



EMC[®] PowerPath[®]
for Linux
Version 5.0

Installation Guide
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Rev A02

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As part of its effort to continuously improve and enhance the performance and capabilities of the EMC product line, EMC periodically releases new versions of PowerPath. Therefore, 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, refer to your product release notes.

If a PowerPath feature does not function properly or as described in this manual, please contact the EMC Customer Support Center for assistance. Refer to “Where to get help” on page xi in this Preface for contact information.

This guide describes how to install and remove PowerPath for Linux Version 5.0 and point releases.

Audience

This document is intended for storage administrators and other information system professionals responsible for installing and maintaining PowerPath in a Linux environment.

In addition to understanding PowerPath, administrators should be familiar with the host operating system where PowerPath runs and the applications used with PowerPath.

Organization

This guide has the following chapters and appendix:

- ◆ [Chapter 1, “Installing PowerPath,”](#) describes how to install and upgrade PowerPath software on a Linux host.
- ◆ [Chapter 2, “Configuring a PowerPath root device on Linux,”](#) describes how to configure a PowerPath device as the root device for a Linux host.
- ◆ [Chapter 3, “Maintaining PowerPath,”](#) discusses PowerPath administrative issues.
- ◆ [Chapter 4, “Removing PowerPath,”](#) describes how to remove PowerPath software from a Linux host.
- ◆ [Chapter 5, “Troubleshooting,”](#) describes how to resolve PowerPath installation problems.
- ◆ [Appendix A, “Files changed by PowerPath,”](#) lists files that are created or modified by PowerPath installation and upgrade.

Related documentation

Here is the complete set of PowerPath documentation; all manuals are available from EMC Corporation:

- ◆ *PowerPath Product Guide*
- ◆ *PowerPath for AIX Installation and Administration Guide*
- ◆ *PowerPath for HP-UX Installation and Administration Guide*
- ◆ *PowerPath for Linux Installation Guide*
- ◆ *PowerPath for Solaris Installation and Administration Guide*
- ◆ *PowerPath for Windows Installation and Administration Guide*
- ◆ *EMC PowerPath for AIX Release Notes*
- ◆ *EMC PowerPath for HP-UX Release Notes*
- ◆ *EMC PowerPath for Solaris Release Notes*
- ◆ *EMC PowerPath for Linux Release Notes*
- ◆ *EMC PowerPath for Windows Release Notes*

These documents are updated periodically. Electronic versions of the updated manuals are available on the Powerlink website:

<http://Powerlink.EMC.com>.

If your environment includes Symmetrix storage systems, refer also to the EMC host connectivity guides, which are available on the Powerlink website.

If your environment includes CLARiON storage systems, refer also to the following manuals:

- ◆ EMC host connectivity guides

- ◆ *EMC Installation Roadmap for CX3-Series, CX-Series, AX-Series, and FC-Series Storage Systems*
- ◆ *EMC Navisphere Manager Version 6.X Administrator's Guide*

If your environment includes other vendors' storage systems, refer to the appropriate documentation from your vendor.

Refer also to the EMC E-Lab Navigator, available on the Powerlink website: <http://Powerlink.EMC.com>.

Conventions used in this document

EMC uses the following conventions for notes, cautions, warnings, and danger notices.

Note: A note presents information that is important, but not hazard-related.



CAUTION

A caution contains information essential to avoid data loss or damage to the system or equipment. The caution may apply to hardware or software.



IMPORTANT

An important notice contains information essential to operation of the software. The important notice applies only to software.

Typographical conventions

EMC uses the following type style conventions in this document:

Normal font

In running text:

- Interface elements (for example, button names, dialog box names) outside of procedures
- Items that user selects outside of procedures
- Java classes and interface names
- Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, filenames, functions, menu names, utilities
- Pathnames, URLs, filenames, directory names, computer names, links, groups, service keys, file systems, environment variables (for example, command line and text), notifications

Bold

In procedures:

- Names of dialog boxes, buttons, icons, menus, fields
- Selections from the user interface, including menu items and field entries
- Key names
- Window names

In running text:

- Command names, daemons, options, programs, processes, notifications, system calls, man pages, services, applications, utilities, kernels

Italic

Used for:

- Full publications titles referenced in text
- Unique word usage in text

Bold Italic

Anything requiring extra emphasis

`Courier`

Used for:

- System output
- Filenames
- Complete paths
- Command-line entries
- URLs

`Courier, bold`

Used for:

- User entry
- Options in command-line syntax

`Courier, italic`

Used for:

- Arguments used in examples of command-line syntax
- Variables in examples of screen or file output
- Variables in path names

`Courier, bold, italic`

Variables used in a command-line sample

< >	Angle brackets enclose parameter or variable values supplied by the user
[]	Square brackets enclose optional values
	Vertical bar indicates alternate selections - the bar means “or”
{ }	Braces indicate content that you must specify (that is, x or y or z)
...	Ellipses indicate nonessential information omitted from the example

Where to get help

EMC support, product, and licensing information can be obtained as follows.

Product information — For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to the EMC Powerlink website (registration required) at:

<http://Powerlink.EMC.com>

Technical support — For technical support, go to EMC WebSupport on Powerlink. To open a case on EMC WebSupport, you must be a WebSupport customer. Information about your site configuration and the circumstances under which the problem occurred is required.

Your comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Please send your opinion of this document to:

techpub_comments@EMC.com

Installing PowerPath

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

- ◆ Before you install..... 1-2
- ◆ Installing PowerPath 1-11
- ◆ After you install..... 1-18
- ◆ Upgrading PowerPath..... 1-21
- ◆ Coexistence with third-party path management software 1-28

Before you install

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

Obtain current information

Obtain current information from the Powerlink website.

- ❑ PowerPath Release Notes — We update release notes periodically and post them on Powerlink. Release Notes are cumulative. They include information about every PowerPath point release, the latest system and environment requirements (including requirements for OS patches), and the latest information about known limitations. Review the Release Notes to determine which point release (if any) you want to install after you initially install PowerPath.
- ❑ EMC E-Lab™ Issue Tracker — Issue Tracker is an application that allows you to search for known problems and defects in EMC software. You can use Issue Tracker to find:
 - Descriptions of PowerPath bugs existing on any PowerPath-supported host platform.
 - Workarounds for existing bugs.

We update this database regularly between scheduled releases and patch releases. Issue Tracker is available on the Powerlink website.

- ❑ PowerPath upgrades and patches — You can download PowerPath patch software from Powerlink.
- ❑ PowerPath documentation — We update this installation guide and the *PowerPath Product Guide* whenever we release new features with a patch.

Locate your license

- ❑ Locate your registration number. The registration number is on the License Key Card that EMC sends you.

Note: Installing PowerPath on a host connected to a CLARiiON® AX-series array does not require a license. PowerPath provides full functionality with or without a PowerPath license when the host is connected to a CLARiiON AX-series array.

TIP: The EMC Powerlink website has the latest versions of PowerPath software and documentation. (<http://Powerlink.EMC.com>.)

Check storage systems

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

- ❑ **Symmetrix® storage systems** — Install PowerPath *after* you set up and verify that the Symmetrix is working properly. Then, install PowerPath using the instructions in this guide.

- ❑ **CLARiiON storage systems:**

PowerPath installation is an integral part of a CLARiiON setup and configuration procedure.

- ❑ To properly install PowerPath on a host with a CLARiiON CX-series array, refer to the *EMC Installation Roadmap for CX3-Series, CX-Series, AX-Series, and FC-Series Storage Systems*. There you will find step-by-step instructions for installing PowerPath and other CLARiiON software. To obtain the latest versions of CLARiiON CX-series documentation, log in to the Powerlink website: <http://Powerlink.EMC.com>.

- ❑ CLARiiON AX-series installation, planning, and troubleshooting documents are located on the AX-series 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 AX-series storage systems.

- ❑ First-time PowerPath installations — Remove any version of Navisphere® Application Transparent Failover (ATF) installed on a host that supports this application.

Note: 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 EMC 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. Enter:

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

Check hosts

TIP: The *Support Matrix* is available in two formats on <http://Powerlink.EMC.com>.

E-Lab Navigator (formerly ESN Builder) is a Web-based, searchable database configurator.

- ❑ **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:

- ❑ The *Environment and System Requirements* section of the *EMC PowerPath for Linux Version 5.0 and Point Releases Release Notes* describes the operating system versions and patches needed to support PowerPath. Refer also to the E-Lab Navigator on the Powerlink website, <http://Powerlink.EMC.com>, for information on host-storage system interconnection topologies and specific PowerPath requirements.
- ❑ EMC recommends that all hosts have at least 2 GB of memory.
- ❑ Ensure the storage-system logical devices are configured for PowerPath support. Refer to the EMC host connectivity guides for both Symmetrix and CLARiiON systems. Also refer to the *EMC Installation Roadmap for CX3-Series, CX-Series, AX-Series, and FC-Series Storage Systems* for CLARiiON systems.
- ❑ 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.

Note: 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. [“Recovering from a failed PowerPath installation” on page 5-2](#) contains 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 by EMC in the E-Lab Navigator and product documentation. 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.
- ❑ PowerPath is not compatible with the native Linux device mapper (DM-MPIO). Configuring both products on the same host can cause system instability. EMC recommends that you do not configure the native device mapper on a host on which PowerPath will be installed.
- ❑ On a 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.

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

Configure 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 E-Lab Navigator on the Powerlink website.

- ❑ If you load the HBA driver as a module, install its binary file in its location in `/lib/modules/`uname -r`/kernel/drivers/scsi`.
 - Valid module names (depending on the HBA installed) are:
 - `qla2xxx`
 - `qla2300`
 - `qla4010`
 - `lpfc`
 - If, according to E-Lab Navigator on the Powerlink 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 and Asianux

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

The HBA driver used to access EMC 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
```

Note: In the line above, the module name could be `qla2xxx`, `qla2300`, `qla4010`, or `lpfc`, depending on the installed HBA.

- ❑ Enable the `max_scsi_luns` parameter in `/etc/modprobe.conf` if the host is connected to either a CLARiiON storage array or an EMC Invista™ system.

In the default RHEL and Asianux 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 `ConfigRequired` 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 EMC 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"
```

Note: In the line above, the module name could be `qla2xxx`, `qla2300`, `qla4010`, or `lpfc`, depending on the installed HBA.

