Dell EMC PowerPath for AIX

Version 6.4

Installation and Administration Guide

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DELL EMC

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PREFACE

As part of an effort to improve its product lines, Dell EMC periodically releases revisions of its software and hardware. Therefore, some functions that are described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information about product features.

Contact your Dell EMC technical support professional if a product does not function properly or does not function as described in this document.

Note: This document was accurate at publication time. Go to Dell EMC Online Support to ensure that you are using the latest version of this document.

Purpose

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

Audience

Readers of this guide are expected to be familiar with:

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

Related documentation

The following Dell EMC publications provide additional information:

- *PowerPath Family for AIX Release Notes*
- *PowerPath Family CLI and System Messages Reference Guide*
- *PowerPath Family Product Guide*
- *PowerPath Management Appliance Installation and Configuration Guide*
- *PowerPath Migration Enabler User Guide*

Table 1 Revision history

Revision	Date	Description
02	August 2019	Updated Configuring PowerPath Boot Device on AIX section.
01	October 2018	First release of the product

Special notice conventions used in this document

Dell EMC uses the following conventions for special notices:

DANGER Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE Addresses practices not related to personal injury.

Note: Presents information that is important, but not hazard-related.

Typographical conventions

EMC uses the following type style conventions in this document:

Bold	Used for names of interface elements, such as names of windows, dialog boxes, buttons, fields, tab names, key names, and menu paths (what the user specifically selects or clicks)
Italic	Used for full titles of publications referenced in text
`Monospace`	Used for: • System code • System output, such as an error message or script • Pathnames, filenames, prompts, and syntax • Commands and options
Monospace italic	Used for variables.
`Monospace bold`	Used for user input.
[ ]	Square brackets enclose optional values.
|	Vertical bar indicates alternate selections - the bar means “or”.
{ }	Braces enclose content that the user must specify, such as x or y or z.
...	Ellipses indicate nonessential information that is omitted from the example.

Where to get help

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

Product information

For documentation, release notes, software updates, or information about Dell EMC products, go to Dell EMC Online Support .

Technical support

Go to Dell EMC Online Support and click Services. You will see several options for contacting Dell EMC Technical Support. You must have a valid support agreement to open a service request. Contact your Dell EMC sales representative for details about obtaining a valid support agreement or with questions about your account.

CHAPTER 1

Installing PowerPath on an AIX host

Before you install

Before installing PowerPath, review the storage system and the host environments, and take necessary preliminary precautions.

Reviewing the Storage System Environment

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

- Symmetrix, XtremIO, DELL SC, Hitachi TagmaStore, HP StorageWorks XP, HP StorageWorks EVA, and IBM ESS systems.
  Install PowerPath after you have set up the storage system and verified that it is working correctly.
- VNX OE block and CLARiiON storage systems.
  PowerPath installation is a part of an CLARiiON setup and configuration procedure. The CLARiiON Support home page provides directions on installing PowerPath on a host with a CLARiiON array.

  The VNX OE block Support home provides directions on installing PowerPath on a host with a VNX array.

Reviewing the host Environment

Installation of PowerPath on a host demands removal of any other existing failover applications from Dell EMC.

Incorrect migration from other failover applications of Dell EMC to PowerPath results in data loss. Therefore, Dell EMC recommends a migration with the support of Dell EMC Professional Services.

The other failover applications of Dell EMC that may pre-exist could be: EMC Navisphere Application Transparent Failover (ATF) or Common Desktop Environment (CDE).

Note: For VNX OE block systems and CLARiiON systems, the Navisphere and the Unisphere applications support limited PowerPath functions.

If you choose to perform the migration, see the *Removing ATF or CDE Software Before Installing Other Failover Software* document. This document is available on the Dell EMC Online Support site.

Obtain up-to-date information

Check the Dell EMC Online Support site for current information:

- PowerPath documentation — The documentation are updated with new features and fixed issues.
- Service packs and upgrades — Dell EMC releases a Service Pack for a set of new features. You can download PowerPath service pack software from Dell EMC Online Support site. Determine which service packs (if any) to install after PowerPath, and if that service pack has any additional installation prerequisites.

Locate the license key

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

Note: While upgrading PowerPath, the existing license key is saved and no input is required.

Prepare the host and storage system

- Preview the environment. Verify if the environment meets the requirements that are described in the *PowerPath Family for AIX Release Notes* and in *E-LabTM Interoperability Navigator.* To verify the requirements, run PowerPath Configuration Checker (PPCC). The *PowerPath Configuration Checker User Guide* provides detailed information about PPCC installation.
- Select the correct HBA initiator type. Disconnect all non-root AIX Logical Volume Managers (LVM). Before taking the LVMs offline, unmount any of the file system or application that uses the volume groups. Use the AIX `varyoffvg` command to take offline all AIX Logical Volume Manager (LVM) volume groups that use storage-system hdisk devices.
  Note: Do not unmount root volume storage group (rootvg).
- Ensure that the required AIX Licensed Program Products (LPPs) are installed.

Table 2 Required AIX LPPs

LPP	Description	Required for
EMC.AIX.TPA.ODM	EMC TPA ODM kit	IBM XIV, HSV 210, HSV 110, HSV 450, HSV 111
EMC.Symmetrix.iscsi.rte	Dell EMC driver kit	Symmetrix iSCSI devices
EMC.CLARiiON.iscsi.rte	Dell EMC driver kit	CLARiiON iSCSI devices
EMC.Symmetrix.aix.rte EMC.CLARiiON.aix.rte EMC.DellSC.aix.rte EMC.INVISTA.aix.rte EMC.XtremIO.aix.rte	Dell EMC driver kit	Fibre Channel devices
EMC.Symmetrix.fcp.rte EMC.CLARiiON.fcp.rte EMC.DellSC.fcp.rte EMC.INVISTA.fcp.rte EMC.XtremIO.fcp.rte	Dell EMC driver kit	Fibre Channel devices
Hitachi.aix.support.rte	Hitachi AIX support for xp disks	All Hitachi Tagmastore configurations
HP.aix.support.rte	HP AIX support for disks	All HP StorageWorks xp configurations
ibm2105.rte	IBM 2105 disk device	All IBM ESS configurations
devices.fcp.disk.ibm.rte	IBM 2107 disk device	All IBM ESS configurations

The Symmetrix, VNX OE block, CLARiiON, DELL SC, and Invista LPPs are included in the Dell EMC Object Data Manager (ODM) fileset. The EMC E-Lab Interoperability Navigator provides details on determining the ODM fileset version that is required for the system. You can download the Dell EMC ODM fileset from: ftp://ftp.emc.com/pub/elab/aix/ODM_DEFINITIONS.

Contact the vendor for the Hitachi, HP, and IBM ODM filesets.

- If logging is not enabled on the AIX host, enable it. PowerPath reports errors, diagnostic messages, and failover recovery messages through the syslog file specified by the administrator. Dell EMC recommends using /tmp/emcpsyslog.log to ensure the support utility, Dell EMC grab, collects the log files. Enable logging on an AIX host provides more information.
- Ensure that the AIX hdisk devices are configured correctly. Each logical path that PowerPath uses to access a storage system device must have a hdisk that is configured for it. If the number of storage system hdisk devices is incorrect, complete the following procedure before installing PowerPath.

  To configure hdisks:

  1. Ensure that all physical device connections are connected.

     a. Remove the AIX hdisks corresponding to storage system devices.
     To remove hdisks corresponding to Dell SC devices, type:

     ```
     lsdev -Ctdell* -rname|xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to Symmetrix devices, type:

     ```
     lsdev -CtSYMM* -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to VNX OE block, Unity, and CLARiiON devices, type:

     ```
     lsdev -CtCLAR* -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to XtremIO devices, type:

     ```
     lsdev -CtXtremIO -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to Hitachi Lightning device, type:

     ```
     lsdev -CtHitachi* -rname | xargs -n1 rmdev -dl
     ```

     To remove HP StorageWorks EVA devices, type:

     ```
     lsdev -CtHSV* -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to IBM ESS devices, type:

     ```
     lsdev -Ct2105* -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to Invista and VPLEX devices, type:

     ```
     lsdev -CtINV* -rname | xargs -n1 rmdev -dl
     ```

     To remove hdisks corresponding to HP StorageWorks XP devices, type:

     ```
     lsdev -CtHP* -rname | xargs -n1 rmdev -dl
     ```

     These commands cannot delete hdisks in use. These hdisks need not to be removed, and you can ignore any error messages.

  Ensure that every path has its hdisks. After all storage system hdisks are removed, run the `usr/lpp/Symmetrix/bin/emc_cfgmgr` script to ensure that hdisks are configured for each path. The `emc_cfgmgr` script invokes the `AIX cfgmgr` tool to probe each adapter bus separately. Running the script configures a storage system hdisk that was missing for each device on each path. You can run `lsdev -Cc` disk to confirm the correct configuration.

  The `emc_cfgmgr` script is available at the following Dell EMC FTP site: ftp://ftp.emc.com/pub/elab/aix/ODM_DEFINITIONS.

- Configure the HBA drivers.

  CAUTION Follow HBA driver configuration guidelines that are outlined in the E-Lab Interoperability Navigator and product documentation. Improper settings can cause erratic failover behavior, such as greatly increased I/O delays.

- Dell EMC recommends setting certain Object Data Manager (ODM) attributes to enable enhanced error recovery during certain failover scenarios. The EMC Host Connectivity Guide

for IBM AIX on Dell EMC Online Support provides more information on ODM attributes the Fast Fail feature.

Note: This does not apply to Cambex cards.

To configure the ODM attributes:

1. For Fibre Channel switched environments only, enable the adapter driver fast_fail feature.

   ```
   chdev -l fscsix -a fc_err_recov=fast_fail -P
   ```

   where x is the specific HBA (fscsi0, fscsi1, and so forth).

2. Run `shutdown -Fr` to restart the host. In addition to changing the `fc_err_recov ODM` attribute, the `num_cmd_elems` should also be added:

   ```
   chdev -l fcsx -a num_cmd_elems=2048 -P
   ```

   For NDU it is recommended to enable following two attributes for all native devices along with `fc_err_recov=fast _fail` and `num_cmd_elems=2048`

   ```
   lsattr -El hdisk3 | egrep "clr_q|q_err"
   clr_q no Device CLEARS its Queue on error True
   q_err yes Use QERR bit True
   ```

3. Set dynamic tracking of devices.
   ```
   chdev -l fscsix -a dyntrk=yes -P
   ```
4. Set the max_xfer_size for FC HBAs to 0x1000000.
   ```
   # chdev -l fcsx -a max_xfer_size=0x1000000 -P
   ```

   Note: In virtual environment, you might need to set max_xfer_size, dyntrk, and fc_err_recov parameters on the Virtual I/O Server and Virtual I/O Client.

5. Set the number of 4k pages in Block IO buffer cache. Where the maximum value is 1000 and the default is 20.

   Note: For higher throughput, the recommended maxbuf value should be set to between 500-800.

   ```
   # chdev -l sys0 -a maxbuf=500 sys0 changed
   ```

6. Set the maximum number of PROCESSES allowed per user.

   Note: For faster device discovery on scale setups with a higher number of devices or paths, the recommended maxuproc value should be set to 1024 with the maxbuf value set to 100.

   ```
   bash-4.0# chdev -l sys0 -a maxuproc=1024 sys0 changed
   ```

7. Restart the host.

- Ensure that the ownership and permission attributes of all hdisk devices are correct. PowerPath configuration sets the ownership and permission values of each hdiskpower device to match the values of one of the path devices.

Installing PowerPath as part of an mksysb master image

You can create a master site backup image from which you can install the complete host images. These host images could include PowerPath software on target systems.

The hdiskpower devices and powerpath0 device from the source system affects the creation of master site backup image. Therefore, remove them before creating the master site backup image.

CAUTION Failure to remove these devices before creating the master site backup image may result in unpredictable behavior on the target host. It could also cause problems that are not immediately obvious, but could affect adding or removing devices in the future.

Removing the hdiskpower devices

About this task

If the source host is to create the master site backup image from the SAN, under PowerPath control, you must perform the following steps before removing the hdiskpower devices:

Procedure

1. Run `pprootdev off`.
2. Restart the host.

   If Naviagent is installed, stop the agent before removing the powerpath0 driver device. Type:
   `/etc/rc.agent stop`

Removing all the hdiskpower devices and the powerpath0 device

About this task

To remove all hdiskpower devices and the powerpath0 device:

Procedure

1. Deactivate all applications, file systems, volume groups, and paging space on PowerPath devices.
2. Remove the hdiskpower devices.

   ```
   lsdev -Ccdisk -tpower -Fname | xargs -n1 rmdev -dl
   ```

3. Remove the powerpath0 device driver.

   ```
   rmdev -dl powerpath0
   ```

4. Create the mksysb backup image from this source system.
5. To create the powerpath0 driver and hdiskpower devices, run the `powermt config` command on the target host after it is started.

   Note: This procedure removes PowerPath device persistency from the source computer's configuration. This removal could result in hdiskpower devices changing the order when you run the `powermt config` command on the source computer.

Installation methods

You can install PowerPath on a host by using the installation CD, the command line, System Maintenance Interface Tool (SMIT), or the tar file.

Note: Ensure that ODM is installed before installing PowerPath for AIX.

Service packs and patches released on AIX are usually full installable packages. The installation and upgrade procedure of a service pack or patch is the same as for the major release on which the service pack or patch is based. For how to install such, see Installing a PowerPath service pack or patch.

If you are upgrading from an earlier release of PowerPath, follow the instructions in Upgrading PowerPath on an AIX Host.

CAUTION Do not try to run `powermt config` while using `installp` or SMIT to add, remove, or update PowerPath software. Doing so can result in a system failure.

Mounting the installation CD

Procedure

1. Log in as root.
2. Create the directory /cdrom to be the mount point for the CD.

   ```
   mkdir /cdrom
   ```

3. Insert the PowerPath installation CD into the CD drive.
4. Mount the CD on /cdrom.

   ```
   mount -v cdrfs -p -r /dev/cd0 /cdrom
   ```

5. Change to the /cdrom/UNIX/AIX directory.

   ```
   cd /cdrom/UNIX/AIX
   ```

6. Install using the command line or SMIT.

Installing by using the command line

Procedure

1. Mount the CD in the CD drive and change to the /cdrom/UNIX/AIX directory as described in Mounting the installation CD.
2. Install the software.

   ```
   installp -agXd . EMCpower
   ```

   Note: The man page for the `installp` command describes optional flags for the command.

   Output similar to the following is shown:

```
+-----------------------------------------------------------+
Summaries:
+-----------------------------------------------------------+
Installation Summary
--------------------
Name                 Level    Part    Event    Result
-------------------------------------------------------------
EMCpower.base             6.x.x.0  USR    APPLY    SUCCESS
EMCpower.mpx             6.x.x.0  USR    APPLY    SUCCESS
EMCpower.migration_enabler 6.x.x.0  USR    APPLY    SUCCESS
EMCpower.MgmtComponent         6.x.x.0  USR    APPLY    SUCCESS
```

Where 6.x.x is the PowerPath for AIX release version, for example, PowerPath 6.4
PowerPath is installed on the host, but before PowerPath can run, you must perform some administrative tasks (including registering PowerPath and starting emcp mond service). After you install provides postinstallation information.

Installing by using SMIT

About this task

The SMIT procedure that is described in this section assumes that you are running the X Window System version of SMIT. You can use the tty version of SMIT, provided you substitute suitable tty SMIT procedures.

