Configuration

If the Navisphere agent (or any application that holds devices open) is running when you try to configure PowerPath devices, the configuration will be incorrect.

To resolve this problem:

STEP 1. Stop the Navisphere agent and any other application that may be holding devices open.

STEP 2. Stop PowerPath:

```
/etc/init.d/PowerPath stop
```

Use only the above script for PowerPath module loading and unloading.

STEP 3. Restart PowerPath:

```
/etc/init.d/PowerPath start
```

STEP 4. Restart the applications you stopped in **STEP 1**.

Problems Booting the Host

If you have previously used emcpower devices and subsequently uninstalled PowerPath without removing these emcpower devices, the host system fails to boot properly.

Manually remove references to PowerPath pseudo devices (emcpower devices) from system configuration files such as /etc/fstab, /etc/auto.master, and /etc/*auto*.

System Hangs

System hangs may be caused by a number of reasons. This section offers solutions to some scenarios you may encounter.

Unsupported HBA Drivers

If your computer hangs after you install PowerPath or after the first time you reboot after installation, check the *Support Matrix* and verify that your fibre driver is currently supported.

The driver version that may have come with your Linux distribution might not be supported. In this case, use the following recovery procedure:

STEP 1. Detach all connections to the storage system before booting.

STEP 2. Reboot to a *safe* kernel and remove the qla entry from the /etc/modprobe.conf or /etc/sysconfig/kernel file.

STEP 3. If a RAM disk is used, rebuild it.

STEP 4. Reboot the host with the new RAM disk.

STEP 5. Build the supported driver and incorporate it into a new RAM disk as desired.

STEP 6. Reattach the connections to the storage system.

STEP 7. Reboot the host with the storage attached.

Other Causes

If your computer hangs and you have the correct HBA drivers, check the Issue Tracker application on Powerlink (http://Powerlink.EMC.com) for other possible causes.

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