Note: 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.

- ❑ In a SLES 9 environment with QLogic HBAs, ensure the native HBA failover functionality is disabled. Set the `ql2xfailover` and `ConfigRequired` parameters to 0 in the `/etc/modprobe.conf.local` file, as shown here:

```
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

Rebuild the RAM disk to incorporate the changes made to the kernel configuration files.

RHEL and Asianux distributions

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> <kernel version>
```

where `<initrd>` corresponds to the configuration identified in step 1.

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 1.

Check PowerPath major number

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

Install Linux patches

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

Select language for installation

The PowerPath 5.0.x for Linux installation and startup procedure has been localized for the following languages.

Table 1-1 Supported languages

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 1-1 on page 1-9](#), 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
```

Note: 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.

Note: 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.

Note: PowerPath does not support SLES 10 SP1 on the IA64 platform.

Distribution	Packages
RHEL 5	ia32el-1.6-13.el5.ia64.rpm (or later) ^a glibc-2.5-12.i386.rpm (or later) ^b
RHEL 4 Asianux 2.0	ia32el-1.1-20.ia64.rpm (or later) ^a glibc-2.3.4-2.i686.rpm (or later) ^b
SLES 10 ^c	ia32el-6.5-17.2.ia64.rpm glibc-x86-2.4-31.2.ia64.rpm
SLES 9 ^c	ia32el-5.3-2.6 (or later) glibc-x86-9-200411051902 (or later)

- a. Available on the Red Hat Extras CD.
- b. Available on the Red Hat Compatibility Layer CD.
- c. These packages should be installed by default on SLES 9 and SLES 10. 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 5.0.x on a Linux host on which PowerPath is not currently installed. “[Upgrading PowerPath](#)” on page 1-21 contains 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.
- ◆ “[Recovering from a failed PowerPath installation](#)” on page 5-2 contains information on recovering from a failed PowerPath installation.

Install PowerPath

Note: To install PowerPath in a Xen environment, refer to “[Installing PowerPath 5.0.x in a Xen environment](#)” on page 1-13 before completing this procedure.

To install PowerPath:

1. Log in as root.

Installing from CD-ROM

If you are installing from the PowerPath CD-ROM, complete steps 2 through 5, and then continue with step 8. If you are installing from a compressed archive, refer to [step 6 on page 1-12](#).

2. Insert the PowerPath installation CD-ROM into the CD-ROM drive.
3. Create the directory `/cdrom` to be the mount point for the CD-ROM. Enter:

```
mkdir /cdrom
```

4. Mount the PowerPath CD on `/cdrom`. Enter:

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

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

For SLES, enter:

```
cd /cdrom/LINUX/2.6/pp5.0.x/sles
```

For RHEL and Asianux, enter:

```
cd /cdrom/LINUX/2.6/pp5.0.x/rhel
```

Installing from a compressed archive

If you are installing from the PowerPath archive, complete steps 6 and 7, and then continue with step 8.

6. Download the PowerPath archive from
<http://Powerlink.EMC.com> > **Support** > **Software Downloads and Licensing** > **Downloads D-R** > **PowerPath for Linux**.
7. Untar the PowerPath archive:

```
tar -xzf EMCpower.LINUX.5.0.<x>.<build>.tar.gz
```

Install PowerPath

8. Install PowerPath. Enter:

```
rpm -i EMCpower.LINUX-5.0.<x>-<build>.<package>.rpm
```

where *<package>* is:

PowerPath version	Package	Description
5.0.1	rhel5.i386	PowerPath 5.0.1 for RHEL5 i386 platform
	rhel5.ia64	PowerPath 5.0.1 for RHEL5 ia64 platform
	rhel5.x86_64	PowerPath 5.0.1 for RHEL5 x86_64 platform
	sles10sp1.i386	PowerPath 5.0.1 for SLES10 SP1 i386 platform
	sles10sp1.x86_64	PowerPath 5.0.1 for SLES10 SP1 x86_64 platform
5.0.0	rhel.x86_64	PowerPath 5.0.0 on RHEL and Asianux x86_64 platforms.
	rhel.ia64	PowerPath 5.0.0 on RHEL IA64 platforms.
	rhel.i386	PowerPath 5.0.0 on RHEL and Asianux i386 platforms.
	sles.x86_64	PowerPath 5.0.0 on SLES 9 x86_64 platforms.
	sles10.x86_64	PowerPath 5.0.x on SLES 10 x86_64 platforms.
	sles.ia64	PowerPath 5.0.0 on SLES 9 IA64 platforms.
	sles10.ia64	PowerPath 5.0.0 on SLES 10 IA64 platforms.
	sles.i386	PowerPath 5.0.0 on SLES 9 386 platforms.
	sles10.i386	PowerPath 5.0.0 on SLES 10 386 platforms.

Note: With PowerPath 5.0.1, kernel modules are not installed or loaded until the `/etc/init.d/PowerPath start` command is run. See [“Register PowerPath” on page 1-15](#) for more information.

Installing PowerPath 5.0.x in a Xen environment

Note: Xen is supported with PowerPath 5.0 on SLES 10 and PowerPath 5.0.1 on RHEL 5 and SLES 10 SP1. Xen is not supported on RHEL 5 IA64 kernels.

1. Verify the following Xen tools and kernel RPMs are installed on the host. If not present, you must install them before installing PowerPath.

RHEL 5

```
xen-libs-3.0.3-25.e15
xen-3.0.3-25.e15
kernel-xen-2.6.18-8.e15
xen-libs-3.0.3-25.e15
bridge-utils-1.1-2
python-2.4.3-19.e15
```

SLES 10 SP1

```
kernel-xen-2.6.16.46-0.12 or
  kernel-xenpae-2.6.16.46-0.12
xen-tools-3.0.4_13138-0.40
xen-tools-ioemu-3.0.4_13138-0.40
xen-doc-pdf-3.0.4_13138-0.40
xen-3.0.4_13138-0.40
xen-doc-html-3.0.4_13138-0.40
xen-libs-3.0.4_13138-0.40
```

SLES 10

```
kernel-xenpae-2.6.16.21-0.8 or
  kernel-xen-2.6.16.21-0.8
xen-tools-3.0.2_09749-0.4
xen-tools-ioemu-3.0.2_09749-0.4
xen-doc-pdf-3.0.2_09749-0.4
xen-3.0.2_09749-0.4
xen-doc-html-3.0.2_09749-0.4
xen-libs-3.0.2_09749-0.4
```

2. If any packages are missing, use YAST (Software Management) to install them.

3. Reboot the host and select the Xen option from the grub boot menu.
4. Create a Xen virtual machine. For more information, refer to the vendor documentation for your operating system.
5. Verify your system is running the Xen kernel. Enter:

```
uname -a
```

Output:

```
Linux lcld0076 2.6.16.21-0.15-xenpae #1 SMP Tue Jul 25 15:28:49 UTC 2006 i686 i686
i386 GNU/Linux
```

6. Install PowerPath. Follow the procedure in [“Install PowerPath” on page 1-11](#).
7. Select a pseudo device (for example, `/dev/emcpowerd`) and open the virtual machine configuration file. Enter:

```
vi /etc/xen/vm/<vm_name>
```

where `<vm_name>` is the name of the virtual machine you created in step 4.

8. Locate the following line in the configuration file:

```
disk = [ 'file:/images/lcle055/hda.img,hda,w' ]
```
9. Add an entry for the new disk, separated by a coma. For example, add the following line:

```
disk = [ 'file:/images/lcle055/had.img,hda,w' , 'phy:/dev/emcpowern,hdb,w' ]
```

where:

`/dev/emcpowern` = the actual device being exported to the virtual machine. Because this is a physical device (not an image file device), `phy`: needs to be included.

`hdb` = the name the virtual machine uses to identify the device.

`w` = read-write mode

10. Boot the virtual machine by entering this command:

```
xm create -c <vm_name>
```

where `<vm_name>` is the name of the virtual machine you created in step 4.

Note: If the VM configuration file resides in the `/etc/xen/vm/` directory, you do not need to include the full path.

- Verify the new device (**/dev/hdb**) is registered with the operating system by looking at the `cat /proc/partitions` file.

```

major  minor  #blocks  name
   3     0    7168000  hda
   3     1    6819561  hda1
   3     2    345397   hda2
   3     6    919680   hdb

```

- As necessary, create partitions on the newly added device using standard procedures.

Register PowerPath

Take note of the following regarding PowerPath registration:

- Installing PowerPath on a host connected to a CLARiiON AX-series array does not require a license. PowerPath provides full functionality with or without a PowerPath license when the host is connected to a CLARiiON AX-series array. Therefore, you do not need to run the `emcprep -install` command when installing PowerPath on a host connected to a CLARiiON AX-series array.
- If you do not register the PowerPath software during PowerPath installation (on a host connected to any storage system other than a CLARiiON AX-series array), and then you run `powermt config` or reboot the host, the load balancing and failover policy is set to Basic Failover. If this happens, you must register PowerPath using the `emcprep -install` command and then run the `powermt set policy` command to reset the policy as appropriate. The *PowerPath Product Guide* contains more information on `powermt` commands.

To register the PowerPath license:

- Enter:

```
emcprep -install
```

You see the following output:

```

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

```

- 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):

3. 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. The *PowerPath Product Guide* contains a list of error messages returned by the `emcpreg` license registration utility.

4. Press ENTER. You see the following output:

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

5. Start PowerPath. Enter:

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

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

Note: If the `LANG` variable is set to the locale ID for a language listed in [Table 1-1 on page 1-9](#), messages from the PowerPath start command are displayed in that language.

Unmount CD-ROM

If you used a CD-ROM, unmount it:

1. Change to the root directory. Unmount the CD. Enter:

```
cd /
umount /cdrom
```

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

Complete post-installation tasks

PowerPath installation is now finished. Refer to [“After you install” on page 1-18](#) for postinstallation information and instructions.

After you install

After installing PowerPath:

- Verify that your PowerPath capabilities are correct.
- Reconfigure device mappings.
- If you load the HBA driver as a module, verify that all PowerPath extensions are loaded.
- On SLES 9 hosts where you plan to install VxVM, edit the `boot.vxvm` file.

Verify your PowerPath capabilities are correct

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.

Note: 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 `emcprep` 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.

Verify extensions are loaded

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”). For example:

Module	Size	Used by
emcpdm	31716	0
emcpgpx	20516	1 emcpdm
emcpx	156600	104
emcp	895412	3 emcpdm, emcpgpx, emcpx
emcplib	6656	1 emcp
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
nvrn	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             116941  9  emcp,sg,qla2xxx,scsi_transport_fc,mptsas,mptspi,
                    mptfc,mptscsi,sd_mod

```

The `/etc/modprobe.conf` file should contain the following text:

```

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

```

The `/etc/modprobe.conf.pp` file should contain the following text:

```

alias ppemcp emcp
alias ppemcpdm emcpdm
alias ppemcpgpx emcpgpx
alias ppemcpx mpemcpx
alias ppemcplib emcplib
options emcp
    managedclass=symm,clariion,hitachi,invista,hpxp,ess,hp
    hsx

```

Edit the `boot.vxvm` file

If you have installed PowerPath on a SLES 9 host where you plan to install VxVM, follow these steps after installing VxVM:

1. Open the `boot.vxvm` startup script.
2. Edit the file by adding the following to the `Required Start` line:

```
boot.powerpath
```

3. Run the `insserv` command.

Editing this file prevents the VxVM boot script from starting before the PowerPath boot script, in which case VxVM would not recognize PowerPath pseudo devices

Upgrading PowerPath

Take note of the following before upgrading PowerPath:

- ◆ You can only upgrade to PowerPath 5.0.0 from PowerPath 4.5.0 or later. You cannot upgrade from a version earlier than PowerPath 4.5.0.
- ◆ You can only upgrade to PowerPath 5.0.1 from PowerPath 5.0.0. You cannot upgrade to PowerPath 5.0.1 from a PowerPath version earlier than 5.0.0.

The following table lists PowerPath upgrade tasks and indicates the sections in this chapter that describe these tasks.

Table 1-2 PowerPath upgrade task matrix

If you want to ...	Read this section ...
Upgrade to PowerPath 5.0.0 on a RHEL or Asianux host	“Upgrading to PowerPath 5.0.0 on a RHEL or Asianux host” on page 1-22
Upgrade to PowerPath 5.0.0 on a SLES host	“Upgrading to PowerPath 5.0.0 on a SLES host” on page 1-24
Upgrade to PowerPath 5.0.1 on a RHEL host	“Upgrading to PowerPath 5.0.1 on a RHEL 4 host” on page 1-25
Upgrade to PowerPath 5.0.1 on a SLES host	“Upgrading to PowerPath 5.0.1 on a SLES 10 or SLES 9 host” on page 1-27

Before you upgrade PowerPath

- ◆ Check the Powerlink website (<http://Powerlink.EMC.com>) for the most current information.
- ◆ Run the `powermt save` command to ensure 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 5.0.x fails to preserve pseudo-to-native device mappings and device policy/priority settings. To avoid this problem:
 1. With the existing version of PowerPath installed, run the `powermt display dev=all` command and redirect the output to a file.
 2. Run the `/etc/init.d/PowerPath stop` command.
 3. Delete all the native devices listed in the `powermt` log file created in step 1.
 4. Use the `mknod` command to recreate the native devices with the default major/minor numbers.
 5. 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 [“Select language for installation” on page 1-9](#) for information on using a localized version of the PowerPath installer when upgrading to PowerPath 5.0.x.
- ◆ **CLARiiON systems only:** Stop the Navisphere agent.

Upgrading to PowerPath 5.0.0 on a RHEL or Asianux host

Take note of the following before upgrading to PowerPath 5.0.0:

- ◆ 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 5-5](#) to correct the problem.
- ◆ Refer to [“Troubleshooting a PowerPath upgrade” on page 5-4](#) if you encounter any problems while upgrading PowerPath.

Upgrading to PowerPath 5.0.0

To upgrade to PowerPath 5.0.0 on a RHEL or Asianux host:

1. Log in as root.

2. Complete the steps described in “Before you upgrade PowerPath” on page 1-21.
3. On a RHEL 4.0 host, install the required update level and kernel revision (documented in the *PowerPath 5.0 for Linux Releases Notes*). After rebooting the host, verify that the correct kernel and HBA drivers are loaded.

Installing from CD-ROM

4. Insert the PowerPath installation CD-ROM into the CD-ROM drive.
5. Create the directory `/cdrom` to be the mount point for the CD-ROM. Enter:

```
mkdir /cdrom
```

6. Mount the PowerPath CD on `/cdrom`. Enter:

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

7. Change directories to the directory for your operating system. For RHEL and Asianux, enter:

```
cd /cdrom/LINUX/2.6/pp5.0.x/rhel
```

Installing from a compressed archive

8. Download the PowerPath archive from <http://Powerlink.EMC.com> > **Support** > **Software Downloads and Licensing** > **Downloads D-R** > **PowerPath for Linux**.
9. Untar the PowerPath archive. Enter:

```
tar -xzf EMCpower.LINUX.5.0.0.<build>.tar.gz
```

Install PowerPath

10. Install the new PowerPath version. Enter:

```
rpm -Uv EMCpower.LINUX-5.0.0-<build>.<package>.rpm
```

where `<package>` is:

Package Name	Description
<code>rhel.x86_64</code>	PowerPath 5.0.0 on RHEL and Asianux x86_64 platforms.
<code>rhel.ia64</code>	PowerPath 5.0.0 on RHEL IA64 platforms.
<code>rhel.i386</code>	PowerPath 5.0.0 on RHEL and Asianux i386 platforms.

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

Upgrading to PowerPath 5.0.0 on a SLES host

Note: You can upgrade to PowerPath 5.0.0 on a SLES 9 host with SP3; you cannot upgrade PowerPath 5.0.0 on a SLES 10 host.

To upgrade to PowerPath 5.0.0 on a SLES host:

1. Log in as root.
2. Remove the existing PowerPath package:

```
rpm -e <PowerPath_package>
```
3. Install the required SLES service pack and kernel (documented in the *PowerPath 5.0 for Linux Releases Notes*). After rebooting the host, verify that the correct kernel and HBA drivers are loaded.

Installing from CD-ROM

4. Insert the PowerPath installation CD-ROM into the CD-ROM drive.
5. Create the directory `/cdrom` to be the mount point for the CD-ROM. Enter:

```
mkdir /cdrom
```
6. Mount the PowerPath CD on `/cdrom`. Enter:

```
mount -o ro /dev/cdrom /cdrom
```
7. Change directories to the directory for your operating system. For SLES, enter:

```
cd /cdrom/LINUX/2.6/pp5.0.x/sles
```

Installing from a compressed archive

8. Download the PowerPath archive from <http://Powerlink.EMC.com> > **Support** > **Software Downloads and Licensing** > **Downloads D-R** > **PowerPath for Linux**.
9. Untar the PowerPath archive. Enter:

```
tar -xzf EMCpower.LINUX.5.0.0.<build>.tar.gz
```

Install PowerPath

10. Install the new PowerPath version. Enter:

```
rpm -iv EMCpower.LINUX-5.0.0-<build>.<package>.rpm
```

where *<package>* is:

Package Name	Description
sles.x86_64	PowerPath 5.0.0 on SLES 9 x86_64 platforms.
sles10.x86_64	PowerPath 5.0.0 on SLES 10 x86_64 platforms.
sles.ia64	PowerPath 5.0.0 on SLES 9 IA64 platforms.
sles10.ia64	PowerPath 5.0.0 on SLES 10 IA64 platforms.
sles.i386	PowerPath 5.0.0 on SLES 9 386 platforms.
sles10.i386	PowerPath 5.0.0 on SLES 10 386 platforms.

11. Start PowerPath:

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

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

Upgrading to PowerPath 5.0.1 on a RHEL 4 host

Take note of the following before upgrading to PowerPath 5.0.1:

- ◆ Upgrade to PowerPath 5.0.1 at the same time that you upgrade the Linux kernel. PowerPath 5.0.1 only works with RHEL 5.
- ◆ Do not use the `-i` option to upgrade to PowerPath 5.0.1 on a RHEL host. 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 5-5](#) to correct the problem.
- ◆ Refer to [“Troubleshooting a PowerPath upgrade” on page 5-4](#) if you encounter any problems while upgrading PowerPath.

Upgrading to PowerPath 5.0.1

To upgrade to PowerPath 5.0.1 on a RHEL 4 host:

1. Log in as root.
2. Complete the steps described in “Before you upgrade PowerPath” on page 1-21.
3. Install the required RHEL 5 kernel (documented in the *PowerPath 5.0 for Linux Releases Notes*) following the RedHat documentation. Reboot the host and verify that the correct kernel and HBA drivers are loaded.

4. Download the PowerPath archive from <http://Powerlink.EMC.com> > **Support** > **Software Downloads and Licensing** > **Downloads D-R** > **PowerPath for Linux**.

5. Untar the PowerPath archive. Enter:

```
tar -xzf EMCpower.LINUX.5.0.1.<build>.tar.gz
```

6. Install the new PowerPath version. Enter:

```
rpm -Uv EMCpower.LINUX-5.0.1-<build>.<package>.rpm
```

where <package> is:

Package Name	Description
rhel.x86_64	PowerPath 5.0.1 on RHEL 5 x86_64 platforms.
rhel.i386	PowerPath 5.0.1 on RHEL 5 i386 platforms.
rhel.ia64	PowerPath 5.0.1 on RHEL 5 IA64 platforms.

7. Start PowerPath:

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

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

Upgrading to PowerPath 5.0.1 on a SLES 10 or SLES 9 host

Note: Upgrade to PowerPath 5.0.1 at the same time that you upgrade the Linux kernel. PowerPath 5.0.1 only works with SLES 10 SP1.

To upgrade to PowerPath 5.0.1 on a SLES 10 or SLES 9 host:

1. Log in as root.
2. Complete the steps described in “[Before you upgrade PowerPath](#)” on page 1-21.
3. Install the required SLES 10 SP1 kernel (documented in the *PowerPath 5.0 for Linux Releases Notes*) following the Novell documentation. Reboot the host and verify that the correct kernel and HBA drivers are loaded.
4. Download the PowerPath archive from <http://Powerlink.EMC.com> > **Support** > **Software Downloads and Licensing** > **Downloads D-R** > **PowerPath for Linux**.