Procedure

1. Mount the CD in the CD drive and change to the `/cdrom/UNIX/AIX` directory as described in Mounting the installation CD.
2. Run `smit` to open SMIT.
3. On the main SMIT window, click **Software Installation and Maintenance**.
4. On the **Software Installation and Maintenance** window, click **Install and Update Software**.
5. On the **Install and Update Software** window, click **Install Software**.
6. For the INPUT device/directory for software field, type:

   `/cdrom/UNIX/AIX`
7. Click **List** to open the list of software to install.
8. Select the first line in the list, EMCpower ALL, and press **Enter**.

   The Install Software dialog box opens.
9. Review the installation options, make any necessary changes, and click **OK**.
10. When prompted, click **OK**.

    Output similar to the following is shown:

```
+-----------------------------------------------------------+
Summaries:
+-----------------------------------------------------------+
Installation Summary
--------------------
Name                 Level     Part     Event     Result
-------------------------------------------------------------------
EMCpower.base             6.x.x.0     USR     APPLY     SUCCESS
EMCpower.migration_enabler  6.x,x.0     USR     APPLY     SUCCESS
EMCpower.mpx              6.x.x.0     USR     APPLY     SUCCESS
EMCpower.MgmtComponent          6.x.x.0     USR     APPLY     SUCCESS
```

    Where 6.x.x is the PowerPath for AIX release version, for example, PowerPath 6.2.

11. Select **Exit SMIT** from the **Exit** menu to close SMIT.

    PowerPath is installed on the host, but before PowerPath can run, you must perform some administrative tasks (including registering PowerPath for first time users and starting emcp mond service). After you install provides postinstallation information.

Installing by using the tar file

Procedure

1. On Dell EMC Online Support, click **Support by Product** > search for **PowerPath for AIX** > **Downloads**.

2. Download the tar file to `/usr`.
3. Extract the installation package.

   `gunzip DellEMCPower.AIX.<version>.<build>.tar.gz` Where <version> is the product version, for example PowerPath 6.4 and <build> is the software build number.
4. Extract the `EMCpower_install` installation file.

   `tar -xvf DellEMCPower.AIX.<version>.<build>.tar`
5. Before installing, check if all the required ODM drivers are available.

   `lslpp -l | grep -i emc`

   This lists all the ODM file sets.
6. Perform one of the following:
   - For existing PowerPath installations, run `rm .toc` from the install directory to delete the `.toc` file.
   - For new PowerPath installations, skip to step 7.
7. Install PowerPath.

   `installp -agXd . EMCpower`
8. View the version of the PowerPath installed.

   powermt version

   PowerPath is installed on the host, but before PowerPath can run, you must perform some administrative tasks (including registering PowerPath for first time users and starting emcp mond service). After you install provides post-installation information.

Installing a PowerPath service pack or patch

Procedure

1. On Online Support, select **Support** > **Downloads**
2. Download the tar file to `/usr`.
3. Extract the installation package.

   `gunzip DellEMCPower.AIX.<version>.<build>.tar.gz`
4. Extract the `EMCpower_install`.

   `tar -xvf DellEMCPower.AIX.<version>.<build>.tar`
5. Perform one of the following:
   - For existing PowerPath installations, run `rm .toc` to delete the `.toc` file.
   - For new PowerPath installations, skip to step 6.
6. Install PowerPath.

   `installp -agXd . EMCpower`
7. Run `powermt config`.

After you install

After installing the PowerPath software:

Register PowerPath on the host

About this task

If you are upgrading from an earlier version of PowerPath, you do not need to reregister. PowerPath uses the existing license key if necessary, converting the old 12-character license key to a 24-character key.

Procedure

1. Register the PowerPath software.

   ```
   emcpreg -install
   ```

   Output similar to the following is shown:

   ```
   bash-4.2# emcpreg -install
   ========== Dell EMC PowerPath Registration ==========
   Do you have a new registration key or keys to enter? [n]
   ```

2. Type `y` and press `Enter`

   Output similar to the following is shown:

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

3. Type the PowerPath registration key and press `Enter`.

   If you typed a valid registration key, output similar to the following is shown:

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

   If you type an invalid registration key, the screen shows an error message and prompts you to type a valid key. The *PowerPath Family CLI and System Messages Reference Guide* provides a list of error messages that are returned by the emcpreg license registration utility.

4. Press `Enter`.

   Output similar to the following is shown:

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

Start emcp mond service

Before you begin

emcp mond service should be running to leverage benefits of PowerPath features such as Auto Host Registration, Auto LUN detection, Device IO Statistics, Device in Use Reporting.

Procedure

1. Start emcp mond service.

   ```
   /etc/rc.emcp_mond start
   ```

   Output similar to the following is shown:

   ```
   bash-4.0# /etc/rc.emcp_mond start
   Starting PowerPath management daemon : emcp_mond
   ```

2. Run `#ps -ef|grep -i mond` to see whether emcp mond is running.

   ```
   # ps -ef|grep -i mond
       root 24707096 26607710   0 07:28:23  pts/3  0:00 grep -i mond
       root 25886878        1   0 07:28:16      -  0:00 /usr/sbin/emcp_mond
   ```

   Note: If supported Open SSL version is installed on the host, emcp_mond service runs. Otherwise, the emcp_mond_no_ssl service runs.

Choose a major number

About this task

By default, PowerPath uses a system-assigned major number for its pseudo devices. To support NFS applications in a clustered environment, the major number of PowerPath pseudo devices (for example, `/dev/*hdiskpower*`) must be the same across all cluster nodes. This number must be a unique major number that is unused by any host in the cluster.

Procedure

1. Determine a free major number common to all nodes. On each node in the cluster, type:

   ```
   lvlstmajor
   ```

   Compare the free ranges on each node to find a major number that is unused on any node.

2. Change the major number of the powerpath0 device. On each node in the cluster, type:

   ```
   chdev -l powerpath0 -a pp_major=x
   ```

   where *x* is the major number you found in step 1.

3. Verify the change. On each node in the cluster, type:

   ```
   lsattr -El powerpath0
   ```

   The major number will take effect after you run the `powermt config` command on each node in the cluster. Initialize PowerPath hdiskpower devices, which follows, provides additional information.

   Change the major number provides instructions on changing the major number.

Initialize PowerPath hdiskpower devices

Initialize the PowerPath hdiskpower devices and make them available to the host. You can initialize devices by using either command line entries or SMIT.

Using the command line

Initialize devices at the command line, type:

```
powermt config
```

Using SMIT

Initialize devices by using SMIT:

1. Run `smit` to open SMIT.
2. On the **System Management** window, select **Devices**.
3. Select **PowerPath Disk**.
4. Select **Configure All PowerPath Devices**.
5. Exit SMIT.

Remove the CD

Before you begin

The CD should be unmounted before removal.

Procedure

1. To unmount the CD, run:

   ```
   cd /umount /cdrom
   ```

2. Remove the CD from the CD drive.

Configure the management daemon

After installing the version of PowerPath that supporting the management daemon, configure the management daemon.

Configuring the management daemon enables you to receive SNMP traps when a path is dead for 1 minute, or when all paths to a device are dead for 5 minutes. Configure the management daemon describes how to configure the management daemon.

Vary on volume groups

About this task

Vary on any existing LVM volume groups that you varied off before installing PowerPath:

Procedure

1. Vary the LVM volume groups:

   ```
   varyonvg vgname
   ```

2. Remount any file systems you unmounted.
3. Restart any applications that you stopped.

   Note: You do not need to reconfigure these volume groups. The installation procedure migrates existing volume groups that use storage system devices from AIX hdisks to PowerPath hdiskpower devices.

   If you failed to vary off a volume group before installing PowerPath, this migration fails. A future vary-on attempts may result in errors. To correct this state:

   a. Vary off the volume group.

   b. Run `powermt config`.

   The `varyonvg` command should now succeed, and the volume group should be using hdiskpower devices.

When defining new volume groups, use PowerPath hdiskpower devices, not AIX hdisk devices.

Reconfigure applications

If an application accesses AIX hdisks directly rather than through a volume group (for example, a DBMS), you must reconfigure that application to use PowerPath hdiskpower devices for load balancing and path failover functionality. Run `powermt display dev=all` to determine the correspondence between PowerPath hdiskpower devices and AIX hdisk devices.

Note: You do not need to reconfigure applications that access hdisks through a volume group.

When adding new applications to the system that typically would access hdisks directly, configure them to use hdiskpower devices instead.

Reserve_policy setting in Dual VIO Server Environments

About this task

From PowerPath Versions 5.5 for AIX onwards, the reserve_lock attribute is replaced by the reserve_policy and PR_Key Value attributes.

On a fresh install of PowerPath 6.x, the `reserve_policy` value is set to `single_path` by default. Dual VIO Server setups with shared disk configurations require the `reserve_policy` attribute to be set to `no_reserve` before configuring them to the VIOS.

Procedure

1. To change reserve_policy from `single_path` to `no_reserve` run:

   ```
   # chdev -l hdiskpower# -a reserve_policy=no_reserve
   ```

   PowerPath supports the `reserve_enable` attribute for the PowerPath control device `powerpath0` which can be used to set the default value for reserve_policy.

2. To set `reserve_policy` setting to `no_reserve` for all the devices by default run the following commands:

   a. To bring all the hdiskpower devices to Defined state:

   ```
   # lsdev -Cc disk -t power -F name | xargs -n1 rmdev -l
   ```

   b. To set `reserve_enable` attribute to `no`:

   ```
   # chdev -l powerpath0 -a reserve_enable=no
   ```

   c. To reconfigure all the devices run `powermt config`:

   ```
   # powermt config
   ```

Deleting redundant entries

During a fresh installation or upgrade, PowerPath deletes redundant entries from the ODM PdAt for array uniquetypes and retains appropriate entries.

When `powermt config` is run, redundant reserve attribute entries for each PowerPath managed uniquetypes are deleted, and `reserve_lock` attributes are converted to `reserve_policy`.

During installation or upgrade or when `powermt config` is run, the following warning message is sent to syslog (if configured) if PowerPath detects the presence of multiple entries for a uniquetype in PdDV:

```
WARNING!!! ODM PdDv database contains duplicate uniquetypes. See the
EMC Knowledge Base Article Number: 000084491 or contact EMC Customer
Support personnel.
```

Coexistence with third-party path management software

This section describes about the coexistence of PowerPath with third-party path management software.

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

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

However, PowerPath cannot comanage devices with third-party path management software. During installation of PowerPath, the installation script tests for the presence of third-party path management software on the system. If such software is installed on the system, the PowerPath installation script disables support for the corresponding array type in PowerPath.

The following table lists the third-party path management software and the corresponding array that is disabled during the installation.

Table 3 Third-party software and corresponding array support

If this software is present	Support for this class is disabled in PowerPath
Hitachi HDLM	hitachi
IBM SDD	ess
HP StorageWorks XP AutoPath	hpxp
Sun Solaris MPxIO	Classes that would ordinarily handle the MPxIO-configured arrays.

The following table lists the software and corresponding command that results in undefined multipathing behavior:

Table 4 Third-party software and corresponding powermt manage class command

If this software is present	Multipathing behavior is undefined if you run this command
Hitachi HDLM	`powermt manage class=hitachi`
IBM SDD	`powermt manage class=ess`
HP StorageWorks XP AutoPath	`powermt manage class=hpxp`
Sun Solaris MPxIO	`powermt manage class=<class>` Where <class> is any class that handles a MpxIO-configured array

Because PowerPath and the third-party software cannot comanage devices, do not initiate comanagement by executing the above commands on third-party array class machines. As long as these commands are not run, support for the relevant third-party arrays remain disabled across restarts.

Similarly, before you install third-party path management software on a system on which PowerPath is installed, you should disable any support by PowerPath for the relevant third-party array devices by running `powermt unmanage class=<class>`.

The following table lists the commands to run before you install third-party path management software:

Table 5 Commands to run before installing third-party software

Before you install this software	Run this command
Hitachi HDLM	`powermt unmanage class=hitachi`
IBM SDD	`powermt unmanage class=ess`
HP StorageWorks XP AutoPath	`powermt unmanage class=hpxp`

CHAPTER 2

Installing PowerPath on Veritas Volume Manager

Install with Veritas Volume Manager on new hosts

To install PowerPath with Veritas Volume Manager on new hosts

Before you begin

When installing PowerPath and Veritas Volume Manager (VxVM) for the first time on a host that is attached to an Dell EMC or third-party storage system, have the Veritas documentation available for reference.

Procedure

1. Install and configure PowerPath following the instructions in Chapter 1, Installing PowerPath on an AIX host.
2. Install Veritas Volume Manager following the instructions in the Veritas documentation.

Run the `vxdisk list` *<PowerPath pseudo device>* command to display the power devices. For MP1 and later, the power devices appear as components of a particular VxDMP node in the VxDMP node in the vxdisk list *<PowerPath pseudo device>* output as follows:

```
# vxdisk list hdiskpower10
Device: hdiskpower10
devicetag: hdiskpower10
type: auto
info: format=none
flags: online ready private autoconfig invalid
pubpaths: block=/dev/vx/dmp/hdiskpower10
char=/dev/vx/rdmp/hdiskpower10
guid: -
udid:
DGC%5FVRAID%5FAPM00114002720%5F6006016075802D00A4188133E1B3E111
site: -
Multipathing information:
numpaths: 1
hdiskpower10 state=enabled
```

Convert to PowerPath hdiskpower devices from DMP

Before you begin

About this task

This section describes how to reconfigure an existing Veritas Volume Manager host configuration to use PowerPath hdiskpower devices instead of DMP devices, without loss of data.

Procedure

1. For each Veritas Volume Manager disk group, unmount all volumes in the disk group.
2. Stop all volumes in the disk group. `vxvol -g <disk_group> stopall`
3. restart the host.`reboot`

   Veritas Volume Manager volumes are now present on PowerPath hdiskpower devices.
4. Start all the volumes in the disk group.`vxvol -g <disk_group> startall`

5. Remount the volumes.

Add a path to a storage system controlled by PowerPath and VxVM

Procedure

1. Run `cfgmgr`.
2. Run `powermt config`.
3. Run `vxdctl enable`.

CHAPTER 3

Configuring a PowerPath Boot Device on AIX

Setting up a PowerPath boot device

On some storage systems, you can use a PowerPath hdiskpower device as a boot device (a device that contains the startup image).

Using a PowerPath hdiskpower device as a boot device provides load balancing and path failover for the boot device.

Consult the PowerPath for AIX Release Notes to find out if your storage system supports PowerPath boot devices.

When you set up a PowerPath boot device, consider the following:

- All path devices that make up the hdiskpower device must be valid AIX boot devices.
- The boot device should not be visible to any other host attached to the same storage system. If using a storage system device as a boot device in a cluster environment (with or without PowerPath), other hosts should not be able to address the boot device.
- The host's boot list must contain all hdisks that compose the hdiskpower device being used as the boot device. Otherwise, the host may fail to boot if one or more paths are disabled while the machine tries to boot.
  Considerations for VNX OE and CLARiiON storage contains additional information if you plan to configure a VNX OE and CLARiiON boot device.
- At startup, the system searches for an AIX boot image in the boot list, a list of hdisks stored in the hardware's NVRAM. If the system fails to boot, you can change the boot list.
  Use one of the following methods:
  - Boot the system from an installation device (CD or tape) into Maintenance Mode. Select the option to access the root volume group, and then run the AIX `bootlist` command from the shell.
  - Enter the *System Management Services* menu when the system starts, and use the *Multiboot* menu options to change the boot list. This method is faster, but it is more difficult to determine the correspondence between devices that are listed in the menu and the storage system device you want to add to or remove from the boot list.

