EMC® PowerPath® for HP-UX

Version 5.1

Installation and Administration Guide

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Preface

As part of an effort to improve and enhance the performance and capabilities of its product line, EMC from time to time releases revisions of its hardware and software. Therefore, some functions described in this guide may not be supported by all revisions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes.

If a product does not function properly or does not function as described in this guide, please contact your EMC representative.

Audience

This guide is part of the PowerPath documentation set, and is intended for use by system or storage administrators during installation, configuration, and administration of the product.

Readers of this guide are expected to be familiar with:

- Storage systems in their environment
- HP-UX operating system
- Applications (for example, clustering software) used with PowerPath

Related documentation

The complete set of EMC enterprise storage documentation for PowerPath, all available from EMC Corporation, includes:

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

- *EMC PowerPath for HP-UX Release Notes*
- *EMC PowerPath for AIX 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 EMC Symmetrix storage systems, refer also to the *EMC Host Connectivity Guide for HP-UX*, which is available on the Powerlink website.

If your environment includes EMC VNX™ Operating Environment (OE) and CLARiiON storage systems, refer also to the following manuals:

- *EMC Host Connectivity Guide for HP-UX*
- VNX OE Storage System Support website (www.emc.com/vnxsupport)
- CLARiiON Storage-System Support website (http://www.emc.com/clariionsupport)
- *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 Interoperability Navigator, available on the Powerlink website.

Conventions used in this guide

This manual uses the following conventions for notes and cautions:

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.

Typographical Conventions

This manual uses the following type style conventions:

AVANT GARDE	Keystrokes
Palatino, bold	◆ Dialog box, button, icon, and menu items in text ◆ Selections you can make from the user interface, including buttons, icons, options, and field names
Palatino, italic	◆ New terms or unique word usage in text ◆ Command line arguments when used in text ◆ Book titles
`Courier, italic`	Arguments used in examples of command line syntax.

`Courier`	System prompts and displays and specific filenames or complete paths. For example:
	`working root directory [/usr/emc]:`
	`c:\Program Files\EMC\Symapi\db`

`Courier, bold`	◆ User entry. For example: **`symmpoll -p`** ◆ Options in command line syntax

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 Customer Service on Powerlink. To open a service request through Powerlink, you must have a valid support agreement. Contact your EMC sales representative for details about obtaining a valid support agreement or to answer any questions about your account.

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 guide to:

`SSGDocumentation@EMC.com`

If you have issues, comments, or questions about specific information or procedures, please include the title and, if available, the part number, the revision (for example, A01), the page numbers, and any other details that will help us locate the subject you are addressing.

1

Installing PowerPath on an HP-UX Host

This chapter includes the following sections:

Before you install

The sequence in which you configure the storage system and install EMC® PowerPath® on a host depends on which storage system you use:

Symmetrix, Hitachi Lightning, Hitachi TagmaStore, HP StorageWorks XP, EVA, EMA, and MA, and IBM ESS systems
Install PowerPath *after* you set up the storage system and verify that it is working properly.

VNX OE and CLARiiON storage systems
PowerPath installation is an integral part of an EMC VNX OE and CLARiiON® setup and configuration procedure. To properly install PowerPath on a host with a VNX OE and CLARiiON array, refer to the support websites:

- CLARiiON Storage-System Support website *(http://www.emc.com/clariionsupport).*
- VNX OE Storage System Support website (*www.emc.com/vnxsupport*)

There you will find step-by-step instructions for installing PowerPath and other CLARiiON software.

To obtain the latest versions of VNX OE and CLARiiON documentation, log in to the EMC Powerlink® website.

Obtain up-to-date information

Check the Powerlink website for current information:

- ❑ PowerPath documentation — EMC updates PowerPath documentation, including this installation guide, when it releases new features with a service pack or when documentation errors are reported. To obtain updated PowerPath documentation on Powerlink, select **Support** > **Technical Documentation and Advisories > Software ~ P-R ~ Documentation > PowerPath Family**.
- ❑ Service packs and upgrades — You can download PowerPath service pack software from Powerlink. Determine which service packs (if any) to install after PowerPath, and whether those service packs have any additional installation prerequisites. To obtain service packs on Powerlink, select **Support** > **Software Downloads and Licensing** > **Downloads P-R** > **PowerPath for HP-UX**.

- EMC Issue Tracker— EMC Issue Tracker is an application on Powerlink that allows you to search for known problems and defects in EMC software. To access Issue Tracker, on Powerlink select **Support** > **Interoperability and Product Lifecycle Information** > **E-Lab Issue Tracker Information** > **E-Lab Issue Tracker**.

  You can use the Issue Tracker to find:

  - Descriptions of PowerPath bugs existing on any host platform that is supported by PowerPath.
  - Workarounds for existing bugs

  EMC updates this database regularly between scheduled releases and service pack releases.

Choose a convenient time

Installing PowerPath entails restarting the host. Plan to install or upgrade PowerPath when a restart will cause minimal disruption.

Locate your license key

The PowerPath license registration key is on the License Key Card that you received from EMC.

Effective February 15, 2011, instead of the physical Right To Use (RTU), the default delivery method for PowerPath licenses is electronic. An electronic License Authorization Code (LAC) is sent by email in order to redeem the license key on the Powerlink Licensing portal. This does not affect upgrades because PowerPath retains existing license information.

Physical RTU cards are still available as an option. EMC Global Support, at 1-800-svc4emc (or 1-800-782-4362), can provide more information. The EMC PowerPath Family Electronic License Ordering Process Technical Notes, available on Powerlink, provides more information about the PowerPath license electronic ordering process.

Note: If you are upgrading from an earlier version of PowerPath, you do not need to reregister. PowerPath will use your existing key.

Prepare the host and storage system

- ❑ Install the required HP-UX service packs. Refer to the HP website and to the EMC E-Lab™ Interoperability Navigator for the most up-to-date service pack requirements.
- ❑ Ensure that the c-bit (common serial number bit) is set on the EMC Symmetrix® interface. Failure to set the c-bit can cause data corruption.
- ❑ Configure the HP-UX host so storage-system disk devices are incorporated into HP-UX. The storage-system devices must be addressed on the Fibre Channel by using SCSI target IDs and SCSI LUNs. Ensure the Symmetrix storage system ports are online.

  The *EMC Host Connectivity Guide for HP-UX* provides more information on both Symmetrix and VNX OE and CLARiiON systems. The VNX OE and CLARiiON systems support websites provide additional information on VNX OE and CLARiiON systems:

  - CLARiiON Storage-System Support website *(http://www.emc.com/clariionsupport).*
  - VNX OE Storage System Support website (*www.emc.com/vnxsupport*)

  For other arrays, refer to the vendor's documentation.
- ❑ Configure the HBA drivers if you have not already done so.

CAUTION

Be sure to follow HBA driver configuration guidelines in the product documentation and E-Lab Navigator (available on Powerlink). Improper settings can cause erratic failover behavior, such as greatly increased I/O delays.

Prepare for a clustered environment

If you are installing PowerPath in a clustered environment, prepare the cluster environment. Chapter 3, "PowerPath in a Cluster," on page 45 contains information on installing PowerPath in a new or existing cluster.

Installing PowerPath

This section describes:

- "Installing from the CD" on page 16.
- "Installing from the tar file" on page 18.
- "Installing a major release and a service pack" on page 20.

Note: If you are upgrading from an earlier release of PowerPath, see "Upgrading PowerPath" on page 28 before you begin the installation.

Table 1 on page 15 shows the operating system names used in this document.

Table 1 Operating system naming convention

Version names	Equivalent names	Supported platforms
11i v1	11.11	PA-RISC
11i v2	11.23	IA64 & PA-RISC
11i v3	11.31	IA64 & PA-RISC

Notes on 11i v3 support

Note the following if you are installing PowerPath on an HP-UX 11i v3 host:

- PowerPath 5.1 disables at the device level the native multipathing for legacy addressed devices. When devices are configured for PowerPath (for example, when you run powermt config), PowerPath disables native multipathing on the devices it manages by setting to false the **leg_mpath_enable** attribute.

  Do not change this setting to enable native multipathing for legacy addressed devices while PowerPath is installed. Removal of devices from PowerPath management reenables multipathing for legacy addressed devices (default HP-UX setting).

  The HP-UX 11i v3 documentation provides more information on legacy addressing in HP-UX 11i v3.

- In earlier releases of HP-UX, failed file system I/Os were retried indefinitely. HP-UX 11i v3 by default no longer retries failed I/Os indefinitely, but instead returns I/O errors to the file system after a finite number of retries. This results in file system error

messages if all paths to a LUN are disabled manually, or fail due to hardware problems. PowerPath does not alter this behavior on HP-UX 11i v3. You can restore the infinite retry on a per device basis by using the HP-UX **scsimgr** command, as follows:

```
scsimgr set_attr -D /dev/rdisk/diskX -a infinite_retries_enable=true
```

The HP website and documentation contains more information.

Installing from the CD

To install PowerPath from the CD:

1. Log in as root.
2. Insert the CD into the CD-ROM drive.
3. Mount the CD on your file system. For example, to mount the CD on **/mnt**, enter:

   `mount /dev/dsk/`*`c#t#d#`* **`/mnt`**

   Note: If the EMC SYMCLI inq utility is installed, you can use it to determine the c#t#d# device for the CD-ROM drive.

4. Install the software:

- If you are performing a fresh PowerPath installation, using the **–x ask=true** option allows you to register PowerPath during the installation process. The following examples use /mnt as the mount point.
  - To install and register PowerPath on HP-UX 11i v1 using the -x ask=true option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false –x ask=true \
-s /mnt/UNIX/HPUX/EMCPower.HPUX.5.1.x/EMCPower.HPUX.5.1.x.GA.bxxx EMCpower.tar
```

  - To install and register PowerPath on HP-UX 11i v2 and 11i v3 using the -x ask=true option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -x ask=true \
-s /mnt/UNIX/HPUX/EMCPower.HPUX.PI.5.1.x/EMCPower.HPUX.PI.5.1.x.GA.bxxx
EMCpower.tar
```

where *SPx* is the service pack number and *bxxx* represents the build number for the release. For example, for PowerPath 5.1 SP2 for HP-UX, the package and build number would be EMCPower.HPUX.5.1.2.GA.b113.

Table 2 on page 17 provides prompts you will need to register PowerPath on the host.

- If you would like to install PowerPath without installing the license keys as part of the installation, and would prefer to install the license keys at a later time, do not use the **–x ask=true** option:
  - To install or upgrade PowerPath on HP-UX 11i v1 without the **–x ask=true** option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.5.1.x.GA.bxxx.tar EMCpower
```

  - To install or upgrade PowerPath on HP-UX 11i v2 or 11i v3 without the **–x ask=true** option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.PI.5.1.x.GA.bxxx.tar EMCpower
```

where *SPx* is the service pack number and *bxxx* represents the build number for the release.

"Registering PowerPath on the host" on page 25 provides information on installing and registering PowerPath license keys on your host. Do not carry out Step 5 of this procedure.

5. Respond to the prompts to register PowerPath, as shown in Table 2 on page 17. User input appears in bold text.

Table 2 Installation prompts

Prompts	Action
`Install PowerPath license keys(s)? [y,n,q,?] (default: n):`	Type: **`y`**
`Specify one PowerPath license key [<key>,q,?]:`	Type the license key: **`xxxx-xxxx-xxxx-xxxx-xxxx-xxxx`**

`Adding key to register:`
`XXXX-XXXX-XXXX-XXXX-XXXX-XXXX`
`Install another PowerPath license key? [y,n,q,?] (default: n):`
	Press **Enter** for the default setting (no).
	To enter another license key, type **`y`** and then respond to the prompts.