5. Untar the PowerPath archive. Enter:

```
tar -xzf EMCpower.LINUX.5.0.1.<build>.tar.gz
```

6. Install the new PowerPath version. Enter:

```
rpm -Uv EMCpower.LINUX-5.0.1-<build>.<package>.rpm
```

where *<package>* is:

Package Name	Description
sles10sp1.x86_64	PowerPath 5.0.1 on SLES 10 SP1 x86_64 platforms.
sles10sp1.i386	PowerPath 5.0.1 on SLES 10 SP1 i386 platforms.

7. Start PowerPath:

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

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

Coexistence with third-party path management software

PowerPath can coexist with the following third-party path management software:

- ◆ Hitachi Dynamic Link Manager (HDLM)
- ◆ IBM Subsystem Device Driver (SDD)
- ◆ HP StorageWorks Secure Path
- ◆ HP StorageWorks Auto Path XP Virtual Array

However, PowerPath cannot *co-manage* devices with third-party path management software. During installation of PowerPath 5.0, the installation script tests for the presence of third-party path management software on the system.

When third-party path management software is installed on the system, the PowerPath installation script disables support for the corresponding array type in PowerPath.

If this software is present	Support for this array type is disabled in PowerPath
HDLM	Hitachi Lightning, Hitachi TagmaStore
SDD	IBM ESS
HP StorageWorks Secure Path	HP StorageWorks EVA, EMA, MA
HP StorageWorks Auto Path XP Virtual Array	HP StorageWorks xp

PowerPath behavior with third-party multipathing software

PowerPath co-management is not supported by third-party array path management products; therefore, when you enable PowerPath (`powermt manage class=<class>`) for a class that is being managed by a third-party product, multipathing behavior is undefined.

Since PowerPath is not supported in third-party path management environments when the corresponding storage system class type is in the managed state, multipathing behavior for any attached arrays in

the corresponding class is undefined if you subsequently execute a `powermt manage class=` command:

If this software is present or enabled	Multipathing behavior is undefined if you execute this command
HDLM	<code>powermt manage class=hitachi</code>
SDD	<code>powermt manage class=ess</code>
HP StorageWorks Secure Path	<code>powermt manage class=hphsx</code>
HP StorageWorks Auto Path XP Virtual Array	<code>powermt manage class=hpxp</code>

Since PowerPath and the third-party software cannot co-manage devices, do not initiate co-management by executing this command on third-party array class machines. As long as this command is not executed, support for the relevant third-party arrays will remain disabled across reboots.

Similarly, before you install third-party path management software on a system on which PowerPath 5.0 is already installed, disable any support by PowerPath for the relevant third-party array devices using a `powermt unmanage class=` command:

Before you install or enable this software	Execute this command
HDLM	<code>powermt unmanage class=hitachi</code>
SDD	<code>powermt unmanage class=ess</code>
HP StorageWorks Secure Path	<code>powermt unmanage class=hphsx</code>
HP StorageWorks Auto Path XP Virtual Array	<code>powermt unmanage class=hpxp</code>

Configuring a PowerPath root device on Linux

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

- ◆ Introduction2-2
- ◆ Configuring a PowerPath root device for SLES2-3
- ◆ Configuring a PowerPath root device for RHEL.....2-6
- ◆ Upgrading the Linux kernel in a boot from SAN setup.....2-8
- ◆ Removing PowerPath from a root device.....2-10

Introduction

On Symmetrix and CLARiiON 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. To use a PowerPath pseudo device as the root device, the device must be under LVM control. 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.

Refer to the *PowerPath for Linux Version 5.0 and Point Releases Release Notes* to see the supported root device configurations.

Root device considerations

Take note of the following before configuring a root device:

- ◆ With PowerPath 5.0.0, EMC recommends using a PowerPath pseudo (`emcpower`) device instead of the native `sd` device in the `/etc/fstab` file.
- ◆ With PowerPath 5.0.1, EMC recommends the following:
 - For RHEL 5, EMC recommends using the default label device in the `/etc/fstab` file to mount the `/boot` file system.
 - For SLES SP1, EMC recommends using a PowerPath pseudo (`emcpower`) device instead of the default `/dev/disk/by-id` device in the `/etc/fstab` file.
- ◆ To use a PowerPath pseudo device as a root device, the device must be under LVM control.
- ◆ When booting from the SAN, duplicate ID messages may appear if you run any LVM-related commands. To avoid seeing duplicate messages, filter all `sd` devices in the `/etc/lvm/lvm.conf` file. Refer to [“Configuring LVM2 support” on page 3-2](#) for information on modifying `/etc/lvm/lvm.conf`.

Configuring a PowerPath root device for SLES

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

1. Install SLES 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.
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.
3. Create a volume group for the LVM partition.
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.
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.
6. Upgrade the kernel revision to a revision compatible with PowerPath. Check the *PowerPath for Linux Version 5.0 and Point Releases Release Notes* for the current PowerPath requirements.
7. Install and configure PowerPath following the instructions in [Chapter 1, "Installing PowerPath."](#)
8. If using:

PowerPath 5.0.0

Edit the `/etc/fstab` file to mount the `/boot` partition on a 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,icharset=utf8 0 0
```

Edit the `/etc/fstab` file so that the `/boot` partition is mounted by a PowerPath pseudo device — 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,icharset=utf8 0 0
```

PowerPath 5.0.1

Edit the `/etc/fstab` file to mount the `/boot` partition on a PowerPath pseudo device instead of the default `/dev/disk/by-id` device in the `/etc/fstab` file. Consider the following host where `emcpowera` is the corresponding PowerPath pseudo name for the default `/dev/disk/by-id` device. The original `/etc/fstab` file is shown below.

```
/dev/system/root / reiserfs acl,user_xattr 1 1
/dev/disk/by-id/scsi-360060160909a1d00eafe889a2941dc11-part1 /boot ext2 acl,user_xattr 1 2
/dev/system/swap swap swap defaults 0 0
proc /proc proc defaults 0 0
sysfs /sys sysfs noauto 0 0
debugfs /sys/kernel/debug debugfs noauto 0 0
usbfs /proc/bus/usb usbfs noauto 0 0
devpts /dev/pts devpts mode=0620,gid=5 0 0
/dev/fd0 /media/floppy auto noauto,user,sync 0 0
```

Edit the `/etc/fstab` file so that the `/boot` partition is mounted by a PowerPath pseudo device — in this example, `/dev/emcpoweru1`. The modified `/etc/fstab` file is shown below.

```

/dev/system/root      /                reiserfs  acl,user_xattr      1 1
/dev/emcpoweru1      /boot           ext2      acl,user_xattr      1 2
/dev/system/swap     swap            swap      defaults              0 0
proc                  /proc           proc      defaults              0 0
sysfs                 /sys            sysfs     noauto                0 0
debugfs              /sys/kernel/debug debugfs   noauto                0 0
usbfs                 /proc/bus/usb   usbfs     noauto                0 0
devpts                /dev/pts        devpts    mode=0620,gid=5      0 0
/dev/fd0              /media/floppy   auto      noauto,user, sync    0 0

```

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

Configuring a PowerPath root device for RHEL

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

1. Install RHEL 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.
2. Install and configure PowerPath following the instructions in [Chapter 1, "Installing PowerPath."](#)
3. If using:

PowerPath 5.0.0

By default, the `/boot` partition is configured to mount by label. In a RHEL 4 environment, mounting by label on a host with multiple active paths may cause problems. Therefore, edit the `/etc/fstab` file to use a PowerPath pseudo (`emcpower`) device 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/LogVol100 / 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/LogVol101 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
```


Edit the `/etc/fstab` file so that the `/boot` partition is mounted by a PowerPath pseudo device — 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/LogVol100 / 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/LogVol101 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
```

PowerPath 5.0.1

No changes to the `/etc/fstab` file are necessary. By default, the `/boot` partition is configured to mount by label, as shown in the following example:

```
/dev/system/LogVol100 / ext3 defaults 1 1
LABEL=/boot /boot ext3 defaults 1 2
devpts /dev/pts devpts gid=5,mode=620 0 0
tmpfs /dev/shm tmpfs defaults 0 0
proc /proc proc defaults 0 0
sysfs /sys sysfs defaults 0 0
/dev/system/LogVol101 swap swap defaults 0 0
```

Use the default "mount by label" device to mount the `/boot` partition.

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 Linux kernel in a boot from SAN configuration.

1. Upgrade the kernel, following the steps provided by RedHat and Novell for upgrading the kernel in the host.
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/LogVol100 / ext3 defaults 1 1
# /dev/emcpowera1 /boot ext3 defaults 1 2
none /dev/pts none devpts gid=5,mode=620 0 0
none /dev/shm none tmpfs defaults 0 0
none /proc none proc defaults 0 0
none /sys none sysfs defaults 0 0
/dev/VolGroup00/LogVol01 swap swap defaults 0 0
/dev/hda /media/cdrom auto 0 0
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed 0 0
/dev/fd0 /media/floppy auto 0 0
pamconsole,fscontext=system_u:object_r:removable_t,exec,noauto,managed 0 0

```

3. Reboot the host.
4. Depending on the version of PowerPath installed on the host:
 - On PowerPath 5.0.0 host, reinstall PowerPath following the directions in [“Upgrading PowerPath” on page 1-21](#). Load the PowerPath modules and configure the devices using the PowerPath `powermt` command.
 - On a PowerPath 5.0.1 host, PowerPath detects that a new version of Linux has been installed on the host and automatically reinstalls the PowerPath drivers. You do not need to reinstall PowerPath after upgrading Linux

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/LogVol100 /                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/LogVol101 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

```

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.