Considerations for Symmetrix storage

In a Symmetrix environment, booting from a PowerPath device is supported in Fibre Channel environments that include specific versions of Dell EMC Enginuity software. The E-Lab Interoperability Navigator provides details. Contact your Dell EMC Customer Support Representative for information about installing Enginuity software.

Considerations for VNX OE and CLARiiON storage

PowerPath can be used to enable multipathing and failover to an external boot device on a VNX series and CLARiiON array, but such a configuration has some functional limitations and extra configuration steps.

The primary limitation to VNX series and CLARiiON boot is that the bootlist search for a suitable boot device to succeed, the boot LUN must either be located on its owner SP or be completely trespassed to its secondary SP. If the boot path to the host is lost while in the process of booting, the host may fail to boot until access to the LUN through the default SP is restored.

In a VNX series and CLARiiON environment, the bootlist for the AIX host should include all hdisks that correspond to active and passive paths of the boot LUN on all associated SPs. If PowerPath is not configured, these devices show a PVID in the output of the lspv command. Passive hdisks show a PVID of None. If PowerPath is configured, use the `powermt display dev=device | all` command to examine the boot device and determine which hdisks are part of the boot LUN.

Once the AIX host is up and running, PowerPath enables it to survive path failures and trespasses of the boot device.

PowerPath and the bosboot tool

After a system boots from a PowerPath device, the *bosboot* tool cannot function correctly. This is because of the state of the configuration after booting from a PowerPath device and the fact that *bosboot* expects the boot device to be a hdisk, not a hdiskpower device.

The *pprootdev fix* command corrects the configuration to enable *bosboot* to work. Run *pprootdev fix* before undertaking any administrative task that runs *bosboot*. This action corrects the configuration for *bosboot* but does not change the PowerPath boot switch. The next system boot still uses PowerPath. After *pprootdev fix* is run on a host in a Boot from SAN environment, *powermt config* moves the PVIDs back to the pseudo and requires rerunning *pprootdev fix* to fix bosboot command failing when the PVID is on the pseudo device.

Run *pprootdev fixback* after completing the administrative tasks such as bosboot or mksysb. It transfers the PVIDs onto the hdiskpower device.

Note: Always use the command *bosboot -ad /dev/ipldevice* to create a boot image from the current boot kernel disk.

VNX OE and CLARiiON trespasses

When a trespass occurs in a VNX OE and CLARiiON environment, a passive interface becomes the active interface. In this situation, *bosboot* fails unless you transfer the rootvg PVID to the newly active interface. To do so, run the command `emcpassive2active`. Once you have run the command, *bosboot* succeed.

Run `emcpassive2active` whenever a trespass occurs.

Configure a new PowerPath installation

About this task

If the system contains sufficient internal storage, install and configure the operating system on the internal devices. Use the procedure that is described in Configure an existing PowerPath installation to clone the operating system image on the storage system.
If there is insufficient internal storage, use the following procedure to install AIX directly onto a storage system device and use PowerPath to manage multiple paths to the root volume group.

Procedure

1. Start with a single connection to the storage subsystem. If you are using a switch, only one logical path should be configured.
2. Install AIX on a storage system device that is accessed through a fibre adapter.
3. Install the current storage system drivers.
4. Restart the host.
5. Delete any hdisks in the Defined state.`rmdev -dl`
6. Install PowerPath.
7. Connect the remaining physical connections between the host and the storage system. If you are using a switch, update the zone definitions to the new configuration.
8. Configure a hdisk for each path.

9. Run `powermt config`.
10. Set up multipathing to the root device. `pprootdev on`
11. Add all active *rootvg* storage devices to the boot list. `bootlist`
12. Restart the host.

Configure an existing PowerPath installation

This section describes the process for converting a system that has AIX installed on an internal disk to boot from a logical device on a storage system.

This process involves:

- Transferring a complete copy of the operating system from an internal disk to a logical device on the storage system.
- Configuring PowerPath so the root volume group takes advantage of multipathing and failover capabilities.

Dell EMC recommends that you use this procedure. In the event of a problem, you can revert operations to the host's internal disks.

Update the system microcode

Procedure

1. Find the system model name.`uname -M`

   Output similar to the following is displayed:
   IBM, 7025-F80

2. Find the system microcode level. `lscfg -vp | grep alterable`

   Output similar to the following is displayed:

   ROM Level.(alterable).....M2P020806

   ROM Level.(alterable).....CL020807

3. Download the latest available microcode from the IBM website.
4. After the system restarts, confirm the microcode level. `lscfg -vp | grep alterable`
5. Confirm that the external disks are now bootable.`bootinfo -B hdiskx`
   - Return code 1 indicates that the disk is bootable.
   - Return code 0 indicates that the disk is not bootable.

Install PowerPath

Procedure

1. Verify that all device connections to the storage system are established.
2. Verify that all hdisks are configured properly, as described in Before you install.
3. Install PowerPath as described in Installation methods.
4. Run `powermt config` to configure the PowerPath driver.

Clone the boot device

Procedure

1. Ensure that the AIX disk includes a copy of the Alternate Disk Installation, *bos.alt_disk_install.* `lslpp -aL | grep bos.alt`

   If the disk does not include *bos.alt_disk_install*, install it from the AIX installation CD: `installp -agXd -d/dev/cd0 bos.alt_disk_install`

2. Locate drives with adequate space.

   `bootinfo -s hdiskx`
   For example, assume hdisks 132-134 are adequate with 8 GB total space.

3. Run `powermt display dev=hdisk132` to determine which hdiskpower device contains hdisk132 (the first hdisk identified in step 2 as well as all the path hdisks for that hdiskpower.

   Output similar to the following is displayed:

```
Pseudo name=hdiskpower0
Symmetrix ID=000195700879
Logical device ID=0FBA
Device WWN=60000970000195700879533030464241
state=alive; policy=SymmOpt; queued-IOs=0
==============================================================
---------- Host ---- - Stor -  - I/O Path -  -- Stats --
### HW Path I/O Paths  Interf.  Mode   State  Q-IOs Errors
==============================================================
1   fscsi2  hdisk173   FA 8e:00 active alive  0      0
1   fscsi2  hdisk41    FA 7e:00 active alive  0      0
0   fscsi3  hdisk161   FA 8e:00 active alive  0      0
0   fscsi3  hdisk123   FA 7e:00 active alive  0      0
```

4. Record the hdisk device to receive a copy of rootvg.
5. Run `powermt config`.
6. If the new boot device is on a VNX OE and CLARiiON storage system, run `powermt restore` to ensure that all LUNs are active on the default SP.
7. Move all the hdiskpower devices from Available to Defined state. `lsdev -Ct power | awk '{print $1}' | xargs -n1 rmdev -l`
8. Clear PVID of all the native disks (hdisks identified in step 3) under the chosen PowerPath pseudo device by running the following command on each of them. `chdev -l hdisk# -a pv=clear`
9. Create a copy of the operating system on the storage system hdisks identified in step 2. `alt_disk_install -C hdisk132`

   Output similar to the following is displayed:

```
Calling mkszfile to create new /image.data file.
Checking disk sizes.
Creating cloned rootvg volume group and associated logical volumes.
...
Bootlist is set to the boot disk: hdisk160 blv=hd5
```

Note: In this example, multiple devices may be used to offer increased capacity.

10. Restart the host. `shutdown -Fr`
11. Specify that all path hdisks identified in step 3 are included in the bootlist.

    ```
    bootlist -m normal hdisk132 hdisk223 hdisk314 hdisk41
    ```

    Note: If you are booting from a VNX series and CLARiiON storage system, the bootlist for the AIX host should include all hdisks that correspond to active and passive paths of the boot LUN on all associated SPs. Considerations for VNX OE and CLARiiON storage provides more information.

12. Run `pprootdev` on to enable PowerPath boot support.
13. Restart the host. `shutdown -Fr`

    When the system starts up, *rootvg* is using hdiskpower devices.
14. Run `pprootdev fix`.
15. Run `bosboot -ad /dev/ipldevice`.
16. Reboot the host.
17. Run `bootlist -m normal -o` to check the boot device (hd5).

Troubleshooting: Delete ghost devices, if created

About this task

Run these commands after the first boot with PowerPath. You do not need to reboot after these commands run.

Procedure

1. Run `powermt check` and, when prompted, select a to remove all dead paths.
2. Run `powermt restore`.
3. Run `pprootdev fix`.
4. Delete all the Defined ghost devices. `rmdev -dl hdisk#`
5. Run `savebase`.
6. Run `bosboot -ad /dev/ipldevice`.

Create a rootvg mirror on AIX

Install PowerPath and configure a boot device

Procedure

1. Install PowerPath on the host.
2. Start the Boot from SAN procedure on the host installed with PowerPath.
3. Run `pprootdev` on and then reboot to configure the boot device under PowerPath control.

Create a Rootvg mirror

Procedure

1. Identify one or more PowerPath pseudo devices which could be used for mirroring the existing root device. Extend the root volume group (rootvg) to include these devices. The new device should have same size of the source/existing device in rootvg.

```
extendvg rootvg <new_pseudo_device>
```

2. Run `lsvg -p rootvg` to verify rootvg extended successfully. You should see both the physical volumes. If rootvg did not extend successfully, and then check for a device issue. This step is optional.
3. Mirror rootvg to the newly added device and then verify that mirroring has been completed with 100% sync.

   ```
   mirrorvg -S rootvg <new_pseudo_device>lsvg -l rootvg
   ```

4. Enable bosboot to function correctly after booting from a PowerPath device.

   ```
   pprootdev fix
   ```

5. Run *bosboot*.

   ```
   bosboot -ad /dev/ipldevice
   ```

PVID mismatch and Usage of 'pprootdev fixback'

Procedure

1. In case of rootvg device failed it could be identified in lsvg with the missing physical volume identifier (PVID).

   ```
   lsvg -p rootvg
   ```

   Note: *powermt display* should show all the paths to this device as dead in case device failed and *lsvg -p rootvg* should show PV missing.

2. When the failed device is online there would be PVID mismatch while running *varyonvg*. This should fail with multiple/identical PVID errors.

   ```
   varyonvg rootvg
   ```

3. Run *pprootdev fixback*. Fixback enables varyonvg of rootvg in a mirrored rootvg environment as it transfers the PVIDs onto the hdiskpower device in the ODM.
4. Run *varyonvg*. varyonvg rootvg should succeed without any error.

Add one or more paths while booting off the array

About this task

Note: If you fail to follow this procedure, the host may stop or fail to boot to the PowerPath pseudo device.

Procedure

1. Run *pprootdev fix*.
2. Add one or more paths.
3. Run *cfgmgr*.
4. Run *powermt config*.
5. Run *savebase*.
6. Run *bosboot –ad /dev/ipldevice*.
7. Modify the bootlist to include the additional devices.
8. Restart the host.

Disable PowerPath on a storage system boot device

About this task

Disable PowerPath load balancing and failover functionality on a storage system boot device.

Procedure

1. Turn off multipathing to the root device.

   ```
   pprootdev off
   ```

2. Restart the host.

Boot an AIX host from a CLARiiON device

Procedure

1. Run *powermt display dev=hdiskpower2*.

   Output similar to the following is displayed:

   ```
   Pseudo name=hdiskpower2
   VNX ID=APM00133736358 [ax202039]
   Logical device ID=60060160262037001C601A44159AE611 [ax202039__1]
   state=alive; policy=CLAROpt; 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
   ==============================================================
   0   fscsi0  hdisk311   SP A0   active alive   0    0
   0   fscsi0  hdisk338   SP B1   active alive   0    0
   1   fscsi1  hdisk356   SP B0   active alive   0    0
   1   fscsi1  hdisk365   SP A1   active alive   0    0
   ```

2. Remove PowerPath control.

   lsdev -Ct power | awk '{print $1}' | xargs –n1 rmdev –l

3. Run the following commands:

   ```
   chdev -l hdisk311 -a pv=clear
   chdev -l hdisk338 -a pv=clear
   chdev -l hdisk356 -a pv=clear
   chdev -l hdisk365 -a pv=clear
   ```

4. Run *alt_disk_install –C hdisk311*.
5. Run *shutdown -Fr*.
6. Add any native disks

   ```
   bootlist -m normal hdisk311 hdisk338 hdisk356 hdisk365
   ```

7. Enable PowerPath boot support.

   ```
   pprootdev on
   ```

8. Reboot the host.

9. Run *pprootdev fix*.
10. Run *bosboot –ad /dev/ipldevice*.
11. Reboot the host.
12. Check the boot device (hd5).

    ```
    bootlist -m normal -o
    ```

13. Run `lslv –l hd5` to list the current physical boot device.
14. Run `ipl_varyon –i` to determine which disks are bootable.

CHAPTER 4

Configuring a PowerPath Logical Device

This chapter includes the following sections:

Reconfiguring PowerPath after making configuration changes

You must reconfigure PowerPath after making configuration changes that affect host-to-storage-system connectivity or logical device identification.

For example:

- Fibre Channel switch zone changes
- Adding or removing Fibre Channel switches
- Adding or removing HBAs or storage-system ports
- Adding or removing logical devices
- Redeploying existing logical devices

Note: If you do not reconfigure PowerPath after making configuration changes, many of these changes are treated as unintentional, and PowerPath tries to prevent them from affecting applications.

Many platform-specific and some PowerPath reconfiguration operations fails if the affected logical devices are in use (either just marked alive or with I/O in progress).

After any reconfiguration, you must monitor the outcome of individual reconfiguration steps and confirm that the resulting changes are as expected, before relying on the new configuration. Otherwise, some paths may not be as expected. For example, on platforms that support native devices, it is possible to inadvertently write to the wrong logical device (thinking that the native device is associated with a different logical device).

Add new paths to a logical device

This procedure adds new paths to a logical device already configured (with at least one path) in PowerPath and to managed storage system classes only. It does not apply to any storage system class that has been excluded from PowerPath control through the powermt unmanage command. The Dell EMC PowerPath Family CLI and Messages Guide contains additional information about the `powermt unmanage` command.

About this task

This procedure can be done without interruption to running applications on AIX hosts. Once the reconfiguration is completed successfully, new native devices can be used like any other native devices.

CAUTION All operations must succeed for the reconfiguration to be successful. If any step fails, resolve that issue before proceeding. Do not use the new configuration until the entire procedure completes successfully.

Note: Do not configure more than 32 paths per logical device.

Procedure

1. Run **powermt display** to confirm the current configuration, and run **powermt display dev=all** to confirm the configuration of the logical devices to which new paths will be added. Ensure that the number of logical devices, hardware paths, and I/O paths are as expected. The path state should be alive for known good paths and dead for known bad paths.

   If there is a problem, correct it before proceeding.

2. Make physical path additions as required:

   a. Map the logical device to additional storage-system ports.

b. Add new HBAs. Your vendor documentation will provide more details.

c. Attach cables.

d. Rezone Fibre Channel switches.

3. If using SAN Manager, Volume Logix, or Access Logix™, make new paths available to the host using those tools.
4. In order for the operating system to recognize new paths so that PowerPath can recognize the new paths, run the **cfgmgr**.

   See emc_cfgmgr script for more information about the emc_cfgmgr script.
5. Run **powermt config**.
6. Inspect the new PowerPath configuration:

   a. Run **powermt display dev=all**.

   The new paths should be displayed with a state of alive.

   b. Run **powermt restore** to test all paths.

   c. Scan operating system error logs to ensure no errors are logged against the new paths.
7. Correct any issues detected.
8. Run **powermt save** to save the new configuration.