`Set PowerPath major number? [y,n,q,?] (default: n):`	Press **Enter** for the default setting (no). **Note:** The major number is not applicable in most configurations.

After swinstall completes, the host restarts automatically. If your configuration includes Veritas Volume Manager, refer to "Supporting Veritas Volume Manager" on page 29.

Installing from the tar file

Use this procedure to install or upgrade to standalone packages. The following PowerPath for HP-UX packages can be installed or upgraded as standalone packages:

- PowerPath 5.1
- PowerPath 5.1 SP2—both fresh installation and upgrade from earlier PowerPath versions

"Installing a major release and a service pack" on page 20 provides information on installing PowerPath 5.1 SP1 for HP-UX.

To download from Powerlink and unzip the compressed tar file:

1. On Powerlink, select **Support** > **Software Downloads and Licensing** > **Downloads P-R** > **PowerPath for HP-UX**.
2. Save the compressed tar file locally. This procedure uses the /tmp directory as the file location.

   If you save the file to another directory and want to copy it to the/tmp directory, use one of the following commands.

   - For HP-UX 11i v1, type:

```
cp <file_location>/EMCPower.HPUX.5.1.x.GA.bxxx.tar.gz /tmp
```

   - For HP-UX 11i v2 or 11i v3, type:

```
cp <file_location>/EMCPower.HPUX.PI.5.1.x.GA.bxxx.tar.gz /tmp
```

   where *SPx* is the service pack number and *bxxx* represents the build number for the release. For example, for PowerPath 5.1 SP2 for HP-UX, the package and build number would be EMCPower.HPUX.5.1.2.GA.b113.

3. Unzip the installation package.

   - For HP-UX 11i v1, type:

     ```
     gunzip /tmp/EMCPower.HPUX.5.1.x.GA.bxxx.tar.gz
     ```

   - For HP-UX 11i v2 or 11i v3, type:

     ```
     gunzip /tmp/EMCPower.HPUX.PI.5.1.x.GA.bxxx.tar.gz
     ```

     where *SPx* is the service pack number and *bxxx* represents the build number for the release.

4. Install the software:

- If you are performing a fresh installation, include the **–x ask=true** option, which initiates the license key registration process as shown in steps 4 on page 16 and 5 on page 17.

  Note: If you are upgrading from PowerPath 5.0.x or 4.5.x, the PowerPath software preserves the license key from the previous version.

  - To install or upgrade PowerPath on HP-UX 11i v1 using the **–x ask=true** option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.5.1.x.GA.bxxx.tar EMCpower
```

  - To install or upgrade PowerPath on HP-UX 11i v2 or 11i v3 using the **–x ask=true** option, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.PI.5.1.x.GA.bxxx.tar EMCpower
```

    where *SPx* is the service pack number and *bxxx* represents the build number for the release.

    Table 2 on page 17 provides prompts you will need to register PowerPath on the host

  The host restarts automatically after swinstall completes. If your configuration includes Veritas Volume Manager, refer to "Supporting Veritas Volume Manager" on page 29.

- If you would like to install PowerPath without installing the license keys, and install the license keys at a later time, do not use the **–x ask=true** option:

  - To install or upgrade PowerPath on HP-UX 11i v1, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.5.1.x.GA.bxxx.tar EMCpower
```

  - To install or upgrade PowerPath on HP-UX 11i v2 or 11i v3, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.PI.5.1.x.GA.bxxx.tar EMCpower
```

    where *SPx* is the service pack number and *bxxx* represents the build number for the release.

    "Registering PowerPath on the host" on page 25 provides information on installing and registering PowerPath license keys on your host.

If your configuration includes Veritas Volume Manager, refer to "Supporting Veritas Volume Manager" on page 29

Installing a major release and a service pack

This procedure describes how to install PowerPath 5.1 and 5.1 SP1 for HP-UX at the same time with one host reboot. Use this procedure if:

- A host uses an ALUA mode or a single-SP CLARiiON AX4-5 device as an external boot device, and you want to install PowerPath. This is because PowerPath 5.1 does not support ALUA or single-SP CLARiiON AX4-5 arrays, so following the normal installation procedure with the reboot after installation of PowerPath 5.1 causes the host to hang during reboot.
- You want to install PowerPath 5.1 SP1 for HP-UX and do not have PowerPath 5.1 installed on the host. PowerPath 5.1 SP1 cannot be installed as a standalone package.

To install the PowerPath 5.1 and 5.1 SP1:

Note: PowerPath 5.1 SP2,shouldbe installed as a standalone package. Follow the procedure provided in "Installing from the tar file" on page 18.

1. Clear out the temporary depot. Type:

```
swremove -x mount_all_filesystems=false -d \* @ /var/spool/sw
```

2. Unzip the installation packages.

   For HP-UX 11i v1, type:

```
gunzip /EMCPower.HPUX.5.1.0.GA.b160.tar.gz
gunzip /EMCPower.HPUX.5.1.SP1.b019.tar
```

   For HP-UX 11i v2 or 11i v3, type:

```
gunzip /EMCPower.HPUX.PI.5.1.0.GA.b160.tar.gz
gunzip /EMCPower.HPUX.PI.5.1.SP1.b019.tar
```

3. Copy PowerPath 5.1 to the temporary depot. Type:
   - For HP-UX 11i v1, type:

```
swcopy -x mount_all_filesystems=false -s
/EMCPower.HPUX.5.1.0.GA.b160.tar EMCpower @ /var/spool/sw
```

   - For HP-UX 11i v2 or 11i v3, type:

```
swcopy -x mount_all_filesystems=false -s
/EMCPower.HPUX.PI.5.1.0.GA.b160.tar EMCpower @ /var/spool/sw
```

4. Copy PowerPath 5.1 SP1 to the temporary depot. Type:

   - For HP-UX 11i v1, type:

```
swcopy -x mount_all_filesystems=false -s
/EMCPower.HPUX.5.1.SP1.b019.tar EMCpower_patch51x @ /var/spool/sw
```

   - For HP-UX 11i v2 or 11i v3, type:

```
swcopy -x mount_all_filesystems=false -s
/EMCPower.HPUX.PI.5.1.SP1.b019.tar EMCpower_patch51x @ /var/spool/sw
```

5. Install from the temporary depot. Type:

   Note: Do not specify a -s option.

```
swinstall -x mount_all_filesystems=false -x autoreboot=true
EMCpower_patch51x
```

   The HP swinstall utility selects 5.1 and 5.1 SP1 to install.

6. Reboot once.

Installing a PowerPath service pack

Take note of the following:

- The procedure provided in "Installing a PowerPath service pack" on page 22 does not apply to PowerPath 5.1 SP2. The procedure provided in "Installing from the tar file" on page 18 applies to both fresh installations of and upgrades to PowerPath 5.1 SP2 from earlier PowerPath versions.
- The procedure provided in "Installing a PowerPath service pack" on page 22 does not apply to a fresh installation of PowerPath 5.1 SP1., The procedure provided in "Installing a major release and a service pack" on page 20 applies to fresh installations of PowerPath 5.1 SP1.
- The procedure provided in "Installing a PowerPath service pack" on page 22 applies to installing PowerPath 5.1 SP1 on a host where PowerPath 5.1 is already installed.
- If you are running an earlier release of PowerPath, do one of the following:
  - Upgrade to PowerPath 5.1 SP2 directly following the procedure in "Installing from the tar file" on page 18.
  - Upgrade to PowerPath 5.1 and then upgrade to PowerPath 5.1 SP1 following the procedure provided in "Installing a PowerPath service pack" on page 22*f*.
  - Remove the earlier release of PowerPath, and then install PowerPath 5.1 and PowerPath 5.1 SP1 simultaneously following the procedure provided in "Installing a major release and a service pack" on page 20.
- All installed hot fixes must be removed before you upgrade to PowerPath 5.1 SP1. Step 2 on page 24 describes how to uninstall hot fixes.
- PowerPath service packs are distributed as tar files on Powerlink.

Installing a PowerPath service pack

To install a PowerPath service pack if you are running PowerPath 5.1:

Note: This procedure does not apply to PowerPath 5.1 SP2. PowerPath 5.1 for HP-UX must be installed on the host.

1. Download the tar file from Powerlink. On Powerlink, select **Support** > **Software Downloads and Licensing** > **Downloads P-R** > **PowerPath for HP-UX**.
2. Save the compressed tar file locally. This procedure uses the /tmp directory as the file location.

   Note: *bxxx* represents the build number for the release. Replace *xxx* with the build number in the filename, for example, b*019*.

   If you save the file to another directory and want to copy it to the/tmp directory, use one of the following commands.

   - For HP-UX 11i v1, type:

```
cp <file_location>/EMCPower.HPUX.5.1.SPx.bxxx.tar.gz /tmp
```

   - For HP-UX 11i v2 or 11i v3, type:

```
cp <file_location>/EMCPower.HPUX.PI.5.1.SPx.bxxx.tar.gz /tmp
```

3. Unzip the installation package.
   - For HP-UX 11i v1, type:

     gunzip /tmp/EMCPower.HPUX.5.1.SP*x*.b*xxx*.tar.gz
   - For HP-UX 11i v2 or 11i v3, type:

     gunzip /tmp/EMCPower.HPUX.PI.5.1.SP*x*.b*xxx*.tar.gz
4. Install the software.
   - For HP-UX 11i v1, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.5.1.SPx.bxxx.tar EMCpower
```

   - For HP-UX 11i v2 or 11i v3, type:

```
swinstall -x autoreboot=true -x mount_all_filesystems=false -s
/tmp/EMCPower.HPUX.PI.5.1.SPx.bxxx.tar EMCpower
```

The host restarts automatically after swinstall completes.

Troubleshooting

Installation of a service pack could fail if the installed hot fixes are not removed before installing the service pack.

Output similar to the following displays from the HP-UX installation utility (swinstall) when installing a service pack:

```
1 filset(s) have been excluded due to exrequisite
dependencies.
```

Cause

Exrequisite information was added to the HP-UX installation utility (swinstall) to fail a service pack installation if hot fixes are installed on the host.

Solution

1. Run **swlist** to view the PowerPath installed packages.
2. If any hot fixes are present, uninstall them by typing:

   ```
   swremove -x mount_all_filesystems=false -x
   autoreboot=true <PowerPath_hotfix_package_name>
   ```

   After the hot fix is removed, the major release remains installed on the host.
3. Install the PowerPath service pack as described in "Installing a PowerPath service pack" on page 22.

After you install

This section describes:

- "Registering PowerPath on the host" on page 25 (first-time installation only).
- "Verify the PowerPath Installation" on page 26

Registering PowerPath on the host

PowerPath 5.1 for HP-UX allows you to register PowerPath license keys during the installation process, as described in Step 4 of "Installing from the CD" on page 16 and Step 4 of "Installing from the tar file" on page 18. If you installed PowerPath for the first time, but did not register the software during the installation process, follow this procedure to register PowerPath.

To register the PowerPath software:

1. Log in as root.
2. Type **emcpreg -install**.

   Output similar to the following appears:

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

3. Type **y** and press **Enter**.

   Output similar to the following appears:

   ```
   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):
   ```

4. Type the PowerPath registration key, and press **Enter**.

   If you enter a valid registration key, output similar to the following appears:

   ```
   1 key(s) successfully added.
   Key successfully installed.
   Key (Enter if done):
   ```

If you enter an invalid registration key, an error message prompts you to enter a valid key. The *EMC PowerPath Version 5.1 Product Guide* provides a list of error messages returned by the emcpreg license registration utility.

5. Press **Enter**. Output similar to the following appears:

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

6. Type **powermt config** to configure PowerPath devices.
7. Enable load balancing and failover by using one of the following commands:

For this storage system	Type this command
VNX OE and CLARiiON storage system	**powermt set policy=co dev=all**
Symmetrix storage system	**powermt set policy=so dev=all**
EMC Invista and other storage systems	**powermt set policy=ad dev=all**

Note: VNX OE devices are managed under the `clariion` storage class. In powermt display, any VNX OE devices that you may have under PowerPath management appear as CLARiiON devices.VNXe devices are managed under the `generic` storage class. In powermt display, any VNXe devices that you may have under PowerPath management appear as Celerra devices.

8. Check the EMC support website, and install any required PowerPath 5.1 service packs.

Verify the PowerPath Installation

1. Verify that PowerPath is installed properly on the host. Enter:

```
# swlist | grep EMC
```

You should see output similar to this:

```
EMCpower HP.5.1.SP2_b083 PowerPath IA64
```

Thereafter can use the following commands for obtaining a more detailed verification in terms of version number and assistance in the monitoring of HBAs and other devices.

- The `powermt version` command

- The `powermt display` command

2. Verify that the PowerPath kernel extension is loaded on the host. Enter:

```
# kcmodule | grep *emc*
```

You should see output similar to this:

```
emcp                 static  best
emcpgpx              static  best
emcpmpx              static  best
emcppbx              static  best
```

Enter the next command:

```
# lsdev | grep *emc*
```

You should see output similar to this:

```
140           6          emcp             pseudo
```

Upgrading PowerPath

- Before upgrading PowerPath, check the Powerlink website for the most current release notes and service packs. Determine which service packs (if any) to install.
- You can upgrade to PowerPath 5.1 from PowerPath 5.0.x and 4.5.x without uninstalling the previous version. Before upgrading, uninstall the previous version:
  - 4.4.x
  - 4.3.x
  - 4.2.x
  - 4.1.x
  - 3.0.x

  All upgrade scenarios require a host restart.

  Note: If a version of PowerPath earlier than 3.0 is installed on the host (for example, PowerPath 1.5 or 2.0), contact your EMC Customer Support representative for upgrade information.
- The upgrade preserves your existing PowerPath license. You do not need to reenter license information.
- Upgrading preserves your 5.x, 4.x, or 3.x customized settings, with this exception: Customized write throttle queue settings are not preserved. You must reinstate those settings after you upgrade.

  To upgrade to PowerPath 5.1, follow the instructions and procedures in "Installing from the tar file" on page 18.

Supporting Veritas Volume Manager

If you run Veritas Volume Manager v3.2 (or later) with a VNX OE and CLARiiON storage system or with an HP StorageWorks MA, EMA, or EVA storage system, use the following procedure after you install PowerPath to prevent a duplicate disk ID. Duplicate disk IDs can cause the Veritas vxinstal or vxconfigd commands to function incorrectly.

1. Type:

For this array	Type this command
VNX OE and CLARiiON	**`vxddladm addjbod vid=DGC pagecode=0x83 offset=8 length=16`** **Note:** Do *not* execute this command if you are booting from the VNX OE or CLARiiON storage system using a VxVM boot disk.
HP MA or EMA	**`vxddladm addjbod vid=DEC pid=HSG80 pagecode=0x83 offset=8 length=16`**
HP EVA 3000/ 5000 with VCS 3.x	**`vxddladm addjbod vid=HP pid=HSV100 pagecode=0x83 offset=8 length=16`**

2. Restart the system for the command to take effect.
3. Ensure the configuration is correct. Run the following command and verify the output:

   `vxddladm listjbod`

   For example, for a VNX OE and CLARiiON system, output similar to the following appears:

```
VID PID      Opcode Page Code Page Offset SNO length
=======================================================
DGC ALL PIDs    18     131        8          16
```

If you subsequently remove PowerPath from the host, return Veritas DMP to its default state for VNX OE and CLARiiON or HP StorageWorks MA, EMA, or EVA devices as follows:

1. Type:

For this array	Type this command
VNX OE and CLARiiON	`vxddladm rmjbod vid=DGC`
HP MA or EMA	`vxddladm rmjbod vid=DEC`
HP EVA 3000 or 5000 arrays with VCS 3.x firmware	`vxddladm rmjbod vid=HP`

2. Restart the host.

PowerPath coexistence with HP-UX native multipath

HP-UX native multi-path (nMP) is a new feature with HP-UX 11.31. When PowerPath is installed on a system running HP-UX 11.31, PowerPath is inserted in the IO stack above nMP. By default, PowerPath will assume management of all PowerPath supported storage classes and thus provide IO path selection on those devices.

To prevent PowerPath from managing a storage class or specific device and return control to HP-UX nMP, use the **powermt unmanage** command.

Coexistence with third-party path management software

Note: This section applies only to HP-UX releases prior to HP-UX 11.31.

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 AutoPath XP Virtual Array

However, PowerPath cannot *co-manage* devices with third-party path management software. During installation of PowerPath 5.1, 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 an HP-UX 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 AutoPath XP Virtual Array	HP StorageWorks XP

Behavior with third-party multipathing software

PowerPath co-management is not supported by third-party array path management products. Therefore, when you enable PowerPath 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 run **powermt manage class=**<*class*>.

If this software is present or enabled	Multipathing behavior is undefined if you type this command
HDLM	`powermt manage class=hitachi`
SDD	`powermt manage class=ess`
HP StorageWorks Secure Path	`powermt manage class=hphsx`
HP StorageWorks AutoPath XP Virtual Array	`powermt manage class=hpxp`

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 run, support for the relevant third-party arrays will remain disabled across restarts.

Similarly, before you install third-party path management software on an HP-UX system where PowerPath 5.1 is already installed, disable any support by PowerPath for the relevant third-party array devices by running **powermt unmanage class=**<*class*>.

Before you install or enable this software	Type this command
HDLM	`powermt unmanage class=hitachi`
SDD	`powermt unmanage class=ess`
HP StorageWorks Secure Path	`powermt unmanage class=hphsx`
HP StorageWorks AutoPath XP Virtual Array	`powermt unmanage class=hpxp`

2

Configuring a PowerPath Boot Device on HP-UX

This chapter includes the following sections:

Configuring a PowerPath device as the boot device

On some storage systems, you can use a PowerPath device as the boot device (device that contains the startup image). Consult the PowerPath release notes to find out if your storage system supports PowerPath boot devices. Use of a PowerPath device as the boot device provides load balancing and path failover.

Considerations for VNX OE and CLARiiON storage

In a VNX OE and CLARiiON environment:

- Use a single LUN for a root volume group from SP A or from SP B.
- Use at least one *active* alternate link in a root volume group configuration *in addition to* the primary link for protection against link failure at boot time. For example, if you select a boot LUN that is owned by SP A, then paths to SP A are considered active.
- Use at least one *passive* alternate link in a root volume group configuration for protection against SP failures at boot time. For example, if you select a boot LUN that is owned by SP A, then paths to SP B are considered passive.

  In configurations, where the root volume group has passive alternate links, LVM reports errors about those alternate links during the boot process. For any passive path, these errors are expected and can be ignored. The following is an example of those errors.

```
LVM : Failure in attaching PV (0/8/0/0.121.6.0.0.0.1) to the root volume group.
error no : 5

lvlnboot: Warning: couldn't query physical volume "/dev/dsk/c25t0d1":
The specified path does not correspond to physical volume attached to this
volume group
lvlnboot: Warning: couldn't query all of the physical volumes.
```

In the event of failure on an active SP (for example, the SP that owns the LUN is down), manually trespass the LUN to the passive SP. The host can then boot from one of the passive alternate links specified in the root volume group configuration. After the trespass, the passive link now becomes the active link.

Configuring a PowerPath boot device with LVM

To configure a PowerPath device as the boot device, follow these steps:

Note: Do not configure or format devices with LVM when the devices are involved in a migration that uses PowerPath Migration Enabler. This is applicable only for HP-UX 11i Version 1.

1. Log in as root.
2. Install PowerPath. Chapter 1, "Installing PowerPath on an HP-UX Host." on page 11 details how to install PowerPath.
3. Boot the host in single-user mode.
4. Mount the **/usr** and **/var** file systems.
5. Create a new volume group that contains the target PowerPath device. Before proceeding, make sure the device you are selecting is not used by any file system or volume group. In the following examples, c2t0d0 is the PowerPath device.
   a. Initialize the boot device and create the LIF utilities and LIF AUTO file on the boot device. Type:

      ```
      pvcreate -B -f /dev/rdsk/c2t0d0
      mkboot /dev/rdsk/c2t0d0
      mkboot -a "hpux" /dev/rdsk/c2t0d0
      ```

   b. Create the new root volume group directory. Type:

      ```
      mkdir /dev/vgboot
      ```

   c. Determine the next available minor number for the group device, and create a character special file for the group device. Type:

      ```
      ls -l /dev/*/group
      mknod /dev/vgboot/group c 64 <minor_number>
      ```

      where <*minor_number*> is the next available minor number.

   d. Create the volume group. Type:

      ```
      vgcreate /dev/vgboot /dev/dsk/c2t0d0
      ```

      If more space is needed, extend the volume group by using **vgextend** to include more PowerPath devices.

6. In the new volume group, create the logical devices (root, stand, dump, swap, and usr) required to boot the host. Their sizes should be equal to or larger than the sizes of the corresponding logical devices in the current boot disk. Type:

```
lvcreate -L 200 -N altstand -r n -s y -C y /dev/vgboot
lvcreate -L 300 -N altroot -r n -s y -C y /dev/vgboot
lvcreate -L 200 -N altswap -r n -s y -C y /dev/vgboot
lvcreate -L 400 -N altusr /dev/vgboot
```

7. Create file systems and ensure that the file system types (HFS or VXFS) match their respective types in the current boot disk. Type:

```
newfs -F vxfs /dev/vgboot/raltroot
newfs -F hfs /dev/vgboot/raltstand
newfs -F vxfs /dev/vgboot/raltusr
```

8. Create mount points, mount the file systems, and check that their sizes match the sizes in the current boot disk. Type:

```
mkdir /altroot
mkdir /altusr
mount /dev/vgboot/altroot /altroot
mount /dev/vgboot/altusr /altusr
```

9. Copy the **root**, **stand**, and **usr** file systems to their alternate locations mounted on altroot, altstand, and altusr, respectively. Type:

```
cd /
find . -xdev| cpio -pdmux /altroot
cd /stand
find . -xdev| cpio -pdmux /altstand
cd /usr
find . -xdev| cpio -pdmux /altusr
```

10. Update the BDRA for the new volume group, to ensure that the host can boot from the alternative disk. Type:

```
lvlnboot -b /dev/vgboot/altstand /dev/vgboot
lvlnboot -r /dev/vgboot/altroot /dev/vgboot
lvlnboot -s /dev/vgboot/altswap /dev/vgboot
lvlnboot -d /dev/vgboot/altswap /dev/vgboot
```

11. Check the boot configurations. Type:

    lvlnboot -v

    Output similar to the following appears:

```
Boot definitions for Volume Group /dev/vg00:
Physical Volumes belonging in Root Volume Group:
     /dev/dsk/c1t5d0 (10/0.5.0) -- Boot Disk
Boot: lvol1 on: /dev/dsk/c1t5d0
Root: lvol3 on: /dev/dsk/c1t5d0
Swap: lvol2 on: /dev/dsk/c1t5d0
Dump: lvol2 on: /dev/dsk/c1t5d0, 0