1. Move the `/etc/init.d/PowerPath` script to a different location.
2. Edit the `/etc/fstab` file to remove any references to PowerPath pseudo (`emcpower`) devices.
3. Reboot the host.
4. Remove PowerPath following the instructions in [Chapter 4, "Removing PowerPath."](#)

Maintaining PowerPath

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

- ◆ Installing QLogic qla2300 HBAs after PowerPath installation ... 3-2
- ◆ Configuring LVM2 support 3-2
- ◆ Upgrading Linux with PowerPath installed 3-7
- ◆ R1/R2 boot failover support 3-8
- ◆ Audit and error messages 3-11

Installing QLogic qla2300 HBAs after PowerPath installation

If you install QLogic qla2300 HBAs and drivers after PowerPath has been installed on a host connected to an HP StorageWorks EVA array, add the following lines to the `/etc/modprobe.conf.pp` file:

```
install qla2xxx /sbin/modprobe emcpsf; /sbin/modprobe qla2xxx --ignore-install
install emcp /sbin/modprobe qla2xxx; /sbin/modprobe emcp --ignore-install
```

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.

Note: If duplicate PV errors occur in a boot from SAN configuration, modify the recommended filters shown in this section to prevent LVM2 from scanning the pseudo device partition node (which causes this issue).

For example, for RHEL 5 and RHEL 4 U4, replace the recommended filter for the root file system mounted on a logical volume with the following:

```
filter = [ "a/sda[1-9]$/", "r/emcpowera2/", "r/sd.*/",  
"r/disk.*/", "a.*/" ]
```

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.

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

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

with the appropriate line for your Linux kernel, as follows:

Kernel	Filter
RHEL 5 RHEL 4 U4	<code>filter = ["r/sd.*/*", "r/disk.*/*", "a/*/*"]</code>
RHEL 4 U3 or lower	<code>filter=["r/sd.*/*", "a/*/*"]</code>
SLES 10 SP1 SLES 10 SLES 9 SP3	<code>filter = ["r /dev/*/*by-path/* ", "r /dev/*/*by-id/* ", "r /dev/*/*by-name/* ", "r/sd.*/*", "a/*/*"]</code>

2. Rebuild the LVM2 cache. Enter:

```
vgscan -v
```

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. Enter:

```
lvmddiskscan
```

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).

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

```
df -k
```

or

```
mount
```

- 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
```

- 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` as follows:

Kernel	Filter
RHEL 5 RHEL 4 U4	<code>filter = ["a/sda[1-9]\$/", "r/emcpowera2/", "r/sd.*/", "r/disk.*/", "a./.*/"]</code>
RHEL 4 U3 or lower	<code>filter=["a/sda[1-9]\$/", "r/sd.*/", "a./.*/"]</code>
SLES 10 SP1 SLES 10 SLES 9 SP3	<code>filter = ["r /dev/.*/by-path/.*/", "r /dev/.*/by-id/.*/", "r /dev/.*/by-name/.*/", "r/sd.*/", "a./.*/"]</code>

Note: 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./.*/"]`

- Rebuild the LVM2 cache. Enter:

```
vgscan -v
```

- 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. Enter:

```
lvmddiskscan
```

- Recreate the `initrd` image to reflect the changes to the `/etc/lvm/lvm.conf` file. Enter:

```
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).

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

```
df -k
```

or

```
mount
```

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
```

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:

Kernel	Filter
RHEL 5 RHEL 4 U4	<code>filter = ["a/sda[1-9]\$/", "r/sd.*/", "r/disk.*/", "a./.*"]</code>
RHEL 4 U3 or lower	<code>filter=["a/sda[1-3]\$/", "a/sdb[1-3]\$/", "r/sd.*/", "a./.*"]</code>
SLES 10 SP1 SLES 10 SLES 9 SP3	<code>filter = ["r /dev./.*by-path/.*/", "r /dev./.*by-id/.*/", "r /dev./.*by-name/.*/", "r/sd.*/", "a./.*"]</code>

Note: 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/.*/"]`.

4. Rebuild the LVM2 cache. Enter:

```
vgscan -v
```

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. Enter:

```
lvmdiskscan
```

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

```
mkinitrd
```

Upgrading Linux with PowerPath installed

Note: Before upgrading to a new version of Linux, check the E-Lab Navigator to verify that that version of Linux has been qualified with PowerPath.

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

1. Install the new errata version.
2. Boot to the new kernel.
3. Reinstall the supported HBA driver.
4. Depending on the version of PowerPath installed on the host:
 - On PowerPath 5.0.0 host, upgrading a Linux kernel causes the installed PowerPath drivers to be deleted. 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-5.0.0-<build>.<package>.rpm
```

- On a PowerPath 5.0.1 host, PowerPath detects that a new version of Linux has been installed on the host and automatically reinstalls the PowerPath drivers. You do not need to reinstall PowerPath after upgrading Linux

R1/R2 boot failover support

If a storage system device corresponding to a bootable emcpower device is mirrored via SRDF®, it is possible in the event of a server failure at the local storage system to fail over the boot disk to the remote mirror disk and then boot the server on an identical remote host.

Contact EMC Customer Support for assistance when configuring R1/R2 boot disk failover.

R1/R2 supported configurations

EMC supports the following specific R1/R2 configurations:

- ◆ In a Symmetrix 5x71 environment, you must set the Symmetrix SPC2 flag to OFF. By default, this flag is set to ON.
- ◆ Each boot host must be connected to only one Symmetrix.
- ◆ The two hosts must have identical hardware.
- ◆ All R1 devices reside on one Symmetrix, *Symmetrix A*, and are visible only to a single host, *Host A*.
- ◆ All R2 devices reside on a separate Symmetrix, *Symmetrix B*, and are visible only to the identical host in reserve, *Host B*.
- ◆ Each R1 device has only one mirror. (Concurrent SRDF is not supported.)
- ◆ Neither host has non-mirrored devices, BCVs, or gatekeepers.
- ◆ SRDF is managed from either of the following two facilities:
 - EMC ControlCenter® Management Server
 - Symmetrix Service Processor
- ◆ The Symmetrix device numbers should match across the R1 and R2 systems. For example, if devices 02a, 02b, 03c are assigned on the R1 Symmetrix, then the same devices (02a, 02b, 03c) should be assigned on the R2 Symmetrix as well

Note: When the system is booted on the R2 device, PowerPath does not support reconfiguring or administering devices (for example, adding or removing devices) on the R1 side. Device configuration and administration must be done on the R2 side.

R1/R2 boot procedure

Note: In an R1/R2 environment:

- The R1/R2 hosts must have the same host architecture. For example, if the R1 host is an x86_64 architecture, then the R2 host must be the same.
- HBA adapters must also be identical on the R1/R2 hosts.

R1/R2 boot support assumes that the systems are configured to boot from a Linux LVM device (that is, a Linux Logical Volume Manager device).

When the host on the R2 side boots, it is connected to a different Symmetrix system and set of volume IDs. Therefore, the `powermt.custom` file (which is identical to the R1 files since the boot disk is identical) is modified to create a valid mapping between the `emcpower` device and native path device for both R1 and R2 locations. PowerPath will determine which Symmetrix volume IDs are valid (that is, the visible ones) and will act accordingly when either the R1 or the R2 host is booted.

Configure the network interface on the R1 host

To ensure R1/R2 boot failover support, you must configure the network interface on the R1 host. Refer to the appropriate section for your Linux kernel.

RHEL 4 and RHEL 5

To configure the R1 host on RHEL 4 and RHEL 5:

1. Disable `kudzu`. Enter:

```
chkconfig kudzu off
```

2. Verify that `kudzu` is disabled. Enter:

```
chkconfig --list kudzu
```

```
kudzu 0:off 1:off 2:off 3:off 4:off 5:off
        6:off
```

3. Change directories to `/etc/sysconfig/network-scripts`. Enter:

```
cd /etc/sysconfig/network-scripts
```

4. Enter:

```
# cat ifcfg-eth0
```

5. Comment out the `HWADDR` line by adding a `#` symbol at the beginning of the line. For example:

```
#HWADDR=00:0D:60:14:C2:98
```

SLES 9, SLES 10, or SLES 10 SP1

To configure the R1 host on SLES 9, SLES 10, or SLES 10 SP1:

1. Using YaST, go to **Network Devices > Network Card**, and then select **Change**.
2. Delete any previously configured network interface. For example, if the `eth0` interface is configured, delete it from YaST.
3. Click **Finish** to save the configuration.
4. On SLES 10 and SLES 10 SP1 hosts only, change the persistent binding setting to `no`, as follows (on SLES 9, go to step 5):

- a. Open the `config` file for editing:

```
vi /etc/sysconfig/network/config
```

- b. In the `config` file, change the persistent binding value to `no`:

```
FORCE_PERSISTENT_NAMES=no
```

5. Open **Network Devices > Network Card** and select the network interface you want to configure, and then select **Edit** (SLES 10) or **Configure** (SLES 9).
6. In the **Configuration Name** field, enter the number of the interface you deleted earlier. For example, to configure the `eth0` interface:

On SLES 9, enter **eth0**.

On SLES 10 and SLES 10 SP1, enter **0**.

7. Enter the IP address in the **IP Address** field, and update other network data as necessary.
8. Select **Next** and then **Finish** to save the configuration.
9. Verify the network service has started correctly. Enter:

```
/etc/sysconfig/network # ifconfig
```

You should see network data for the `eth0` interface in the `ifconfig` output.

Audit and error messages

PowerPath reports any errors, diagnostic messages, and failover recovery messages to the system console and to the `/var/log/messages` file, or to the file you specify. By default, messages are logged to the `/var/log/messages` files. Refer to the *PowerPath 5.0 Product Guide* for a complete list of PowerPath error messages.

Audit log messages

Some `powermt` commands generate audit messages that allow you to track the commands run on a particular host. On Linux hosts, the following commands generate audit messages:

- ◆ `powermt set path_latency_monitor`
- ◆ `powermt set path_latency_threshold`
- ◆ `powermt set policy`

These PowerPath commands also generate audit messages, but are not supported on PowerPath for Linux at this time.