   PowerPath AIX online path addition automatically inherits existing path attributes.
   If the pseudo device and its underlying native devices have no_reserve as the reserve policy and if new paths are added to this device, the new paths will inherit the reserve policy of the pseudo device which is no_reserve in this case.

   Note: PowerPath reconfiguration operations will fail if the affected devices are in use (example, VG is active on the PP device or I/Os are running).

   Note: If affected devices are in use:

   - If the reconfiguration fails because affected devices are in use, run the chdev command with the -P flag.
   - Restart the host for the attribute change to come into effect.

Add new logical devices

This procedure adds new logical devices (with one or more paths) to be managed by PowerPath and applies to managed storage system classes only. It does not apply to any storage system class that has been excluded from PowerPath control through the powermt unmanage command.

About this task

On AIX hosts, logical devices can be added without interruption of service, since no existing application can be using a logical device that is not yet available. However, the procedure to use a new logical device (regardless of whether it is managed by PowerPath) is platform-specific and may require service interruption.
Once the reconfiguration is completed successfully, new pseudo devices and native devices can be used.

CAUTION All operations must succeed for the reconfiguration to be successful. If any step fails, resolve that issue before proceeding. Do not use the new configuration until the entire procedure completes successfully.

To add logical devices to the PowerPath configuration:

Procedure

1. Run **powermt display** to confirm the current configuration. Ensure that the number of logical devices, hardware paths, and I/O paths are as expected. The path state should be alive for known good paths and dead for known bad paths.
2. Make logical device and physical path changes as required:
   a. Create new logical devices.
   b. Map logical devices to one or more storage-system ports.
   c. Add new HBAs. Your vendor documentation will provide more details.
   d. Attach cables.
   e. Rezone Fibre Channel switches.
3. If using SAN Manager, Volume Logix, or Access Logix, make new paths available to the host using those tools.
4. In order for the operating system to recognize a new logical device so that PowerPath can then recognize a new logical device, run the `emc_cfgmgr` script.

   See emc_cfgmgr script for more information on the `emc_cfgmgr` script.
5. Run **powermt config**.
6. Inspect the new PowerPath configuration:
   a. Run **powermt display dev=all**.

      All paths associated with the new logical devices should be displayed with a state of alive.
   b. Run **powermt restore** to test all paths to the new logical device.
   c. Scan operating system error logs to ensure no errors are logged against the new paths and logical device.
7. Correct any issues detected, before saving the PowerPath configuration or using the new logical device.
8. Set PowerPath-specific options for the new logical devices, such as load-balancing and failover policy, path modes, write throttle enablement, and priority.
9. Run **powermt config**.
10. Run **powermt save** to save the new configuration.
11. Run the command that refreshes the ControlCenter database of device information, where **EMC ControlCenter** is installed,. The documentation for your version of EMC ControlCenter provides information.

Remove paths or logical devices

This section describes how to remove the following from a PowerPath configuration: Specified paths to logical devices.

About this task

Note: Before physically removing a device, ensure that the device is removed from PowerPath and AIX configurations. Otherwise, PowerPath may mark all paths dead for other devices and bring them alive again or data loss may occur.

Once a device is removed from the PowerPath configuration, you can remove it from the AIX configuration, and then replace hardware as needed. PowerPath maintains static information about the characteristics of an hdiskpower device in several places in the ODM and also within the

powerpath0 driver. This static information enables PowerPath to restore a failed path and to maintain persistent hdiskpower numbers across host reboots.

You should also follow this procedure to:

- Delete a PowerPath configuration, for example, as part of an ODM cleanup.
- Change logical unit numbers on storage devices.
- Restore a mksysb image from one host to another when the image contains preconfigured PowerPath devices.

CAUTION Failure to follow this procedure could cause unexpected behavior when you later try to add devices to PowerPath.

Note: To reconfigure for PowerPath control any device you have removed from the PowerPath configuration, you must run powermt config.

Procedure

1. Run **powermt display dev=all** to:
   - Confirm the configuration of the logical devices from which paths are removed. Check the number of existing paths. The path state should be alive for known good paths and dead for known bad paths. If there is a problem, correct it before proceeding.
   - Identify the PowerPath HBA number associated with the paths to be removed. In complex topologies, there can be multiple paths on an HBA.
2. As necessary, identify the physical paths to be removed or zoned out, and confirm that there are other paths to the affected logical devices. (Otherwise, applications using those logical devices could experience I/O errors when you proceed.)
3. Run **powermt remove** for each device you want to unmap. This updates the information in the powerpath0 driver. Specify on the command line:
   - The HBA—to remove the entire HBA.
   - The device—to remove all paths to the specified logical device.
   - Both HBA and device—to remove a single path to the specified logical device.
4. Run **rmdev -dl** for each PowerPath device or HBA you want removed from the host. This command deletes old entries and characteristics from the ODM.
5. Run **rmdev -dl** on the underlying hdisks associated with the devices you removed in the previous step.
6. Run **savebase -v** to update phase 1 device attributes in the boot logical volume.
7. Inspect the new PowerPath configuration.
   - Run powermt display. The output should show fewer total paths than before. All paths should have a state of optimal.
   - Run **powermt display dev=all**. All remaining paths associated with the affected logical devices should be displayed with a state of alive.

   Correct any issues detected above before saving the PowerPath configuration or using the new logical devices.
8. Run **powermt save** to save the new configuration.

Clean up incorrect path or logical volume removal

Procedure

1. Identify the removed volume and its paths.

   ```
   powermt display
   ```

   In the output the volume and its path should all display as **dead**.
2. Run **powermt check dev =<dev>** for device in question.

CHAPTER 5

PowerPath in a Cluster

This chapter includes the following sections:

PowerPath in a PowerHA/HACMP Cluster

`emcpowerreset` is a binary that is required only for Symmetrix and VNX Family for any HACMP installation on AIX when PowerPath is also installed. You can download the binary from the Dell EMC Online Support site.

Note: The upgrade procedure of PowerPath with PowerHA/HACMP is identical to the procedures described for other cluster environments.

Install PowerPath and PowerHA/HACMP on new hosts

To install and configure PowerPath and PowerHA/HACMP when neither PowerPath nor HACMP is installed:

Procedure

1. On all hosts, prepare the cluster hardware, making the necessary networking and disk connections between the hosts and the storage system. The relevant AIX HACMP documentation provides information. For Symmetrix or CLARiiON systems, the *EMC Host Connectivity Guide for IBM AIX* on Dell EMC Online Support or the CLARiiON storage-system support website contains additional information.
2. On one host in the cluster:
   a. Install PowerPath. Installing PowerPath on an AIX host contains additional information.
   b. Identify the LVM volume groups that use PowerPath hdiskpower devices:
      a. First run `powermt display dev=all` to list each hdiskpower device.
      b. Then run `lspv` to identify the volume group to which each hdiskpower device belongs.
   c. Install PowerHA/HACMP following the instructions in the relevant AIX PowerHA/HACMP documentation. Configure PowerHA/HACMP to use the volume groups that are identified in step 2b. Ensure that they are the same volume groups on each host.

      When using PowerPath in a concurrent resource group environment, the `/usr/sbin/cluster/diag/clconraid.dat` file must be updated to recognize power devices:

      - For any storage system, you can update clconraid.dat manually by inserting the word power in the first line of the file using a text editor.

   d. Stop all applications that use the volume groups that are identified in step 2b.

      Unmount all file systems that use these volume groups.

      Run `smit varyoffvg` to deactivate each volume group.
3. On each remaining host in the cluster:
   a. Install PowerPath. Installing PowerPath on an AIX host contains additional information.

      If any hdisk attached to the host does not have a PVID or has a different PVID on different hosts, run rmdev on that hdisk. And then run the `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr` script, followed by powermt config, to configure the devices for the host.

      The emc_cfgmgr script is available at the following EMC FTP site: ftp://ftp.EMC.com/pub/elab/aix/ODM_DEFINITIONS

Do not define any volume groups. Instead, import the volume groups from the host on which you installed PowerPath.

b. Use the `smit importvg` command to import each volume group identified in step 2b.

c. Use the `smit chvg` command to change the autoactivation status of each volume group that you imported in step 3b from yes to no.

d. Install PowerHA/HACMP, following the instructions in the relevant AIX HACMP documentation. Configure HACMP to use the volume groups imported in step 3b.

4. On all hosts, start cluster services, using the `smit clstart` command.

   The volume groups and the underlying PowerPath hdiskpower devices are now under the control of the HACMP software.

5. Implement the `emcpowerreset` binary. `emcpowerreset` is required for any HACMP installation on AIX 5.x when PowerPath is installed. You can download the `emcpowerreset` binary from http://support.emc.com (search for PowerReset). See EMC Knowledgebase Solutions emc69100 and emc104555 for more information.

   When using PowerPath with HACMP in a CLARiiON environment, cfgscsi_id binary in a CLARiiON environment provides information.

Integrate PowerHA/HACMP in a PowerPath environment

When PowerPath, but not HACMP, is installed on the hosts to be part of the cluster, follow these steps:

About this task

On each host in the cluster, one host at a time:

Procedure

1. Prepare the cluster hardware, making the necessary networking and disk connections among the hosts and the storage system. The relevant AIX HACMP documentation provides information. For Symmetrix or CLARiiON systems, the *EMC Host Connectivity Guide for IBM AIX* on Dell EMC Online Support or the CLARiiON storage-system support website contains additional information.
2. Identify the LVM volume groups that use PowerPath hdiskpower devices:

   a. First run `powermt display dev=all` to list each hdiskpower device.

   b. Then run `lspv` to identify the volume group to which each hdiskpower device belongs.

3. Install PowerHA/HACMP, following the instructions in the relevant AIX HACMP documentation. Configure HACMP to use the volume groups that are identified in step 2. Ensure that they are the same volume groups on each host.

   When using PowerPath in a concurrent resource group environment, the /usr/sbin/cluster/diag/clconraid.dat file must be updated to recognize power devices:

   - For any storage system, you can update `clconraid.dat` manually by inserting the word power in the first line of the file using a text editor.

4. Stop all applications that use the volume groups that are identified in step 2. Unmount all file systems that use these volume groups. Use the smit varyoffvg command to deactivate each volume group.
5. Start cluster services, using the `smit clstart` command.

   The volume groups and the underlying PowerPath hdiskpower devices are now under the control of the HACMP software.

6. Implement the emcpowerreset binary. emcpowerreset is required for any HACMP installation on AIX 5.x when PowerPath is installed. You can download the `emcpowerreset` binary from http://support.emc.com (search for PowerReset). See EMC Knowledgebase Solutions emc69100 and emc104555 for more information.

cfgscsi_id binary in a CLARiiON environment

In a CLARiiON environment the cfgscsi_id binary is required in addition to the emcpowerreset binary. When you install PowerPath, the cfgscsi_id binary is unpacked to the /usr/sbin directory.

Note: The synchronization for the cluster fails if cfgscsi_id is not used.

Synchronize volume group information between cluster nodes

If a shared volume group must be extended, use the following procedure:

Procedure

1. Run the /usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr script to configure any new devices to the active host.

   The `emc_cfgmgr` script is available at the following Dell EMC FTP site: ftp://ftp.EMC.com/pub/elab/aix/ODM_DEFINITIONS

2. Run **powermt config**.
3. Run `chdev -l hdiskpowerx -a pv=yes` to create a PVID on the new devices.
4. Configure the new devices to all other nodes in the cluster, following steps 1 and 2.

   Once this is complete, you can extend your volume group on the active node.

5. Import the shared volume group to the standby node, using the HACMP CSPOC utilities. On the standby node, use the smit fastpath `smitty cl_vg` command.
6. Select Import a **Shared Volume Group**.
7. Select the volume group that was just extended on the active node.
8. Select the node and physical hdiskpower device on which the volume group was extended.

   The nodes volume group is updated with the new extended volume.

hdiskpower devices in a PowerHA/HACMP environment

As a safety feature, PowerPath does not put a PVID on an hdiskpower entry unless it can read the information from the disk itself. If the disk is reserved (varied ON) by another AIX node, no other AIX node can access the disk. This includes PowerPath commands run on the other AIX nodes to try to read the PVID information from the disk.

About this task

hdiskpower devices may lose PVID and VG information after becoming Defined in an AIX shared disk environment. If this happens, an HACMP cluster does not fail over correctly. Use the following online procedure to correct the situation:

Procedure

1. Run `lspv` to confirm that all PVID and VG information is correct on all the underlying hdisk entries. (If it is not, EMC Knowledgebase Solution emc74494 provides additional information)
2. Run `rmdev -l hdiskpowerx` to put all the hdiskpower entries back into a defined state.
3. Run `lsdev -Cc` disk to confirm all hdiskpower entries are defined.

4. Move (fail over) all the HACMP resource groups to this AIX node. With the hdiskpower entries in a defined state, an HACMP failover will now work because the correct break SCSI reservation utility will be called.
5. Run `powermt config` to move the PVID and VG information from the hdisk to the hdiskpower entries and make them **Available**. Once all the HACMP resources are owned by this node, PowerPath commands can access the disk.

   Note: If you reboot a host when the hdiskpower device is Available and the PVID is on the underlying hdisk, lspv output loses all PVID and VG information. If a failover is attempted at this point, it will fail. The Troubleshooting section provides information to help you solve this problem.

   See EMC Knowledgebase Solution emc74494 for more information.

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.

Install PowerPath in a new VCS cluster

To install PowerPath and VCS when neither PowerPath nor VCS is installed on any host:

Procedure

1. On each host to be included in the cluster:
   a. Prepare the cluster hardware, making the necessary networking and disk connections among the hosts and the storage system. Refer to the relevant VCS documentation.
   b. Verify that all storage system devices are seen by each host.
   c. Install PowerPath as described in Chapter 1, Installing PowerPath on an AIX host. Verify that PowerPath can see all the devices.
   d. Install any applications.
   e. Install the VCS software, following the installation procedure described in the relevant Veritas Cluster Server documentation. Initially configure VCS to run without a service group.
2. On each node in the cluster:
   a. Define the resources (for example, VxVM volumes) that make up the service group.

      Note: How to configure the service group is given in step 3.

   b. Identify the LVM volume groups that use PowerPath hdiskpower devices.
      - First, run **powermt display dev=all** to list each hdiskpower device.
      - Then, run `lspv` to identify the volume group to which each hdiskpower device belongs.
3. On one host 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 PowerPath pseudo (hdiskpower) 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. Configure VCS to use the volume groups that are identified in step 2b. Ensure that they are the same volume groups on each host.

c. 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.

Integrate PowerPath into a VCS cluster

To integrate PowerPath into an existing VCS cluster, follow these steps on each cluster node, one node at a time:

Procedure

1. Run `hastop -local -evacuate` to stop cluster services on the node.
2. Install or upgrade PowerPath. Chapter 1, Installing PowerPath on an AIX host contains additional information.
3. Run `hastart` to start cluster services on the node.

   Wait for each node to be fully integrated into the cluster before running `hastart` on the next node.

Change the naming scheme for Veritas volumes

Use this procedure to change the namingscheme for Veritas volumes when PowerPath is installed.