Boot definitions for Volume Group /dev/vgboot:
Physical Volumes belonging in Root Volume Group:
     /dev/dsk/c2t0d0 (10/8.0.0) -- Boot Disk
Boot: altstand on: /dev/dsk/c2t0d0
Root: altroot on: /dev/dsk/c2t0d0
Swap: altswap on: /dev/dsk/c2t0d0
Dump: altswap on: /dev/dsk/c2t0d0, 0
```

12. Update the **/altroot/etc/fstab** file to reflect the root, stand, swap, usr, and any other file systems. Also, in fstab, change the volume group name and logical device names to reflect their correct assignments. For example:

```
# System /etc/fstab file. Static information about file systems
# See fstab(4) and sam(1M) for further details on configuring devices
/dev/vgboot/altroot  / vxfs delaylog 0 1
/dev/vgboot/altstand  /stand  hfs defaults 0 1
/dev/vg00/lvol4  /tmp vxfs delaylog 0 2
/dev/vg00/lvol6  /opt   vxfs delaylog 0 2
/dev/vgboot/altusr  /usr vxfs delaylog 0 2
/dev/vg00/lvol8 /var vxfs delaylog 0 2
/dev/dsk/c3t2d0 /cdrom cdfs ro,suid 0 0
```

13. Change the boot path. Enter:

    setboot -p *<hardware_path>*

14. Shut down and restart the host.

15. To create redundancy in the event the primary boot path fails, configure an alternate path by using the LVM pvlink feature. For example, type:

    vgextend /dev/vgboot /dev/dsk/c3t0d0

    where c3t0d0 is the boot power device from a different hardware path.

16. Change the alternate boot path to the new hardware path, by entering the following at the **Main Menu: Enter command** or **menu** prompt while the host boots:

    path alternate <*hardware_path*>

17. Boot from the alternate path. Type:

    boot alternate

    This example assumes the **var**, **tmp**, and **opt** file systems are still located on their original logical devices on the *non-power* device boot disk. If disk space permits, you can migrate these file systems to logical devices created on the new boot volume group.

For HP-UX 11i Versions 2 and 3

To configure a PowerPath device as the boot device using HP-UX 11i Versions 2 or 3, the procedure is as follows:

The Dynamic Root Disk (DRD) product enables the creation of a clone of boot disk to minimize both planned and unplanned downtime. By using DRD commands, the application of all patches, the PowerPath package and other modifications to the cloned image without affecting the system's active image, is possible. The DRD product is available with HP-UX 11i Version 3 operating system (September 2009) by default. On the HP-UX 11i Version 2, the DRD product is available with June 2009 operating system patch bundle; and this product can be downloaded from the HP website.

1. To check whether the DRD is currently available in the system, run the following command.

```
# swlist -l product | grep DRD
  DRD                    A.1.1.0.344    Dynamic Root Disk
```

2. To access the help menu of the drd command, do the following:

```
# drd clone -?
Usage:
    drd clone  [options]
```

The available options are:

- p: To activate the preview mode
- q: To decrease the verbosity of the output
- t block device file: Specifies the target
- v: Increase the verbosity of the output
- x ext_option = value: set the extended option to value (multiple -x options can be specified)

- x option_file: Read extended option settings from this file

Use the "drd clone -<option> - ?" command to obtain a description of options that have arguments.

To create the external boot device, select a target disk and complete the following procedure:

1. Login as root.
2. Note down the Agile or Legacy name (For example: disk62 or c2t1d4).
3. Execute the following command to create a clone disk for external boot.

```
root@lcla221:> drd clone -t /dev/disk/disk62
```

The output is as follows:

```
=======  10/01/09 12:46:08 MDT  BEGIN Clone System Image (user=root)
(jobid=lcla221)

       * Reading Current System Information
       * Selecting System Image To Clone
      * Converting legacy DSF "/dev/dsk/c2t0d0" to "/dev/disk/disk47"
       * Selecting Target Disk
       * Selecting Volume Manager For New System Image
       * Analyzing For System Image Cloning
       * Creating New File Systems
       * Copying File Systems To New System Image
       * Making New System Image Bootable
       * Unmounting New System Image Clone

=======  10/01/09 13:44:49 MDT  END Clone System Image succeeded.
(user=root)  (jobid=lcla221)
```

4. To view the clone root status of the system, execute the following command.

```
# drd status
```

5. View log messages in /var/opt//drd/drd.log.
6. To activate the new clone disk as default boot disk after next reboot, execute the following command:

```
# drd activate
```

The output is as follows:

```
=======  10/01/09 14:14:11 MDT  BEGIN Activate Inactive System Image
(user=root)  (jobid=lcla221)
```

```
       * Checking for Valid Inactive System Image
       * Reading Current System Information
       * Locating Inactive System Image
       * Determining Bootpath Status
       * Primary bootpath : 0/1/1/0.0x0.0x0 before activate.
       * Primary bootpath : 0/4/1/0.0x5006016039a036b9.0x4006000000000000 after
         activate.
       * Alternate bootpath : 0/1/1/0.0x1.0x0 before activate.
       * Alternate bootpath : 0/1/1/0.0x1.0x0 after activate.
       * HA Alternate bootpath : 0/1/2/0 (LAN Interface) before activate.
       * HA Alternate bootpath : 0/1/2/0 (LAN Interface) after activate.
       * Activating Inactive System Image