- ◆ `powermt disable hba`
- ◆ `powermt enable hba`
- ◆ `powermt set port_disable`

For more information on these commands, refer to the *PowerPath 5.0 Product Guide*, available on the Powerlink website. The following sample messages are logged when you enable path latency monitoring and set a latency threshold value.

```
Sep 20 05:15:10 Host1a emcpAudit: CMD: Info: powermt set path_latency_monitor=on
Sep 20 05:15:10 Host1a emcpAudit: CMD: Info: powermt set path_latency_monitor=on
Sep 20 05:15:10 Host1a emcpAudit: CMD: Info: powermt set path_latency_monitor=on
Sep 20 05:15:10 Host1a emcpAudit: CMD: Info: powermt set path_latency_monitor=on
Sep 20 05:15:14 Host1a syslog-ng[4694]: STATS: dropped 0
Sep 20 05:15:45 Host1a emcpAudit: CMD: Info: powermt set path_latency_threshold=10
Sep 20 05:15:45 Host1a emcpAudit: CMD: Info: powermt set path_latency_threshold=10
Sep 20 05:15:45 Host1a emcpAudit: CMD: Info: powermt set path_latency_threshold=10
```

Message format and description

Audit messages have the following format:

```
<timestamp> <hostname> emcpAudit: CMD: Info <message>
```

Table 3-1 describes the components of an audit message.

Table 3-1 Audit message description

Message	Description
Sep 20 05:15:10	Date and time the event occurred.
Host1a	Name of the host where PowerPath resides.
emcpAudit:	The program performing the auditing function. This is the tag used for audit messages for PowerPath.
CMD: Info:	The source or the messages and the message priority level (info).
powermt set path_latency_monitor=on	The message text. This is a sample message that would appear when you enable path latency monitoring.

Error log messages Error log messages appear along with audit messages in the when you configure PowerPath for common logging. The error-log messages capture unexpected events that occur. Some error-log messages convey information that appears on-screen when a command fails. The basic error-log message format is:

```
<timestamp> <hostname> kernel: <level>:<module>: <message>
```

Sample message and description

The following sample error message is logged when a path failure occurs, in this case, on a CLARiiON storage system:

```
Sep 7 10:20:45 Host1a kernel: Error:Mpx:Path Bus 5 Tgt 0 Lun 0 to FCNBD054405535 is dead.
```

Table 3-2 describes the components of the sample error-log message.

Table 3-2 Error-log message description

Message	Description
Sep 7 10:20:45	Date and time the event occurred.
Host1a kernel	Name of the host where PowerPath resides and error source.

Table 3-2 Error-log message description (continued)

Message	Description
Error:Mpx:	Message type (Info, Error, or Warning) and program or module that is reporting the message. Mpx indicates that PowerPath mpx module is reporting the message.
Path Bus 5 Tgt 0 Lun 0 to FCNBD054405535 is dead.	The error message. For error message descriptions, refer to the <i>PowerPath Product Guide</i> , available on the Powerlink website.

Removing PowerPath

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

- ◆ [Before you remove PowerPath.....4-2](#)
- ◆ [Removing PowerPath.....4-3](#)

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 (CLARiiON only).
- ❑ 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 Symmetrix or CLARiiON 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

1. Log in as root.
2. Display the package name. Enter:

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

3. Remove the software. Enter:

```
rpm -e EMCpower.LINUX-5.0.<release>--<build>
```

Note: 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 5.0.x configuration on the host, or upgrade to a later version of PowerPath without PowerPath 5.0.x installed on the host while re-using the 5.0.x configuration.

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..... 5-2
- ◆ Troubleshooting a PowerPath upgrade 5-4
- ◆ No visible pseudo devices 5-6
- ◆ Missing or deleted files 5-7
- ◆ Incorrect PowerPath configuration 5-8
- ◆ Problems booting the host 5-8
- ◆ System hangs 5-9

Recovering from a failed PowerPath installation

If PowerPath installation fails, correct any error conditions reported by the install program. Then complete the following steps. After completing the steps, install PowerPath following the instructions in [Chapter 1, “Installing PowerPath.”](#)

1. Edit the appropriate file for your Linux version (shown in the following table):

Linux version	File
RHEL 5	/etc/rc.sysinit (linked to /etc/rc.d/rc.sysinit)
RHEL 4 Asianux	/etc/rc.sysinit
SLES 10 SP1 SLES 10	/etc/init.d/boot.d/S04boot.powerpath (linked to /etc/init.d/boot.powerpath)
SLES 9 SP3+ SLES 9 SP3	/etc/init.d/boot.localfs

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 file you modified contains the lines above.

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

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

3. 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
```

4. Rename the `/etc/init.d/PowerPath` file. Enter:

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

5. Check the `/etc/opt/emcpower/EMCpower.LINUX-5.x/log` file for additional information about the failure.
6. 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-5.0.<release>-<build>
```

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

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

Note: 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 section describes how to resolve problems that can occur when upgrading to PowerPath 5.0.0.

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 5.0.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 5.0.0 (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 5.0.0, the custom configuration recorded in the saved `powermt.custom` file is not applied during the upgrade to PowerPath 5.0.0. 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 Channel 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 to reinstall PowerPath on the host:

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`.
2. Uninstall PowerPath following the instructions in Chapter 4, "Removing PowerPath."
3. Remove any file saved to the `/etc/emc/archive` directory by the uninstall process.
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.
5. Reinstall PowerPath on the host. Refer to ["Installing PowerPath" on page 1-11](#) for more information.

Correcting multiple PowerPath entries in the RPM database

Using the `-i` option to upgrade to PowerPath 5.0.0 creates multiple PowerPath entries in the RPM database, which can cause ongoing maintenance issues. To resolve this problem, remove the PowerPath 4.5 for Linux package using the following commands:

```
rpm -qa | grep EMCpower.LINUX  
rpm -ev --noscripts EMCpower.LINUX-4.5.0-<build_number>
```

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:

1. Stop PowerPath. Enter:

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

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

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

```
install emcp /sbin/modprobe <hba_module_name>;  
/sbin/modprobe emcp --ignore-install
```

3. Restart PowerPath. Enter:

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

4. Ensure that all of the PowerPath modules listed in [“Verify extensions are loaded” on page 1-19](#) are loaded, in addition to the HBA driver.

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:

1. Stop PowerPath. Enter:

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

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

2. Remove PowerPath. Enter:

```
rpm -qa | grep EMCpower.LINUX  
rpm -ev EMCpower.LINUX-5.0.<release>-<build>
```

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

3. Remove `/etc/opt/emcpower`. Enter:

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



CAUTION

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

4. Reinstall PowerPath. Refer to [“Installing PowerPath” on page 1-11](#) 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:

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

2. Stop PowerPath. Enter:

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

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

3. Restart PowerPath. Enter:

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

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 E-Lab Navigator and verify that your fibre driver is currently supported.

Note: The E-Lab Navigator, which is updated every month, is available on the Powerlink website: <http://Powerlink.EMC.com>.

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

1. Detach all connections to the storage system before booting.
2. Reboot to a <safe> kernel and remove the `qla` entry from the `/etc/modprobe.conf` or `/etc/sysconfig/kernel` file.
3. If a RAM disk is used, rebuild it.
4. Reboot the host with the new RAM disk.
5. Build the supported driver and incorporate it into a new RAM disk as desired.
6. Reattach the connections to the storage system.
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.

Files changed by PowerPath

This appendix lists files that are created or modified by PowerPath installation and upgrade.

- ◆ Linux files modified by PowerPath installation.....A-2
- ◆ Files created by PowerPath 5.0.0 installation.....A-3
- ◆ Files created by PowerPath 5.0.1 installation.....A-10

Linux files modified by PowerPath installation

The following files are modified when PowerPath is installed on a Linux host:

- ◆ `/etc/init.d/boot.localfs`
- ◆ `/etc/init.d/boot.powerpath` (SLES 10 SP1 only)
- ◆ `/etc/modprobe.conf`
- ◆ `/etc/rc.d/rc.sysinit`
- ◆ `/lib/modules/*/modules.dep`—For each `/lib/modules` subdirectory that gets a set of PowerPath drivers installed.

Files created by PowerPath 5.0.0 installation

The files in this section are created when PowerPath 5.0.0 is installed on a Linux host. The first section includes files common to all Linux packages; package-specific files are called out in subsequent sections.

Note: The directory *basedir* is the directory you specified as the PowerPath installation directory (*opt*, if you selected the default).

Common files

The files in this section are common to all Linux packages.

- /etc**
- ◆ emc/mpaa.excluded
 - ◆ emc/mpaa.lams
 - ◆ emc/ppme
 - ◆ emcp_devicesDB.dat
 - ◆ emcp_devicesDB.idx
 - ◆ modprobe.conf.pp
 - ◆ /etc/*basedir*/emcpower/.archive.tar
 - ◆ /etc/*basedir*/emcpower/emcpmgr
 - ◆ powermt.custom
 - ◆ rc.d/init.d/PowerMig
 - ◆ rc.d/init.d/PowerPath
 - ◆ rc.d/rc3.d/K99PowerMig
 - ◆ rc.d/rc3.d/S99PowerMig

/etc/*basedir*/emcpower/EMCpower.LINUX-5.0.0/bin

- ◆ .cmds
- ◆ cmds/emcpadm
- ◆ cmds/emcpdiscover
- ◆ cmds/emcpmgr
- ◆ cmds/emcppurge
- ◆ cmds/emcpreg
- ◆ cmds/powercf
- ◆ cmds/powermig
- ◆ cmds/powermt
- ◆ powerprotect
- ◆ driver/emcp*
- ◆ .drivers_base
- ◆ .drivers_ext
- ◆ .drivers_mgr
- ◆ /lib/libemcp_core.so
- ◆ /lib/libemcp_lam.so
- ◆ /lib/libemcp_lic_rtl.so
- ◆ /lib/libemcp_mp_rtl.so

- ◆ /lib/libemcpmp.so
- ◆ /lib/libemcp.so
- ◆ /lib/libpn.so
- ◆ sharedlibs
- ◆ .staticlibs

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/i18n/catalog

- ◆ de/LC_MESSAGES/EMCpower.mo
- ◆ de/LC_MESSAGES/PowerPath.mo
- ◆ es/LC_MESSAGES/EMCpower.mo
- ◆ es/LC_MESSAGES/PowerPath.mo
- ◆ fr/LC_MESSAGES/EMCpower.mo
- ◆ fr/LC_MESSAGES/PowerPath.mo
- ◆ it/LC_MESSAGES/EMCpower.mo
- ◆ it/LC_MESSAGES/PowerPath.mo
- ◆ ja/LC_MESSAGES/EMCpower.mo
- ◆ ja/LC_MESSAGES/PowerPath.mo
- ◆ ko/LC_MESSAGES/EMCpower.mo
- ◆ ko/LC_MESSAGES/PowerPath.mo
- ◆ pt/LC_MESSAGES/EMCpower.mo
- ◆ pt/LC_MESSAGES/PowerPath.mo
- ◆ zh/LC_MESSAGES/EMCpower.mo
- ◆ zh/LC_MESSAGES/PowerPath.mo