Procedure

1. To display the attributes of a specified enclosure like enclosure type, enclosure serial number, status, array type, and number of LUNs, run:

   ```
   # vxdmpadm listenclosure all
   ```

   Output similar to the following is displayed:

   ```
   ENCLR_NAME ENCLR_TYPE ENCLR_SNO STATUS ARRAY_TYPE LUN_COUNT
   ============================================================
   pp_emc_clariion0 PP_EMC_CLARiiON APM00120202000 CONNECTED A/A 44
   pp_emc0 PP_EMC 000195700879 CONNECTED A/A 45
   ibm_vscsi0 IBM_VSCSI VSCSI CONNECTED VSCSI 2
   ```

2. Change the device naming scheme for TPD-controlled enclosures:

   ```
   # vxdmpadm setattr enclosure enclosure_name tpdmode=native
   ```

   Example: `# vxdmpadm setattr enclosure pp_emc0 tpdmode=native`

3. Select the operating system-based naming:

   ```
   # vxddladm set namingscheme=osn
   ```

4. Display the current disk-naming scheme and the mode of operations:

   ```
   # vxddladm get namingscheme
   ```

   Output similar to the following is displayed:

   ```
   NAMING_SCHEME PERSISTENCE LOWERCASE USE_AVID
   ============================================================
   OS Native No Yes Yes
   -bash-3.00# vxdisk list
   hdiskpower124 auto:none - - online invalid
   hdiskpower125 auto:none - - online invalid
   hdiskpower126 auto:none - - online invalid
   hdiskpower127 auto:none - - online invalid
   hdiskpower128 auto:LVM - - LVM
   hdisk1 auto:LVM - - LVM
   hdisk6 auto:LVM - - LVM
   ```

5. Scan the disks:

   ```
   # vxdisk scandisks
   ```

6. Display information about all the disks that are known to VxVM:

   ```
   # vxddladm set namingscheme=ebn
   ```

   Output similar to the following is displayed:

   ```
   # vxdisk list
   DEVICE TYPE DISK GROUP STATUS
   pp_emc_clariion0_0 auto:LVM - - LVM
   pp_emc_clariion0_1 auto:none - - online
   invalid
   pp_emc_clariion0_2 auto:none - - online
   invalid
   pp_emc_clariion0_3 auto:none - - online
   invalid
   pp_emc_clariion0_4 auto:LVM - - LVM
   pp_emc_clariion0_5 auto:LVM - - LVM
   pp_emc_clariion0_6 auto:LVM - - LVM
   pp_emc0_0 auto:none - - online invalid
   pp_emc0_1 auto:cdsdisk - - online invalid
   pp_emc0_2 auto:LVM - - LVM
   pp_emc0_3 auto:none - - online invalid
   pp_emc0_4 auto:none - - online invalid
   pp_emc0_5 auto:none - - online invalid
   pp_emc0_6 auto:LVM - - LVM
   pp_emc0_7 auto:none - - online invalid
   ```

CHAPTER 6

PowerPath features for PowerMax array

PowerPath for AIX 6.4 supports the following features when the host is connected to a PowerMax array running microcode 5978 and above.

PowerPath Host Registration

This section provides information on the PowerPath Host Registration feature.

Overview

PowerPath Host Registration is a feature that enables a host to be registered with a storage array. This makes it easier to configure storage for a new host from an array. This section describes how PowerPath Host Registration works with a PowerMax array running microcode 5978 and above only.

Note: All references to PowerMax refers only to PowerMax running microcode 5978 and above.

Initial Registration and Storage Configuration

This section provides information on the initial registration and storage configuration of the host with a storage array.

When a new host is zoned to a PowerMax array, virtual devices known as LUNZ devices are presented to the host, one per logical path. These devices are automatically configured in PowerPath. However, `powermt display` does not show these devices. Once the LUNZ devices are configured in PowerPath, registration commands are automatically sent on each path to the array through the LUNZ devices.

The registration commands contain information such as hostname, UUID, OS version and PowerPath version. On receipt of these registration commands, the PowerMax array creates a host record and all the WWNs of the host's HBAs are grouped under this record. If AUTO IG creation feature is enabled on the array, then an Initiator Group is created automatically.

After the Initiator Group is created (automatically or manually), then other entities such as, the Storage Group, Port Group, and Masking view can be created to configure data LUNs for the host. On creation of these entities, PowerPath automatically triggers a bus scan on the host and then executes a `powermt config` command to configure the new LUNs on the host. The new LUNs are available for use by applications.

Mode of operation

PowerPath Host Registration works in the following two modes:

Automatic

PowerPath Host Registration is configured automatically in the following scenarios:

- On emcp mond start or host reboot, the registration is attempted within 5 minutes.
- Once every 24 hours after the initial registration, registration is again attempted. This helps in the array being aware that the host is active.
- If any of the host information such as the hostname changes, then a registration is attempted within 60 minutes.
- If the host is zoned to a new PowerMax array, then the registration is attempted within 5 minutes.

  Note: Ensure that emcp mond is running for this feature to work. See the Start emcp mond service section for more details.

Manual

The `powermt update host_registration` command can be run at any time to send registration to all connected PowerMax arrays. This is useful in scenarios where the hostname is changed and the array needs to be updated immediately.

Settings

This section provides information on the settings that you need to configure the PowerPath Host Registration.

PowerPath Host Registration is enabled by default for Symmetrix arrays. This can be seen with the `powermt display options` command.

```
bash-4.0# powermt display options

        Show CLARiiON LUN names:      true

        Path Latency Monitor: Off

        Performance Monitor: disabled

        Autostandby:  IOs per Failure (iopf): enabled
                      iopf aging period     : 1 d
                      iopf limit            : 6000

        Storage
        System Class  Attributes
        ------------  ----------

        Symmetrix     periodic autorestore = on
                      reactive autorestore = on
                      status = managed
                      proximity based autostandby = off
                      auto host registration = enabled
                      device to array performance report = enabled
                      device in use to array report = enabled
```

This setting can be changed with the following powermt set command:

```
powermt set auto_host_registration={on|off} class=<class>
```

There is also a setting on the PowerMax array which enables or disables accepting host registration commands. If the host registration is disabled on the array, but enabled on the host, registration is not attempted.

Viewing Host Registration

The Solutions Enabler software is used to check the details of the host from the array after registration. In this PowerPath release, cluster details are not sent in the registration commands and hence the array does not display any cluster details even if the host is running a cluster software.

```
bash-4.2# ./symcfg -sid 413 list -ppreg -host ax202033

Symmetrix ID     : 000197801413

    Host Name:              ax202033
    OS Version:             AIX-7.2
    OS Revision:            02-02-1810
    Hardware Vendor Name:   IBM
    PowerPath Version:      6.4.0
    PowerPath Patch Level:  00.00-059
    PowerPath License Info: xxxx-xxxx-xxxx-xxxx-xxxx-xxxx
```

```
    Host Registration Time: 09/24/2018 06:50:19
    Host Connectivity type: FC
    Cluster Info:
       Cluster Name:
       Cluster Node Name:
    WWNs:
       (1): 10000090FA1F0E46
       (2): 10000090FA1F0E47
    VMs:

bash-4.2#
```

FX Licensing

This section provides information on the FX licensing feature.

Overview

PowerPath gets licensed automatically when it detects any data device from PowerMax with FX software package.

The number of hosts that can thus be licensed is limited to 75 hosts per FX bundle. PowerPath is fully licensed for all LUNs and paths from all array types.

Viewing FX licensing information

You can view the FX licensing information as follows:

```
[root@lnd198032 ~]# powermt check_registration
Host is licensed through FX array.
```

PowerPath Device IO Statistics

This section provides information on the PowerPath Device IO Statistics feature.

Overview

The PowerPath Device IO Statistics feature provides host IO performance collection and reporting to PowerMax.

These statistics are collected per PowerPath managed PowerMax device and reported to array at one minute intervals.

Note: Ensure that emcp mond is running for this feature to work. See the Start emcp mond service section for more details.

Settings

This section provides information about the settings that you need to configure the PowerPath Device IO Statistics.

PowerPath Device IO Statistics is enabled by default for Symmetrix arrays. This can be seen with the `powermt display options` command.

```
bash-4.0# powermt display options

        Show CLARiiON LUN names:      true

        Path Latency Monitor: Off
```

```
        Performance Monitor: disabled

        Autostandby:  IOs per Failure (iopf): enabled
                      iopf aging period     : 1 d
                      iopf limit            : 6000

        Storage
        System Class  Attributes
        ------------  ----------

        Symmetrix     periodic autorestore = on
                      reactive autorestore = on
                      status = managed
                      proximity based autostandby = off
                      auto host registration = enabled
                      device to array performance report = enabled
                      device in use to array report = enabled
```

This setting can be changed with the following powermt set command:

```
#powermt set device_perf_to_array_report={on|off} [class=<class>|all]
```

Viewing PowerPath Device IO Statistics

PowerMax populates these performance statistics in Unisphere providing a single pane of display with both host and array level statistics.

PowerPath Device in Use Reporting

This section provides information on the PowerPath Device in Use Reporting feature.

Overview

PowerPath Device in Use Reporting feature provides a way to report if devices are used on the host. Once every 24 hours, for each PowerMax device, PowerPath sends details such as if the device is mounted and name of the process that used the device in the preceding 24 hours to the array.

The device usage statistics can be used by storage administrators to determine LUN usage on hosts as well as in array capacity and resource planning.

Note: Ensure that emcp mond is running for this feature to work. See the Start emcp mond service section for more details.

Settings

This section provides information on the settings that you need to configure the PowerPath Device in Use.

PowerPath Device in Use is enabled by default for Symmetrix arrays. This can be seen with the `powermt display options` command.

```
bash-4.0# powermt display options

        Show CLARiiON LUN names:      true

        Path Latency Monitor: Off

        Performance Monitor: disabled

        Autostandby:  IOs per Failure (iopf): enabled
                      iopf aging period     : 1 d
                      iopf limit            : 6000
```

```
       Storage
       System Class  Attributes
       ------------  ----------

       Symmetrix     periodic autorestore = on
                     reactive autorestore = on
                     status = managed
                     proximity based autostandby = off
                     auto host registration = enabled
                     device to array performance report = enabled
                     device in use to array report = enabled
```

This setting can be changed with the following powermt set command:

```
#powermt set dev_inuse_to_array_report={on|off} [class=<class>|all]
```

Viewing PowerPath Device in Use information

You can view the PowerPath Device in Use information as follows:

```
bash-4.2# ./symdev list -ppi -dev 23FA -sid 000197801413

Symmetrix ID     : 000197801413

        P O W E R P A T H  D E V I C E  S T A T U S
Device Last I/O Time      Mounted Hostname         Process name
------ -----------------  ------- ---------------- ----------------
 023FA 10/12/18 07:12:56      Yes ax202033         cfgpowerdisk
bash-4.2#
```

CHAPTER 7

Upgrading PowerPath on an AIX Host

This chapter includes the following sections:

Upgrading PowerPath

Based on your environment and requirements, you can upgrade PowerPath using:

- Full package installation: You can directly upgrade PowerPath from a previous version with the later version of PowerPath package.

Before upgrading PowerPath

- Download the latest version of Dell EMC Grabs, available on Dell EMC Online Support, and then run the PowerPath Configuration Checker (PPCC).
- Check the Dell EMC Online Support site, for the most current release notes and service packs.
- You do not need to remove the previous version of PowerPath before upgrading to PowerPath 6.x.

During an upgrade

Do not add devices to your PowerPath configuration.

After an upgrade

You do not need to restart the host after the upgrade, if you have closed all applications that use PowerPath devices before you install PowerPath 6.x.

You do not need to re-enter license information for PowerPath multipathing. PowerPath uses your existing license key.

Note: Disabling the cluster services before upgrading PowerPath is not a mandatory requirement. You can ensure continuous availability of the services despite the disk being closed for the PowerPath upgrade. For continuous service availability, fail over the resources of the disk to another node.

Upgrade procedure

This section explains upgrade procedure.

About this task

Note: When upgrading in a dual VIO server environment, follow the procedure described in Upgrade PowerPath in a VIO server environment. When upgrading in PowerHA/HACMP configurations, follow the procedure described in Integrate PowerHA/HACMP in a PowerPath environment.

Procedure

1. Close all applications that use PowerPath devices, and vary off all volume groups except the root volume group (rootvg).

   Note: If any application is holding a PowerPath device open, the upgrade will fail. Note that certain applications such as EMC ControlCenter® agents or the Navisphere agent running on a host attached to a VNX OE block and CLARiiON system may have PowerPath devices open; and, this will cause the upgrade to fail.

   - If EMC Solutions Enabler daemons, such as storwatchd and storapid, are running, run stordaemon shutdown <daemon> to stop the daemons before you install PowerPath.

- If EMC ControlCenter is running on the host, stop the ControlCenter agents.
- In a VNX OE block and CLARiiON environment, if the Navisphere Host Agent is running, type /etc/rc.agent stop, to stop the agents before uninstalling PowerPath.

2. Install PowerPath.
3. When upgrading from PowerPath 5.3 SP1/5.5, the configuration data from the powermt.custom file needs to be loaded to the default /etc/powermt_custom.xml file. To do this, specify file =/etc/powermt.custom in the powermt load command. If this is not specified, the configuration data is loaded from the default .xml file.
4. Run **powermt config**.
5. Run **powermt save** to save configuration data to the `/etc/powermt_custom.xml` file.

   When you upgrade from an unlicensed to a licensed version of PowerPath, the load balancing and failover device policy is set to bf/nr (BasicFailover/NoRedirect). You can change the policy by using the powermt set policy command.

Upgrade PowerPath in a VIO server environment

You can perform an upgrade with a full package installation or by uninstalling the existing version and then installing the later version. Each of these methods differently affects the mapping information in a Virtual I/O (VIO) server environment. Therefore, based on your choice, the upgrading procedure also differs in a VIOS environment.

About this task

When you upgrade by using the full package installation, the mapping information is maintained by default. However, if you choose to uninstall PowerPath and install PowerPath 6.x, you need to follow this procedure:

Procedure

1. Before uninstalling PowerPath, back up the mapping information first.
2. Unmap the devices. Follow the procedure in Unmap PowerPath.
3. Uninstall PowerPath.
4. Install PowerPath 6.x.
5. Use the stored mapping information and map the devices.

Reserve policy setting

Upgrading PowerPath from 5.3 and its minor releases to PowerPath 6.x changes the reserve_lock attribute of the devices to reserve_policy and PR_Key Value. After the upgrade, the default value of the reserve_policy attribute is set to single_path 60 EMC PowerPath for AIX Installation and Administration Guide provided reserve_lock = yes. Dual VIO Server setups with shared disk configurations require the reserve_policy attribute to be set to no_reserve before configuring them to the VIO Client.

For information about how to set `reserve_policy` to `no_reserve` before running `powermt config`, see Reserve_policy setting in Dual VIO Server Environments.

Unmap PowerPath

This section describes information about unmapping PowerPath.

Procedure

1. On one of the VIO servers, run **lsmap -all**.

   This command shows the mapping among physical, logical, and virtual devices.

Output similar to the following is displayed:

```
$ lsmap -all
SVSA        Physloc            Client Partition ID
--------------  ------------------------- --------------------
vhost1          U8203.E4A.069BE95-V2-C12   0x00000007
VTD         vtscsi0
Status          Available
LUN         0x8100000000000000
Backing device     hdiskpower3
Physloc     U789C.001.DQD6R05-P1-C2-T2-L11
Mirrored     false
VTD         vtscsi1
Status          Available
LUN         0x8200000000000000
Backing device     hdiskpower5
Physloc     U789C.001.DQD6R05-P1-C2-T2-L17
Mirrored     false
```

2. Log in on the same VIO server as the **padmin** user.
3. Unconfigure all the VTDs using hdiskpower devices identified in step 1, by running:

   ```
   # rmdev -dev <VTD> -ucfg
   ```

   where <VTD> is the virtual target device.

   For example: `rmdev -dev vtscsil -ucfg`

   The VTD status changes to Defined.

   Note: Run `rmdev -dev <VTD> -ucfg` for all VTDs identified in step 1.