=======  10/01/09 14:14:21 MDT  END Activate Inactive System Image succeeded.
(user=root)  (jobid=lcla221)
```

Instead of “drd activate”, the “setboot” command can also be used to set the new boot path as primary after next reboot.

The DRD Product support cloning of a VxVM root on HP-UX 11i v3 from March,08 release onward.

Configuring a PowerPath boot device with VxVM

The process described here assumes that the host is running HP-UX 11i v1.0 (September 2002 or later) and Veritas Volume Manager (VxVM).

To configure a PowerPath device as the boot device:

Note: Do not configure or format devices with VxVM while the devices are involved in a migration that uses PowerPath Migration Enabler. For the PowerPath 5.1 SP2 release, EMC recommends using VxVM 5.0 MP1 RP3.

1. Ensure that VxVM is configured.
2. Select a storage system device as the new VxVM rootable boot disk. The device you choose must have a capacity approximately equal to that of the current LVM boot disk volume.

   For example, select c10t0d0.
3. If there is more than one path to the selected storage system device, use the **vxdiskadm** command to select a path that is known to VxVM.

   For example, the storage system device has two paths, c10t0d0 and c12t0d0, but only c10t0d0 is known to VxVM.
4. Type:

   `/etc/vx/bin/vxcp_lvmroot -v -b` *`<device>`*

   Where *<device>* is the storage system device you selected in step 2.

   For example, type:

   `/etc/vx/bin/vxcp_lvmroot -v -b c10t0d0`

   This command incudes the storage system device c10t0d0 in the rootdg, creates all the file systems on this device, and runs the setboot command to set the boot path to this device.

   Note: If the selected storage system device is slightly smaller than the local LVM disk, use the **-R** option in the vxcp_lvmroot command to compress file systems that are not full. For example, if the selected device is 20% smaller than the local LVM disk, use the following command:
   `/etc/vx/bin/vxcp_lvmroot -v -R 20 -b c10t0d0`
   For more information, refer to the vxcp_lvmroot man page.
5. Restart the host.

3

PowerPath in a Cluster

This chapter includes the following sections:

PowerPath in an MC/ServiceGuard cluster

This section describes how to:

- Install PowerPath and MC/ServiceGuard in a new cluster, that is, where neither PowerPath nor MC/ServiceGuard software is installed on any host to be included in the cluster.
- Integrate PowerPath into an existing MC/ServiceGuard cluster.
- Integrate MC/ServiceGuard into a PowerPath environment.

Note: If you are running PowerPath on an HP-UX 11i v3.0 host, do not use any new command options designed for new-style device special files. PowerPath 5.1 does not support the new style of devices

Installing PowerPath in a new MC/ServiceGuard cluster

To install and configure PowerPath and MC/ServiceGuard when neither PowerPath nor the MC/ServiceGuard software is installed:

1. On all hosts, prepare the cluster hardware. Make the necessary networking and disk connections among the hosts and the storage system. Refer to the relevant HP documentation. In Symmetrix or VNX OE and CLARiiON environments, refer also to the support system websites:
   - VNX OE Storage System Support website (www.emc.com/vnxsupport)
   - CLARiiON Storage-System Support website (http://www.emc.com/clariionsupport).
2. Complete the following steps on one host:
   a. Install PowerPath. Follow the instructions in "Installing PowerPath" on page 15.
   b. Run **vgdisplay -v** to identify the volume group to which each PowerPath device belongs.
   c. Run **vgchange -a n** *<volume_group>* to deactivate the volume group to share with the other hosts in the cluster.
   d. Install the MC/ServiceGuard software by following the instructions in the relevant HP documentation. Configure MC/ServiceGuard to use the shared volume group identified in step 2b.

e. Run **vgexport -p -s -v -m** <*map_file volume_group*> to export the volume group.

f. Use **rcp** or **ftp** to copy the map file to the other hosts in the cluster.

3. Complete the following steps on each remaining host in the cluster:

   a. Install PowerPath. Follow the instructions in "Installing PowerPath" on page 15. Do not create any volume groups; instead, you will import the shared volume group from the host on which you installed PowerPath in step 2a.

   b. Run **vgimport -s -v -m** <*map_file volume_group*> to import the shared volume group.

   c. Run **vgchange -a n** <*volume_group*> to deactivate the shared volume group.

   d. Install MC/ServiceGuard following the instructions in the relevant HP documentation. Configure MC/ServiceGuard to use the shared volume group identified in step 2b.

4. On all hosts in the cluster:

   a. To prevent package volume groups from being activated at system boot time, set the **AUTO_VG_ACTIVATE** flag to **0** in the **/etc/lvmrc** file.

   b. Include all the volume groups that are not cluster-bound in the **custom_vg_activation** function. Volume groups that will be used by packages should not be included anywhere in the file, since they will be activated and deactivated by package control scripts.

      The root volume group does not need to be included in custom_vg_activation, since it is activated automatically before /etc/lvmrc is used at boot time.

   c. Start cluster services by using the **cmrunnode** command. Alternatively, enable automatic cluster startup by setting the **AUTOSTART_CMCLD** flag to **1** in the **/etc/rc.config.d/cmcluster** file. With automatic cluster startup, the host joins the cluster at boot time.

Note: Automatic cluster startup is the preferred way to start a cluster.

Once cluster services are started, the shared volume group and its underlying PowerPath devices are under the control of MC/ServiceGuard for failure monitoring and detection, and for automated shutdown and failover of critical data services.

Integrating PowerPath into an MC/ServiceGuard cluster

Integrating PowerPath into an existing MC/ServiceGuard cluster requires that you coordinate actions among hosts, so you do not disrupt cluster services. On a host-by-host basis, you must shut down the packages that are running on the host, start them on other hosts, halt the cluster services on the host, install PowerPath, and restart with clustering enabled. Ideally, you should schedule this for a time when cluster activity is at a minimum.

To integrate PowerPath into an existing MC/ServiceGuard cluster, on each host in the cluster, one host at a time:

1. Run **cmhaltpkg** <*package_name*> (or use SMH or SAM) to stop each package running on the current host.
2. Run **cmrunpkg -n** <*host_name package_name*> (or use SMH or SAM) to start each package on an adoptive (takeover) host.
3. Run **cmhaltnode** (or use SMH or SAM) to stop the cluster services on the current host.
4. Install PowerPath. Follow the instructions in "Installing PowerPath" on page 15.
5. Run **cmrunnode** to start cluster services on the current host.

Once cluster services are started, the shared volume group and its underlying PowerPath devices are under the control of MC/ServiceGuard for failure monitoring and detection and for automated shutdown and failover of critical data services.

Integrating MC/ServiceGuard in a PowerPath environment

When one or more of the hosts that will be part of the cluster have PowerPath installed, but none has MC/ServiceGuard installed, follow this procedure:

1. On all hosts, prepare the cluster hardware. Make the necessary networking and disk connections among the hosts and the storage system. Refer to the relevant HP documentation. In Symmetrix or VNX OE and CLARiiON environments, refer also to the *EMC Host Connectivity Guide for HP-UX* or to the support system websites:
   - VNX OE Storage System Support website (www.emc.com/vnxsupport)
   - CLARiiON Storage-System Support website (http://www.emc.com/clariionsupport).
2. On every host on which PowerPath is already installed:
   a. Run **vgdisplay -v** to identify the volume group to which each PowerPath device belongs.
   b. Run **vgchange -a n** <*volume_group*> to deactivate the volume group you want to share with the other cluster hosts.
   c. Install MC/ServiceGuard, following the instructions in the relevant HP documentation. Configure MC/ServiceGuard to use the shared volume group identified in step 2a.
   d. Run **vgexport -p -s -v -m** <*map_file volume_group*> to export the volume group.
3. On a single host on which PowerPath is already installed:

   Use **rcp** or **ftp** to copy the map file to the hosts in the cluster that do not have PowerPath installed.
4. On every host on which PowerPath is not installed:
   a. Install PowerPath. Follow the instructions in "Installing PowerPath" on page 15. Do not create any volume groups. Instead, you will import the shared volume group from a host on which PowerPath is already installed.
   b. Run **vgimport -s -v -m** <*map_file volume_group*> to import the shared volume group.

c. Run **vgchange -a n** <*volume_group*> to deactivate the shared volume group.

d. Install MC/ServiceGuard, following the instructions in the relevant HP documentation. Configure MC/ServiceGuard to use the shared volume group identified in step 2a.

5. On all hosts in the cluster:

   a. To prevent package volume groups from being activated at system boot time, set the **AUTO_VG_ACTIVATE** flag to **0** in the **/etc/lvmrc** file.

   b. Then include all volume groups that are not cluster-bound in the **custom_vg_activation** function. Volume groups that will be used by packages should not be included anywhere in the file, since they will be activated and deactivated by package control scripts.

      The root volume group does not need to be included in **custom_vg_activation,** since it is activated automatically before /etc/lvmrc is used at boot time.

   c. Start cluster services using the **cmrunnode** command. Alternatively, enable automatic cluster startup by setting the **AUTOSTART_CMCLD** flag to **1** in the /etc/rc.config.d/cmcluster file. With automatic cluster startup, the host joins the cluster at boot time.

      Note: Automatic cluster startup is the preferred way to start a cluster.

Once cluster services are started, the shared volume group and its underlying PowerPath devices are under the control of MC/ServiceGuard for failure monitoring and detection and for automated shutdown and failover of critical data services.

PowerPath in a Veritas Cluster Server cluster

This section describes how to:

- Install PowerPath and VCS in a new cluster, that is, where neither PowerPath nor VCS software is installed on any host to be included in the cluster.
- Integrate PowerPath into an existing VCS cluster.

Installing PowerPath in a new VCS cluster

To install PowerPath and VCS when neither is installed on any host:

1. On each host to be included in the cluster:
   a. Prepare the cluster hardware. Make the necessary networking and disk connections among the hosts and the storage system. Refer to the relevant VCS documentation. In Symmetrix or VNX OE and CLARiiON environments, refer also to the *EMC Host Connectivity Guide for HP-UX* or the storage system websites:
      – VNX OE Storage System Support website (www.emc.com/vnxsupport)
      – CLARiiON Storage-System Support website (http://www.emc.com/clariionsupport).
   b. Use the HP **ioscan -fnC disk** or EMC **inq** utility to verify that all storage system devices are seen by each host.
   c. Install PowerPath. Follow the instructions in "Installing PowerPath" on page 15. Verify that PowerPath can see all the devices.
   d. Install any applications.
   e. Install the VCS software. Follow the installation procedure described in the relevant Veritas Cluster Server documentation. Initially configure VCS to run without a service group. Start cluster services on all hosts.
2. On each node in the cluster, define the resources (for example, VxVM volumes) that make up the service group. (You will configure the service group in step 3.)

3. On one node in the cluster:
   a. Configure the service group by adding the resources you defined in step 2 to the **/etc/VRTSvcs/conf/config/main.cf** file. The disk or logical device resources should use native c#t#d# devices. In addition, if you use service group heartbeat disks, they too should use native c#t#d# devices.

      Note: Using a disk for service group heartbeat instead of a network is subject to restrictions. Not all disks can be used. Consult the Veritas documentation.

   b. Start cluster services on the host.
4. Start cluster services on each remaining node in the cluster. These hosts rebuild their local configuration files from the **main.cf** file you edited in step 3a.
5. On each node in the cluster:
   a. Verify that the service group is up and running, and use either the VCS GUI (hagui) or the **hagrp -list** command to verify that the service group can successfully fail over to all hosts in the cluster.
   b. Add other service groups as needed.

Integrating PowerPath into a VCS cluster

To integrate PowerPath into an existing VCS cluster:

1. Type **hastop -local -evacuate** on each node in the cluster to stop cluster services on the node.
2. On each node in the cluster, install or upgrade PowerPath. Follow the instructions in "Installing PowerPath" on page 15.
3. Run **hastart** to start cluster services on the node where you changed the **main.cf** file, and wait for the node to be fully reintegrated into the cluster.
4. Run **hastart** to start the remaining nodes in the cluster, waiting for each node to be fully integrated into the cluster before running **hastart** on the next node.

4

Migrating to PowerPath

This chapter includes the following sections:

Migrating from HP StorageWorks Secure Path

This section describes how to migrate to PowerPath from Secure Path.

Secure Path operation on HP-UX

Secure Path replaces all native cXtYdZ devices that belong to a particular EVA or HSG80 LUN (there is one such native device for each path) with one unique cPt0dZ device. The original native devices are not usable as long as Secure Path is installed. The pseudo devices can be initialized and added to Veritas disk groups. Volumes can be built on them.

Migration procedure

Note: This procedure applies only to migrating data that resides directly on raw Secure Path pseudo devices, or file systems that are built directly on raw Secure Path pseudo devices. If Veritas volumes are built by using Secure Path pseudo devices and Secure Path is then uninstalled, the Veritas recovery manager subsequently fails to detect the volumes on the underlying c*X*t*Y*d*Z* devices. You must back up such volumes *before* you uninstall Secure Path and then restore them to freshly built PowerPath-based volumes.

To migrate from Secure Path to PowerPath:

1. Stop I/O activity from the host to the Secure Path pseudo devices:
   a. Unmount any layered file systems.
   b. In **/etc/fstab**, comment out any file system entries that directly use Secure Path pseudo names.
2. Install PowerPath.

   PowerPath detects an existing Secure Path installation and appear unmanaged on the HP hsx devices.
3. Uninstall Secure Path.

   This forces a host restart.

4. After the host boots, restore all devices that are managed by the hsx driver back to the native sdisk driver. To accomplish this for all EVA and HSG80 LUNs:

   a. Identify any HSG or HSV devices currently owned by the hsx driver, and transfer ownership of these devices to the sdisk driver. Type the following commands:

```
ioscan -fn | grep HSG | grep hsx | awk '{print "ioscan -H ", $3, " -M sdisk"}' \
                > /tmp/fix_hsx.txt
ioscan -fn | grep HSV | grep hsx | awk '{print "ioscan -H ", $3, " -M sdisk"}' \
                >> /tmp/fix_hsx.txt
ksh < /tmp/fix_hsx.txt
```

   b. Rebuild c*X*t*Y*d*Z* devices as needed for EVA or HSG LUNs. Type the following commands:

```
ioscan -fnC disk
insf -e
ioscan -fnC disk
```

   The last ioscan command should show one c*X*t*Y*d*Z* device for every logical path to every EVA or HSG LUN allocated to the host.

5. Type the following command:

```
powermt manage class=hphsx
```

6. Verify that all paths to all StorageWorks LUNs are visible to PowerPath. Type the following command:

```
powermt display dev=all class=hphsx
```

7. If, for performance, LUNs were originally distributed *preferred* across both EVA or HSG80 controllers, run the **powermt restore** command.

8. Edit **/etc/fstab** for those file systems that formerly used Secure Path pseudo devices directly (that is, with no volume manager):

   a. Add the corresponding c*X*t*Y*d*Z* device names.

   b. Type **mount -a**.

Migrating From HP StorageWorks AutoPath XP Virtual Array

This section describes how to migrate to PowerPath from AutoPath.

AutoPath operation on HP-UX

Structurally, AutoPath is very similar to PowerPath on HP-UX: It does not create pseudo-devices. AutoPath provides multipathing and load balancing whenever any one of the underlying native c*X*t*Y*d*Z* devices is used for a LUN. There is one such device per path.

Veritas volumes can be built by using these native c*X*t*Y*d*Z* device names. Such volumes remain accessible across removal of AutoPath and installation of PowerPath.

Migration is straightforward, since any device names originally used under AutoPath remain usable after PowerPath installation.

Migration procedure

To migrate from AutoPath to PowerPath:

1. Install PowerPath. This forces a restart.

   PowerPath detects an existing AutoPath installation and appear unmanaged on the HP XP devices.

2. Uninstall **AutoPath**. This forces a restart.
3. Ensure that PowerPath will henceforth handle multipathing for all HP XP devices:
   a. Run **vxdiskadm**, select option 17, and suppress all but one path to every HP XP device from the VxVM point of view.
   b. Run the command **powermt manage class=hpxp**.
   c. Verify that PowerPath can now see all paths to every HP XP LUN. Type the command:

      `powermt display dev=all class=hpxp`.

Migrating from IBM Subsystem Device Driver (SDD)

This section describes how to migrate to PowerPath from SDD.

SDD operation on HP-UX

For each ESS LUN on HP-UX, there are typically several native c*X*t*Y*d*Z* devices in /dev/dsk and /dev/rdsk, that is, one native device per path to the LUN. SDD adds one extra pseudo device, vdisk*N*, for each unique ESS LUN. Note that *all* these device entries are usable for any given LUN:

- For I/O issued directly to the native c*X*t*Y*d*Z* device, SDD does not multipath.
- For I/O issued to the vdisk*N* device, SDD does multipath over all available native paths to the LUN.

Veritas can recognize only the native c*X*t*Y*d*Z* devices. SDD does not provide any install-time utilities to make its pseudo devices visible to Veritas. Thus, an ESS LUN is typically configured within Veritas by using one native c*X*t*Y*d*Z* path. Since Veritas /DMP does support ESS arrays, DMP can provide multipathing for ESS LUNs.

Migration procedure

To migrate from SDD to PowerPath:

1. Stop I/O activity from the host to the sdd pseudo devices:
   - Unmount any layered file systems.
   - In **/etc/fstab**, comment out any file system entries that directly use the pseudo names.
2. Install PowerPath.

   PowerPath detects an existing IBMsdd installation and appear unmanaged on the ESS devices.
3. Uninstall **sdd**, which may require a reboot.
4. Ensure that PowerPath will now handle multipathing:
   a. Run **vxdiskadm**, select option 17, and suppress all but one path to every ESS device from the VxVM point of view.
   b. Run **powermt manage class=ess**.
   c. Run **powermt display dev=all class=ess** to verify that PowerPath can now see all paths to every ESS LUN.

5. Edit **/etc/fstab** for those file systems that formerly used sdd pseudo devices directly. Add the equivalent cXtYdZ device names, then **mount -a**.

5

Removing PowerPath From an HP-UX Host

This chapter includes the following sections:

Before removing PowerPath

Before you remove PowerPath, check the Powerlink website for the most current information. EMC updates the PowerPath release notes periodically and posts them on the Powerlink website.

IMPORTANT

Before PowerPath is uninstalled in a Symmetrix or VNX OE and CLARiiON environment, ensure that no devices are being used by LVM (Logical Volume Manager), or by any other application, and that I/O to the device is not active. This requirement is also documented in OPT 214468.

Removing PowerPath

You can remove PowerPath using:

- An HP console with an X-Windows graphics display
- An HP console with terminal access

The removal process builds a new kernel and then reboots.

Note: You cannot remove PowerPath if you have any pending migrations that uses PowerPath Migration Enabler. The removal process checks for pending migrations, and if it finds any, aborts the removal and displays an error message.

HP console with X-Windows graphics display

To remove PowerPath:

1. Log in as root.
2. Run **swremove**. Type:

   ```
   swremove -x mount_all_filesystems=false
   ```

   Note: If all entries in /etc/fstab can be mounted, do not use the -x mount_all_filesystems=false option.

3. In the SD Remove–Software Selection window:
   a. Select **EMCpower**.
   b. From the **Actions** menu, choose **Mark for Remove**.
      The word **Yes** appears in front of **EMCpower**.
   c. Select **EMCpower**.
   d. From the **Actions** menu, choose **Remove (Analysis)**.
4. In the **Remove Analysis** window, click **OK** after analysis completes and the **Status** field reads **Ready**.
5. In the **Confirmation**, click **Yes**, and then click **Yes** again.
6. In the **Remove** window, click **Done** after removal completes and the **Status** field reads **Completed**.
7. In the **Note**, click **OK** to restart.

HP console with terminal access

To remove PowerPath:

1. Log in as root.
2. Run **swremove**. Type:

   ```
   swremove -x mount_all_filesystems=false
   ```

   Note: If all entries in /etc/fstab can be mounted, do not use the -x mount_all_filesystems=false option.

   The screen displays an explanation of the menus and navigational tools.
3. Select **RETURN** and press **Enter**.
4. At the SD Remove–Software Selection screen:
   a. Use the down/up arrow key and the space bar to select **EMCpower**.
   b. Use the Tab key to select **File**.
   c. Use the right arrow key to select **Actions**, and press **Enter**.
   d. Use the down arrow key to select **Mark for Remove**, and press **Enter**.

      The word **Yes** appears in front of **EMCpower**.
   e. Use the spacebar to select **EMCpower**.
   f. Use the Tab key to select **File**.
   g. Use the right arrow key to select **Actions**, and press **Enter**.
   h. Use the down arrow key to highlight **Remove (analysis)**, and press **Enter**.
5. At the **Remove Analysis** screen, when analysis completes and the status is **Ready**, use the Tab key to select **OK**, and press **Enter**.
6. At the **Confirmation** screen, select **Yes**, and then select **Yes** again.
7. At the **Remove** window, select **Done** after removal completes and the status is **Ready**.
8. At the **Note** window, select **OK** to restart the system.

6

PowerPath Administration on HP-UX

This chapter includes the following sections:

Device naming

PowerPath for HP-UX supports only native devices. A native device describes a device special file of one of the following forms:

- Block device —`/dev/dsk/<c#t#d#>`
- Raw device —`/dev/rdsk/<c#t#d#>`

where:

- *c#* is the instance number for the interface card.
- *t#* is the target address of the logical device on the bus.
- *d#* is the logical device at the target.

Reconfiguring PowerPath devices online

Whenever the physical configuration of the storage system or the host changes, you must reconfigure the PowerPath devices to reflect the new configuration. Configuration changes that require you to reconfigure PowerPath devices include the following:

- Adding or removing HBAs
- Adding, removing, or changing storage system logical devices
- Changing the cabling routes between HBAs and storage system ports
- Adding or removing storage system interfaces

To reconfigure PowerPath devices:

1. Type **ioscan -f** to verify that the HP-UX host recognizes the connected devices.
2. Type **insf -e -C disk** to assign LUNs to the disk devices.
3. Type **rmsf -a** to remove any device files for which the underlying devices no longer exist.
4. Run **powermt check** to remove unwanted devices.
5. Run **powermt config** to configure the paths to the storage system device.
6. Run **powermt save** to save the new PowerPath configuration.

Agile device support

PowerPath 5.1 SP2 supports agile devices on HP-UX 11.31. Agile devices are location-independent names that reside above the native MPIO layer. PowerPath 5.1 SP2 and later show the agile lunpaths in **powermt display** output, rather than showing hardware paths for legacy devices, as done in previous releases.

The following PowerPath 5.1 SP1 output shows the hardware paths for legacy-style devices.

```
Powermt display
Symmetrix ID=000187431312
Logical device ID=0C04
state=alive; policy=SymmOpt; priority=0; queued-IOs=0
==============================================================================
------------------ Host ---------------   Stor -     -- I/O Path -     -- Stats--
###  HW Path                   I/O Paths   Interf.   Mode    State    Q-IOs Errors
==============================================================================
165 0/3/1/1.112.223.128.0.6.2  c165t6d2   FA1  0aA     active  alive    0       0
167 0/3/1/1.112.63.0.0.6.2     c167t6d2   FA   7aA     active  alive    0       0
173 0/3/1/0.112.63.0.0.6.2     c173t6d2   FA   7aA     active  alive    0       0
175 0/3/1/0.112.223.128.0.6.2  c175t6d2   FA   10aA    active  alive    0       0
```

The following output from PowerPath 5.1 SP2 shows the agile device lunpaths. For more information about the components of a lunpath, refer to the HP-UX documentation.

```
Pseudo name=disk2971
Symmetrix ID=000187431312
Logical device ID=0C04
state=alive; policy=SymmOpt; priority=0; queued-IOs=0;
==============================================================================
------------------ Host ------------------------------ - Stor    ---I/O Path---Stats-
###  HW Path                                 I/O Paths Interf. Mode State Q-IOs Errors
==============================================================================
1 0/3/1/1.0x50060482cafe6406.0x4032000000000000   c167t6d2  FA7aA active alive 0 0
0 0/3/1/0.0x50060482cafe6406.0x4032000000000000   c173t6d2  FA7aA  active alive 0 0
1 0/3/1/1.0x50060482cafe6409.0x4032000000000000   c165t6d2  FA10aA active alive 0 0
0 0/3/1/0.0x50060482cafe6409.0x4032000000000000   c175t6d2  FA10aA active alive 0 0
```

Refer to the HP-UX documentation for more information about agile devices.

iSCSI devices

When running PowerPath on an HP-UX host with iSCSI devices, you can identify iSCSI paths by their virtual hardware address in the **powermt display** output. The **powermt display** output uses one format for HP-UX 11.11 and 11.23, and another format for 11.31.

HP-UX 11.23 and 11.11

On HP-UX 11.11 and 11.23 hosts, the hardware address begins with **255/0**. The following example shows the iSCSI hardware paths in bold text.

The following examples show CLARiiON devices and storage class. Note that VNX OE devices are managed under the `clariion` storage class. In powermt display, any VNX OE devices that you may have under PowerPath management appear as CLARiiON devices.

```
powermt display
CLARiiON logical device count=23
================================================================================
----- Host Bus Adapters --------- ------ I/O Paths ----- ------ Stats ------
### HW Path               Summary    Total    Dead   IO/Sec   Q-IOs     Errors
================================================================================
32 255/0/0.0              optimal        7       0       -       0           0
39 255/0/7.0              optimal        7       0       -       0           0
(Output truncated)
```

where **255/0/0.0** is the iSCSI hardware path.

With multiple NIC cards configured, the number representing the NIC card changes. For example, a second NIC card display could be 255/0/**1**.

The following example shows the iSCSI HW and I/O paths.

The following example shows CLARiiON storage class. Note that VNX OE devices are managed under the `clariion` storage class. In powermt display, any VNX OE devices that you may have under PowerPath management appear as CLARiiON devices.

```
powermt display dev=all class=clariion
CLARiiON ID=APM00063804561 [hosta]
Logical device ID=600601609A101A0032CA1814F0BDDB11 [LUN 13]
state=alive; policy=CLAROpt; priority=0; queued-IOs=0
Owner: default=SP A, current=SP A Array failover mode: 1
==============================================================================
---------- Host -------------   - Stor -    - I/O Path -------   ---- Stats ---
### HW Path          I/O Paths    Interf.      Mode      State    Q-IOs   Errors
==============================================================================
```

```
32 255/0/0.0.0.1      c32t0d1   SP A0      active       alive      0        0
39 255/0/7.0.0.1      c39t0d1   SP B3      active      alive      0        0
```

HP-UX 11.31

On HP-UX 11.31 hosts, the PowerPath bus instance number is determined by the controller class and the instance number. An iSCSI virtual controller with an instance number **1** in **ioscan** output will appear as **11** in **powermt display**. This is expected behavior. PowerPath uses a mutually exclusive set of numbers for each controller class. Bus numbers between iSCSI and Fibre Channel may not be sequential.

Examples

The following example shows Fibre Channel and iSCSI HW paths. The iSCSI device is shown in bold text.

The following example shows CLARiiON devices. Note that VNX OE devices are managed under the `clariion` storage class. In powermt display, any VNX OE devices that you may have under PowerPath management appear as CLARiiON devices.

```
powermt display
Symmetrix logical device count=28
CLARiiON logical device count=28
Hitachi logical device count=0
Invista logical device count=0
HP xp logical device count=42
Ess logical device count=0
HP HSx logical device count=0
==============================================================================
- Host Bus Adapters ------    ----- I/O Paths ----   ----- Stats ------
###  HW Path        Summary   Total   Dead  IO/Sec   Q-IOs Errors
==============================================================================
0    0/3/1/0        optimal     128      0      -       0     0
1    0/3/1/1        optimal     52       0      -       0     0
2    0/4/1/0        optimal     128      0      -       0     0
3    0/4/1/1        optimal     52       0      -       0     0
11   64000/0x2/0x0  optimal     32       0      -       0     0
```

The following example shows information for iSCSI agile device **disk932**. The **11** in the HBA ### column in the previous example, and the **11** in the ### column in the example that follows is the PowerPath bus instance number for iSCSI virtual controller **1**.

The following example shows CLARiiON devices. Note that VNX OE devices are managed under the `clariion` storage class. In powermt display, any VNX OE devices that you may have under PowerPath management appear as CLARiiON devices.