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/man

- ◆ emcpadm.1
- ◆ emcpreg.1
- ◆ emcpupgrade.1
- ◆ .man
- ◆ powerformat.1
- ◆ powermig.1
- ◆ powermt.1
- ◆ powerprotect.1

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0

- ◆ modprobe.conf.pp
- ◆ PowerMig
- ◆ PowerPath.rhel
- ◆ PowerPath.sles
- ◆ .pp_build_version
- ◆ .pp_major_version
- ◆ .pp_minor_version
- ◆ .pp_patch_version
- ◆ .pp_vendor

/etc/basedir/emcpower

- ◆ log
- ◆ .os_version
- ◆ patch.log
- ◆ powercf
- ◆ .pp_build_version
- ◆ .pp_major_version
- ◆ .pp_minor_version
- ◆ .pp_patch_version
- ◆ .TAG
- ◆ .TAGS

/lib

- ◆ libemcp_core.so
- ◆ libemcp_lam.so
- ◆ libemcp_lic_rtl.so
- ◆ libemcp_mp_rtl.so
- ◆ libemcpmp.so
- ◆ libemcp.so
- ◆ libpn.so
- ◆ modules/*/extra/emcpdm.ko
- ◆ modules/*/extra/emcpgpx.ko
- ◆ modules/*/extra/emcpioc.ko
- ◆ modules/*/extra/emcp.ko
- ◆ modules/*/extra/emcplib.ko
- ◆ modules/*/extra/emcpmpx.ko

/sbin

- ◆ emcpadm
- ◆ emcpdiscover
- ◆ emcppurge
- ◆ emcpreq
- ◆ powermig
- ◆ powermt
- ◆ powerprotect

/usr/share/man/man1

- ◆ emcpadm.1
- ◆ emcpreq.1
- ◆ emcpupgrade.1
- ◆ powerformat.1
- ◆ powermig.1
- ◆ powermt.1
- ◆ powerprotect.1

/var/lock/subsys

- ◆ PowerMig

Red Hat ia64 files

On RHEL ia64 hosts, the following files appear in addition to the common files.

`/emul/ia32-linux/lib`

- ◆ `libemcp_core.so`
- ◆ `libemcp_lam.so`
- ◆ `libemcp_lic_rtl.so`
- ◆ `libemcp_mp_rtl.so`
- ◆ `libemcpmp.so`
- ◆ `libemcp.so`
- ◆ `libpn.so`

`etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin`

- ◆ `lib32/libemcp_core.so`
- ◆ `lib32/libemcp_lam.so`
- ◆ `lib32/libemcp_lic_rtl.so`
- ◆ `lib32/libemcp_mp_rtl.so`
- ◆ `lib32/libemcpmp.so`
- ◆ `lib32/libemcp.so`
- ◆ `lib32/libpn.so`
- ◆ `.sharedlibs32`
- ◆ `driver/emcp_rhelsmp_ia64`
- ◆ `driver/emcpdm_rhelsmp_ia64`
- ◆ `driver/emcpgpx_rhelsmp_ia64`
- ◆ `driver/emcpioc_rhelsmp_ia64`
- ◆ `driver/emcplib.Makefile`
- ◆ `driver/emcplib.c`
- ◆ `driver/emcplib_rhelsmp_ia64`
- ◆ `driver/emcpmpx_rhelsmp_ia64`

SuSE ia64 files

On SuSE ia64 hosts, the following files appear in addition to the common files.

`/emul/ia32-linux/lib`

- ◆ `libemcp_core.so`
- ◆ `libemcp_lam.so`
- ◆ `libemcp_lic_rtl.so`
- ◆ `libemcp_mp_rtl.so`
- ◆ `libemcpmp.so`
- ◆ `libemcp.so`
- ◆ `libpn.so`

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin

- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcump.so
- ◆ lib32/libemcp.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32
- ◆ driver/emcp_slesdefault_ia64
- ◆ driver/emcpdm_slesdefault_ia64
- ◆ driver/emcpgpx_slesdefault_ia64
- ◆ driver/emcpioc_slesdefault_ia64
- ◆ driver/emcplib.Makefile
- ◆ driver/emcplib.c
- ◆ driver/emcplib_slesdefault_ia64
- ◆ driver/emcpx_slesdefault_ia64

Red Hat i386 files

On RHEL i386 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin/driver

- ◆ emcp_rhelhugemem
- ◆ emcp_rhelsmp
- ◆ emcp_rheluni
- ◆ emcpdm_rhelhugemem
- ◆ emcpdm_rhelsmp
- ◆ emcpdm_rheluni
- ◆ emcpgpx_rhelhugemem
- ◆ emcpgpx_rhelsmp
- ◆ emcpgpx_rheluni
- ◆ emcpioc_rhelhugemem
- ◆ emcpioc_rhelsmp
- ◆ emcpioc_rheluni
- ◆ emcplib.Makefile
- ◆ emcplib.c
- ◆ emcplib_rhelhugemem
- ◆ emcplib_rhelsmp
- ◆ emcplib_rheluni
- ◆ emcpx_rhelhugemem
- ◆ emcpx_rhelsmp
- ◆ emcpx_rheluni

SuSE i386 files

On SuSE i386 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin/driver

- ◆ emcp_slesbigsm
- ◆ emcp_slesdefault
- ◆ emcp_slessmp
- ◆ emcpdm_slesbigsm
- ◆ emcpdm_slesdefault
- ◆ emcpdm_slessmp
- ◆ emcpgpx_slesbigsm
- ◆ emcpgpx_slesdefault
- ◆ emcpgpx_slessmp
- ◆ emcpioc_slesbigsm
- ◆ emcpioc_slesdefault
- ◆ emcpioc_slessmp
- ◆ emcplib.Makefile
- ◆ emcplib.c
- ◆ emcplib_slesbigsm
- ◆ emcplib_slesdefault
- ◆ emcplib_slessmp
- ◆ emcpx_slesbigsm
- ◆ emcpx_slesdefault
- ◆ emcpx_slessmp

Red Hat x86_64 files

On RHEL x86_64 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin

- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcpx.so
- ◆ lib32/libemcp.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32
- ◆ driver/emcp_rhellargesmp_x8664
- ◆ driver/emcp_rhelsmp_x8664
- ◆ driver/emcpdm_rhellargesmp_x8664
- ◆ driver/emcpdm_rhelsmp_x8664
- ◆ driver/emcpgpx_rhellargesmp_x8664

- ◆ driver/emcpgpx_rhelsmp_x8664
- ◆ driver/emcpioc_rhellargesmp_x8664
- ◆ driver/emcpioc_rhelsmp_x8664
- ◆ driver/emcplib.Makefile
- ◆ driver/emcplib.c
- ◆ driver/emcplib_rhellargesmp_x8664
- ◆ driver/emcplib_rhelsmp_x8664
- ◆ driver/emcpmpx_rhellargesmp_x8664
- ◆ driver/emcpmpx_rhelsmp_x8664

SuSE x86_64 files

On SuSE x86_64 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.0/bin

- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcpmp.so
- ◆ lib32/libemcp.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32
- ◆ driver/emcp_slessmp_x8664
- ◆ driver/emcpdm_slessmp_x8664
- ◆ driver/emcpgpx_slessmp_x8664
- ◆ driver/emcpioc_slessmp_x8664
- ◆ driver/emcplib.Makefile
- ◆ driver/emcplib.c
- ◆ driver/emcplib_slessmp_x8664
- ◆ driver/emcpmpx_slessmp_x8664

Files created by PowerPath 5.0.1 installation

The files in this section are created when PowerPath 5.0.1 is installed on a Linux host. The first section includes files common to all Linux packages; package-specific files are called out in subsequent sections.

Note: The directory *basedir* is the directory you specified as the PowerPath installation directory (*opt*, if you selected the default).

Common files

The files in this section are common to all Linux packages.

/etc

- ◆ `emcp_devicesDB.dat`
- ◆ `emcp_devicesDB.idx`
- ◆ `emcp_registration`
- ◆ `init.d/PowerMig`
- ◆ `init.d/PowerPath`
- ◆ `modprobe.conf.pp`
- ◆ `opt/emcpower/emcpmgr`
- ◆ `opt/emcpower/log`
- ◆ `opt/emcpower/patch.log`
- ◆ `opt/emcpower/powercf`
- ◆ `powermt.custom`
- ◆ `udev/rules.d/05-udev-pp.rules`

/etc/basedir/emcpower

- ◆ `.__emcp_db_global_lock`
- ◆ `.__emcp_db_lock`
- ◆ `.os_version`
- ◆ `.pp_version`
- ◆ `.tmp/rollbackfiles.tar`
- ◆ `.tmp/rollbackfiles12549.tar`
- ◆ `.tmp/undolist`
- ◆ `.tmp/undolist12549`

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1

- ◆ .pp_build_version
- ◆ .pp_vendor
- ◆ .pp_version
- ◆ PowerMig
- ◆ PowerPath.rhel
- ◆ PowerPath.sles
- ◆ modprobe.conf.pp
- ◆ powermig.sles
- ◆ pp_udev.sh
- ◆ udev-pp.rules
- ◆ boot.powerpath
- ◆ enable

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin

- ◆ .cmds
- ◆ .drivers_base
- ◆ .drivers_ext
- ◆ .drivers_mgr
- ◆ .sharedlibs
- ◆ .staticlibs
- ◆ cmds/emcpadm
- ◆ cmds/emcpdiscover
- ◆ cmds/emcpmgr
- ◆ cmds/emcppurge
- ◆ cmds/emcpreg
- ◆ cmds/powercf
- ◆ cmds/powermig
- ◆ cmds/powermt
- ◆ cmds/powerprotect
- ◆ cmds/pp_inq
- ◆ driver/emcplib.Makefile
- ◆ driver/emcplib.c
- ◆ driver/*

Note: Driver files are documented under each platform.