4. Upgrade PowerPath as described in Upgrade procedure.
5. Run **powermt config**.
6. Run **cfgmgr**
7. Run **lspath** on all clients to verify that all paths are enabled.
8. Perform steps 1 through 5 on the second VIO server.
9. At times the path status may be displayed as Disabled even if the 'lsmap-all' output in the VIOS is displayed as Available. If this happens, run the following:

   a. #chpath -l <hdisk#> -p <vscsi#> -s disable

   b. #chpath -l <hdisk#> -p <vscsi#> -s enable

Upgrade PowerPath on PowerHA7.1

When upgrading PowerPath for AIX on PowerHA/HACMP clusters, it is recommended to use concurrent volume groups (VGs). PowerPath for AIX does not support seamlessupgrades on PowerHA/HACMP configuration with non-concurrent volume groups. Recommended setting is either `reserve_policy=no_reserve` or `reserve_lock=no`

About this task

To upgrade PowerPath on PowerHA7.1:

Procedure

1. Select the node where you want to upgrade PowerPath.

   a. Stop PowerHA Cluster Services through smitty on the passive node.

b. Enter `smitty hacmp`.

c. Select **System Management (CSPOC)** > **PowerHA System Mirror Services** > **Stop Cluster Service**

d. Press Enter.

Note: Ensure that cluster services are stopped and verify the status using **lssrc -ls clstrmgrES**

2. Set the passive node to maintenance mode:

   `clctrl -stop -n <clustername> -m <nodename>`

   Example: clctrl -stop -n powerha_cluster -m aix154.emc.com. Where:

   - clctrl is the system administration function for managing a cluster
   - powerha_cluster is the cluster name
   - aix154.emc.com is the node name

   This will deactivate the Caavg_private on the passive node.

3. Ensure that Naviagent and stordaemons are stopped.
4. Upgrade PowerPath on the passive node. Use either:

   `smit update_all or installp -agXd EMCpower_install all`

5. Run **cfgmgr -v** and **powermt config**, after PowerPath is upgraded.
6. Bring cluster back to normal mode, on the passive node:

   clctrl -start -n <clustername> -m <nodename>

   Example: clctrl -start -n powerha_cluster -m aix154.emc.com

   This will activate the Caavg_private on the passive node.

7. Start cluster services on the passive node.

   a. Enter `smitty hacmp`.

   b. Select **System Management (CSPOC)** > **PowerHA System Mirror Services** > **Start Cluster Service**

   c. Press Enter.

8. Move the resource groups from an active node to passive node.

   a. Enter `smitty hacmp`

   b. Select **System Management (CSPOC)** > **Resource Groups and Applications** > **Move a Resource Group to Another Node / Site** > **Move Resource Groups to Another Node**

9. After resource groups get online on the passive node, repeat the same steps for all other nodes where PowerPath needs to be upgraded.

Upgrade PowerPath in a PowerHA/HACMP concurrent VG environment

When upgrading PowerPath for AIX on PowerHA/HACMP clusters, Dell EMC recommends using concurrent volume groups (VGs). PowerPath for AIX does not support seamlessupgrades on

PowerHA/HACMP configuration with nonconcurrent volume groups. Recommended setting is either reserve_policy=no_reserve or reserve_lock=no.

Procedure

1. Fail over all resource groups to one node (For example, node A).
2. Stop PowerHA/HACMP on node B.
3. Stop the following daemons and agents:
   a. Vary off all volume groups on node B (except rootvg).
   b. If EMC Solutions Enabler daemons are running, shutdown the daemons by running:
      `stordaemon shutdown <daemon>`
   c. If NaviSphere Host Agent is running, stop the agents by running:
      `/etc/rc.agent stop`
4. Install PowerPath following the steps described in Upgrading PowerPath.
5. Bring up PowerHA/HACMP on this cluster.
6. Fail over all resource groups to node B and repeat steps 2 to 5 for node A.

Troubleshooting the upgrade

Upgrading from PowerPath 5.5 or later could fail for the following reasons:

- Not all applications that use PowerPath devices were closed before starting the upgrade procedure.

If you failed to close applications

If you failed to close all applications that use PowerPath devices before starting the upgrade, you would see a message indicating that the driver could not be uninstalled or a message stating that the Navisphere agent was still running.

In this case, stop all applications that use PowerPath devices and then restart the upgrade procedure.

If a PowerPath device is the boot device

If your previous PowerPath version uses a PowerPath device as the boot device, disable multipathing to the root device before upgrading.

Procedure

1. Run `pprootdev off`.
2. Restart the host.

   After upgrading, enable multipathing to the root device again:

   a. Run `pprootdev on`.
   b. Run `pprootdev fix and bosboot -ad /dev/ipldevice`.

Upgrading the AIX operating system

You can upgrade AIX operating systems on a host:

- AIX migration upgrade
- AIX Technology Level Upgrades or Service Pack Upgrades
- Upgrading AIX operating system using nimadm command

Upgrade AIX operating systems for major releases

Procedure to upgrade the AIX operating system on a host that has PowerPath installed.

Procedure

1. Uninstall PowerPath, as described in Chapter 7, Removing PowerPath from an AIX Host.
2. Upgrade the AIX operating system. Refer to the relevant AIX documentation.
3. Reinstall PowerPath.

Upgrade AIX operating systems for Technology Level upgrades or Service Pack upgrades

Procedure to upgrade the AIX operating system for a Technology Level upgrade or Service Pack on a host that has PowerPath installed.

Procedure

1. Do not uninstall PowerPath.
2. Upgrade the AIX operating system. Refer to the relevant AIX documentation.

   Note: In case a PowerPath hdiskpower device is a boot device, **pprootdev** fix needs to be run before the upgrade, for the **bosboot** command to function correctly.

Upgrade AIX operating system using nimadm command

Procedure to upgrade AIX operating system using `nimadm` command.

Procedure

1. Identify the large hdiskpowerX device for the AIX upgrade. The device is on the target host and not on the NIM master. This device will be unmanaged in the next step.

   For example, **powermt display dev=hdisk80**

   Note: If a PowerPath hdiskpowerX device is a boot device, **pprootdev fix** must be run before the nimadm migration upgrade in order for the bosboot command to function correctly.

2. Run **powermt unmanage** to unmanage the device from PowerPath control.

   For example, **powermt unmanage dev=hdisk80**

   Note: You can clear pvids for all the native disks of the chosen hdiskpowerX using **chdev –l <hdisk#> -a pv=clear**.

3. On the NIM server, create a Volume Group to be used for the upgrade.
4. On the NIM server, run the **nimadm** command, specifying the target host (for example, hdisk80), to upgrade to AIX 7.1. The **nimadm** command executes 12 phases. If an error is

encountered during any phase, the issue needs to be resolved and the **nimadm** command should be repeated after a cleanup.

5. Run shutdown -Fr to reboot the device listed in step 1. The bootlist is now set to the hdisk. After reboot, the device is upgraded to AIX 7.1.
6. Run **powermt manage dev** to manage the hdisk.

   For example, **powermt manage dev=hdisk80**
7. Run powermt manage dev to manage the hdisk. In a Boot from SAN environment, run shutdown -Fr to reboot the system from the PowerPath hdiskpower pseudo device. After reboot the host is booted from SAN and the AIX level is 7.1. In a non-Boot from SAN environment, reboot is not required.
8. Upgrade ODM if required, for example when upgrading from AIX 5.3 or AIX 6.1 to AIX 7.1.

   Note: If upgrade fails in a BFS environment, run the following and then upgrade ODM.

   - pprootdev on
   - pprootdev fix
   - bosboot –ad /dev/ipldevice

CHAPTER 8

Removing PowerPath from an AIX Host

This section explains about removing PowerPath from an AIX Host.

Before removing PowerPath

About this task

Before you remove PowerPath from the host:

Procedure

1. Disable VxVM volumes on pseudo devices. Ensure that no pseudo devices are in use and unmount any mounted file systems that are contained on pseudo devices.
   a. Unmount any mounted filesystem on pseudo devices.
   b. Close VxVM volumes: `Vxvol -g <DG> stopall`
   c. Deport DG, run: `Vxdg deport <DG>`
   d. Remove pseudo devices from VxVM control: `Vxdisk rm <hdiskpowerx>`
2. Deactivate all LVM volume groups that use PowerPath hdiskpower devices. Otherwise, the uninstall procedure fails.
3. Close any application that is using a hdiskpower device.

   If an application is using a hdiskpower device when you try to remove PowerPath, the uninstall procedure terminates with the following message:

   ```
   Error removing PowerPath devices. Unable to remove PowerPath.
   ```

   If this error occurs, close the application that is using the hdiskpower device and repeat the uninstall.
4. If EMC Solutions Enabler daemons, such as `storwatchd` and `storapid`, are running, type `stordaemon shutdown`*<daemon>* to stop the daemons before you uninstall PowerPath.
5. If EMC ControlCenter is running on the host, stop the ControlCenter agents before you uninstall PowerPath.
6. In a CLARiiON environment, if the Navisphere Host Agent is running, type `/etc/rc.agent stop` to stop the agent before uninstalling PowerPath.
7. If you are not reinstalling PowerPath after completing the removal procedure, disconnect all duplicate physical connections between the host and the storage system except one cable, leaving a single path. In addition, reconfigure any switches so devices be displayed only once.

Removing PowerPath

To remove PowerPath, you can use either command line entries or the SMIT utility.

Note: Do not attempt to run `powermt config` while using installp or SMIT to add, remove, or update PowerPath software. Doing so can result in a system crash.

Use command line entries

About this task

To remove PowerPath by using command line entries:

Procedure

1. Log in as root.
2. Run `installp -u EMCpower`

Results

Output similar to the following is displayed:

```
+-----------------------------------------------+

                                                    Summaries:
+-------------------------------------------------------------+
Installation Summary
--------------------
Name
               Level         Part Event                 Result
-------------------------------------------------------------
EMCpower.MgmtComponent                  6.x.x.0 USR     DEINSTALL SUCCESS
EMCpower.migration_enabler 6.x.x.0 USR     DEINSTALL SUCCESS
EMCpower.mpx                                                        6.x.x.0
USR     DEINSTALL SUCCESS
EMCpower.base                                                     6.x.x.0
USR     DEINSTALL SUCCESS
```

Where 6.x.x is the PowerPath for AIX release version, for example, PowerPath 6.4. PowerPath is now removed from the host. After removing PowerPath contains additional information.

Note: The `installp -up EMCpower` command removes all hdiskpower devices and the powerpath0 driver, but leaves the product that is installed.

Use SMIT

SMIT procedure that is described in this section assumes that you run the X Windows version of SMIT.

About this task

You can use the `tty` version of SMIT if you substitute the appropriate `tty SMIT` commands in the following steps.
To remove PowerPath by using SMIT:

Procedure

1. Log in as root.
2. To open SMIT run `smit`.
3. Select **Software Installation and Maintenance**, and then select **Software Maintenance and Utilities**.
4. Select **Remove Installed Software.**

   The Remove Installed Software dialog box opens.
5. Click **list** to open the Multi-select list of installed software.
6. Select entries starting with EMCpower, and then click **OK**.
7. Change the `Preview Only?` field to *No*, and click **OK**.
8. When prompted, confirm that you want to remove the software.

   Output similar to the following is displayed:

```
+-----------------------------------------------+
```

```
                                                Summaries:
+-------------------------------------------------------------+
Installation Summary
--------------------
Name
                     Level         Part Event                 Result
-------------------------------------------------------------
EMCpower.MgmtComponent                   6.x.x.0 USR     DEINSTALL SUCCESS
EMCpower.migration_enabler 6.x.x.0 USR     DEINSTALL SUCCESS
EMCpower.mpx
6.x.x.0 USR     DEINSTALL SUCCESS
EMCpower.base
6.x.x.0 USR     DEINSTALL SUCCESS
```

Where 6.x.x is the PowerPath for AIX release version, for example, PowerPath 6.4.

9. From the **EXIT** menu, select **EXIT SMIT**.

   PowerPath is now removed from the host. After removing PowerPath, contains additional information.

   Note: SMIT preview of uninstall removes all hdiskpower devices and the powerpath0 driver but leaves the product that is installed.

When a storage system device is the boot device

About this task

If your PowerPath installation uses a storage system device as the boot device, follow these steps to remove PowerPath:

Procedure

1. Run `pprootdev off` to disable multipathing to the root device.
2. Restart the host.
3. Remove PowerPath as described in Removing PowerPath.
4. Run `bosboot -ad /dev/ipldevice` to create a boot image.

After removing PowerPath

If you are not reinstalling PowerPath after completing the removal, run `rm /etc/emcp_registration` to remove the `/etc/emcp_registration` file from your system.

CHAPTER 9

PowerPath Administration on AIX

This section explains PowerPath administration on AIX.

Management daemon using SNMP

The PowerPath management daemon monitors specific PowerPath events and sends an SNMP (Simple Network Management Protocol) trap when access to devices is disrupted.

The configuration file for the event monitoring daemon specifies the events to monitor and a filter parameter for each event. This way, only those events needing intervention from an administrator are displayed.

An SNMP trap is issued for events that are listed in the configuration file, `/etc/emc/emcp_mond.conf`. The traps are sent to a master SNMP agent running locally. The master agent forwards the trap to a remote network manager where an administrator can view them and take corrective action as necessary.

Monitored events

The PowerPath management daemon monitors and sends an SNMP trap when either of the following events occur:

Note: Traps are only generated for Path Dead and All Paths Dead events when there is I/O running.

- A path is dead for one minute.
- All paths to a volume are dead for five minutes.

When a monitored event occurs on a path, a timer is started. After a given delay time elapses, a trap is generated to report the event. If a canceling event occurs on the path before the delay time elapses, a trap is not generated. In this way, the delay time is used to filter out transient path events.

Table 1 shows the events, event descriptions, and event IDs and time thresholds. It also shows whether for each case an SNMP trap is issued.

Table 6 Table 1 Management daemon monitored events

Monitored event	Event cause	Event ID	SNMP trap
Path is Dead	Path is dead for one minute.	0x2,0x4,60	Yes
	Path is dead and then recovers within one minute.	0x2,0x4,60	No
All Paths Dead	All paths are dead for five minutes.	0x20,0x40,300	Yes
	All paths are dead and then recover within five minutes.	0x20,0x40,300	No

The time threshold for each event can be modified as described in Edit the event.

The configuration file for the event monitoring daemon contains comment lines beginning with a hash mark, event lines containing the ID of each event to monitor, the ID of its canceling event, and the delay time in seconds for the event. These three event parameters are delimited by commas. For example, the line for the path dead event is 0x2,0x4,60.

Configure the management daemon

After PowerPath is installed on the host being managed, configure the event monitoring daemon to send traps to the SNMP manager.

Configure each host on which path monitoring is desired.

Configure emcp_mond_edit related settings

Procedure

1. Run `/etc/emc/bin/emcp_mond_edit`

```
Item                                    Value
=====                                   ======
1 Change remote management service status      Enabled
2 Change management service heartbeat interval 10 minutes
3 Change management service port                9083
4 Single path gatekeeper devices                Allow
5 Change SNMP trap generation status            Enabled
6 Change "Path Dead" event                      Enabled, delay 0 sec
7 Change "Path Alive" event                     Enabled, delay 0 sec
8 Change "All Paths Dead" event                 Enabled, delay 0 sec
9 Change "Not All Paths Dead" event             Enabled, delay 0 sec
10 Change "Volume Dead" event                   Enabled, delay 0 sec
11 Change "Max. Path Latency Exceeded" event    Enabled, delay 0 sec
12 Write configuration file
13 Exit
```

2. Select 12 and 13 from this list.

Configure management daemon to send the traps to SNMP TrapReceiver

Procedure

1. Edit the IP address to include the destination IP where the trap should be sent.
   a. Edit the `/etc/snmpd.conf` file:
   `< trap public <Trap_Destination_IP> <Unique_Object_Identifier> fe`

   where `<Trap_Destination_IP>` is the IP address of the host where the SNMP manager is installed.