```
powermt display dev=disk932 wide
Pseudo name=disk932
CLARiiON ID=FCNTR073500025 [lcla219_ISCSI]
Logical device ID=600601602C201E00CF08C69E63C5DE11 [Thin LUN 118]
state=alive; policy=CLAROpt; priority=0; queued-IOs=0;
Owner: default=SP A, current=SP A       Array failover mode: 4
==============================================================================
---------------------------------- Host -----------------------------------
- Stor ----------------------   -- I/O Path --  -- Stats ---
###  HW Path I/O Paths Interf. Mode    State   Q-IOs Errors
==============================================================================
11 64000/0x2/0x0.0x0.0x9000000000000 c101t1d1 SP A2 active  alive       0      0
11 64000/0x2/0x0.0x2.0x9000000000000 c102t1d1 SP B2 active  alive       0      0
11 64000/0x2/0x0.0x3.0x9000000000000 c103t1d1 SP B3 active  alive       0      0
11 64000/0x2/0x0.0x1.0x9000000000000 c104t1d1 SP A3 active  alive       0      0
```

Removing devices

Removal of VNXOE and CLARiiON devices directly from the array Storage group causes all paths to other devices, from the same storage group, to go dead momentarily. This is caused by not removing the devices from the host correctly.

To remove devices:

1. Identify the devices to remove.
2. Note the hardware path.
3. Run **powermt remove** to remove the devices from PowerPath control.
4. Take the devices from the storage group using Navisphere.
5. Run **rmsf** on the hardware path to completely remove from the system.

Removing a single logical device

If you manually disable or remove a single logical device from a storage group, and then return the same device to the storage group, PowerPath takes an unusually long time (up to 24 hours) to recognize and restore the device.

Use **powermt restore** to restore the logical device immediately.

Note that autorestore of entire paths occurs in the normal time frame.

LVM alternate links (PVLinks)

The HP-UX LVM can be configured to support multiple hardware paths to the same storage system logical device.

- HP-UX LVM supports up to eight paths (one primary and seven alternate links) to the same logical device.
- PowerPath supports up to 32 paths to the same logical device.

EMC recommends the use of LVM alternate links (PVLinks) when you boot from a storage system. If the primary path fails, an automatic switch to the alternate path occurs. If PowerPath is not installed, use of alternate links increases availability in the event of hardware problems.

PowerPath uses alternate links as part of its boot/root failover strategy, but not for load balancing, path prioritization, or for other reasons associated with PowerPath. Thus, use LVM alternate links when booting from a storage system. Otherwise, EMC recommends that you disable PVLinks when using PowerPath.

Considerations for VNXOE and CLARiiON storage

In a VNXOE and CLARiiON environment:

- An LVM volume group should use an active path as the primary path to the storage device.
- One passive path should also be specified as an alternate link to protect against SP failures at boot time.

Using powermt config when a path is lost

If a physical path is lost, run **ioscan -fn** before you run **powermt config**. Otherwise, powermt config may take a very long time.

PowerPath and the HORCM command device

Note that for Hitachi Lightning and HP XP HORCM operations, PowerPath does not provide redundancy to the HORCM command device, leaving a failure point for HORCM operations should the path to the command device fail. To avoid this, place both paths to the command device in the HORCM instance configuration file under the HORCM_CMD section on the host. The paths must be on the same line. For example:

```
HORCM_CMD
#Path 1 to command device #Path 2 to command device
/dev/rdsk/c2t16d250s2     /dev/rdsk/c3t17d250s2
```

Replacing Secure Path with PowerPath

To replace HP StorageWorks Secure Path with PowerPath:

1. Uninstall Secure Path.

   Secure Path does not seem to uninstall properly: All devices are still registered with the **hsx** driver installed by Secure Path, even after removal of the package.

2. Reregister the StorageWorks devices as sdisk devices:

   a. Enter the following command:

      ioscan -fn | grep {DEC | HSV} | grep hsx

      For example:

      ioscan -fn | grep HSV | grep hsx

```
disk  122 0/7/0/0.98.20.19.0.0.1 hsx  UNCLAIMED  DEVICE  HP  HSV100
disk  154 0/7/0/0.98.20.19.0.0.4 hsx  UNCLAIMED  DEVICE  HP  HSV100
```

   b. For each entry reported in step 2a, enter the following command:

      ioscan -H *<hardware_path>* **-M sdisk**

      For example:

      ioscan -H 0/7/0/0.98.20.19.0.0.1 -M sdisk
      ioscan -H 0/7/0/0.98.20.19.0.0.4 -M sdisk

3. Install PowerPath as described in "Installing PowerPath" on page 15.

4. Restart the host.

PowerPath and VxVM best practice

On HP-UX 11i v2 (11.23) hosts, when PowerPath and VxVM (Veritas Volume Manager) coexist, EMC recommends suppressing all but one path to VxVM and letting PowerPath handle the multipathing functionalities. Not doing so may cause the boot sequence to take many times longer to complete.

To suppress VxVM paths, perform one of the following:

- Suppress all paths from the view of VxVM.
  1. Run **vxdiskadm**.
  2. Choose option **17 Prevent multipathing/Suppress devices from VxVM's view**.
  3. Choose option **1 Suppress all paths through a controller from VxVM's view**.
- Edit **/etc/vx/vxvm.exclude** and include the paths you intend to suppress.
  1. Run **/usr/lib/vxvm/diag.d/vxdmpdbprint** and determine which paths to suppress.

     For example, output similar to the following appears:

```
Devlist with enclosure name = EMC1, da_type = EMC DMPNODES :
1> name=c15t3d2, ap=4, fp=0, tp=4, state=ENABLED
1> subpath=c15t3d2 state=ENABLED
2> subpath=c16t3d2 state=ENABLED
3> subpath=c23t3d2 state=ENABLED
4> subpath=c26t3d2 state=ENABLED
```

  2. Edit **/etc/vx/vxvm.exclude** to suppress all paths but one. Include the c# of the controllers you want to suppress in the controllers section.

     For example, suppress c16, c23, and c26, but not c15.

```
exclude_all 0
paths
controllers
c16 2/0/14/1/0.111.0.20
c23 0/0/14/1/0.110.0.9.1
c26 0/0/14/1/0.110.0.10.1
product
pathgroups
```

  3. Save /etc/vx/vxvm.exclude and then reboot.

4. Run **/usr/lib/vxvm/diag.d/vxdmpdbprint**.

   For example, output similar to the following appears:

```
Devlist with enclosure name = EMC1, da_type = EMC DMPNODES :
1> name=c15t3d2, ap=1, fp=0, tp=1, state=ENABLED
1> subpath=c15t3d2 state=ENABLED
```

For more information on Veritas DMP, refer to the Veritas documentation.

Upgrading HP-UX

Before upgrading HP-UX, you must uninstall PowerPath. After completing the operating system upgrade, reinstall PowerPath. This applies only when you upgrade between major operating system revisions. When you install operating system patches or updates, you do not need to uninstall PowerPath.

Error messages

The *EMC PowerPath Product Guide* contains a complete list of PowerPath error messages.

PowerPath reports errors to the **/var/adm/syslog/syslog.log** file. The powermt utility reports errors to standard error (stderr). You can use the HP-UX syslogd command to control where the messages are reported. Refer to the HP-UX syslogd (1M) manual page for more information.

A

Files Changed by PowerPath Installation

This chapter includes the following sections:

Files added by PowerPath installation

This section lists the files that are added when you install PowerPath. Separate lists appear for the following releases and architectures:

- "HP-UX 11i v1 (PA-RISC)" on page 76
- "HP-UX 11i v2 and 11i v3 (PA-RISC)" on page 79
- "HP-UX 11i v2 or 11i v3 (IA64)" on page 82

HP-UX 11i v1 (PA-RISC)

The following files are added when PowerPath is installed on HP-UX 11i v1:

/etc

- powermt.custom
- emcp_registration
- emcpdaemon
- emcp_cleanup
- emc/bin/emcp_discover
- emc/bin/emcp_purge
- emc/bin/emcpdiscover
- emc/bin/emcppurge
- emc/emcp_devicesDB.dat
- emc/emcp_devicesDB.idx
- emc/emcphostid
- emc/lib/dld.sl
- emc/lib/libc.2
- emc/lib/libdld.2
- emc/lib/libpthread.1
- emc/mpaa.excluded
- emc/mpaa.lams
- emc/powerkmd.custom
- emc/ppme/__db.001
- emc/ppme/__db.002
- emc/ppme/__db.003
- emc/ppme/__db.004
- emc/ppme/__db.005
- emc/ppme/__db.006
- emc/ppme/__db.register
- emc/ppme/filelock
- emc/ppme/log.0000000001
- emc/ppme/sequence.db

- emc/ppme/umdDB

/opt/EMCpower

- bin/cgmt
- bin/emcp_cleanup
- bin/emcphostid
- bin/emcpminor
- bin/emcpupgrade
- bin/powerprotect
- driver/emcp_11_00_32.o
- driver/emcp_11_00_64.o
- driver/emcp_11_11_32.o
- driver/emcp_11_11_64.o
- driver/emcpcg_11_00_32.o
- driver/emcpcg_11_00_64.o
- driver/emcpcg_11_11_32.o
- driver/emcpcg_11_11_64.o
- driver/emcpgpx_11_00_32.o
- driver/emcpgpx_11_00_64.o
- driver/emcpgpx_11_11_32.o
- driver/emcpgpx_11_11_64.o
- driver/emcpgpx_dm_11_00_32.o
- driver/emcpgpx_dm_11_00_64.o
- driver/emcpgpx_dm_11_11_32.o
- driver/emcpgpx_dm_11_11_64.o
- driver/emcpmpx_11_00_32.o
- driver/emcpmpx_11_00_64.o
- driver/emcpmpx_11_11_32.o
- driver/emcpmpx_11_11_64.o
- driver/emcpsapi_11_00_32.o
- driver/emcpsapi_11_00_64.o
- driver/emcpsapi_11_11_32.o
- driver/emcpsapi_11_11_64.o
- driver/master.emcp
- driver/master.emcpcg
- driver/master.emcpgpx
- driver/master.emcpgpx_dm
- driver/master.emcpmpx
- driver/master.emcpsapi
- driver/space.h.emcp
- driver/system
- lib/libcg_11_00_32.sl
- lib/libcg_11_00_64.sl
- lib/libemcp_11_00_32.sl

- lib/libemcp_11_00_64.sl
- lib/libemcp_core_11_00_32.sl
- lib/libemcp_core_11_00_64.sl
- lib/libemcp_lam_11_00_32.sl
- lib/libemcp_lam_11_00_64.sl
- lib/libemcp_lic_rtl_11_00_32.sl
- lib/libemcp_lic_rtl_11_00_64.sl
- lib/libemcp_mp_rtl_11_00_32.sl
- lib/libemcp_mp_rtl_11_00_64.sl
- lib/libemcpmt_11_00_32.sl
- lib/libemcpmt_11_00_64.sl
- lib/libmp_11_00_32.sl
- lib/libmp_11_00_64.sl
- lib/libpn_11_00_32.sl
- lib/libpn_11_00_64.sl
- share/man1m/emcpminor.1m
- share/man1m/emcpreg.1m
- share/man1m/emcpupgrade.1m
- share/man1m/powermig.1m
- share/man1m/powermt.1m

/sbin

- powercf
- powermig
- powermt
- emcpstartup
- emc/emcpmgr
- init.d/emccg
- init.d/emcp
- rc0.d/K999emcp
- rc2.d/S910emccg
- rc2.d/S999emcp

/usr/lib

- libcg.sl
- libcg_11_00_32.sl
- libcg_11_00_64.sl
- libemcp.sl
- libemcp_11_00_32.sl
- libemcp_11_00_64.sl
- libemcp_core.sl
- libemcp_core_11_00_32.sl
- libemcp_core_11_00_64.sl
- libemcp_lam.sl
- libemcp_lam_11_00_32.sl
- libemcp_lam_11_00_64.sl

- libemcp_lic_rtl.sl
- libemcp_lic_rtl_11_00_32.sl
- libemcp_lic_rtl_11_00_64.sl
- libemcp_mp_rtl.sl
- libemcp_mp_rtl_11_00_32.sl
- libemcp_mp_rtl_11_00_64.sl
- libemcpmt.sl
- libemcpmt_11_00_32.sl
- libemcpmt_11_00_64.sl
- libmp.sl
- libmp_11_00_32.sl
- libmp_11_00_64.sl
- libpn.sl
- libpn_11_00_32.sl
- libpn_11_00_64.sl

HP-UX 11i v2 and 11i v3 (PA-RISC)

The following files are added when PowerPath is installed on HP-UX 11i v2 or 11i v3 (PA-RISC):

/etc

- powermt.custom
- emcp_registration
- emcpdaemon
- emcp_cleanup

/etc/emc

- bin/emcp_discover
- bin/emcp_purge
- bin/emcpdiscover
- bin/emcppurge
- emcp_devicesDB.dat
- emcp_devicesDB.idx
- emcphostid
- lib/dld.sl
- lib/libc.2
- lib/libdld.2
- lib/libpthread.1
- mpaa.excluded
- mpaa.lams
- powerkmd.custom
- ppme/__db.001
- ppme/__db.002
- ppme/__db.003

- ppme/__db.004
- ppme/__db.005
- ppme/__db.006
- ppme/__db.register
- ppme/filelock
- ppme/log.0000000001
- ppme/sequence.db
- ppme/umdDB

/opt/EMCpower/bin

- cgmt
- emcp_cleanup
- emcphostid
- emcpmajor
- emcpminor
- powerprotect

/opt/EMCpower/lib

- libcg_11_00_32.sl
- libcg_11_00_64.sl
- libemcp_11_00_32.sl
- libemcp_11_00_64.sl
- libemcp_core_11_00_32.sl
- libemcp_core_11_00_64.sl
- libemcp_lam_11_00_32.sl
- libemcp_lam_11_00_64.sl
- libemcp_lic_rtl_11_00_32.sl
- libemcp_lic_rtl_11_00_64.sl
- libemcp_mp_rtl_11_00_32.sl
- libemcp_mp_rtl_11_00_64.sl
- libemcpmt_11_00_32.sl
- libemcpmt_11_00_64.sl
- libmp_11_00_32.sl
- libmp_11_00_64.sl
- libpn_11_00_32.sl
- libpn_11_00_64.sl

/sbin

- powercf
- powermig
- powermt
- emcpstartup
- emc/emcpmgr
- init.d/emccg
- init.d/emcp
- rc0.d/K999emcp

- rc2.d/S910emccg
- rc2.d/S999emcp

/usr/lib

- libcg.sl
- libcg_11_00_32.sl
- libemcp.sl
- libemcp_11_00_32.sl
- libemcp_core.sl
- libemcp_core_11_00_32.sl
- libemcp_lam.sl
- libemcp_lam_11_00_32.sl
- libemcp_lic_rtl.sl
- libemcp_lic_rtl_11_00_32.sl
- libemcp_mp_rtl.sl
- libemcp_mp_rtl_11_00_32.sl
- libemcpmt.sl
- libemcpmt_11_00_32.sl
- libmp.sl
- libmp_11_00_32.sl
- pa20_64/libcg.sl
- pa20_64/libcg_11_00_64.sl
- pa20_64/libemcp.sl
- pa20_64/libemcp_11_00_64.sl
- pa20_64/libemcp_core.sl
- pa20_64/libemcp_core_11_00_64.sl
- pa20_64/libemcp_lam.sl
- pa20_64/libemcp_lam_11_00_64.sl
- pa20_64/libemcp_lic_rtl.sl
- pa20_64/libemcp_lic_rtl_11_00_64.sl
- pa20_64/libemcp_mp_rtl.sl
- pa20_64/libemcp_mp_rtl_11_00_64.sl
- pa20_64/libemcpmt.sl
- pa20_64/libemcpmt_11_00_64.sl
- pa20_64/libmp.sl
- pa20_64/libmp_11_00_64.sl
- pa20_64/libpn.sl
- pa20_64/libpn_11_00_64.sl

HP-UX 11i v2 or 11i v3 (IA64)

The following files are added when PowerPath is installed on HP-UX 11i v2 or 11i v3 (IA64):

/etc

- powermt.custom
- emcp_registration
- emcpdaemon
- emcp_cleanup

/etc/emc

- bin/emcp_discover
- bin/emcp_purge
- bin/emcpdiscover
- bin/emcppurge
- emcp_devicesDB.dat
- emcp_devicesDB.idx
- emcphostid
- lib/dld.so
- lib/libc.so.1
- lib/libdl.so.1
- lib/libpthread.so.1
- lib/uld.so
- mpaa.excluded
- mpaa.lams
- powerkmd.custom
- ppme/__db.001
- ppme/__db.002
- ppme/__db.003
- ppme/__db.004
- ppme/__db.005
- ppme/__db.006
- ppme/__db.register
- ppme/filelock
- ppme/log.0000000001
- ppme/sequence.db
- ppme/umdDB

/opt/EMCpower

- bin/cgmt
- bin/emcp_cleanup
- bin/emcphostid
- bin/emcpminor
- bin/powerprotect
- driver/emcp_11_23_64.o

- driver/emcp_11_31_64.o
- driver/emcpcg_11_23_64.o
- driver/emcpcg_11_31_64.o
- driver/emcpgpx_11_23_64.o
- driver/emcpgpx_11_31_64.o
- driver/emcpgpx_dm_11_23_64.o
- driver/emcpgpx_dm_11_31_64.o
- driver/emcpmpx_11_23_64.o
- driver/emcpmpx_11_31_64.o
- driver/emcpsapi_11_23_64.o
- driver/emcpsapi_11_31_64.o
- lib/libcg_11_00_32.sl
- lib/libcg_11_00_64.sl
- lib/libcg_11_23_32.so
- lib/libcg_11_23_64.so
- lib/libemcp_11_00_32.sl
- lib/libemcp_11_00_64.sl
- lib/libemcp_11_23_32.so
- lib/libemcp_11_23_64.so
- lib/libemcp_core_11_00_32.sl
- lib/libemcp_core_11_00_64.sl
- lib/libemcp_core_11_23_32.so
- lib/libemcp_core_11_23_64.so
- lib/libemcp_lam_11_00_32.sl
- lib/libemcp_lam_11_00_64.sl
- lib/libemcp_lam_11_23_32.so
- lib/libemcp_lam_11_23_64.so
- lib/libemcp_lic_rtl_11_00_32.sl
- lib/libemcp_lic_rtl_11_00_64.sl
- lib/libemcp_lic_rtl_11_23_32.so
- lib/libemcp_lic_rtl_11_23_64.so
- lib/libemcp_mp_rtl_11_00_32.sl
- lib/libemcp_mp_rtl_11_00_64.sl
- lib/libemcp_mp_rtl_11_23_32.so
- lib/libemcp_mp_rtl_11_23_64.so
- lib/libemcpmt_11_00_32.sl
- lib/libemcpmt_11_00_64.sl
- lib/libemcpmt_11_23_32.so
- lib/libemcpmt_11_23_64.so
- lib/libmp_11_00_32.sl
- lib/libmp_11_00_64.sl
- lib/libmp_11_23_32.so
- lib/libmp_11_23_64.so

- lib/libpn_11_00_32.sl
- lib/libpn_11_00_64.sl
- lib/libpn_11_23_32.so
- lib/libpn_11_23_64.so
- share/man1m/emcpminor.1m
- share/man1m/emcpreg.1m
- share/man1m/powermig.1m
- share/man1m/powermt.1m

/sbin

- powercf
- powermig
- powermt
- emcpstartup
- emc/emcpmgr
- init.d/emccg
- init.d/emcp
- rc0.d/K999emcp
- rc2.d/S910emccg
- rc2.d/S999emcp

/usr/lib

- libcg.sl
- libcg_11_00_32.sl
- libemcp.sl
- libemcp_11_00_32.sl
- libemcp_core.sl
- libemcp_core_11_00_32.sl
- libemcp_lam.sl
- libemcp_lam_11_00_32.sl
- libemcp_lic_rtl.sl
- libemcp_lic_rtl_11_00_32.sl
- libemcp_mp_rtl.sl
- libemcp_mp_rtl_11_00_32.sl
- libemcpmt.sl
- libemcpmt_11_00_32.sl
- libmp.sl
- libmp_11_00_32.sl

/usr/lib/hpux32

- libcg.so
- libcg_11_23_32.so
- libemcp.so
- libemcp_11_23_32.so
- libemcp_core.so
- libemcp_core_11_23_32.so
- libemcp_lam.so

- libemcp_lam_11_23_32.so
- libemcp_lic_rtl.so
- libemcp_lic_rtl_11_23_32.so
- libemcp_mp_rtl.so
- libemcp_mp_rtl_11_23_32.so
- libemcpmt.so
- libemcpmt_11_23_32.so
- libmp.so
- libmp_11_23_32.so
- libpn.so
- libpn_11_23_32.so

/usr/lib/hpux64

- libcg.so
- libcg_11_23_64.so
- libemcp.so
- libemcp_11_23_64.so
- libemcp_core.so
- libemcp_core_11_23_64.so
- libemcp_lam.so
- libemcp_lam_11_23_64.so
- libemcp_lic_rtl.so
- libemcp_lic_rtl_11_23_64.so
- libemcp_mp_rtl.so
- libemcp_mp_rtl_11_23_64.so
- libemcpmt.so
- libemcpmt_11_23_64.so
- libmp.so
- libmp_11_23_64.so
- libpn.so
- libpn_11_23_64.so

/usr/lib/pa20_64

- libcg.sl
- libcg_11_00_64.sl
- libemcp.sl
- libemcp_11_00_64.sl
- libemcp_core.sl
- libemcp_core_11_00_64.sl
- libemcp_lam.sl
- libemcp_lam_11_00_64.sl
- libemcp_lic_rtl.sl
- libemcp_lic_rtl_11_00_64.sl
- libemcp_mp_rtl.sl
- libemcp_mp_rtl_11_00_64.sl
- libemcpmt.sl

- libemcpmt_11_00_64.sl
- libmp.sl
- libmp_11_00_64.sl
- libpn.sl
- libpn_11_00_64.sl

Files modified by PowerPath installation

The following files are modified when PowerPath is installed on HP-UX:

- /etc/inittab
- /etc/inittab.b4EMC
- /dev/emcp
- /opt/EMCpower/log
- /stand/system
- /stand/vmunix
- /var/adm/sw/products/EMCpower

On HP-UX 11i v2 or 11i v3, the following additional files are modified:

- /usr/conf/mod/emcp
- /usr/conf/mod/emcpcg
- /usr/conf/mod/emcpgpx
- /usr/conf/mod/emcpgpx_dm
- /usr/conf/mod/emcpmpx
- /usr/conf/mod/emcpsapi
- /usr/sam/lib/kc/drivers_emcp.tx
- /usr/sam/lib/kc/drivers_emcpcg.tx
- /usr/sam/lib/kc/drivers_emcpgpx.tx
- /usr/sam/lib/kc/drivers_emcpgpx_dm.tx
- /usr/sam/lib/kc/drivers_emcpmpx.tx
- /usr/sam/lib/kc/drivers_emcpsapi.tx

On HP-UX 11i v1, the following additional files are modified:

- /stand/system.d/emcp
- /stand/system.d/emcpcg
- /stand/system.d/emcpgpx
- /stand/system.d/emcpdm
- /stand/system.d/emcpmpx
- /stand/system.d/emcpsapi
- /usr/conf/km.d/emcp/mod.o
- /usr/conf/km.d/emcpcg/mod.o
- /usr/conf/km.d/emcpgpx/mod.o
- /usr/conf/km.d/emcpdm/mod.o
- /usr/conf/km.d/emcpmpx/mod.o
- /usr/conf/km.d/emcpsapi/mod.o
- /usr/conf/master.d/emcp
- /usr/conf/master.d/emcpcg

- /usr/conf/master.d/emcpgpx
- /usr/conf/master.d/emcpdm
- /usr/conf/master.d/emcpmpx
- /usr/conf/master.d/emcpsapi

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