- ◆ lib/libemcp.so
- ◆ lib/libemcp_core.so
- ◆ lib/libemcp_lam.so
- ◆ lib/libemcp_lic_rtl.so
- ◆ lib/libemcp_mp_rtl.so
- ◆ lib/libemcpmp.so
- ◆ lib/libpn.so

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/i18n/catalog

- ◆ de/LC_MESSAGES/EMCpower.mo
- ◆ de/LC_MESSAGES/PowerPath.mo
- ◆ es/LC_MESSAGES/EMCpower.mo
- ◆ es/LC_MESSAGES/PowerPath.mo
- ◆ fr/LC_MESSAGES/EMCpower.mo
- ◆ fr/LC_MESSAGES/PowerPath.mo
- ◆ it/LC_MESSAGES/EMCpower.mo
- ◆ it/LC_MESSAGES/PowerPath.mo
- ◆ ja/LC_MESSAGES/EMCpower.mo
- ◆ ja/LC_MESSAGES/PowerPath.mo
- ◆ ko/LC_MESSAGES/EMCpower.mo
- ◆ ko/LC_MESSAGES/PowerPath.mo
- ◆ pt/LC_MESSAGES/EMCpower.mo
- ◆ pt/LC_MESSAGES/PowerPath.mo
- ◆ zh/LC_MESSAGES/EMCpower.mo
- ◆ zh/LC_MESSAGES/PowerPath.mo

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/man

- ◆ .man
- ◆ emcpadm.1
- ◆ emcpreg.1
- ◆ emcpupgrade.1
- ◆ powerformat.1
- ◆ powermig.1
- ◆ powermt.1
- ◆ powerprotect.1

/lib

- ◆ libemcp.so
- ◆ libemcp_core.so
- ◆ libemcp_lam.so
- ◆ libemcp_lic_rtl.so
- ◆ libemcp_mp_rtl.so
- ◆ libemcpmp.so
- ◆ libpn.so
- ◆ udev/pp_udev.sh

/lib/modules/`uname -r`/powerpath

- ◆ emcp.ko
- ◆ emcpdm.ko
- ◆ emcpgpx.ko
- ◆ emcpioc.ko
- ◆ emcplib.ko
- ◆ emcpx.ko

/sbin

- ◆ emcpadm
- ◆ emcpdiscover
- ◆ emcppurge
- ◆ emcpregr
- ◆ powermig
- ◆ powermt
- ◆ powerprotect
- ◆ pp_inq

/usr/share/man/man1

- ◆ emcpadm.1
- ◆ emcpregr.1
- ◆ emcpupgrade.1
- ◆ powerformat.1
- ◆ powermig.1
- ◆ powermt.1
- ◆ powerprotect.1

Common SLES 10 SP1 files

The files in this section are common to all SLES 10 SP1 packages.

etc/init.d

- ◆ boot.d/K18boot.powerpath
- ◆ boot.d/S04boot.powerpath
- ◆ boot.powerpath
- ◆ powermig.sles
- ◆ rc3.d/K15powermig.sles
- ◆ rc3.d/S07powermig.sles

Common RHEL 5 files

The files in this section are common to all RHEL 5 packages.

etc/rc3.d

- ◆ K99PowerMig
- ◆ S99PowerMig

RHEL 5 i386

On RHEL 5 ia64 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin/driver

- ◆ rhel5-i686/emcpdm.ko
- ◆ rhel5-i686/emcpgpx.ko
- ◆ rhel5-i686/emcpioc.ko
- ◆ rhel5-i686/emcp.ko
- ◆ rhel5-i686/emcplib.ko
- ◆ rhel5-i686/emcpx.ko
- ◆ rhel5-PAE-i686/emcpdm.ko
- ◆ rhel5-PAE-i686/emcpgpx.ko
- ◆ rhel5-PAE-i686/emcpioc.ko
- ◆ rhel5-PAE-i686/emcp.ko
- ◆ rhel5-PAE-i686/emcplib.ko
- ◆ rhel5-PAE-i686/emcpx.ko
- ◆ rhel5-xen-i686/emcpdm.ko
- ◆ rhel5-xen-i686/emcpgpx.ko
- ◆ rhel5-xen-i686/emcpioc.ko
- ◆ rhel5-xen-i686/emcp.ko
- ◆ rhel5-xen-i686/emcplib.ko
- ◆ rhel5-xen-i686/emcpx.ko

RHEL 5 x86_64

On RHEL 5 x86_64 hosts, the following files appear in addition to the common files.

/lib

- ◆ libemcp_core.so
- ◆ libemcp_lam.so
- ◆ libemcp_lic_rtl.so
- ◆ libemcp_mp_rtl.so
- ◆ libemcpx.so
- ◆ libemcp.so
- ◆ libpn.so

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin

- ◆ lib32/libemcp.so
- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcpx.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32

- ◆ driver/rhel5-x86_64/emcpdm.ko
- ◆ driver/rhel5-x86_64/emcpgpx.ko
- ◆ driver/rhel5-x86_64/emcpioc.ko
- ◆ driver/rhel5-x86_64/emcp.ko
- ◆ driver/rhel5-x86_64/emcplib.ko
- ◆ driver/rhel5-x86_64/emcpmpx.ko
- ◆ driver/rhel5-xen-x86_64/emcpdm.ko
- ◆ driver/rhel5-xen-x86_64/emcpgpx.ko
- ◆ driver/rhel5-xen-x86_64/emcpioc.ko
- ◆ driver/rhel5-xen-x86_64/emcp.ko
- ◆ driver/rhel5-xen-x86_64/emcplib.ko
- ◆ driver/rhel5-xen-x86_64/emcpmpx.ko

RHEL 5 ia64

On RHEL 5 ia64 hosts, the following files appear in addition to the common files.

/emul/ia32-linux/lib

- ◆ libemcp.so
- ◆ libemcp_core.so
- ◆ libemcp_lam.so
- ◆ libemcp_lic_rtl.so
- ◆ libemcp_mp_rtl.so
- ◆ libemcpmp.so
- ◆ libpn.so

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin

- ◆ lib32/libemcp.so
- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcpmp.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32
- ◆ driver/rhel5-ia64/emcpdm.ko
- ◆ driver/rhel5-ia64/emcpgpx.ko
- ◆ driver/rhel5-ia64/emcpioc.ko
- ◆ driver/rhel5-ia64/emcp.ko
- ◆ driver/rhel5-ia64/emcplib.ko
- ◆ driver/rhel5-ia64/emcpmpx.ko

SLES 10 SP1 i386

On SLES 10 SP1 i386 hosts, the following files appear in addition to the common files.

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin/driver

- ◆ sles10sp1bigsmg/emcpdm.ko
- ◆ sles10sp1bigsmg/emcpgpx.ko
- ◆ sles10sp1bigsmg/emcpioc.ko
- ◆ sles10sp1bigsmg/emcp.ko
- ◆ sles10sp1bigsmg/emcplib.ko
- ◆ sles10sp1bigsmg/emcpmpx.ko
- ◆ sles10sp1default/emcpdm.ko
- ◆ sles10sp1default/emcpgpx.ko
- ◆ sles10sp1default/emcpioc.ko
- ◆ sles10sp1default/emcp.ko
- ◆ sles10sp1default/emcplib.ko
- ◆ sles10sp1default/emcpmpx.ko
- ◆ sles10sp1smg/emcpdm.ko
- ◆ sles10sp1smg/emcpgpx.ko
- ◆ sles10sp1smg/emcpioc.ko
- ◆ sles10sp1smg/emcp.ko
- ◆ sles10sp1smg/emcplib.ko
- ◆ sles10sp1smg/emcpmpx.ko
- ◆ sles10sp1xen/emcpdm.ko
- ◆ sles10sp1xen/emcpgpx.ko
- ◆ sles10sp1xen/emcpioc.ko
- ◆ sles10sp1xen/emcp.ko
- ◆ sles10sp1xen/emcplib.ko
- ◆ sles10sp1xen/emcpmpx.ko
- ◆ sles10sp1xenpae/emcpdm.ko
- ◆ sles10sp1xenpae/emcpgpx.ko
- ◆ sles10sp1xenpae/emcpioc.ko
- ◆ sles10sp1xenpae/emcp.ko
- ◆ sles10sp1xenpae/emcplib.ko
- ◆ sles10sp1xenpae/emcpmpx.ko

SLES 10 SP1 x86_64

On SLES 10 SP1 x86_64 hosts, the following files appear in addition to the common files.

/lib

- ◆ libemcp_core.so
- ◆ libemcp_lam.so
- ◆ libemcp_lic_rtl.so
- ◆ libemcp_mp_rtl.so
- ◆ libemcpmp.so
- ◆ libemcp.so
- ◆ libpn.so

/etc/basedir/emcpower/EMCpower.LINUX-5.0.1/bin

- ◆ lib32/libemcp.so
- ◆ lib32/libemcp_core.so
- ◆ lib32/libemcp_lam.so
- ◆ lib32/libemcp_lic_rtl.so
- ◆ lib32/libemcp_mp_rtl.so
- ◆ lib32/libemcpmp.so
- ◆ lib32/libpn.so
- ◆ .sharedlibs32
- ◆ driver/sles10sp1smp_x8664/emcpdm.ko
- ◆ driver/sles10sp1smp_x8664/emcpgpx.ko
- ◆ driver/sles10sp1smp_x8664/emcpioc.ko
- ◆ driver/sles10sp1smp_x8664/emcp.ko
- ◆ driver/sles10sp1smp_x8664/emcplib.ko
- ◆ driver/sles10sp1smp_x8664/emcpmpx.ko
- ◆ driver/sles10sp1xensmp_x8664/emcpdm.ko
- ◆ driver/sles10sp1xensmp_x8664/emcpgpx.ko
- ◆ driver/sles10sp1xensmp_x8664/emcpioc.ko
- ◆ driver/sles10sp1xensmp_x8664/emcp.ko
- ◆ driver/sles10sp1xensmp_x8664/emcplib.ko
- ◆ driver/sles10sp1xensmp_x8664/emcpmpx.ko

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