   `<Unique_Object_Identifier>` is 1.3.6.1.4.1.1139.12.1. This is the Object identifier for EMC error log trap.

   `< trap public <IP>` 1.3.6.1.4.1.1139.12.1 fe

   b. Edit the `/etc/snmpdv3.conf TARGET_ADDRESS` to match the destination IP address:
   `<TARGET_ADDRESS TargetX UDP <Trap_Destination_IP> traptag trapparms1---`

   where `TargetX` is the next Target number available.

   c. Modify the `/etc/snmpdv3.conf` file to see the trap notifications in the trap receiver.

Receive SNMP traps

Procedure

1. Edit the /etc/snmpdv3.conf file.
2. Uncomment # VACM_VIEW defaultView internet - included to ensure the TrapReceiver receives Trap notifications.

   Example: <TARGET_ADDRESS Target1 UDP < IP> traptag trapparms1---
3. Update or create snmpd soft link, if required.

```
To update the link
# snmpv3_ssw -l
Confirm the change has taken place
# cd /usr/sbin
# ls -l snm*
lrwxrwxrwx   1 root     system           17 Jan 30 2008 snmpd -> /usr/
sbin/snmpdv1
"
```

4. Restart the SNMP daemon (snmpd), and then verify the status:
   a. Run stopsrc -s snmpd.
   b. Run startsrc -s snmpd.
   c. Run lssrc -s snmpd.

   Output in the following format is displayed:
   `Subsystem Group PID Status snmpd tcpip 32258 active`
5. Start the emcp_mond daemon, run:

   `/etc/rc.emcp_mond start`

Edit the event

The time threshold before an alert is generated can be modified by editing the *emcp_mond.conf* file.

About this task

To edit the time threshold:

Procedure

1. Open the `/etc/emc/emcp_mond.conf` file.
2. To change the time threshold, for example, from 60 seconds to 90 seconds for the Path is dead event, edit the following line:

   0x2,0x4,60 to 0x2,0x4,90
3. Close the *emcp_mond.conf file*.
4. Restart the daemon by running:
   a. Run `stopsrc -s snmpd`.
   b. Run `startsrc -s snmpd`.
   c. Run `/etc/rc.emcp_mond start`.

emc_cfgmgr script

This section explains about *emc_cfgmgr* script.

PowerPath requires that a hdisk be configured for each logical path it uses to access a storage system logical device. However under certain circumstances, AIX does not configure a hdisk for each logical path to a storage system logical device.

For example, you attach four new SCSI cables to an AIX host. Each cable addresses the same four storage system logical devices, and was part of a volume group at one time and is configured with a PVID (which is written on the disk). You then reboot the host. When AIX boots, it does the device discovery on those new SCSI busses in one step. When it sees two or more devices with the same PVID, AIX creates only one hdisk. As a result, there are only 4 new hdisks, even though you attached 16 new devices.

Note: Do not share a PowerPath pseudo device that is used for paging with another host or cluster node. The hdiskpower device must be visible to only one host or cluster node.

To ensure that hdisks are configured correctly for PowerPath, PowerPath for AIX provides the script `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr`. The *emc_cfgmgr* script invokes the AIX *cfgmgr* tool to probe each HBA separately, so the configuration program restarts before it gets confused by disks that be displayed to be the same. After *emc_cfgmgr* runs, a storage system hdisk is configured for each device on each path.

The *emc_cfgmgr* script is available at the following Dell EMC FTP site: ftp://ftp.EMC.com/pub/elab/aix/ODM_DEFINITIONS

Change the major number

Procedure to change the major number.

Procedure

1. Determine a free major number common to all nodes. On each node in the cluster, type:

   `lvlstmajor`
   Compare the free ranges on each node to find a major number that is unused on any node.

2. Run `rmdev -l powerpath0`.
3. Change the major number of the powerpath0 device. On each node in the cluster, type:

   `chdev -l powerpath0 -a pp_major=x`, where x is the major number you found in step 1.

4. Verify the change. On each node in the cluster, type:

   `lsattr -El powerpath0`

Results

The major number takes effect after you run the `powermt config` command on each node in the cluster.
When all the hdiskpower devices are removed and the powerpath0 driver is in the available state, *pp_major* is not considered when configuring new hdiskpower devices. However, if the powerpath0 driver is in the *defined* state or if a hdiskpower device exists, the *pp_major* attribute is correctly considered when configuring a hdiskpower device.

PowerPath hdiskpower devices

PowerPath for AIX supports only pseudo devices, not native devices. To get the benefits of PowerPath load balancing and path failover in an AIX environment, you must use PowerPath pseudo devices.

PowerPath pseudo devices on AIX use this naming convention:

- Block device — */dev/hdiskpowerx*
- Raw device — */dev/rhdiskpowerx*

Where x is the disk number.

During installation, PowerPath creates a hdiskpower device for every logical device that is configured for the AIX host. After PowerPath is installed, both hdisk and hdiskpower devices exist on the host. The hdiskpower devices reside on top of the hdisk devices.

You can run `powermt display dev=all` to determine the correspondence between PowerPath hdiskpower devices and AIX hdisk devices.

Once PowerPath is installed, applications should direct I/O to hdiskpower devices. Using hdiskpower devices provides the PowerPath load-balancing and path failover functionality. PowerPath then selects the best path (hdisk) to handle the I/O.

During installation, PowerPath migrates existing LVM volume groups that use storage system hdisks to PowerPath hdiskpower devices. You need not reconfigure existing volume groups after installing PowerPath. If you want PowerPath load-balancing and path failover functionality and you have an application that accesses AIX hdisks directly rather than through a volume group (for example, a DBMS), you must reconfigure that application to use PowerPath hdiskpower devices.

If an application does not access a hdisk directly, you need not reconfigure the application for PowerPath.

When defining new volume groups, use PowerPath hdiskpower devices, not AIX hdisk devices. If you add an application to your system that typically would access hdisks directly, configure the application to use hdiskpower devices instead.

Although the underlying hdisk devices remain after PowerPath is installed, Dell EMC recommends that you not use them for normal I/O because they might interfere with one another. If the parent hdiskpower device is open, it might not be possible to open hdisk devices. Device reservations on the hdisk can interfere with device reservations on hdiskpower devices. Applications that use the SymmAPI cannot use both hdisk and hdiskpower devices.

PVIDs

A physical volume identifier (PVID) is a unique number that is written on the first block of the device. The AIX LVM uses this number to identify specific disks.

When a volume group is created, the member devices of the group are just a list of PVIDs. The LVM does not read each device when searching for member devices of a volume group. Instead, it expects the PVIDs to be saved in the ODM, and it uses the ODM attribute when determining which device to open.

The PVID for each device is stored in the ODM when the device is configured. When a device is made Available (including device creation and when the device begins in the Defined state), the configuration program tries to read the first block of the device. If it succeeds and the first block contains a valid PVID, the PVID value is saved as an attribute in the ODM for that device. Once the PVID is set in the ODM, it can be seen in the output of the `lspv` command. In a configuration with multiple paths to the same logical devices, multiple hdisks show the same PVID in the output of

`lspv`. When the LVM needs to open a device, it selects the first hdisk in the list with the matching PVID.

hdiskpower and PVID

The PVID for a hdiskpower device is set essentially the same way as a hdisk, but with an extra step or two.

When a hdiskpower device is made Available, the configuration program tries to open the device and read the first block. Several conditions can prevent this read from succeeding, including the following:

- There is a SCSI reservation on the device. This condition is usually caused by an active volume group using one of the hdisk paths on the local machine or varied on from a remote host.
- hdisk paths to the hdiskpower are marked dead because of a deleted hdisk device. This condition can prevent the configuration program from opening the device and reading the first block.

These failure conditions happen primarily when PowerPath is being configured long after system boot, and other programs are using hdisk devices on the local machine.

If the hdiskpower configuration program cannot read the first block on the device, it cannot determine the PVID and cannot store it in the ODM for the hdiskpower device.

When the configuration program for the hdiskpower device reads and stores the PVID for the hdiskpower device, it also removes the PVID from the ODM for the corresponding hdisk devices. This is done so the LVM uses the hdiskpower devices instead of the hdisks and take advantage of PowerPath functionality.

When configuring PowerPath devices, keep in mind that:

- Deleting all hdiskpower devices does not erase the PowerPath knowledge of which hdisks correspond to paths to logical devices. To cause PowerPath to completely rebuild its configuration, you must unconfigure the powerpath0 device.
- hdisks need not be deleted to make them redo their PVID processing. They can be unconfigured by running `rmdev -l hdisk#,`, and reconfigured by rerunning `cfgmgr` on the bus or running `mkdev -l hdisk#`.
- To have PVIDs on hdiskpower devices, you need only put the hdisks into the Available state. You do not need to delete them, and you do not need to first get the PVID to be displayed in `lspv` output. You do, however, need to ensure that the associated path hdisks are not in use and the device is not reserved.

PowerPath and the lsvg command

This section explains the usage of `lsvg` command for PowerPath.

The AIX `lsvg` command, when used with the `-p` flag, displays devices in use by the specified volume group. This command, however, is not designed to operate with PowerPath or with storage system logical devices that are addressable as different hdisk devices. In general, the output of `lsvg -p vgname` shows correct information, but several administrative tasks change the ODM and could cause `lsvg` to show misleading information. These tasks include:

- Use of the `pprootdev` tool. This tool changes the ODM and is intended to be used when you expect to reboot the system soon after using `pprootdev`. The `lsvg` command shows misleading device information when run after `pprootdev`. This is not a wrong indication. A reboot corrects the lsvg output, but reboot is not required.

- Use of `cfgmgr` to create hdisk devices after PowerPath is already configured. Always run `powermt config` after adding new devices to include them in the PowerPath configuration.

PowerPath and the iostat command

The `iostat -a` command output may show most I/O going through a single HBA, when in fact I/O is balanced across all HBAs. This section explains why.

PowerPath assigns the parent device of a pseudo device based on the last native device retrieved from the ODM database. Thus, if the last native device for every pseudo device happens to be on the same fcs device, all pseudo devices have that device as parent. For example, if the last native device for every pseudo device is on fcs0, all pseudo devices have fcs0 as parent.

The `iostat -a` command combines data for adapters based on the ODM parent attribute for each disk. Thus, in this example, all I/O to all hdiskpower devices show up on the fcs0 parent. It appears that fcs0 is getting most of the activity, when multipathing is occurring below the pseudo device.

BCVs and cfgmgr operations

This section explains BCVs and the `cfgmgr` command operations.

If you run the `cfgmgr` command, hdisks that correspond to Business Continuance Volumes (BCVs) is changed to the Defined state. If those hdisks are current members of the PowerPath configuration, PowerPath may mark them Failed during periodic testing. After the hdisk paths are made Available, run `powermt restore`.

This causes PowerPath to test the hdisks and change their state to Alive.

Bring hdiskpower-based BCV Symmetrix logical devices online

This section explains how to bring hdiskpower-based BCV Symmetrix logical devices online.

About this task

Note: If the hdisks for the BCVs already exists, do not delete them. Do not specify the `-d` flag in the `rmdev` command. It is appropriate to delete and re-create the hdisk devices only when the device mapping changes so the Symmetrix serial number for the hdisk is different than when the hdisks were last in the *Available* state. Change the target/LUN address of a storage system logical device provides additional information.

Procedure

1. Use the EMC management tool of your choice to split the BCV (and make it ready).
2. Use `/usr/lpp/EMC/Symmetrix/bin/mkbcv` to bring the BCV hdisks to the *Available* state.
3. Run `powermt config`.
4. Run `powermt restore`.

   If errors are reported, configuration of PowerPath was changed. Verify that all paths are functioning, and run `powermt check` to remove all dead hdisks. Rerun `powermt config`. You should now be able to run `powermt restore` without errors.

5. Verify that expected PVIDs are assigned to hdiskpower devices in `lspv` output.

   If they are not, ensure that corresponding hdisks are not in use or reserved (locally or remotely). And then, unconfigure the corresponding hdiskpower devices (`rmdev -l`

`hdiskpower#`) and reconfigure them (`mkdev -l hdiskpower#`). If the expected PVID is not set, the device cannot be accessed due to path failures or a conflict on the device.

Import an LVM volume group from a remote host

Procedure to import an LVM volume group from a remote host.

Procedure

1. On the remote host, vary off the volume group to be imported.
2. Verify that all path hdisks for the volume group to be imported are configured on the local host. If they are not, configure them with the `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr.` script.

   The `emc_cfgmgr` script is available at the following Dell EMC FTP site: ftp://ftp.emc.com/pub/elab/aix/ODM_DEFINITIONS
3. If the hdiskpower devices for the volume group exist, unconfigure them with `rmdev -l hdiskpower#`.
4. Verify that the devices are not in use on any host.
5. To reconfigure or create the hdiskpower devices run `powermt config`.
6. Verify that expected PVIDs are assigned to hdiskpower devices in `lspv` output.

   If they are not, ensure that corresponding hdisks are not in use or reserved (locally or remotely). If the expected PVID is not set, the device cannot be accessed due to path failures or a conflict on the device.

Change the target/LUN address of a storage system logical device

This section explains how to change the target/LUN address of a storage system logical device.

About this task

If you need to change device mapping on the storage system, where a target or LUN address are changed to access a different storage system logical device with a different serial number, that logical device must be deleted from the PowerPath configuration before the change is made. Otherwise, PowerPath begins marking hdisk paths dead because they no longer point to the storage system logical device where they should point.

Procedure

1. To determine which hdiskpower devices need to be removed run `powermt display`.
2. Run `powermt remove dev=`*<device>* for each hdiskpower device corresponding to a storage system logical device whose address is changing.
3. Change the storage system addressing configuration.
4. Ensure that all required hdisks are configured for the new storage system configuration and are in the Available state.
5. Run `powermt config`.

Add new devices to an existing configuration

This section explains how to add new devices to an existing configuration.

Procedure

1. Verify that all hdisks for new storage system volumes is configured.
2. Verify that all BCV hdisks are in the Available state.

   PowerPath does not configure hdisks in the Defined state. If you are adding BCV hdisk devices to the PowerPath configuration, they must be split and Available before proceeding.

3. Run `powermt config`.

Managing and unmanaging EMC Celerra iSCSI devices

This section explains how to manage and unmanage EMC Celerra iSCSI devices.

PowerPath treats EMC Celerra iSCSI devices as generic devices. Enable generic Loadable Array Module (LAM) support so that PowerPath can recognize and manage and unmanage Celerra iSCSI devices.

Manage EMC Celerra iSCSI devices under PowerPath

Procedure

1. Add the following line to the `/etc/emc/mpaa.lams` file:

   `managed:generic:EMC:Celerra`

2. Run `powermt init`.
3. Reboot the host.

Unmanage EMC Celerra iSCSI devices under PowerPath

Procedure

1. Remove the following line from the `/etc/emc/mpaa.lams` file:

   `managed:generic:EMC:Celerra`

2. Run `powermt init`.
3. Reboot the host.

Manage IBM XIV devices under PowerPath

This section explains how to manage IBM XIV devices under PowerPath.

Procedure

1. Install the EMC TPA ODM kit.

```
bash-4.0# lslpp -l | grep TPA
EMC.AIX.TPA.ODM 1.3.0.2 COMMITTED EMC TPA ODM kit
```

2. Present IBM XIV devices under the host (by default the devices come under MPIO control).

```
bash-4.0# lsdev -Cc disk | grep XIV
hdisk47             Available 00-08-02 MPIO 2810 XIV Disk
hdisk48             Available 00-08-02 MPIO 2810 XIV Disk
```

3. Remove devices from MPIO control.

```
rmdev -Rdl hdisk47
rmdev -Rdl hdsik48
```

4. Run the manage command to manage IBM XIV under PowerPath.

```
# manage_disk_drivers -d 2810XIV -o EMCPP_XIV
```

5. Reboot the host.

Replace an HBA that PowerPath is using online

Procedure

1. Run `powermt display` to determine the HBA number.
2. Run `powermt remove hba=`*<hba#>*.

   Where *<hba#>* is the adapter number that is identified in step 1.
3. Use `rmdev` to remove all hdisks associated with the HBA that you removed in step 2, as well as the parent HBA.

Move LUNs in and out of a storage group

About this task

In a CLARiiON environment, if you remove LUNs from a storage group, and then return them to the storage group with different HLU numbers, `powermt restore` fails, complaining that native devices are dead. This is because the LUNs now have different SCSI addresses and are treated as new devices by the OS.

Procedure

1. To configure new native devices run `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr`.
2. To configure new PowerPath pseudo devices run `powermt config`.
3. To remove the dead paths run `powermt check force`.

Eliminate ghost devices

About this task

Ghost devices are created when the system continues to recognize hardware or a service after it has been disconnected from the system. If you reboot the host when a cable is detached, you must reconfigure the devices using both `emc_cfgmgr` and `powermt config`.

Procedure

1. Reconnect the cable.
2. Run `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr`.
3. Run `powermt config`.
4. Run `powermt restore`.

Reconfigure PowerPath devices online

About this task

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:

Procedure

1. Ensure that all physical device connections are connected.
2. To ensure that hdisks are configured for each path run the `/usr/lpp/EMC/Symmetrix/bin/emc_cfgmgr` script. This script invokes the AIX cfgmgr tool to probe each adapter bus separately. After it runs, there should be a storage system hdisk configured for each device on each path.

   The `emc_cfgmgr` script is available at the following Dell EMC FTP site: ftp://ftp.emc.com/pub/elab/aix/ODM_DEFINITIONS
3. To test all configured paths run `powermt restore`.
4. To remove any hdiskpower devices that are no longer available run `powermt check`.
5. To configure new devices and paths that were added to the system configuration run `powermt config`.
6. Optionally, run `powermt save` to save the new PowerPath configuration.

Failover in switched environments

PowerPath includes a configurable control, `QueueDepthAdj`, that can improve path failover performance in certain limited situations.

`QueueDepthAdj` affects failovers only:

- In switched environments.
- When the failover is due to an outage between the switch and the storage system.

Extensive testing indicates that the default setting is best for virtually all installations. If you experience slow failover in a switched environment, contact Dell EMC Customer Support for information about setting `QueueDepthAdj`.

SMIT screens

PowerPath for AIX provides a set of System Management Interface Tools (SMIT) screens that implement `powermt` functionality.

About this task

Using a SMIT screen relieves you of the burden of having to know PowerPath command syntax.

Procedure

1. Type `smit`.
2. Press **Enter**.
3. Select **Devices** > **PowerPath Disk**

   The **PowerPath Disk SMIT** screen opens. Select the desired option.

Audit and error messages

PowerPath reports any errors, diagnostic messages, and failover recovery messages through the `syslog` file that is specified by the administrator (for example, `/usr/safe.log`).

Refer the *Dell EMC PowerPath Family CLI and System Messages Reference* for the complete list of PowerPath error messages.

Error log messages

Error log messages are displayed along with audit messages in the log file when you configure the AIX operating system for common logging as described in Enable logging on an AIX host. The error-log messages capture unexpected events that occur. Some error-log messages convey information that is displayed on-screen when a command fails.

PowerPath provides error notification through the AIX `errlog/errpt` facility. The `powermt` utility reports errors to standard error (`stderr`).

The AIX documentation contains information about the AIX `errlog/errpt` facility.

Enable logging on an AIX host

Before you begin

Enable logging on the AIX host to log PowerPath messages.

Note: Use `/tmp/emcpsyslog.log` to ensure that the support utility Dell EMC grab can collect the log files.

Procedure

1. Add the following entry to the `/etc/syslog.conf` file:

   `*.info /tmp/emcpsyslog.log`
   Optionally, configure `/etc/syslog.conf` to rotate the log file.

   For example, to rotate the file daily, keep one week's worth of files, and compress files to save space, add the following entry:

   ```
   *.info /tmp/emcpsyslog.log rotate files 7 time 1d compress
   ```

2. Create the `/tmp/emcpsyslog.log` file.

   For example, `touch /tmp/emcpsyslog.log`

3. Run `refresh -s syslogd` to enable logging.

Troubleshooting

This section describes problems that you might encounter and suggests how to resolve them.

Table 7 List of problems, causes, and solution

Problem	Cause	Solution
The following error message displays. `A device is already configured at this location`	A defined hdisk cannot be configured if it has the same connection string (in *lsdev* output as the corresponding hdiskpower and the hdiskpower device is in the Available state.	Run `mkdev -l hdiskpower#` for the corresponding hdiskpower device. This action changes the connection string for the hdiskpower device or unconfigures the hdiskpower device to enable the hdisk to be configured. If the condition exists for multiple hdisks, you can run `powermt config` instead.
hdisk paths are marked as failed.	If you delete a hdisk (running *rmdev -dl hdisk#*) before removing it from PowerPath's configuration, PowerPath marks the hdisk paths as failed because it can no longer access the hdisk that it expects to find. In some cases, a hdisk is present, but it points to the wrong storage system logical device.	1. Run `powermt restore` to test and mark dead all paths that are missing or point to the wrong logical device. 2. Run `powermt check`. When prompted to remove a dead path, respond with *a* to remove all dead paths. 3. Run `powermt config` to configure all hdisks that might be pointing to storage system logical devices different from the devices PowerPath is aware of.
`powermt display dev=all` shows all paths as dead or unknown.	Deleting and remaking hdisk devices while the powerpath0 device is in the Available state can put PowerPath in a state where it has incorrect path information for hdiskpower devices. The `powermt restore` command cannot restore these paths, because they no longer refer to the	1. Run `powermt restore`. 2. Run `powermt check`. When prompted to remove a dead path, respond with *a* to remove all dead paths 3. Run `powermt config`. 4. Verify that a hdisk is configured for each

Table 7 List of problems, causes, and solution (continued)

Problem	Cause	Solution
	correct storage system logical device.	connection and device. Before you install contains more information. If a hdisk is not configured, complete the procedure to correct the hdisk configuration, and then run powermt config again.
/spv output loses all Physical Volume ID (PVID) and Volume Group (VG) information. This causes a failover attempt to fail.	If you reboot a host when the hdiskpower device is Available and the PVID is on the underlying hdisk, */spv* output loses all PVID and VG information. If a failover is attempted at this point, it fails. Before you proceed, complete the procedure that follows.	1. Run `rmdev -l hdiskpowerx` to put all the hdiskpower entries back into a Defined state. 2. Run `rmdev -dl hdiskall_ghost_X` to remove all the new "ghost" devices created during the reboot. 3. Run `mkdev -l hdiskall_original_X` to make all the original hdisk entries, now Defined, Available again. 4. Start the HACMP Cluster Services on this node. 5. Once the HACMP Cluster Services are up, run the lspv command. Confirm that the PVID and VG information is back on the original hdisks, and then follow the procedure in the preceding section.
I/O for a particular application appears to be failing.	If I/O for a particular application appears to be failing, it is possible that the correct flags were not set. The application would recognize it specifically as pass-through I/O, though the user may not be able to distinguish this particular I/O type.	Ensure that the *SC_SIMPLE_Q* flag is set for applications that uses pass-through SCSI commands with devices handling I/O. Such applications must set the *SC_SIMPLE_Q* flag to indicate command tag queuing. If this flag is not set, the pass-through SCSI commands could fail. The user application is responsible for handling this condition.

APPENDIX A

Files Changed by PowerPath Installation

This appendix includes the following sections:

Files added by installation

The following files are added when PowerPath is installed on AIX:

```
/usr/lib/methods/power.cat
/usr/lib/methods/powerpath
/usr/lib/methods/powerpath/cfgudid
/usr/lib/methods/powerpath/cfgmpx
/usr/lib/methods/powerpath/cfgdm
/usr/lib/methods/cfgpower
/usr/lib/methods/chgpowerdisk
/usr/lib/methods/ucfgpower
/usr/lib/methods/cfgpowerdisk
/usr/lib/methods/ucfgpowerdisk
/usr/lib/methods/undpowerdisk
/usr/lib/methods/undpower
/usr/lib/nls/msg/en_US/power.cat
/usr/lib/drivers/powerdd
/usr/lib/drivers/powerdiskdd
/usr/lib/drivers/mpxext
/usr/lib/drivers/dmext
/usr/lib/drivers/gpxext
/usr/lib/boot/protoext/disk.proto.ext.scsi.pseudo.power
/usr/lib/libemcp_sockcom.a
/usr/lib/libemcp_xml.a
/usr/lib/libemcp_pp_util.a
/usr/lib/libemcp_pp_util.so
/usr/lib/libemcp_mpapi.a
/usr/lib/libemcp_mpapi_rtl.so
/usr/lib/libcg.so
/usr/lib/libcg.a
/usr/lib/libemcp.so
/usr/lib/libemcp.a
/usr/lib/libemcp_core.so
/usr/lib/libemcp_core.a
/usr/lib/libemcp_lam.so
/usr/lib/libemcp_lam.a
/usr/lib/libemcp_mp_rtl.so
/usr/lib/libemcp_mp.a
/usr/lib/libmp.a
/usr/lib/libemcp_power.a
/usr/lib/libemcp_shlib.a
/usr/lib/libemcp_lic_rtl.so
/usr/lib/libpn.so
/usr/lib/libpn.a
/usr/lib/libpower.a
/usr/sbin/cfgscsi_id
/usr/sbin/powercf
/usr/sbin/powermt
/usr/sbin/emcp_mond
/usr/sbin/emcp_mond_no_ssl
/usr/sbin/emcpmgr
/usr/sbin/emcpreg
/usr/sbin/emcpminor
/usr/sbin/emcpupgrade
/usr/sbin/emcpadm
/usr/sbin/pprootdev
/usr/sbin/emcpassive2active
/usr/sbin/powermig
/usr/sbin/emcpmigd
/usr/share/man/man1/emcpminor.1
/usr/share/man/man1/emcpreg.1
/usr/share/man/man1/emcpadm.1
/usr/share/man/man1/powermt.1
/usr/share/man/man1/powermig.1
```

```
/usr/lpp/EMCpower/liblpp.a
/etc/rc.emcpower
/etc/emc/diag/powermt_display_dead
/etc/emc/bin/emcp_mond_edit
/etc/emc/emcp_mond.conf
/etc/opt/emcpower/server.pem
/etc/rc.emcp_mond
/etc/rc.powermig
/etc/emc/bin/ppconfigdev
```

Note: The location of the `/etc/disk.proto.ext.scsi.pseudo.power` file is part of the list of files added as part of the installation process, by default. However, after the boot of a SAN setup, the location of the file is `/usr/lib/boot/protoext/disk.proto.ext.scsi.pseudo.power`.

Files modified by installation

When you install PowerPath on AIX, the PowerPath template for error logging is updated. In addition, the following files are modified as follows:

- `/etc/trcfmt` is updated with the PowerPath trace format file.
- `/etc/inittab` is modified with entries added for `/etc/rc.emcpower` and `/etc/rc.powermig`.

APPENDIX B

Dynamic Linking of OpenSSL libraries

This section provides information on the linking of OpenSSL libraries in PowerPath.

Note: PowerPath 6.4 supports any 1.0.x version of OpenSSL library only.

Overview

OpenSSL libraries are used by PowerPath in the remote management feature. When Dell EMC PowerPath Management Appliance (PPMA) host connects to a PowerPath host, the socket calls are secured by the OpenSSL library.

In earlier versions of PowerPath for AIX, the PowerPath host agent daemon, *emcp_mond*, was statically linked to OpenSSL libraries. It did not matter if a compatible version of OpenSSL is installed on the host or not.

From PowerPath for AIX 6.4 version, the host agent daemon, *emcp_mond* is dynamically linked to OpenSSL libraries. It is necessary that a compatible version of OpenSSL library is installed on the host in order for the remote management feature to work properly.

Changes

From PowerPath for AIX 6.4, *emcp_mond* is dynamically linked to OpenSSL libraries. And *emcp_mond* uses the version of OpenSSL libs that are installed on host. Even if multiple versions of OpenSSL libraries are installed, *emcp_mond* looks for and uses the latest version of the libs.

There may be rare instances when OpenSSL library is not installed or an incompatible version is installed. In such cases, if *emcp_mond* does not start, other features dependent on *emcp_mond* such as, Auto Host Registration, is impacted.

To address this scenario, two versions of *emcp_mond* binaries are included in the PowerPath package. The first version, *emcp_mond* is used when a compatible version of OpenSSL libs is found to be installed on the host. The second version, *emcp_mond_no_ssl* is used when OpenSSL library is not installed or an incompatible OpenSSL version is found to be installed.

Note: PowerPath 6.4 supports any 1.0.x version of OpenSSL library.

Expected behavior

This section provides information about the expected behavior of PowerPath with or without installing OpenSSL.

With OpenSSL 1.0.x

There is no change in how PowerPath works if a compatible version of OpenSSL is available on a host. `ps -ef` output should show `/usr/sbin/emcp_mond` running when PowerPath is active.

With no OpenSSL library or incompatible version

This section provides information about how PowerPath behaves when no OpenSSL library or an incompatible version is installed.

`ps -ef` output should show `/usr/sbin/emcp_mond_no_ssl` running when PowerPath is active.

PowerPath generates the following warning:

```
+-----------------------------------------------------------------------------+
                         Installing Software...
+-----------------------------------------------------------------------------+

installp:  APPLYING software for:
        EMCpower.base 6.4.0.0
        EMCpower.mpx 6.4.0.0
```

```
        EMCpower.migration_enabler 6.4.0.0
        EMCpower.MgmtComponent 6.4.0.0


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0518-307 odmdelete: 0 objects deleted.
```

Warning: Install OpenSSL library to use PowerPath remote management services

```
Finished processing all filesets.  (Total time:  16 secs).

+-----------------------------------------------------------------------------+
                                Summaries:
+-----------------------------------------------------------------------------+

Installation Summary
--------------------
Name                        Level      Part     Event    Result
-------------------------------------------------------------------
EMCpower.base               6.4.0.0    USR      APPLY    SUCCESS
EMCpower.mpx                6.4.0.0    USR      APPLY    SUCCESS
EMCpower.migration_enabler  6.4.0.0    USR      APPLY    SUCCESS
EMCpower.MgmtComponent      6.4.0.0    USR      APPLY    SUCCESS
bash-4.2#
```

PowerPath installed on host with no OpenSSL library

This section provides information about the warning that `emcp_mond_edit` tool generates when the PowerPath package is installed on a host which does not have OpenSSL library installed.

`emcp_mond_edit` tool generates the following warning.

```
WARNING:Please install OpenSSL libraries to enable remote management service
```

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